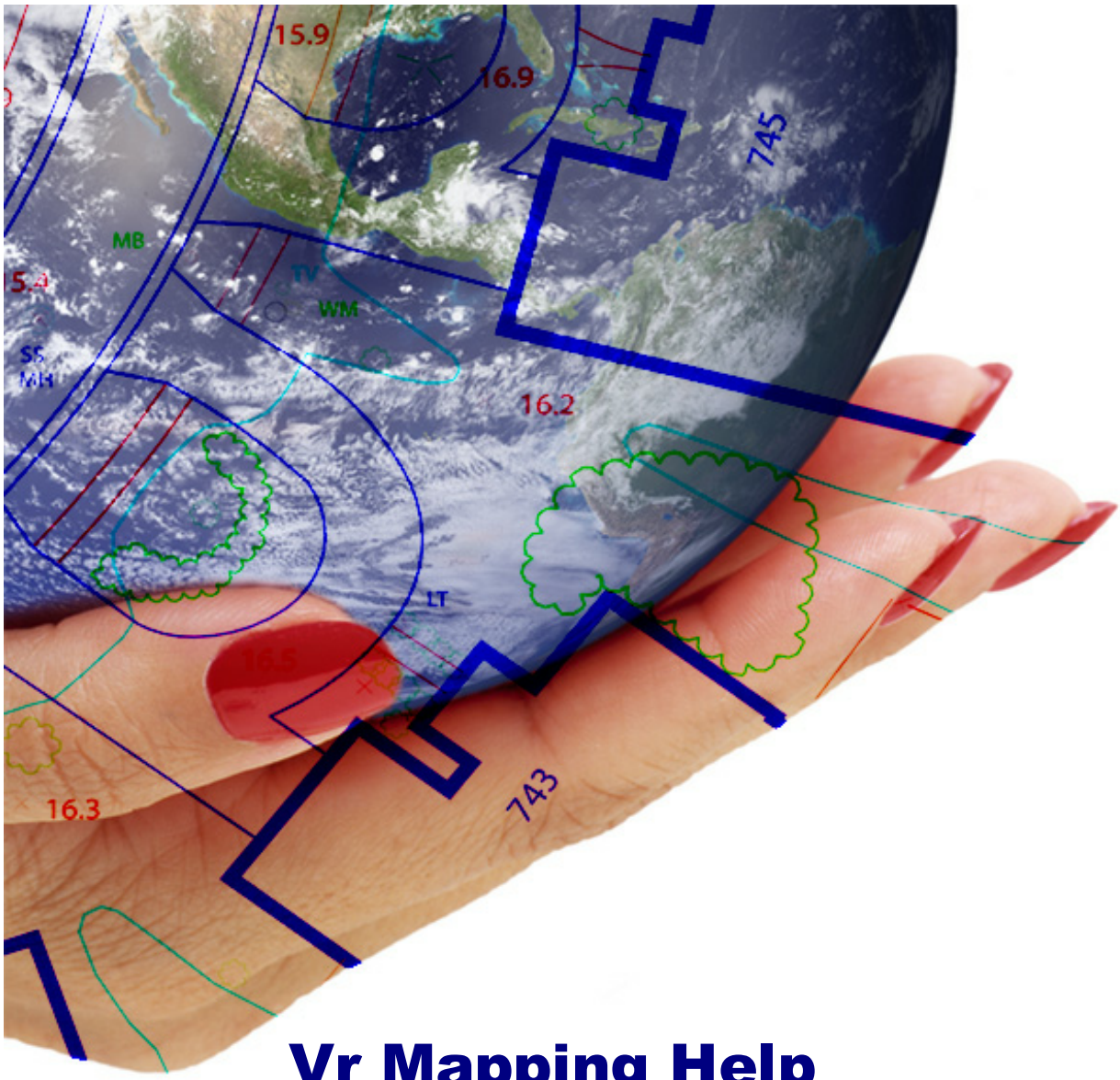

Vr Mapping Help

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Vr Mapping
The NEW Standard

Vr Mapping

Reference Documentation

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by Cardinal Systems, LLC

"entia non sunt multiplicanda praeter necessitatem"
(Entities must not be multiplied beyond necessity)

"All other things being equal.
The simplest solution is the best."

- Occam's razor
William of Ockham - 14th-century

Vr Mapping Help

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Printed: March 2025

Publisher

Cardinal Systems, LLC

Technical Editors

Mike Kitaif

Special thanks to:

The professionals that use Vr Mapping

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1 Configuration

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DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Configuration



Configuration of Vr Mapping parameters, instructions on downloading and installing the software, and instructions on printing the Vr Mapping help manual.

Vr Configuration
Downloading - Installation
Printing Vr Mapping Help
Compatibility

1.1 Vr Configuration

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Vr Mapping

Vr Configuration

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Type: Stand-alone program (vrcfig.exe)

Detailed Description

Vr Configuration is a stand-alone program to set and edit program parameters for all Vr Mapping programs. The Vr Configuration program can be accessed from the \vr\bin folder. The executable name is vrcfig.exe. Alternately, Vr Configuration can be started from Windows Start -> VrOne -> VrConfiguration.



Vr Configuration Main Window

Project Parameters	XYZ Digitizer	Multiple Windows Settings	Numlock Control
Vector Graphics	Mouse Buttons	Backup Parameters	Correlation Settings
Image Graphics	VrTwo Cursor	Keyport/Touchscreen	Plotter
General Graphics	VrOne/VrTwo Start Windows	Z Source	Videomap
General	VrTwo 3D Input Device	Beep	
XY Digitizer	VrTwo Model Manager	File Paths	

Project Parameters

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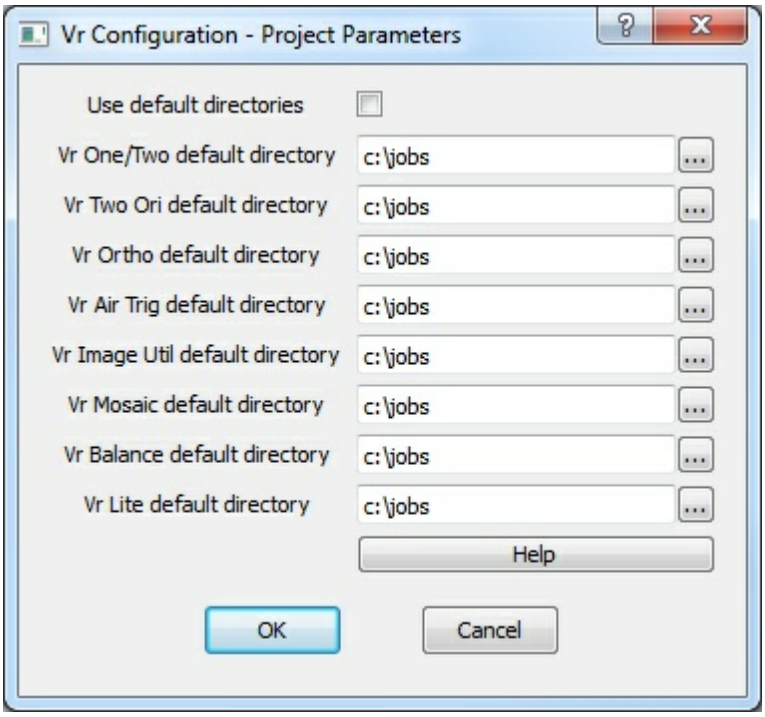
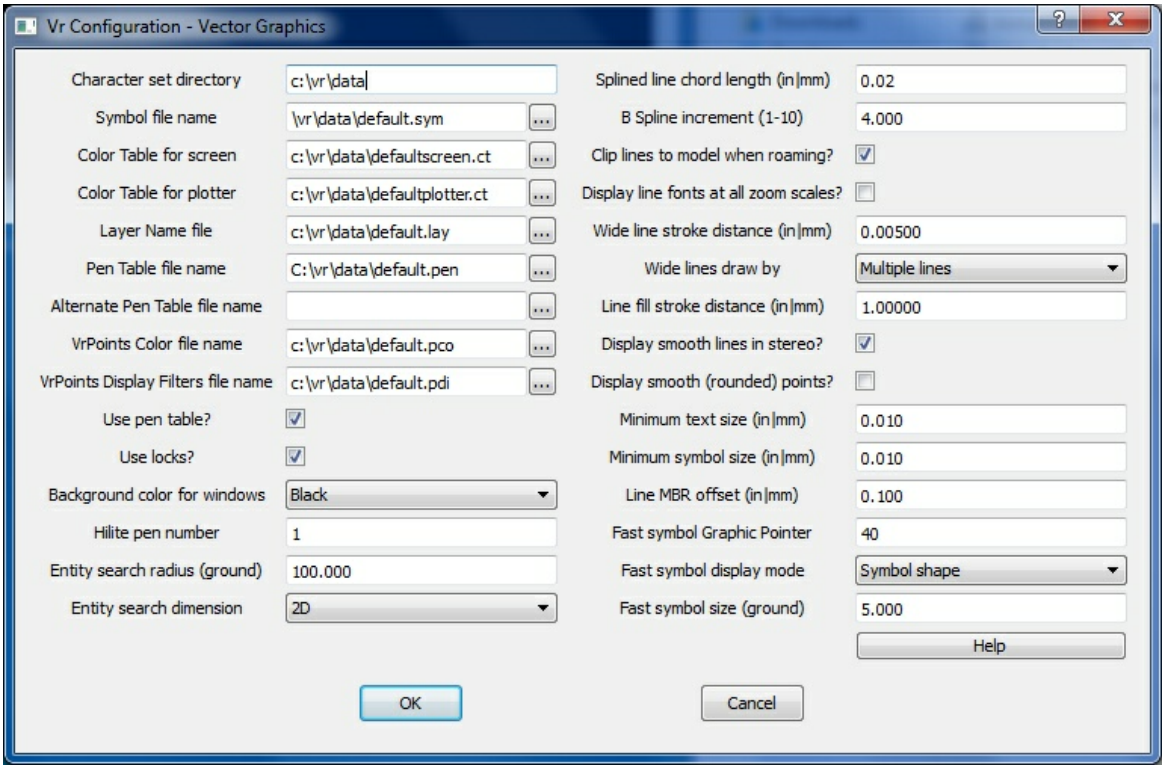


Project Parameters dialog

Sets the default directories for new files opened in Vr Mapping Software programs.

Vector Graphics



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Vector Graphics dialog

Character set directory

Defines the directory where the thirteen VrOne character set files reside. The default character sets are: Ci, Cr, Cs, Dr, Ge, Gg, Gi, Hs, In, Sr, Ss, Ti, Tr The drive letter and path must be included in the file name.
Default: c:\vr\data

Symbol file name

Defines file name for the VrOne symbol file, which contains symbol and line font definitions. These are used to draw symbols and font lines when displaying a map. The drive letter and path must be included in the file name.
Default: c:\vr\data\symbols.sym

Color table for screen

Defines the file name for the color table, which cross-references VrOne Pen Numbers with colors. This is a text file and may be edited. The default Screen and Plotter color tables are the same but for Pen number 1, which is white for the screen and black for the plotter. The drive letter and path must be included in the file name.
Default: c:\vr\data\defaultscreen.ct

Color table for plotter

Defines the file name for the plotter table, which is used when drawing to a hard copy plotter from VrOne. The default Screen and Plotter color tables are the same but for Pen number 1, which is white for the screen and black for the plotter. The drive letter and path must be included in the file name.
Default: c:\vr\data\defaultplotter.ct

Layer Name file

Defines the file name for the layer name file, which cross-references VrOne layer numbers with a layer name. The layer name is used for display purposes in VrOne and is used for the default layer names in DXF Out. The Layer Name file is a text file and may be edited with any text editor. The drive letter and path must be included in the file name.
Default: c:\vr\data\default.lay

Pen Table file name

Defines the file name for the pen table, which allows assignment of pen numbers to layers and modes. These pen numbers represent graphic screen colors or pen numbers on a line plotter. Each of the four modes in every layer can be given a separate pen number. Pen table use is optional in VrOne. Each VrOne entity stores a pen number in its header.

The color of a pen number is defined in the Screen or Plotter Color Table and is an RGB value. The Pen Table file is a text file and may be edited with any text editor.

The following is an example of one line in the Pen Table file:

```
Layer   5041   2  3  4  5
```

where:

```
5041    - Layer number (1-10,001)
```

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```
2       - Pen number for lines (1-256)
3       - Pen number for splined lines (1-256)
4       - Pen number for symbols (1-256)
5       - Pen number for text (1-256)
```

The drive letter and path must be included in the file name.
NOTE: The VrOne application Change Pen (ChaPen) may be used in VrOne to change entity colors which will modify the Pen Table.
Default: c:\vr\data\default.pen

Alternate Pen Table file name

Defines the file name for the alternate pen table. If specified, all non-active workspaces will use this pen table. The active workspace uses the Pen Table file name.
Default: none

VrPoints Color file name

Defines the file name for the VrPoints color file, which contains parameters for LiDAR data point coloration. Vr Points are typically used to represent LiDAR data and require more options for coloring than the Vr Pen Table offers. The VrOne/VrTwo command Point Display (PoiDis or PO) sets these parameters.
Default: C:\vr\data\default.pco

VrPoints Display Filters file name

Defines the file name for the VrPoints Display Filter file, which contains parameters for LiDAR data point isolation filters. Vr Points are typically used to represent LiDAR data and there are filters available to isolate points for display and processing. The VrOne/VrTwo command Point Display (PoiDis or PO) sets these parameters.
Default: C:\vr\data\default.pdi

Use Pen Table?

If the Use Pen Table is checked, a Pen Table is used to set the entity colors. The Pen Table value overrides the value set in the Entity Header when an entity is saved.

If this parameter is not checked, each entity can have its own Pen Number and thus its own color. The VrOne application Change Pen (ChaPen) may be used to change entity colors even if Use Pen Table is not checked.
Default: Checked

Use locks?

Entities may be locked and are not editable. If this parameter is unchecked, all entities, including locked entities will be editable.
Default: Checked

Background color for windows

This parameter sets the background color for the VrOne graphics windows. A white background is useful to copy windows from VrOne and paste them into a program like Word for printing.
Default: Black

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Highlight pen number
When VrOne "locks on" to an entity and the entity is tentatively selected, the color of the entity's lines change to the Highlight Color. The Highlight Color is normally white but may be changed as per the user's preferences. This parameter is entered as a VrOne Pen Number with a range of 1-256.
Default: 1

Entity search radius
Defines the search radius in ground units for lines, symbols or text in VrOne and VrTwo.
Default: 100.0

Entity search dimension
Defines the number of axes to use when searching for an entity. For normal photogrammetry, where the ground Z axis increases toward the eye point (camera), the two-dimensional search should be used. For close range or oblique photography, where the ground surface is at an oblique angle to the model plane, the three-dimensional search should be used.
Default: 2D

Splined line chord length (in|mm)
Determines in inches or millimeters the spacing between points on a splined line. A spline is used in VrOne as a curved line display mode. The splined points are not stored in the VrOne file, but are generated when this line is displayed. The curved line generated by this algorithm passes through all the points on the line. See Vr Definitions for more information.
Default: 0.02

B Spline increment (1-10)
This spline may be used to generate contours from the Digital Modeling application in VrOne. The points on the splined line are stored in the VrOne file. The curved line generated by this algorithm is an approximation and may not pass through all the points on the line. The higher is B Spline Increment, the more points will be placed on the line. For example: If the B Spline Increment is set to 3 and the original line has 100 points, the B Splined line will contain 300 points. See Vr Definitions for more information.
Default: 3

Clip lines to model when roaming?
Specifies whether to clip lines to the model edge when roaming in stereo in VrTwo.
Default: Checked

Display line fonts at all zoom scales?

Default: Not checked

Wide line stroke distance (in|mm)

Determines the distance in inches or millimeters between wide lines provided "Draw Wide Lines" is set to "Multiple Lines".
Default: 0.005

Draw wide lines by
Some display drivers and plotting devices have the ability to draw wider lines. Options are "Graphics Driver if Able" and "Multiple Lines". If the graphics device cannot draw wide lines,

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this parameter may be set to Multiple Lines. When Multiple Lines are active, lines are drawn parallel to the original to make a wide line. The "Wide Line Stroke Distance" determines the offset between lines. When multiple lines are drawn the line corners are mitered.
Default: Multiple Lines

Line fill stroke distance (in|mm)
Not yet implemented.

Display smooth lines in stereo
Uses anti-aliasing to smooth out lines in stereo display mode. This removes the staircase effect from vector lines.

Minimum text size (in|mm)
When the camera zooms out, the display of text may become so small that it is unreadable. This parameter sets the minimum size in inches or millimeters for which text will be drawn. Text smaller than this will be drawn as a line. This results in faster drawing times.

Minimum symbol size (in|mm)
When the camera zooms out, symbols may become so small that they are unreadable. This parameter sets the minimum size in inches or millimeters for which symbols will be drawn. Symbols smaller that this will be drawn as a slash. This results in faster drawing times.

Line MBR offset (in|mm)
Defines in inches or millimeters the amount by which each line's minimum bounding rectangle is extended. To lock on to a line, the search point must be within the line's MBR. If the search point is slightly outside the MBR, the line is not found. Extending the line's MBR slightly makes locking easier.
Default: 0.1

Fast symbol Graphic Pointer
To draw the same symbol many times in VrTwo roaming, it is faster to use a predefined symbol (display mode) instead of a symbol from the Vr symbol library. The Fast symbol Graphic Pointer is the Vr Graphic Pointer number that is replaced by the predefined symbol (see below).

NOTE: This parameter is used in VrTwo roaming only. See also Fast symbol display mode and Fast symbol size below.

Fast symbol display mode
To draw the same symbol many times in VrTwo roaming, it is faster to use a predefined symbol (display mode) instead of a symbol from the Vr symbol library. The Fast symbol display mode is the predefined symbol that replaces the Fast symbol Graphic Pointer.

Fast symbol size
To draw the same symbol many times in VrTwo roaming, it is faster to use a predefined symbol (display mode) instead of a symbol from the Vr symbol library. The Fast symbol size specifies in ground units the size of the predefined symbol (Fast symbol display mode).
NOTE: This parameter is used in VrTwo roaming only. See also Fast symbol Graphic Pointer and Fast symbol display mode.

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Image Graphics

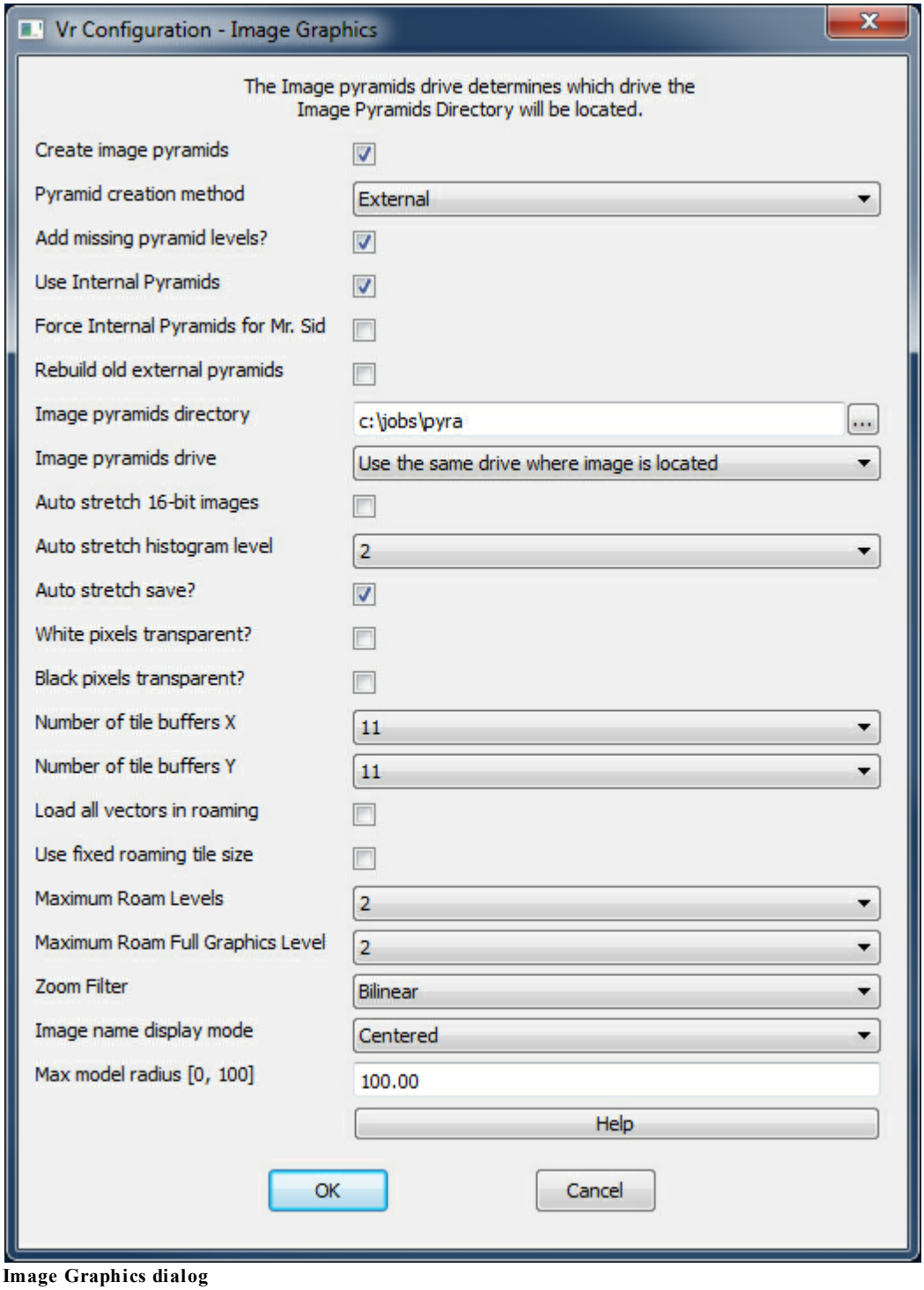

Image Graphics dialog

Image pyramids are used to display zoomed out images whose scales are greater than 1:1. Pyramids are similar to thumbnail images, but there are several images to help with multiple

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display scales. If the desired scale is between two image pyramids, the higher resolution image pyramid is used.

Image pyramids decrease display time by loading and displaying only the necessary pixels. These files are temporary and may be removed once a project is complete. If "Create Image Pyramids?" is enabled, image pyramids are created when an image without pyramids is opened.

Create image pyramids?

Specifies whether to create image pyramids when an image without them is opened. This parameter should always be checked.
Default: Checked

Pyramid creation method

External - Pyramid files are created externally in the pyramid directory.
Internal - Pyramid files are created internally within the main image.

Image pyramids directory

Defines the directory in which to place image pyramids. The drive letter and path must be included.
Default: C:\jobs\pyra

Image pyramids drive

Specifies the drive on which to place image pyramids. This is useful when using removable drives so the pyramids are not recreated when the drive is moved from one computer to another.
Options are:

- **Use drive specified in Image pyramids directory (above) –** Places pyramids in the directory specified by the Image Pyramids Directory field.
- **Use the same drive where the image is located** – Places pyramids in the directory specified by the Image Pyramids Directory field but defines drive by the location of the source image. For example, if the source image is `F:\jobs\images\image1.TIF` and the Image Pyramids Directory was `C:\jobs\pyra`, image pyramids would be stored in the `F:\jobs\pyra` directory.

Default: C:\jobs\pyra

Use internal pyramids

Specifies whether to use internal pyramids when they are found inside an image. Disabling "Use internal pyramids" ignores the internal pyramids when images are read.

Force internal pyramids for Mr. Sid

Specifies whether internal pyramids should always be used with Mr. Sid files regardless of the "Use internal pyramids" setting.

Rebuild old external pyramids

Specifies whether to rebuild external pyramid images if the date of the image is older than the image being opened.

Auto stretch 16-bit images?

Specifies whether to perform a histogram stretch (auto levels adjustment) on 16-bit images.

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Auto stretch histogram level

Defines image level to use to compute histogram for auto stretching. Higher levels compute faster.

Auto stretch save?

Specifies whether to save levels file after auto stretching.

White pixels transparent?

Black pixels transparent?

Specifies whether to display white/black pixels as transparent. Images often have black or white pixels surrounding the image. This is especially true in the case of rotated images. In most cases, these border pixels are the same color as the window background and are not noticed. These pixels become a problem when images overlap. White and/or black pixels can be displayed as transparent to reveal underlying images through the image border.

Number of tile buffers X / Number of tile buffers Y

Defines number of image tiles to keep in memory in the X and Y direction. This applies to stereo roaming mode only. During roaming, image data loads in multiple tiled sections from disk into a memory cache. The tiles always surround the current cursor location. Each tile is typically the size of the current graphics window.This parameter controls how much image data is buffered at any given time. Raising this number allows roaming a larger area before new image data has to be loaded from disk but also requires more memory, which is a limited resource. The recommend setting is between 3 and 7. The "buffer" command can be used to display a graphical representation of the current tile buffer positions in relation to the current stereo model.

Load all vectors in roaming?

This applies to stereo roaming mode only. If this is turned on, then all vectors are loaded at the current zoom level. Normally this is turned off, and only vectors for the current buffer area are loaded, which is controlled by the Number of tile buffers in the X and Y direction. Turning this on will make initial loading slower, but will allow roaming across the entire file area without pausing again to load vectors. If any problems with low memory are encountered when using this option then it will need to be turned off.

Use fixed roaming tile size?

Specifies whether the internal size of the image cache tiles should match the internal tile size of the images being displayed.This applies to stereo roaming mode only. This is normally disabled, causing the image cache tile size to match the current graphics window size. Disabling this parameter guarantees that the tile buffer will cover enough area to provide clean roaming. Enabling this may parameter may make roaming faster, but if the graphics window is too large then the image display may not always fill the graphics window.

Maximum Roam Levels

Defines the maximum number of zoom levels to keep in memory (quick access cache) in stereo roaming mode. When zooming through different image levels using Page Up/Page Down, the levels that are not currently displayed are kept in memory for fast display the next time they are accessed. If running low on memory (as displayed at the top of the buffer window, which can be

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turned on with the "buffer" command), set this to 2 or 3. This does not prevent zooming between levels, but causes levels to load a little slower than if they were in the cache.

Maximum Roam Full Graphics Level

Defines the maximum zoom level that should display full graphics in stereo roaming mode. Full graphics displays line fonts and line splining. This is useful for zooming out to view a larger portion of a project while roaming a file with heavy graphics. Turning full graphics off decreases memory usage and increases roaming speed.

NOTE: Level 1 is 1:1 zoom level, level 2 is 1:2 level, level 3 is 1:4 etc.

Zoom Filter

Determines zoom filter mode to use when zooming below 1:1 in stereo roaming graphics.

- **Nearest Neighbor** - Uses nearest neighbor resampling.
- **Bilinear** - Uses bilinear resampling will be used. This produces a smoother image display.

Image name display mode

Determines the method with which to display image names in the VrOne graphics window.

- **Centered** - Displays labels in the center of the images.
- **Upper Left** - Displays labels in the upper left corner of the images.

Max Model Radius

Dynamically limits the compilation area in on-the-fly models. The radius is the distance from the center to the corner of the image. The max is a maximum percentage of the radius that will be displayed. The range is from 0 to 100%. The default is 100%. A graphical description of the max radius percentage is given below.

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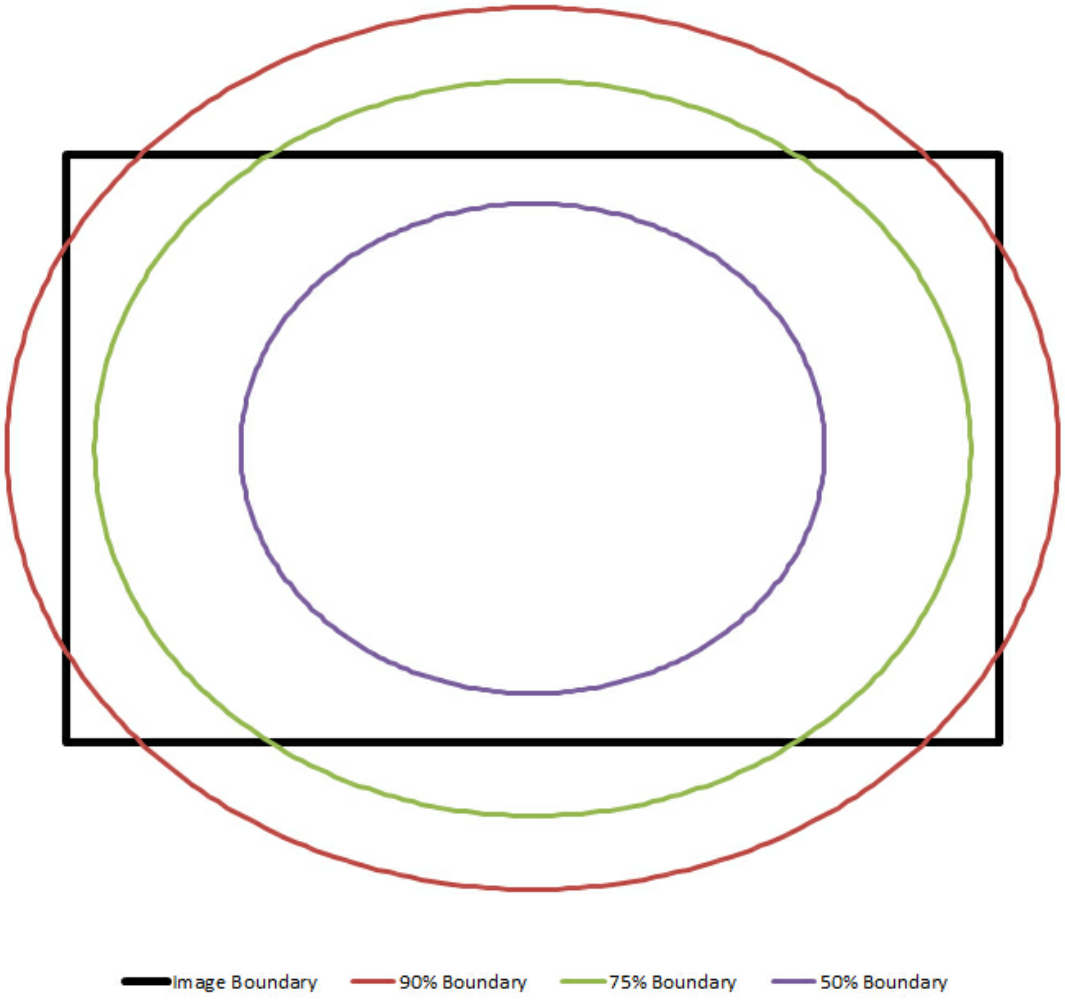

General Graphics

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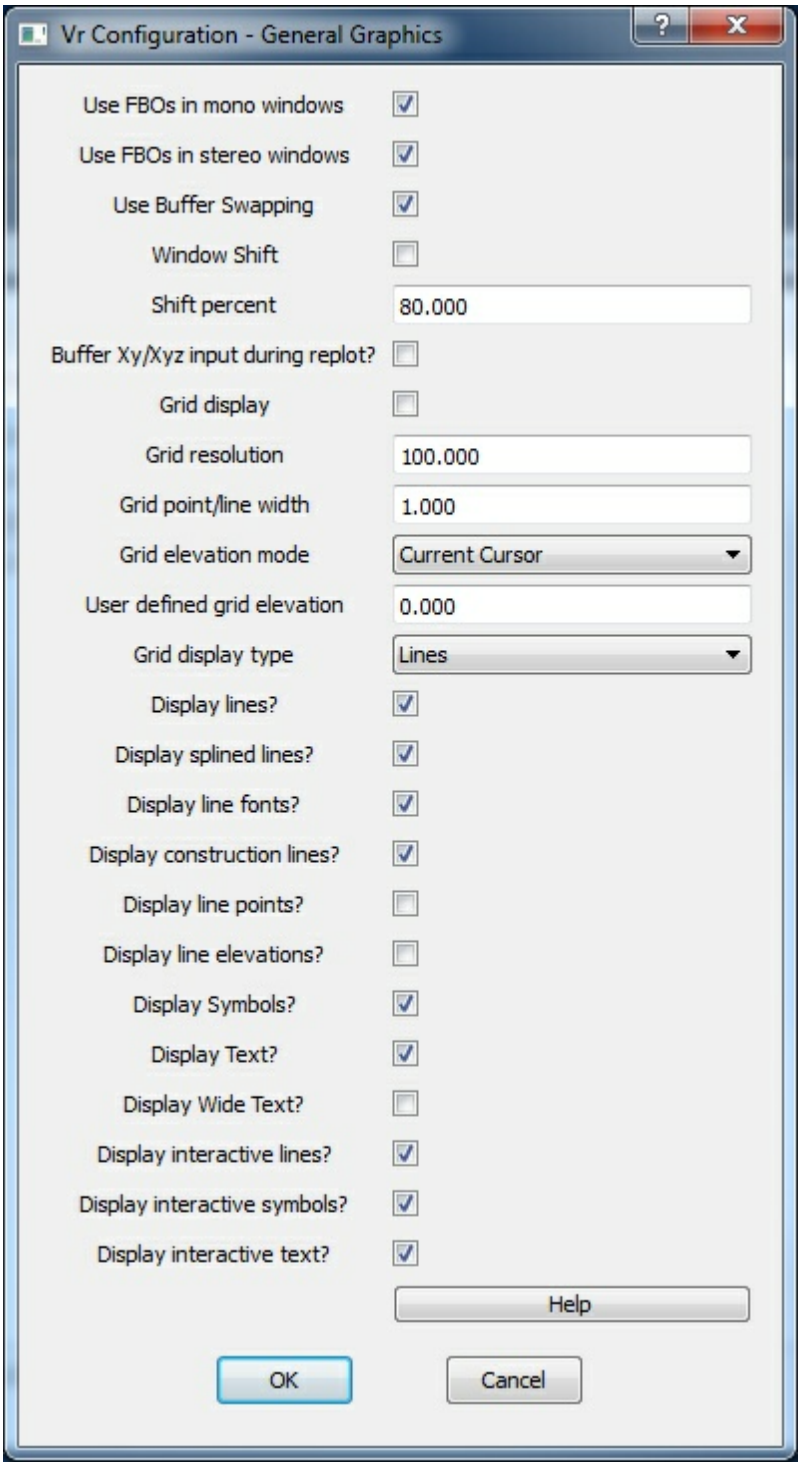

General Graphics dialog

Use FBOs in mono windows

Specifies whether to use Frame Buffer Objects in non-stereo (mono) windows. This is an advanced feature on newer graphics cards that provides cleaner and faster graphics and cursors throughout the Vr Mapping applications. The recommended setting is on, but this may be

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disregarded if your card has problems using FBOs. Graphics performance may be lessened slightly if this setting is turned off.
Default: On

Use FBOs in stereo windows

Specifies whether to use Frame Buffer Objects in stereo windows. This is an advanced feature on newer graphics cards that provides cleaner and faster graphics and cursors throughout the Vr Mapping applications. The recommended setting is on, but this may be disregarded if your card has problems using FBOs. Graphics performance may be lessened slightly if this setting is turned off.
Default: On

Use Buffer Swapping

Specifies whether to use Buffer Swapping in stereo roaming graphics windows. This is only used when "Use FBOs" is disabled. If "Use FBOs" is off and there are graphics problems, turning buffer swapping offmay fix the problem. Disabling Buffer Swapping may lower roaming speed.
Default: On

Window Shift

Specifies whether to shift the graphics window to center the cursor when the cursor nears the window's edge. This is normally enabled in VrOne for use with an analog or analytical stereo plotting instrument.
Default: Off

Shift percent

Sets the amount by which to shift the graphics window when the arrow keys are used to pan.
Default: 80%.

Buffer Xy/Xyz input during replot?

When "Window Shift" is enabled and the cursor reaches the edge of the window, the window is replotted with the cursor in the center. If there are a lot of graphics to replot, the computer may lose some reads from the input device. If this parameter is checked, input from the stereo plotter is buffered during the replot operation so no reads are lost. This is useful when using applications such as Insert Fly Line (InsFly).
Default: Off

Grid display

Specifies whether to display grid points on the graphics window.
Default: Off

Grid resolution

Defines, in ground units, the resolution at which display the grid points provided "Grid display" is enabled. If the scale of the screen would result in too many grid points displayed, a multiple of the grid resolution will be used but the Grid Resolution parameter will remain unchanged.
Default: 100

Display lines?

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Specifies whether to display lines in graphics window. If disabled, neither lines nor splined lines to be displayed.
Default:On

Display splined lines?

Specifies whether to display splined lines in the graphics window. If disabled, splined lines are still displayed, but only the original vertex points are shown. No splining is displayed between them.
Default: Off

Display line fonts?

Specifies whether to display line fonts on the graphics window. If disabled, fonted lines are shown as solid lines.
Default: Off

Display construction lines?

Specifies whether to display construction lines on the graphics window. If disabled, lines with their Construction Flag turned on are not displayed.
Default: On

Display line points?

Specifies whether to display a small cross on each line vertex. This can slow the graphics replotting.
Default: Off

Display line elevations?

Specifies whether to display elevation at each line vertex drawn. This can slow the graphics replotting.
Default: Off

Display symbols?

Specifies whether to display symbols on the graphics window.
Default: On

Display text?

Specifies whether to display text entities on the graphics window.
Default: On

Display interactive lines?

As lines are placed with applications such as Insert Line, the line is shown as a tentative line until it is saved. When points are being digitized, an interactive, tentative line is displayed from the last point digitized to the current cursor position. If this parameter is disabled, this interactive, tentative line segment is not displayed. Disabling is useful on a slower graphics device or one that cannot handle interactive graphics.
Default: On

Display interactive symbols?

When a symbol is being placed or edited, a tentative symbol is displayed. This tentative symbol

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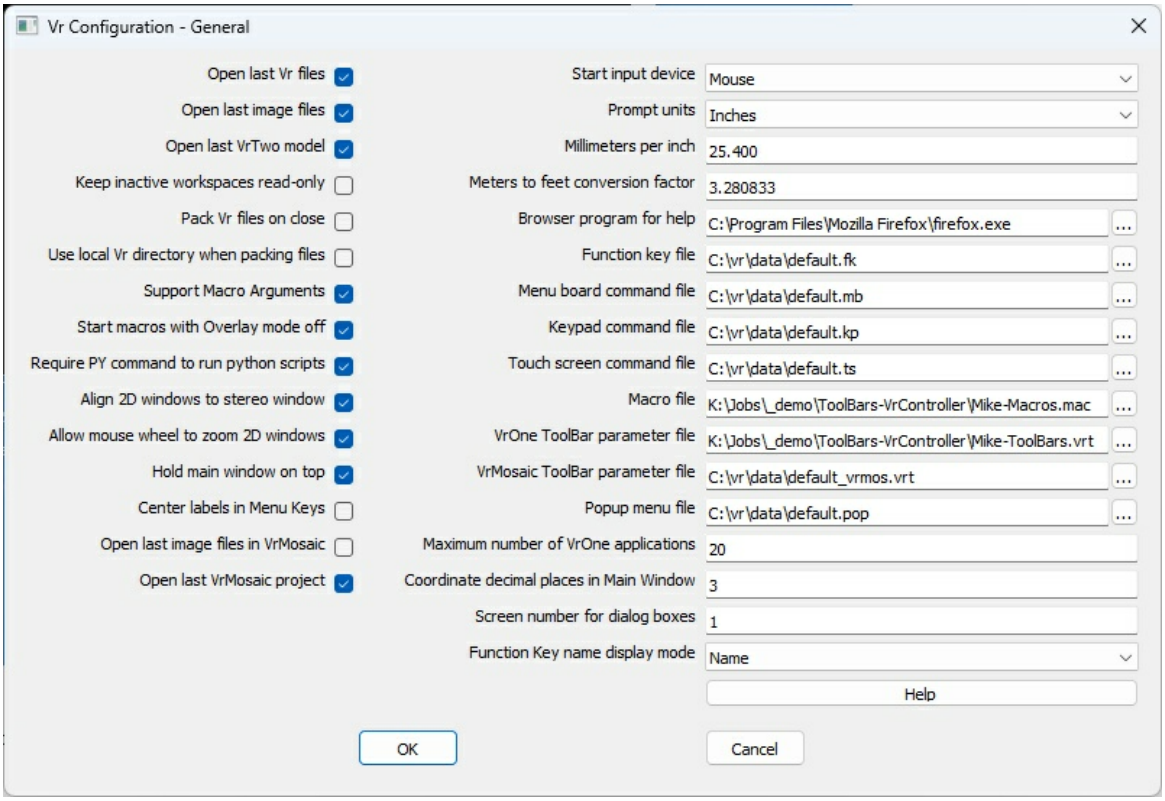
follows cursor movement during the operations. If this parameter is disabled, this tentative symbol is not displayed. This setting is useful on a slower graphics device or a one that cannot handle interactive graphics.
Default: On

Display interactive text?

When a text entity is being placed or edited, a tentative text entity is displayed. Tentative entities are normally white and may be moved, rotated and scaled without disturbing the existing graphics. If this parameter is disabled, tentative entities are not displayed. This setting is useful on a slower graphics device or one that cannot handle interactive graphics.
Default: On

General



General configuration dialog

Open last VR files

VrOne remembers the VrOne vector files that are open when it ends. Checking "Open Last VR Files" reopens these files when VrOne is started.
Default: On

Open last image files

VrOne remembers the VrOne image files that are open when it ends. Checking "Open Last Image Files" reopens these images when VrOne is started.
Default: On

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Open last VrTwo model
VrOne remembers the last VrTwo model open when it ends. Checking "Open Last VrTwo model" reopens the model when VrTwo is started.
Default: On

Keep inactive workspaces read-only?
Specifies whether to keep all open inactive workspaces (.vr files) in read-only mode. This allows other Vr applications to open those workspaces in read-write mode. If disabled, then all open workspaces are kept as read-write and other Vr applications can only open them in read-only mode.
Default: Off

Pack Vr files on close?
Packs Vr files before they are closed.
Default: Off

Use local Vr directory when packing files?
Checking this parameter improves packing speed when working with files over the network.
Default: Off

Support macro arguments
Specifies whether to replace any occurrence of %# (where # represents any number) with the corresponding argument typed in after the macro command. Arguments must be separated by spaces. If an argument contains spaces it must be surrounded by quotes. For example, if a macro named "D" contains the text "DRI %1", and the user types in "D 10", then the command "DRI 10" will be issued.
Default: On

Start macros with Overlay mode off
Specifies whether to run macros with overlay mode off. This ensures that no application will start before the previous one is finished when running Macro commands.
Default: On

Require PY command to run python scripts
Specifies whether to require the PY command to run python scripts. For example, to run a python script named fixlines.py, the command “py fixlines” would be necessary. If this is not on, then the name of the script may be typed to run it, assuming the script name does not match any other built-in command, function key, or macro name. For example, to run fixlines.py, “fixlines” could be entered.
Default: On

Align 2D windows to stereo window
Specifies whether to automatically align 2D windows to match Z rotation of the stereo window. This applies to static and roaming stereo modes.
Default: On

Allow mouse wheel to zoom 2D windows
Allows the mouse wheel to zoom 2D windows. The window is zoomed about the current cursor position. Pressing the SHIFT key while rotating the mouse wheel will center the window at the

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current cursor location. This option is available with VrOne 2D windows only.
Default: Off

Center labels in Menu Keys
Determines whether to center the button labels in the Menu Keys dialog boxes used by VrOne/ VrTwo interactive applications.
Default: On

Open last image files in VrMosaic
VrMosaic remembers the image files that are open when it ends. Checking this option reopens these images when VrMosaic is started.
Default: On

Open last VrMosaic project
Specifies whether to load the last project upon starting VrMosaic.
Default: On

Start input device
Specifies the input device to be used when VrOne first opens. When VrOne starts, it may initialize and start several input devices, but one must be the active device. This parameter is normally used when connected to a stereoplotter. Options for the Start Input Device are:
- XY digitizer
- XYZ stereoplotter
- Mouse

If a device is chosen that is not configured, the Mouse is used as the Start Input Device.
Default: Mouse

Prompt units
Specifies the prompt scale units (millimeters or inches). Each VrOne vector file contains a Target Scale which determines its plotting scale and is used to scale symbols and line fonts. Many size parameters in VrOne are entered in inches or millimeters and are converted to ground units at display time.
Default: Inches

Millimeters per inch
As there are several conversion constants to convert millimeters to inches, VrOne allows this constant to be defined by the user.
Default: 25.4

Meters to feet conversion factor
As there are several conversion constants to convert meters to feet, VrOne allows this constant to be defined by the user.
Default: 3.280833

Browser program for help
Sets the browser to user to view the VrOne help system. The help system in VrOne is based on standard HTML (Hypertext Markup Language).
Default: C:\Program Files\Internet Explorer\iexplore.exe

Function key file

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Defines the location of the VrOne Function Key (.fk) file. This file contains VrOne Function keys. Edit Function Key (EdiFun) may be used to edit this file from within VrOne.
Default: C:\vr\data\default.fk

Menu board command file

Defines the location of the VrOne Menu Board Command file. This file contains button assignments for the Menu Board. It is a text file and may be edited. Each button may contain VrOne key-ins, Macros, or Function Keys.
Default: C:\vr\data\default.mb

Keypad command file

This parameter defines the location of the VrOne Keypad Command file. This file contains button assignments for a keypad such as the Keyport 252. It is a text file and may be edited. Each button may contain VrOne key-ins, Macros, or Function Keys.
Default: C:\vr\data\default.kp

Touch screen command file

Defines the location of the Vr Touchscreen command file. This file contains button assignments for the Vr 567 button LCD touch pad. It is a text file and may be edited. It is recommended that the editor provided with the touchscreen be used and that the text file not be edited directly.
Default: C:\vr\data\default.ts

Macro file

Defines the location of the VrOne Macro file. Macros may contain key-ins, other Macros, and/or Function keys. It is a text file and may be edited. It is recommended that the Edit Macro (EdiMac) command be used and with VrOne for editing and that the text file not be edited directly.
Default: C:\vr\data\default.mac

VrOne ToolBar parameter file

Defines the location of the ToolBar parameter file used in VrOne, VrTwo and VrLite. The VrOne ToolBar parameter file name should have a .vrt postfix.
Default: C:\vr\hostdir\vrone.vrt

VrMosaic ToolBar parameter file

Defines the location of the ToolBar parameter file used in VrMosaic. The VrMosaic ToolBar parameter file name should have a .vrt postfix.
Default: C:\vr\hostdir\vrmosaic.vrt

Popup menu file

Defines the location oft he VrLite popup menu file. This file contains the definitions of all popup menu and is edited by the EdiPop command in VrLite.

Maximum number of VrOne applications

VrOne supports Application Overlaying, where multiple mapping applications may be active at the same time. The application at the top is the active application. This parameter sets the maximum number of applications that can be active at a time up to a maximum of 20. When the application stack is full and another application is started, the application at the bottom of the stack is terminated. When an application is terminated for any reason, current data is saved.

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Default: 20

Coordinate decimal placed in Main Window

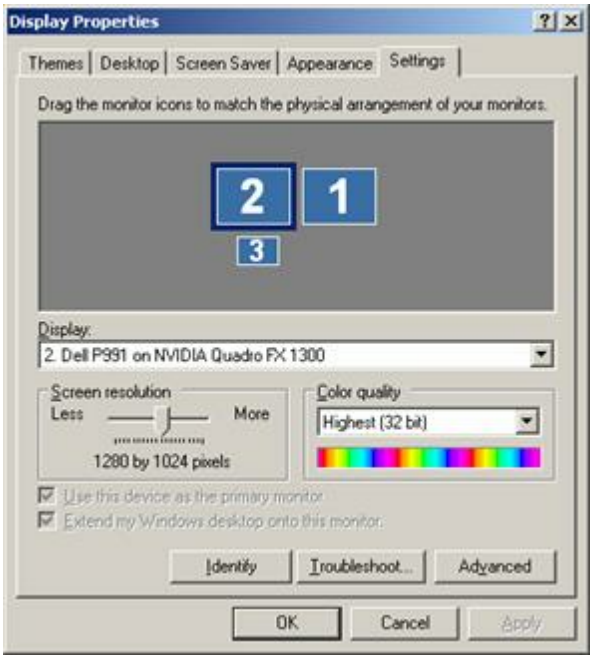
Sets the number of display positions to the right of the decimal point for the XYZ coordinate displayed in the VrOne Main Window. The VrOne data base stores its XYZ positions as double-precision numbers with an accuracy of approximately 14 decimal digits. Setting this parameter does not change the way these numbers are stored in the data base; it simply determines how they are displayed.
Default: 3

Screen number for dialog boxes

There are certain dialog boxes in VrOne that appear in the middle of the screen and do not remember their last position. These are normally temporary information or data entry dialog boxes. Since it is possible to configure Windows to run more than one monitor screen, this parameter sets the screen number on which to display these dialog boxes. The current screen number can be found by Right Clicking on the desktop and choosing Properties then pressing the Settings tab.

Function Key name display mode

Option to display the Function Key name in the Vr Main Window. The options are display the Function Key name or display the Function Key number or both.



Display Properties dialog from Windows XP

XY Digitizer

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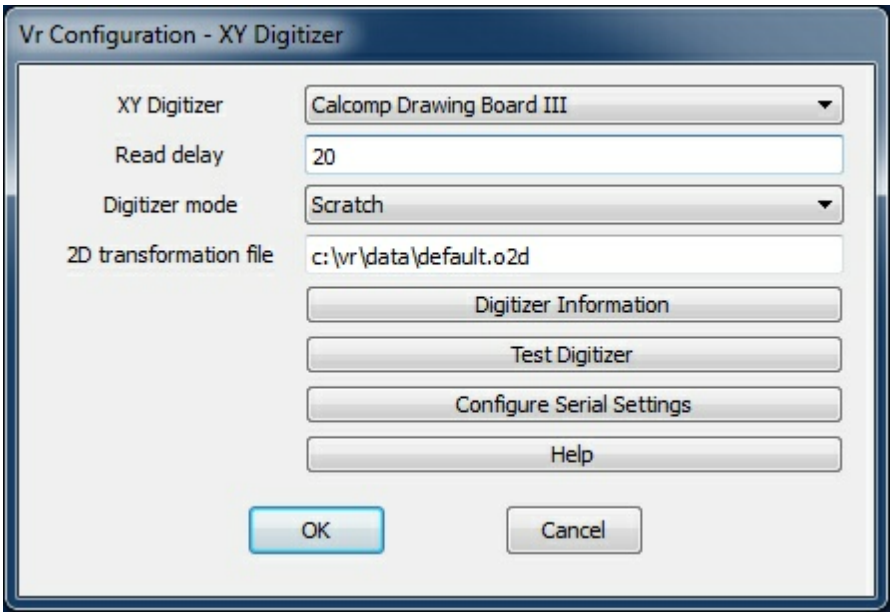

XY Digitizer dialog

XY digitizers are always connected to the VrOne application computer via RS-232 (Serial) interface. Digitizers allow input so VrOne can set up existing map sheets for digitizing. VrOne can also be configured for input to behave similarly to a mouse when in the graphics window.

An advantage to using a digitizer rather than a mouse for editing is function selection from the 12 button keypad on the digitizer puck. This speeds editing by keeping operator typing on the system keyboard to a minimum. Production is also helped by the use of the Vr Menu Board on the digitizing surface allowing for faster menu selections along with Menu Board definitions to suit production needs.

With some digitizer configurations, raw button presses can be cross-referenced to VrOne button presses. For cases where this is supported, an ASCII file with the .key extension is stored in the \vr\hostdir directory. The filename is the device name plus the .key file extension. For example, the key cross-reference file for the Hitachi Puma Plus is **puma.key**. VrOne commands cannot be mapped to the puck buttons. Only VrOne keys 0-9, *, and # are allowed.

XY Digitizer

Selects an XY digitizer as input to VrOne. Various types of XY digitizers may be chosen.
Default: No XY digitizer

Read delay

On slower computers, the input from the XY digitizer may be too fast for the application. The Read Delay, entered in milliseconds, slows input from of the device by placing a delay between each device read.
Default: 0

Digitizer mode

Specifies the adjustment to perform on raw input from an XY digitizer.

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- **Scratch** – Defines a 10”x10” area of the digitizer that is mapped to the graphics screen. Square's origin is the lower left corner of the graphics window. The XY digitizer movements are similar to a mouse, except the cursor has no effect if it is moved from the graphics window.
- **Least Squares** – Transforms input coordinates to the last orientated map sheet ground coordinates.The Vr program Orient 2D (ori2d) can set up an existing map sheet on an XY digitizer and collect 2D data from the map sheet. This is useful for digitizing existing maps into current databases or for digitizing flight lines from USGS Quadrangle sheets.

Default: Scratch

2D transformation file

When the Digitizer Mode is set to Least Squares, VrOne looks for a 2D transformation file to convert raw digitizer coordinates to ground coordinates. The Vr program Orient 2D writes this file upon completion of a map sheet orientation. This parameter defines the 2D transformation file name. If multiple map sheets are set up on the same digitizer, this parameter may be changed to match the desired map sheet input.
Default: C:\vr\data\default.o2d

Digitizer Information

Displays the help page with configuration information for supported digitizers.

Test Digitizer

Tests a digitizer to ensure that it is operational. The test may be done after configuration is complete. Pressing this button displays a text window in which raw coordinates are displayed along with digitizer puck button presses.

Configure Serial Settings

All digitizers supported by VrOne use the RS-232 (serial) interface. It may be necessary to change the settings from the defaults if using a non-standard configuration. This may be the case if using the same digitizer for VrOne and another CAD program on the same computer. The most common change is in the COM port. The default COM1 port may be used by another device.

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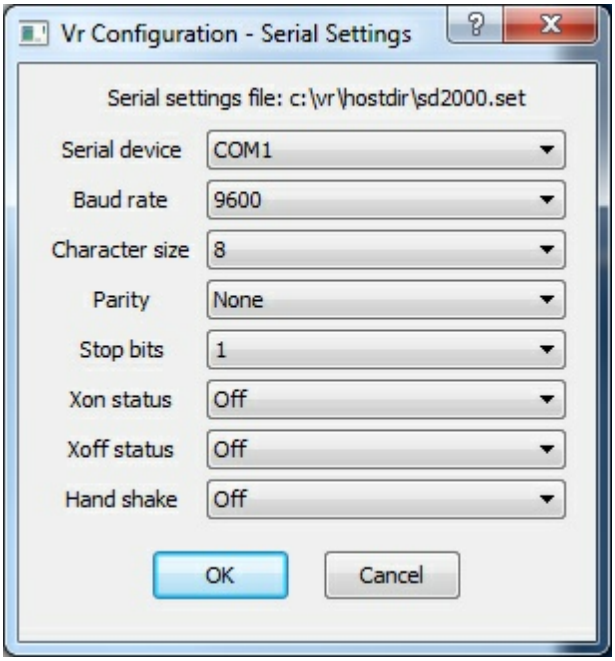

Serial (RS-232) Settings dialog

- The Serial device may be set from COM1 to COM9.
- The Baud rate, Character size, Parity and Stop bits are standard serial settings. The digitizer documentation should be consulted for more information about these settings.
- The Xon Status and Xoff status control software flow control between the digitizer and the computer and are normally Off.
- The Hand Shake parameter ensures the input driver performs a bi-directional communication with the input device each read. This parameter is always set to "Off" for XY digitizers.

XYZ Digitizer

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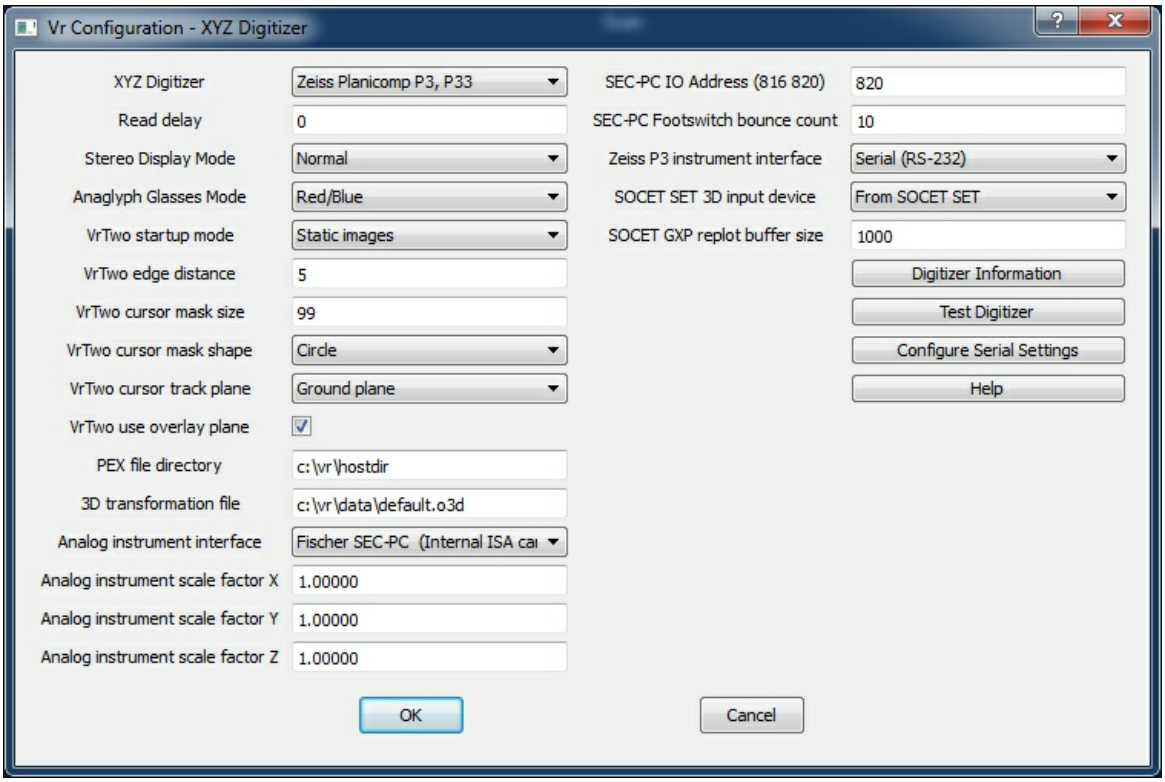

XYZ Digitizer dialog

XYZ digitizers are analog stereo plotters (like the Wild B8), analytical stereo plotters (like the Zeiss P3), and 3D softcopy systems (like VrTwo the SOCET SET).

With some of digitizer configurations, raw button presses can be cross-referenced with VrOne button presses. For configurations where this is supported, an ASCII file with a .key extension is stored in the \vr\hostdir directory. The filename is the device name plus the .key file extension. For example, the key cross-reference file for the Zeiss P1/P2/P3 stereo plotter is **p3.key**.

XY Digitizer

Sets an XYZ 3D digitizer as input to VrOne. Various types of XYZ digitizers may be chosen.
Default: No XYZ digitizer

Read delay

On slower computers the input from the Xyz digitizer may be too fast for the application. The Read Delay parameter slows input from the device by placing a delay between each device read. This parameter is entered in milliseconds .
Default: 0

Stereo display mode

Sets the display mode for stereo viewing. "Normal mode" uses the graphics card stereo mode (such as shuttered glasses). "Anaglygh mode" uses different colors for the left and right images.

Default: Normal

Anaglyph Glasses Mode

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Controls the colors used for the left and right images provided "Anaglyph mode" is selected as the Stereo display mode. Select the option that matches the type of anaglyph glasses being used. The following options are available:

- **Red/Blue** - Red left eye, blue right eye
- **Red/Green** - Red left eye, green right eye
- **Red/Cyan** - Red left eye, cyan right eye
- **Blue/Red** - Blue left eye, red right eye
- **Green/Red** - Green left eye, red right eye
- **Cyan/Red** - Cyan left eye, red right eye

Default: Red/Blue

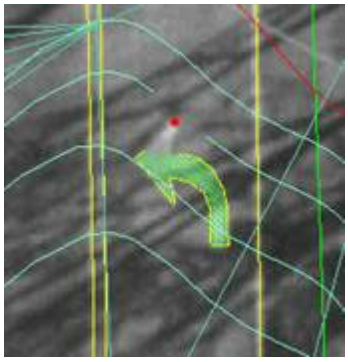
VrTwo startup mode

Sets the stereo image viewing mode ("static" or "roaming"). In "Static mode", the images do not move but the cursor does. In "Roaming mode", images move and the cursor stays in the center of the viewing window. Roaming mode is similar to viewing analytical stereo plotting instruments.
Default: Static images

VrTwo edge distance

When VrTwo is in static image mode and the cursor approaches the edge of the graphics window, the stereo image re-centers, placing the cursor in the middle of the window. The Edge Distance parameter sets in pixels the distance from the edge of the window from which the images will be re-centered.
Default: 5 pixels

VrTwo cursor mask size



Cursor Masking example

VrTwo displays two images and the line, symbol and text vectors which make up the stereo softcopy display. When there is a large amount of vector data, the stereo image may become difficult to see. VrTwo offers a Cursor Mask which blanks out the vectors around the cursor so the operator can see the ground clearly. The Cursor Mask may be turned on and off by pressing the Delete key on the system keyboard.

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In VrTwo roaming mode, the cursor mask and a magnifier can be toggled. In this mode, vectors are blanked around the cursor and the image is magnified for better pointing ability. In all modes tentative lines that are being placed or edited will display through the cursor mask.
This parameter defines the size of the cursor mask in pixels and has a range of 1-99.
Default: 50

VrTwo cursor mask shape

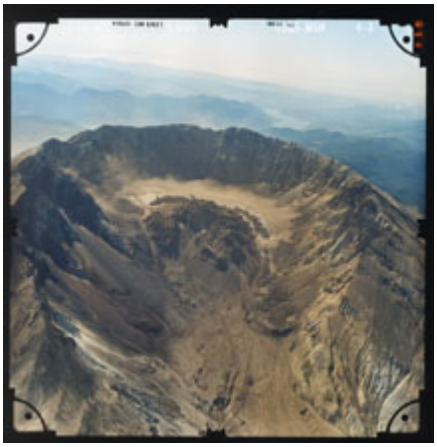
The VrTwo cursor mask may be displayed as a circle or a square when in roaming mode.
Default: Circle

VrTwo cursor track plane

VrTwo has the ability to track the 3D cursor along one of two planes. The View or Model Plane is formed when a stereo pair are formed. The Ground Plane is formed by the ground control system.

For standard aerial photography, where the image plane is almost parallel to the ground, the Ground Plane should always be used. In the case of oblique aerial photography or oblique close range photography, the View Plane can be used for predictable cursor movements. In both modes, the correct XYZ coordinate is always computed for the cursor location. In View Plane, the Z coordinate will change when the cursor is moved from the 3D input device.
Default: Ground Plane

Following is an example of an aerial oblique photo of Mount St. Helens where tracking the View Plane would be useful.



Mount St. Helens, Washington State

VrTwo user overlay plane

If checked, the overlay plane is used in VrTwo stereo to display the cursor and temporary graphics. This parameter typically is the same as the overlay plane setting for the graphics card.

Default: checked

PEX file directory

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When VrTwo is interfaced to a Zeiss P1/P2/P3 analytical instrument or an instrument that emulates the Zeiss stereo plotter format, a PEX file is required. The PEX file provides information for the transformation from model to ground and other model information. Orientation programs such as PCAP, AP32 and OriP3 writes this file after model orientation. This parameter sets the directory in which VrOne is to look for a PEX file. VrOne will open the first occurrence of a file with the .PEX extension. Consult orientation program documentation to determine were the program is placing this file.
Default: c:\vr\hostdir

3D transformation file

When VrTwo is interfaced to an analog instrument a 3D Transformation File is needed to convert raw encoder values to ground coordinates. The analog instrument model orientation program Orient 3D (ori3d.exe) will write this file after model orientation. This parameter sets the file name for VrOne to open.
Default: c:\vr\data\default.o3d

Analog instrument interface

When VrTwo is interfaced to an analog instrument there are three interfaces that are supported:

- **Fischer SEC-PC (Internal ISA card)** – This is the original 3-axis stereo plotter card and is not as widely used because of the lack of an ISA slot in newer computers.
- **Fischer SEC-232 (External interface)** – This interface is an external device that connects to the instrument and connects to the application computer via RS-232 (Serial). It was commonly used when interfacing a UNIX computer to an analog stereo plotter.
- **Fischer SEC-PCI (Internal PCI card)** – This is the latest card available to interface to an analog instrument and support the widely used PCI interface that is available on most computers.

Default: Fischer SEC-PC

More information about these interface products may be found on the Fischer Computer Systems web page at http://www.secpc.com/.

Analog instrument scale factor X / Y / Z

When VrTwo is interfaced to an analog instrument, the instrument may have encoders that output different amounts of counts per revolution. The least squares adjustment for analog instruments requires a square input where all three encoders output the same amount of counts. The amount of counts can be measured from the analog instrument using the 3D Orientation program (or3d). A ruler can be placed on the instrument model motion to measure the axis movement. Normally encoders of different counts will output a significant difference in counts so the measurement does not need to be exact. For example one encoder may output 1000 counts while another may output 5000 counts for the same distance traveled.
The scale factors must be set so that all three axis output the same amount of counts for the same distance traveled. Incorrect settings of the scale factors will make it impossible to set an

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accurate model.
Default: 1.0

SEC-PC IO Address (816 820)

When using a Fischer SEC-PC interface card to connect to an analog instrument the IO address of the card must be entered. Valid entries are 816 and 820 (decimal). This setting is set on the interface card and the Fisher documentation should be consulted to determine the IO address of the card your using.
Default: 820

SEC-PC Footswitch bounce count

The SEC-PC analog instrument interface comes with a two-pedal footswitch. The hardware does not offer "de-bouncing" so its possible to get several readings from a footswitch press as the switch bounces between on and off. This parameter defines the number of footswitch down readings that must be obtained before it is considered a valid press.
Default: 10

Zeiss P3 instrument interface

The Zeiss P1/P2/P3 analytical stereo plotter instruments support two interface types; RS-232 (Serial) and GPIB (General Purpose Interface Bus). If the GPIB interface is selected then a card must be installed in the application computer. The GPIB interface that VrOne uses is the CEC-488 card from Capitol Equipment Corp (http://www.cec488.com/).
Default: Serial (RS-232)

SOCET SET 3D input device

When VrOne is interfaced to SOCET SET, the 3D input device may be configured and input from SOCET SET or from VrOne. Normally this device is configured on SOCET SET. Configuring it on VrOne will result in a slower read rate as more data is transmitted between VrOne and SOCET SET.
Default: From SOCET SET

SOCET GXP replot buffer size

When VrOne is interfaced to SOCET GXP, this parameter defines the buffer size when plotting all graphics from VrOne.
Default: 1000

Digitizer Information

Pressing this button will display the help page for the supported digitizers. This information will help in the configuration of stereo plotters.

Test Digitizer

After configuring a digitizer, it may be tested here to make sure it is operational before entering VrTwo. Pressing this button displays a text window in which raw coordinates are displayed along with raw stereo plotter button presses.
If testing an analog stereo plotter, a Preset Analog button is available in the text window to allow the initialization of the stereo plotter encoders to preset values. If testing an analytical stereo plotter, a Drive Analytical button is available in the text window which will drive the instrument to the stereo plotter location at the time the test was started. This is to test the drive functionality of

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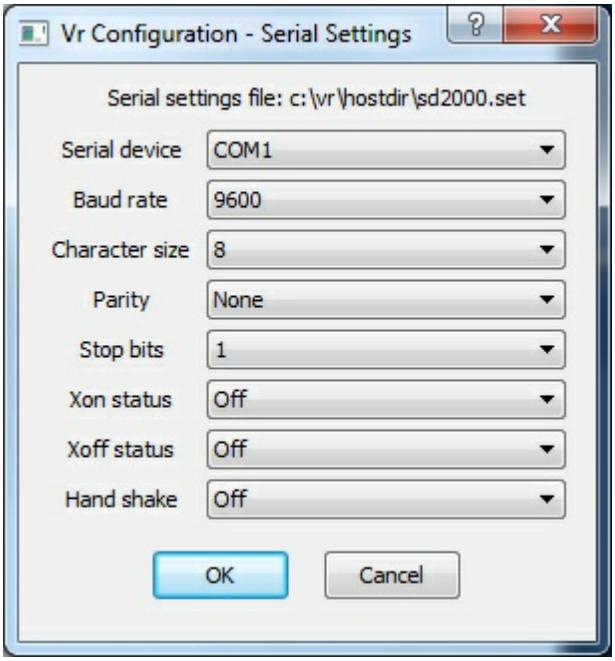
the instrument.

Configure Serial Settings

Many of the analytical instruments that are supported by VrOne use the RS-232 (serial) interface. When a digitizer is selected the most commonly used serial settings are automatically selected. However it may be necessary to change these settings if a non-standard configuration is being used. This may be true if the orientation software is using different serial settings than the VrOne defaults. The most common change is in the COM port. The default COM1 port may be used by another device.



Serial (RS-232) Settings dialog

- The Serial device may be set from COM1 to COM9.
- The Baud rate, Character size, Parity and Stop bits are standard serial settings and the digitizer documentation should be consulted for more information about these settings.
- The Xon Status and Xoff status control software flow control between the digitizer and the computer and are normally Off.
- The Hand Shake parameter makes sure the input driver performs a bi-directional communication with the input device each read. This parameter being set to Yes is needed with some SD2000 formatted interfaces and is required when driving the instrument.

Default: Determined by the Xy Digitizer

Mouse Buttons

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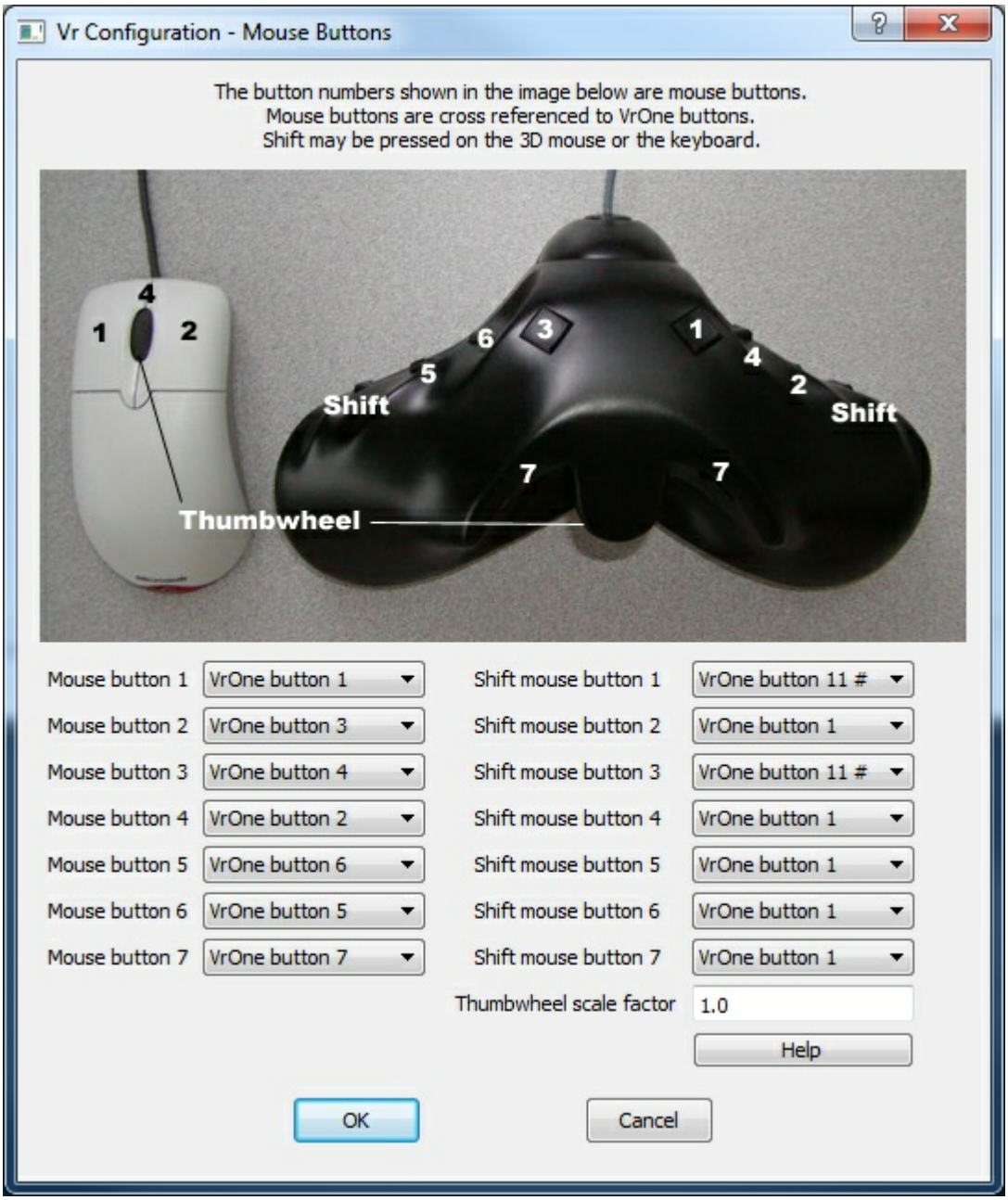

Mouse Buttons dialog

Mouse buttons on the system mouse and the Stealth 3D mouse may be cross-referenced to any of the twelve VrOne buttons (0 through 9, * and #). The original Stealth mouse can be configured with this dialog. This is different from the Stealth Z-Mouse. See the Hardware Configurations help page for more information about the Stealth mice.

VrTwo Cursor

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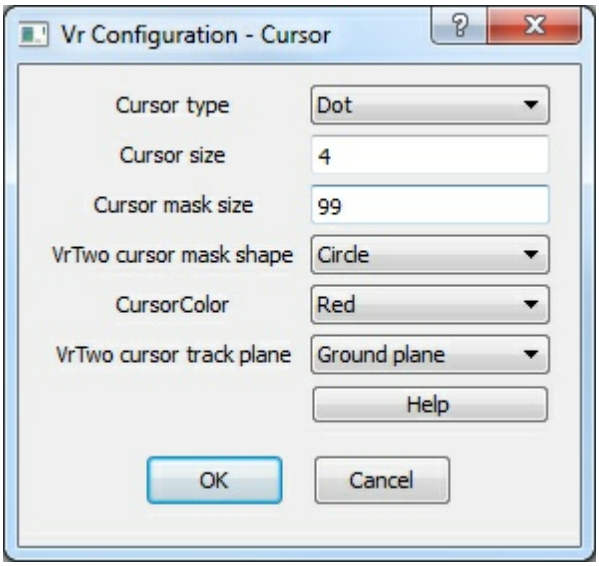


VrTwo Cursor settings dialog

This dialog configures the VrTwo cursor.

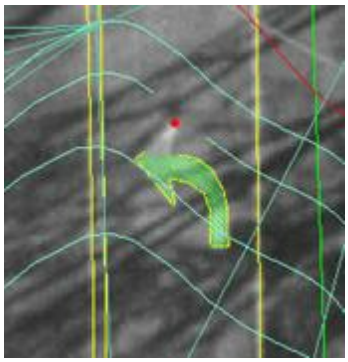
Cursor type

This parameter sets the cursor type to Dot or Cross.
Default: Cross

Cursor size

This parameter sets the size of the cursor and is entered as pixels. Fifteen pixels is an adequate size for the cross cursor and four pixels is good for the dot cursor.
Default: 15

VrTwo cursor mask size



VrTwo Cursor Mask example

VrTwo displays two images to and line, symbol and text vectors which make up the stereo softcopy display. At times when there is a large amount of vector data the stereo image may become difficult to see. VrTwo offers a Cursor Mask which blanks out the vectors around the cursor so the operator can see the ground clearly. The Cursor Mask may be turned on and off by pressing the Delete key on the system keyboard.

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In VrTwo roaming mode, it is possible to toggle the cursor mask and a magnifier. In this mode, vectors are blanked around the cursor and the image is magnified for better pointing ability. In all modes, tentative lines are displayed through the cursor mask.
This parameter defines the size of the cursor mask in pixels and has a range of 1-99.
Default: 50

VrTwo cursor mask shape

Sets display of the VrTwo cursor mask shape (circle or square) in roaming mode.
Default: Circle

Cursor color

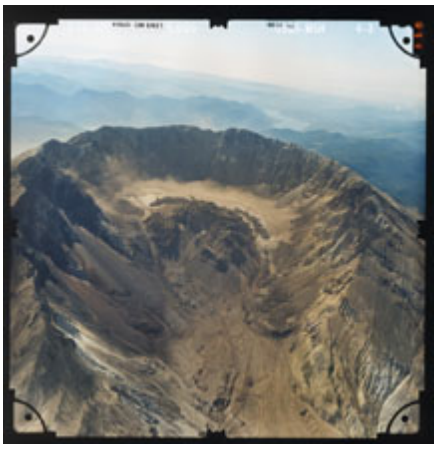
Sets cursor color. Options are white, black, red, green, blue and yellow.
Default: White

VrTwo cursor track plane

VrTwo has the ability to track the 3D cursor along one of two planes: the view (or model) plane and the ground plane. The view plane is formed when a stereo pair is. The Ground Plane is formed by the ground control system.

For standard aerial photography, where the image plane is almost parallel to the ground, the Ground Plane should always be used. In oblique aerial photography or oblique close range photography, the View Plane may be used for predictable cursor movements. In both modes, the correct XYZ coordinate is always computed for the cursor location. In View Plane, the Z coordinate will change when the cursor is moved from the 3D input device.
Default: Ground Plane

The following is an example of an aerial oblique photo of Mount St. Helens where tracking the View Plane would be useful.



Mount St. Helens, Washington State

VrOne/VrTwo Start Windows

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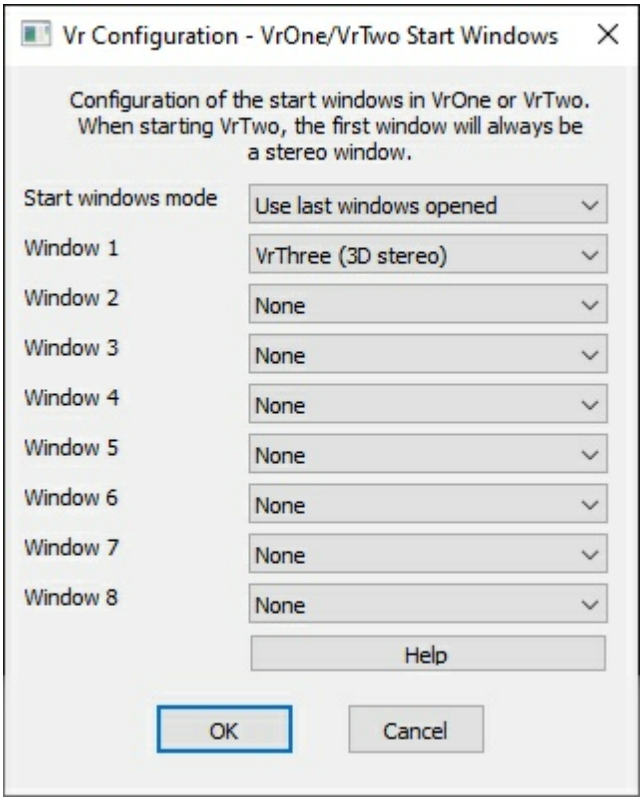

VrOne/VrTwo Start Windows dialog

The graphics windows that created when VrOne or VrTwo start may be configured with VrOne/VrTwo Start Windows. Up to eight graphics windows may be created. 2D VrThree (2D window), 3D VrThree (3D stereo) and 2.5D VrThree (psuedo-3D) windows are supported.

Start windows mode
Defines the parameters to use upon creating graphics windows. "Use last windows opened" copies the parameters from the last open windows. "Use window parameters" follows the parameters listed beside "Window 1-8".
NOTE: When VrTwo starts, the 3D softcopy stereo graphics window will always be opened as Window 1.

Window 1 - Window 8
Defines parameters for new graphics windows if the "Start windows mode" is set to "Use parameters below". Graphic windows options are "VrOne 2D Window", "3D VrThree (3D stereo) or 2.5D "VrThree (pseudo 3D)".

VrTwo 3D Input Device

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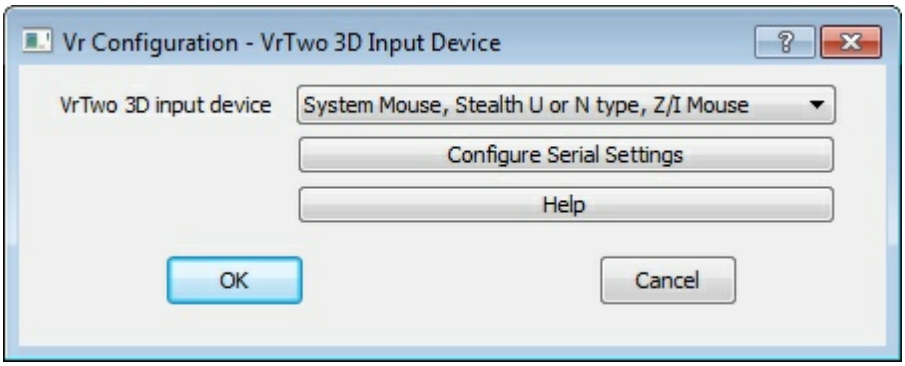

VrTwo 3D Input Device dialog

VrTwo 3D input device

VrTwo supports several types of input devices. These devices are typically hand held controllers that supply the XYZ movement of the floating mark in VrTwo. They also support multiple buttons for digitizing points controlling VrTwo applications. VrTwo can also be operated with the system mouse, in which case the Z is controlled by the wheel. "System Mouse, Stealth U or N type, Z/I Mouse" should be selected.

Options for the 3D Input Type are: System Mouse or Stealth U or N type Mouse, Z/I Mouse, DAT/EM Handwheels, TopoMouse from LH Systems, Stealth Z-Mouse, Stealth Handwheels and Immersion/Stealth E-Mouse
Default: System Mouse, Stealth U or N type, Z/I Mouse

Configure Serial Settings

Many of the 3D input devices that are supported by VrOne use the RS-232 (serial) interface. It may be necessary to change the serial settings from the defaults if you are using a non-standard configuration. The most common change is the COM port. The default COM1 port may be used by another device.

- The Serial device may be set from COM1 to COM9.
- The Baud rate, Character size, Parity and Stop bits are standard serial setting. See the 3D input device documentation for more information.
- The Xon and Xoff statuses control software flow between the digitizer and the computer and are normally Off.
- The Hand Shake parameter ensures the input driver performs a bi-directional communication with the input device each read. This parameter is not used for any 3D input device.

Default: Determined by the current 3D input

VrTwo Model Manager

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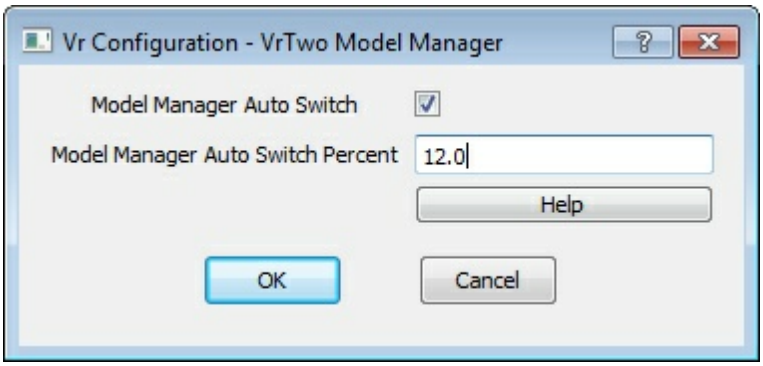


VrTwo Model Manager dialog

Model Manager Auto Switch

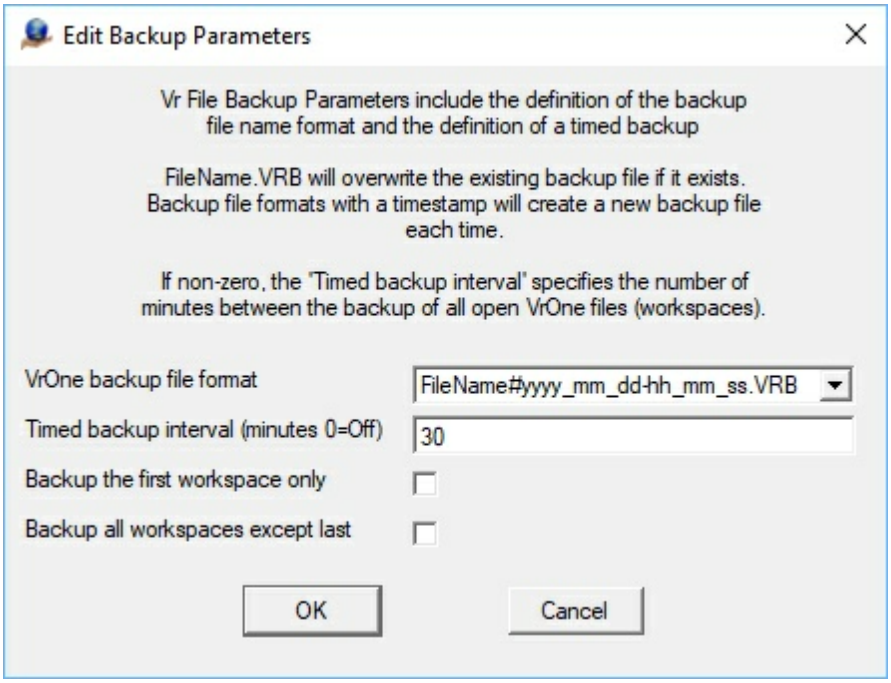
If this is on, VrTwo automatically switches between models when the Model Manager window is open. Model switching occurs when mouse approaches the edge of the current model. How close the mouse has to be to the edge is controlled by the Model Manager Auto Switch Percent setting. This setting can be controlled with the AutSwi 0 or AutSwi 1 key-in commands in VrTwo.

Model Manager Auto Switch Percent

Controls the size of the auto switch margin around the model boundary. A smaller percent requires the cursor to be closer to the model edge before switching to the adjoining model. This setting can be controlled with the AutSwi key-in command in VrTwo.

See VrTwo Model Manager for more information.

Backup Parameters



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The Edit Backup Parameters dialog

VrOne backup file format - Three backup file name formats are available as follows.

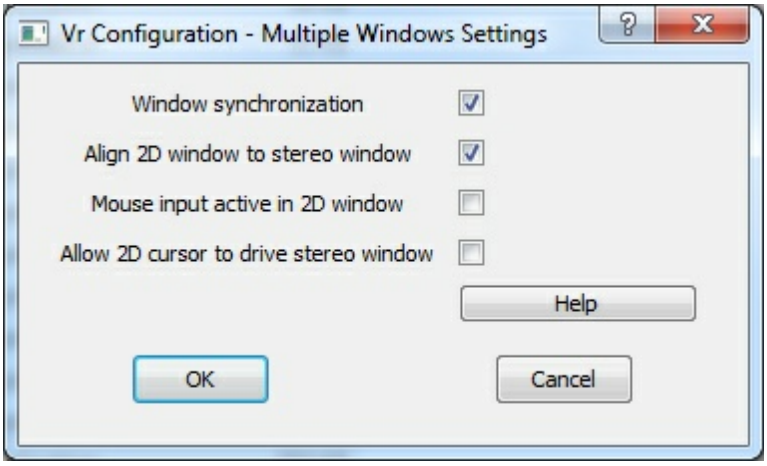
- **FileName.VRB** - The backup file name is the same as the original file except the file extension is .VRB instead of .VR. This option will overwrite the same backup file each time. Example: Original file name: m1703.vr - Backup file name: m1703.VRB
- **FileName#yyyy_mm_dd-hh_mm_ss.VRB** - The backup file name has a timestamp included which consists of the day and the time. This option will create a new backup file each time.
  Example: Original file name: m1703.vr - Backup file name: m1703#2019_02_23-11_23_45.VRB where the date is 2/23/2019 and the time is 11:23:45.
- **FileName#yyyymmddThhmmss.VRB** - The backup file name has a timestamp included which consists of the day and the time. This is similar to the previous timestamp format but is more compact but harder to read. This date/time format conforms to the ISO 8601 date/time format specification. This option will create a new backup file each time.
  Example: Original file name: m1703.vr - Backup file name: m1703#20190223T112345.VRB where the date is 2/23/2019 and the time is 11:23:45

Timed backup interval (minutes 0=off) - A value greater than zero will turn on the automatic backing up of open VrOne file(s). This value is entered as minutes.

Note: If a timestamp VrOne backup file format is selected, the backup of the VrOne files will generate a new files each time a backup is performed. This will occur even if the computer is idle with VrOne, VrTwo, or VrThree running. The user should perform disk maintenance and remove older backup files once they are not needed.

See Backup VrOne File / Backup Parameters for more information.

Multiple Windows Settings



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Multiple Windows Settings dialog

Controls window behavior when multiple graphics windows are open. Useful when a 3D stereo window and a 2D graphics window are open.

Window synchronization
When two or more 2D windows are open and this option is checked, a window center operation in one window causes the same window center operation to be performed in all windows. This parameter may be toggled in VrOne/VrTwo with the "Toggle Window Synchronization" (TogSyn)command.
Default: On

Align 2D window to stereo window
Aligns the 2D window rotation to the stereo window rotation. Selecting this option causes the cursor to track in the same X,Y window direction in the stereo window and all 2D windows. This parameter may be toggled in VrTwo with the "Window Align" (WinAli) command.
Default: On

Mouse input active in 2D window
Allows mouse input in the 2D window when the stereo window and one or more 2D windows are open. If enabled, moving the system pointer into a 2D window causes XY cursor movement in all open windows. This parameter may be toggled in VrTwo with the "Toggle Mouse Input From 2D Windows" (Tog2D) command.
Default: Off

Allow 2D cursor to drive the stereo window
Allows XY movement in any open 2D windows to drive the stereo window in the XY direction if the "Mouse input active in 2D window" is active . This parameter may be toggled in VrTwo with the "Toggle Roaming Cursor Drive" (TogRoaCur) command.
Default: Off

Keyport/Touchscreen

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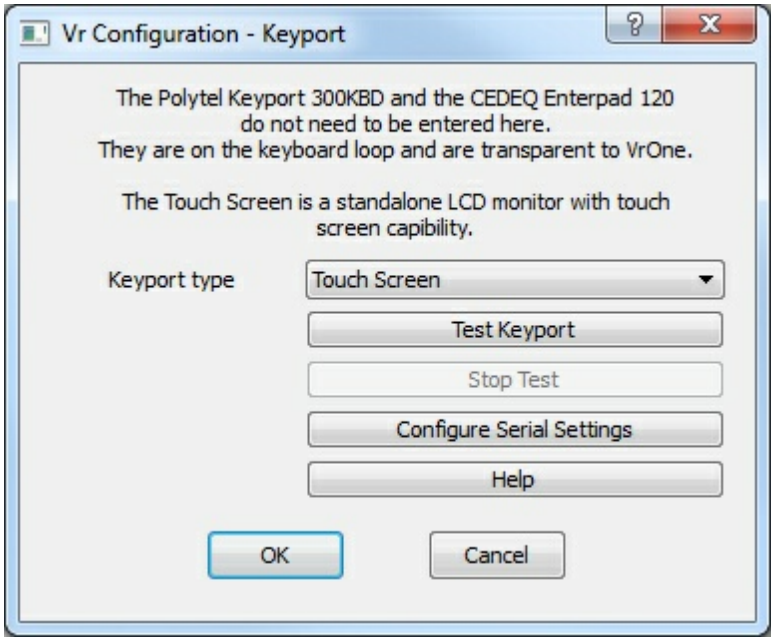

Keyport specification dialog

Keyports are devices that connect to VrOne, giving the user the ability to place commands, macros and/or function keys on buttons for easier program usage.

Keyport type

This parameter defines the current keyport that is interfaced to the computer. Options are:

- None – No keyport is connected. All input will come from the system keyboard;
- Polytel Keyport 300 KBD – The Polytel Keyport 300, connected in the keyboard loop;
- Polytel Keyport 300 Serial – The Polytel Keyport 300, connected to the application computer through an external RS-232 (Serial) interface;
- CEDEQ Enterpad 120 – The CEDEQ Enterpad 120, a keypad connected in the keyboard loop;
- Keyport 252 USB or Serial – The DAT/EM Keyport, connected through the USB or Serial interface. It is recommended to use the Serial interface only.
- Vr Touchscreen – The Vr Touchscreen offers 567 buttons in a 7-inch form factor. This is an LCD touch screen with dynamic menus. It is configured as another screen in Windows.

Test Keyport

Tests the current keyport by displaying button presses in a text window.

Stop Test

Stops a keyport test in progress.

Configure Serial Settings

Several supported keyports are connected via RS-232 (Serial) interface. It may be necessary to change the serial settings if you are using a non-standard configuration. The most common

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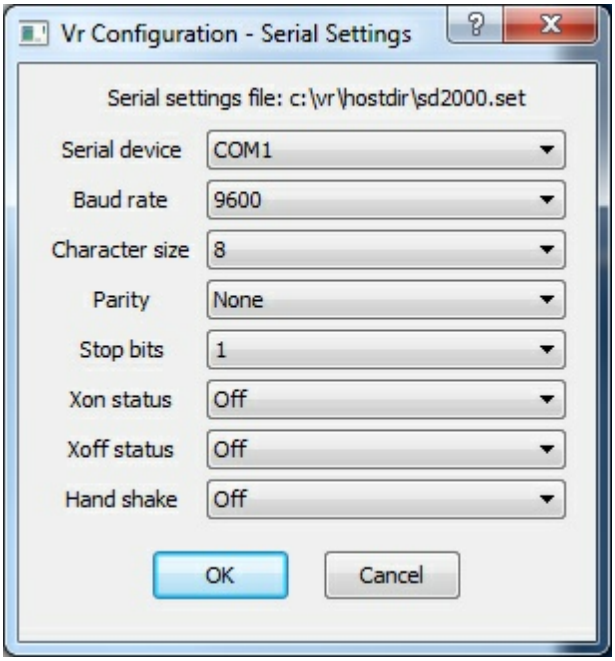
change is in the COM port. The default COM1 port may be used by another device.



Serial (RS-232) Settings dialog

- The Serial device may be set from COM1 to COM9
- The Baud rate, Character size, Parity and Stop bits are standard serial settings. Consult keyport documentation for more information.
- The Xon and Xoff statuses control software flow between the keyport and the computer and are normally Off.
- The Hand Shake parameter makes sure the input driver performs a bi-directional communication with the input device each read. This parameter is always set to Off for the Keyport configuration.

Default: Determined by the Keyport Type

NOTE: The VrController touchscreen is not included in this documentation since it does not require configuration.

Z Source

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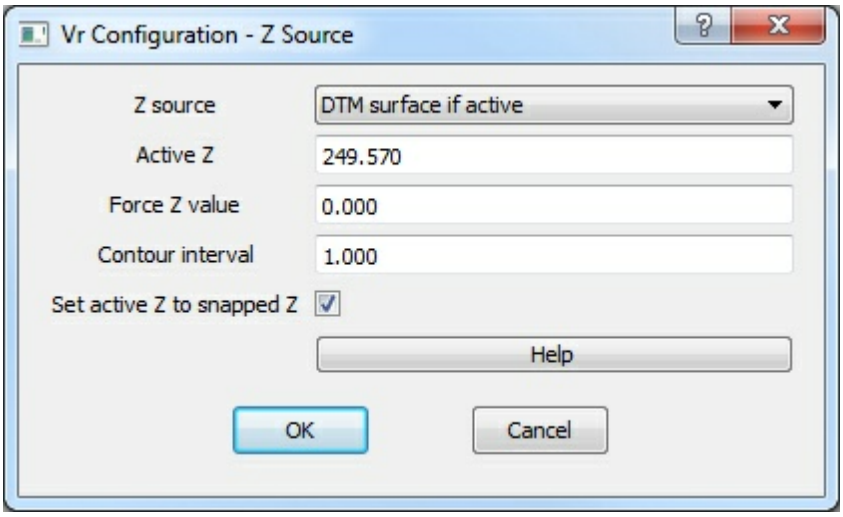

Z Source dialog

Z Source

There are several possible sources for the Z axis.

- **XYZ digitizer or Active Z** – If the current input device is capable of inputting Z, that value is used. If the current input device cannot input Z, the Active Z is used. The active Z can be set at any time with one of the Z management commands.
- **DTM surface if active** – If a DTM surface is active, the elevation is interpolated from the DTM surface based on the current XY position
- **Force Z** – Forces Z to a constant value

Force Z value

Defines an elevation to be used as the Z input if "Force Z" is enabled.

Contour interval

Defines, in ground units, the contour interval to be used by several Z management commands (such as Z +, which adds the contour interval to the current elevation).

Set active Z to snapped Z?

Sets the Active Z to the elevation of the snapped point. This is useful to label symbol X's with their elevations in VrOne when an XY digitizer or mouse is the active input device.

Beep

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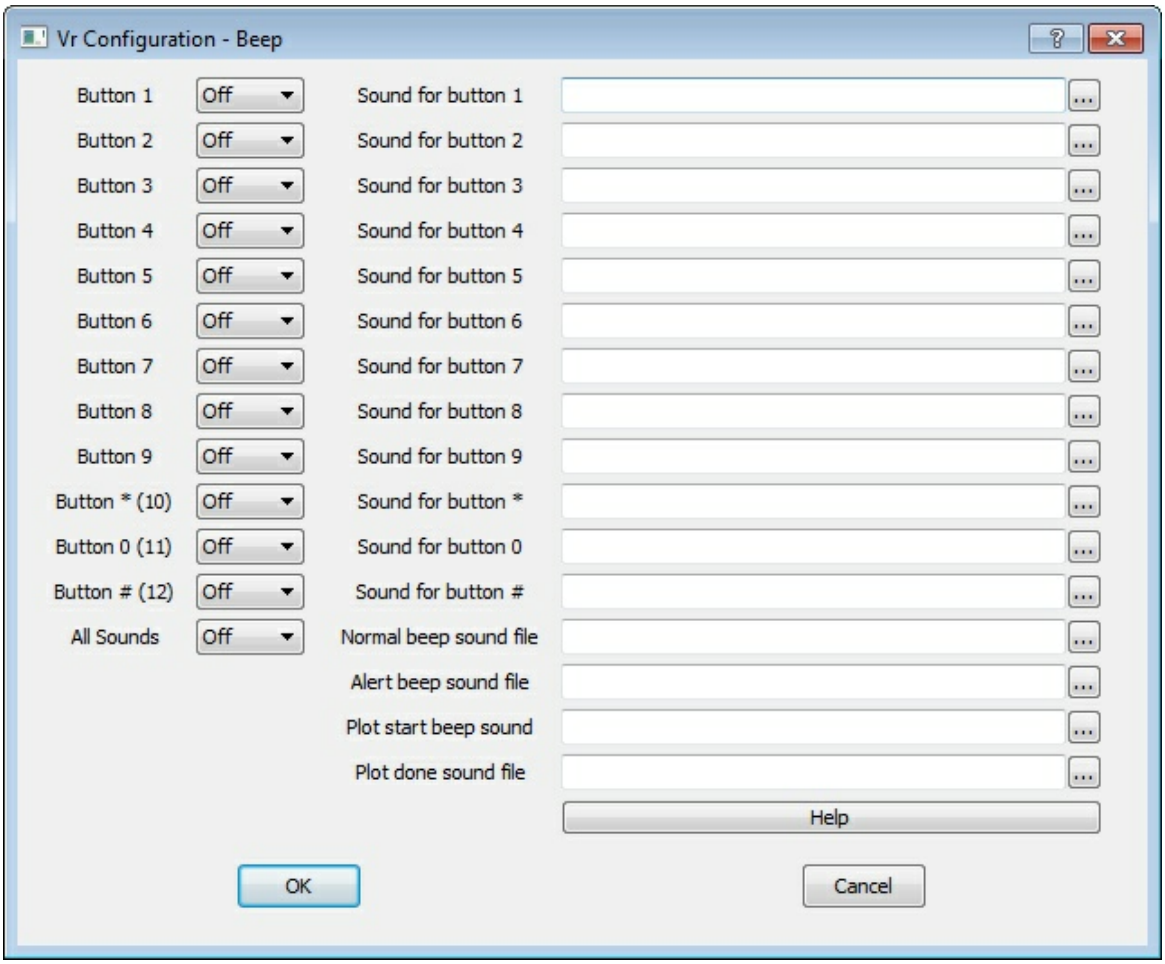

Beep configuration dialog

Sets sounds for each of the twelve VrOne buttons and for other VrOne actions. Any wave sound file (.wav) may be played when a button is pressed or an action occurs.

File Paths

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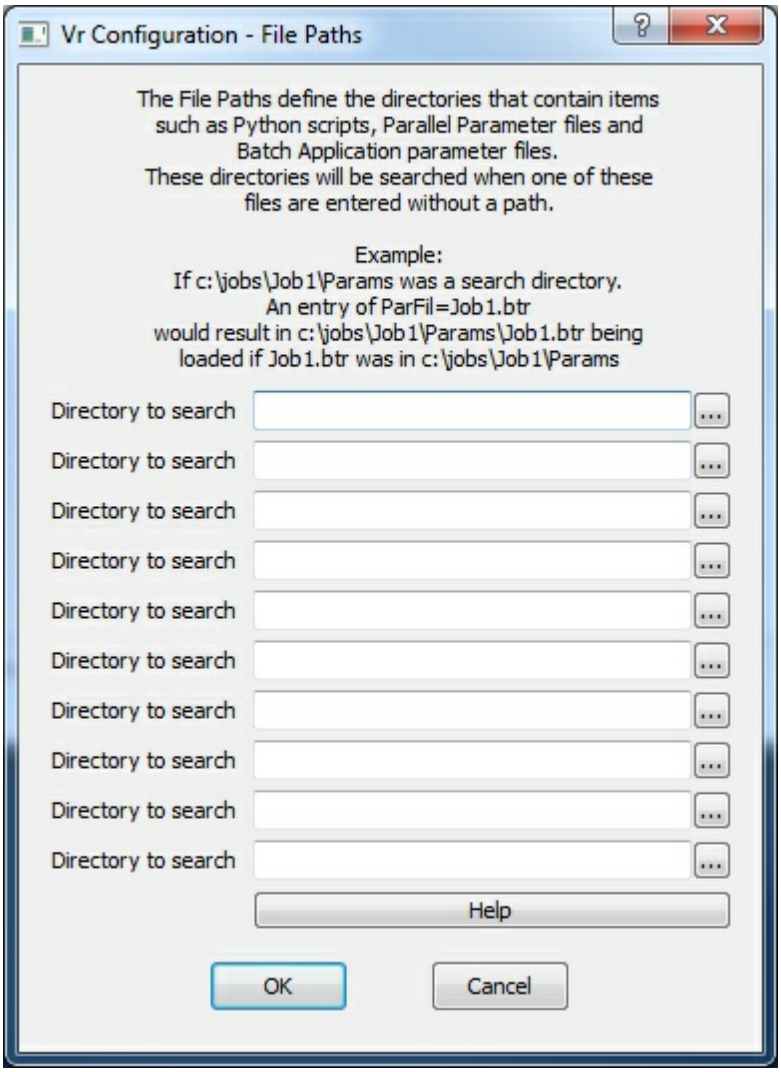

File Paths definition dialog

File Paths define the directories that contain items like Python scripts, Parallel Line parameter files and Batch Application parameter files. These File Path directories will be searched when one of these files isentered without a path.

For example:
If `C:\jobs\Job1\Params` was a search directory and an entry of ParFil=Job1.btr was entered in a Macro. This would result in `c:\jobs\Job1\Params\Job1.btr` being loaded if `Job1.btr` was in the `c:\jobs\Job1\Params` directory.

NumLock Control

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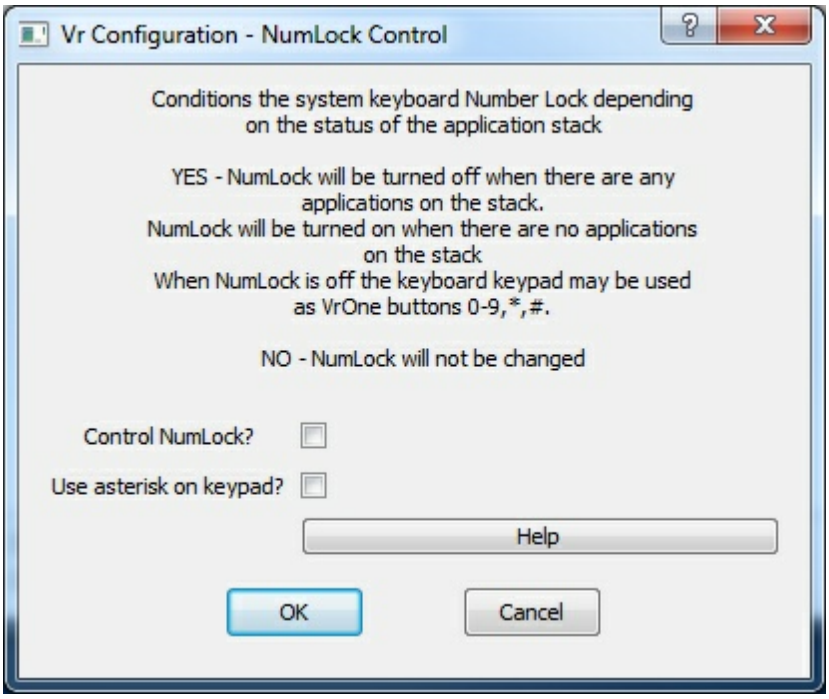

NumLock Control dialog

The NumLock Control conditions the system keyboard Number Lock depending on the status of the VrOne Application Stack. Using NumLock Control helps use the system keyboard keypad as a method to start VrOne commands and press one of the twelve VrOne buttons instead of using the F1-F12 buttons at the top of the keyboard.

Control NumLock?

- Checked – NumLock is turned off if there are any applications on the stack. NumLock is turned on if there are no applications on the stack. When NumLock is off, the keyboard keypad may be used as VrOne buttons 0-9, * and #.
- Not checked – NumLock is not changed.

Default: Off

Use asterisk on keypad?

- Checked – The asterisk key on the keypad is used for VrOne button *.
- Not checked – The period key is used from VrOne button *.

Correlation Settings

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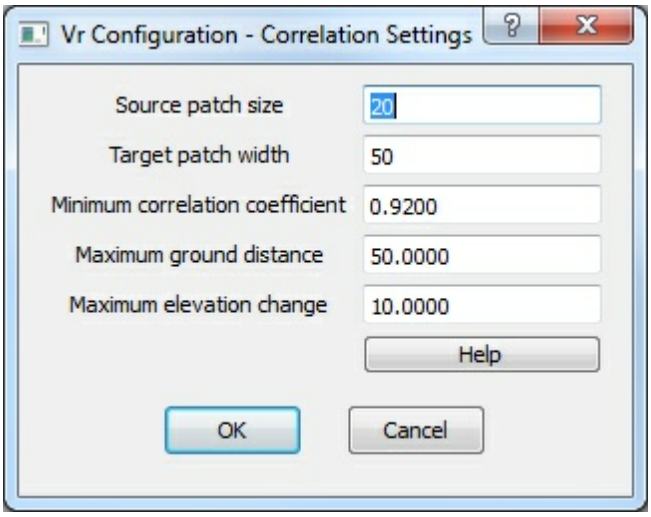

Correlation Settings dialog

The Correlation Settings are used with the VrOne application Correlate Area (CorAre). See Correlate Area for more information.

Source patch size

Sets the size in pixelsof the smaller source patch of pixels to be iterated through the Target Patch. The Source Patch is from one photo, normally the left, and the Target Patch from the other, normally the right. The Source Patch Size should be an even multiple of the Target Patch width. .
Default: 20

Target patch width

The Target Patch Size sets the width in pixels of the larger target patch of pixels through which the Source Patch iterates. The Source Patch is from one photo, normally the left, and the Target Patch from the other photo, normally the right. The Source Patch Size should be an even multiple of the Target Patch.

Minimum correlation coefficient

The result of a correlation is the Correlation Coefficient. A Coefficient of 1.0 indicates a perfect match, while values less than 0.9 indicate a less desirable result. It is recommended that and values below 0.6 be rejected. This parameter is the minimum acceptable correlation result. This parameter is entered as a reasonable coefficient value from 0.50 to 0.99.
Default: 0.92

Maximum ground distance

Specifies the value in ground units which cannot be exceeded by the XY distance of a new correlated point from the last accepted point.
Default: 50

Maximum elevation change

Specifies the value in ground units which cannot be exceed by the elevation distance of a new

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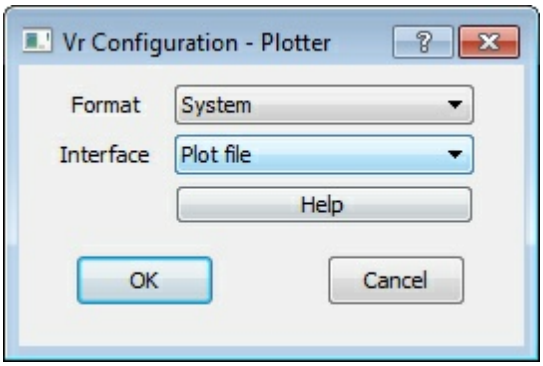
correlated point from the last accepted point.
Default: 10

Plotter



Plotter dialog

Sets the parameters for plotting to hard copy devices. See the VrOne command Plot (Plo) for more information about plotting.

Format

Several plot formats are supported.

- **HP-GL** – Basic Hewlett Packard Graphics Language. This is used to plot vectors.
- **HP-GL/2** – Hewlett Packard Graphics Language 2. This is a compressed version of HP-GL and is used to plot vectors.
- **Hp-GL/2 and HP RTL** – Hewlett Packard Graphics Language 2 and Hewlett Packard Raster Transfer Language. These two formats are combined into one plot file and enable plotting vectors over images. This format may also be used when plotting vectors without images or images without vectors.
- **Postscript** – Basic Adobe Postscript format. This format is used by many publishers.

Default: HP-GL/2 and HP RTL

Interface

The Interface parameter defines the interface to the plotter.

- **Plot file** – Writes the contents of the plot to a plot file which can then be transferred to the plotter
- **RS-232** – The computer is connected to the plotter via RS-232 (Serial) cable. This is an interface for older line plotters only. It is no longer supported.

Default: Plot file

Videomap

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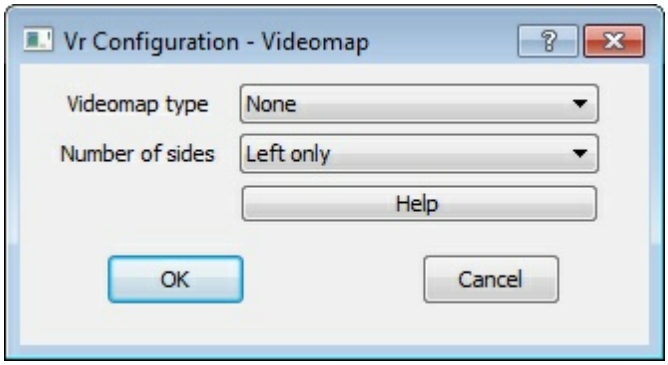

Zeiss Videomap dialog

VrOne supports the Zeiss Videomap 2 and the Zeiss Videomap 30 vector super-imposition systems on the Zeiss P1/P2/P3 analytical instruments.

Videomap type

Defines the Videomap type. Options are None, Videomap 2, Videomap 30 and Test.
Default: None

Number of sides

Videomap is normally imposed on the left image. However, it is possible to have two Videomap units for the left and right sides when using a Zeiss P1. Options for this parameter are Left only and Stereo.
Default: Left only

1.2 Downloading - Installation

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Downloading and Installing Vr Mapping

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Downloading and Installing the Vr Mapping Software

This document applies to Vr Mapping versions 6 and above. The latest versions of Vr Mapping Software can be downloaded from the Cardinal Systems web site

- Visit: http://www.cardinalsystems.net
- Choose "Download Vr Mapping Software" under Support
- Agree to the License agreement
- Select and download the 32-bit and 64-bit versions of a release
- Run the .exe files to install the software

A username and password is required to log onto the download area of the Cardinal Systems web site. Another password is required to un-compress and install the software once it is downloaded. Please contact Cardinal Systems for the username and password to log onto the download area of the web page and for the un-compress password to install the software.

Installation Notes

On Windows 7 and Windows 10, the 32-bit and 64-bit versions of the software should be installed. The 32-bit version contains the support files for both versions and must be installed first. Do not attempt to run the software with the 64-bit version without the installation of the 32-bit version.

The 32-bit installation file name contains the version number. For example, "vr-06_08_2.exe" 3 is Vr Mapping version 6 with a minor release number of 8 and a build number of 23. The installation file name of the 64-bit is similar to the 32-bit version and has a _x64 addition to the file name. For example, the 64-bit file name version of 06.08.23 would be "vr-06_08_23_x64.exe".

Download and Install

1. Download the desired version and save the 32-bit and 64-bit install files it in a temporary folder.

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2. Run the downloaded executables (32-bit and then 64-bit). Use the un-compress password supplied by Cardinal Systems to install each version.
3. Follow the instructions provided by the install programs.

Check the relevant release notes for your software version.

Licensing

Vr Mapping supports two types of licensing.

- Floating license - A specified number of independent instances of a licensed product (VrOne, VrTwo, etc...) can be run anywhere on your network. This is facilitated by running a license server on a computer on the network. This is the preferred licensing method.
- Node-locked license- A node locked license may be run on a single computer and only on that computer. A computer running a node-locked license does not require a connection to a network. If all the licenses at a location are node-locked then running a license server is not required.

Obtaining A License File

Host information from the computer or computers running the Vr Mapping software is required to obtain a license file from Cardinal Systems. The host information consists of the HostName and the HostId. This information may be obtained by installing the software and running one of the applications. Since there is no license, an error will be generated and the HostName and HostId will be displayed in the error message. Also, a text file named "hostinfo.txt" which contains this information will be created in the Vr license folder which is typically c:\vr\license.

If obtaining the license file before installation the software is preferred then the HostName and HostId can be found without the staring a Vr Mapping application. The HostName can be obtained from the Windows system information. Typically, the HostId is the MAC address of the network card and there are several Windows methods for obtaining this information.

The HostName and HostId may be e-mailed to Cardinal Systems and should be emailed to support@cardinalsystems.net.

Existing Vr users with a license file for Vr Mapping version 6 or higher are ready to use the new version. For an upgrade from version 5 or lower require a new license file.

For new or evaluation passwords, run one of the Vr Mapping programs. A password dialog box will be displayed. Please fill out the password request form and passwords will be returned via email. If requesting passwords by email, please include your Computer Name and HostId, company name, address, phone number, e-mail address, and contact name in the e-mail. If requesting an evaluation copy, please include the products you wish to evaluate and the length of time for evaluation.

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Installation Notes

Version Numbers

The Vr Mapping version is shown in the file name of the download file. For example, vr-05_01_23.exe is the Vr Mapping version 5 release with a minor release number of 1 and a build number of 23.

Transferring Vr Licenses

It may be necessary to transfer the Vr Mapping Software from one computer to another. To transfer a license it is necessary to first unregister the software from the old computer and then request a new password. This may be performed with the key-in UNREGISTER. After the software has been unregistered, a code will be displayed that must be e-mailed to Cardinal Systems. The e-mail must also include user's company name, address, phone number, e-mail address, contact name, old Computer Name and HostId, and the new Computer Name and HostId. For Vr Mapping users with Vr Mapping Support Contracts there is no charge for the transfer.

Will the Existing Parameter Files be Overwritten?

If Vr Mapping is already installed and the installation is updating to a new version, the install program will overwrite the program files but not the default parameter files that are delivered with each version of Vr Mapping. Even though the parameter files are not overwritten on subsequent installations, it is suggested that the default parameter files be renamed, moved to another folder, and backed up. After the files have been renamed and moved, the Vr Configuration program must be used to define the location and names of these files. The default parameter files are:

```
\vr\data\default.sym       - Symbol and line fonts
\vr\data\defaultscreen.ct  - Screen color table
\vr\data\defaultplotter.ct - Plotter color table
\vr\data\default.pen       - Pen table
\vr\data\default.pco       - Points (LiDAR) color parameters
\vr\data\default.fk        - Function keys
\vr\data\default.mac       - Macro file
\vr\data\default.mb        - Menu board definitions
\vr\data\default.kp        - Key pad definitions
\vr\data\default.ts        - Touch screen definitions
\vr\data\default.pop       - Pop up menu parameters
```

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1.3 Printing Vr Mapping Help

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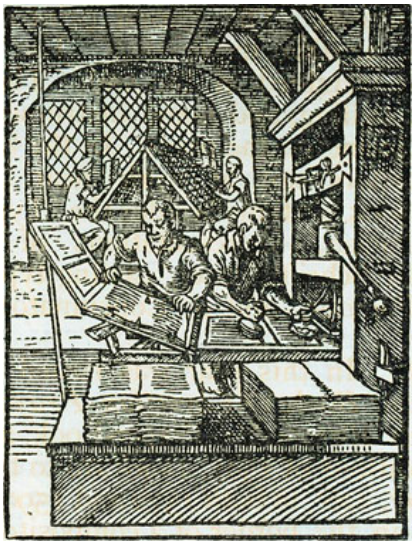
Vr Mapping

Printing Vr Mapping Help



Engraving by Jost Amman, 1568.

A PDF version of the Vr Mapping Help is available on the Cardinal Systems webpage. This version is suitable for printing and can be downloaded at Vr Mapping Help - PDF.

NOTE: This is a large file and will likely take some time to download.

1.4 Compatibility

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Vr

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Mapping

Compatibility



Vr Mapping Version 5 is available in both 32-bit and 64-bit versions. The 32-bit version runs on Windows XP and Windows 7 32-bit and Windows 7 64-bit. The 64-bit version of Vr Mapping runs only on Windows 7 64-bit. For information on graphics drivers, please see Graphics Card Drivers.

Windows 7

Quadro FX 1400 Graphics Card
Stereo display is not supported by the NVIDIA drivers for the Quadro FX 1400 graphics card in Windows 7.

VrBalance
The 32-bit version of VrBalance is supported only.

Immersion / Stealth E-Mouse
Vr Mapping version 05.02.00 (32-bit and 64-bit) and above supports the Immersion / Stealth E-Mouse for Windows 7.

CEC-488 Interface Card
This card is used to connect VrOne to the Zeiss P1/P2/P3 stereo plotters using the GPIB interface instead of the serial (RS-232) interface. It is not supported in Windows 7 64-bit and although it should run in Windows 7 32-bit, it has not been tested in this configuration.

Windows XP

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The NVIDIA Quadro FX 1400 Graphics Card and Dual and Single Monitors with Version 5

In order to run a stereo window on one screen and a 2D graphics window on the other screen on Windows XP, the NVIDIA driver 191.87 is required for version 05.02.00 and above. On systems that use a single stereo display, the NVIDIA graphics card driver versions from 191.87 to 197.90 may be used. See Graphics Card Drivers for more information.

Vr Mapping Version 5

Basic Graphics Card Requirements

Vr Mapping version 5 requires an OpenGL based graphics card that supports Frame Buffer Objects. Your system can be tested for compatibility with Vr Mapping version 5 by downloading and installing a test program. This program will be made available before downloading version 5 from the web page. The use of this small test program is recommended before downloading the full installation. This graphics card requirement applies to all graphics in Vr Mapping. To display 3D stereo a supported stereo graphics card is required.

2 VrMapping

Vr Mapping

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Vr Mapping

Vr Mapping is a collection of software applications written specifically for creating digital maps. The software was designed for the Photogrammetry industry, and is the result of over 20 years of software development in this field. From its initial roots as an interface to stereo plotters, it has

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evolved into a full digital mapping toolset for multiple disciplines with worldwide customers from private mapping companies to NASA.

The Vr Mapping line of products include:

VrOne	Vector collection, editing, processing, DTM, translation
VrTwo	Static and roaming stereo with the power of VrOne
VrThree (VrLiDAR)	Integrates point clouds data (LiDAR, DSM) data and processing into the VrMapping's software
VrDSM	Point cloud generation or Digital Surface Models (DSM) are generated using the stand-alone VrDSM program
VrOrtho	Orthophoto production in a stand-alone package
VrAirTrig	Modern and familiar aerial triangulation
VrVolumes	Fast, flexible volume calculations between surfaces
Model Orientations	Stereo model orientation programs
VrImageUtility	Image utilities for project management

2.1 VrOne - VrTwo

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Vr Mapping

VrOne - VrTwo

VrOne

Photogrammetric Vector Collection and Editing Package

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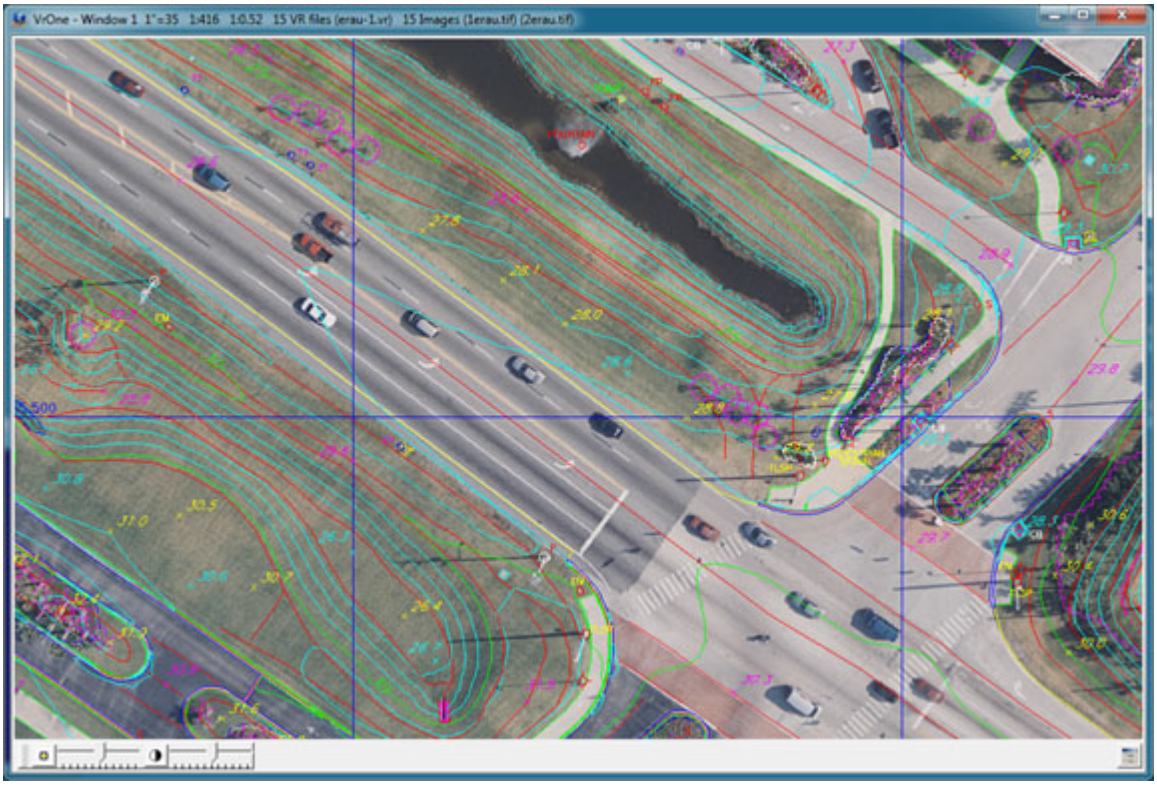

The VrOne 2D graphics window

VrOne is a powerful photogrammetric vector collection and editing package with Digital Terrain Modeling and image display capability.

The program design and implementation is the result of over twenty years of software development experience in the mapping industry. Photogrammetry today requires the mapping professional to deliver vector, image, and DTM data as digital products. VrOne addresses many of the problems encountered in handling the collection, editing and plotting of vector, image, and DTM data.

It is a highly efficient, stand-alone, 3D graphic system designed for photogrammetry. Years of service in software development and support in the field of mapping have generated the most practical mapping tool available today. VrOne is an easy-to-learn system that offers fast data acquisition, easy editing, powerful data storage and specialized mapping applications.

VrTwo

Stereo Viewing, Collection and Editing

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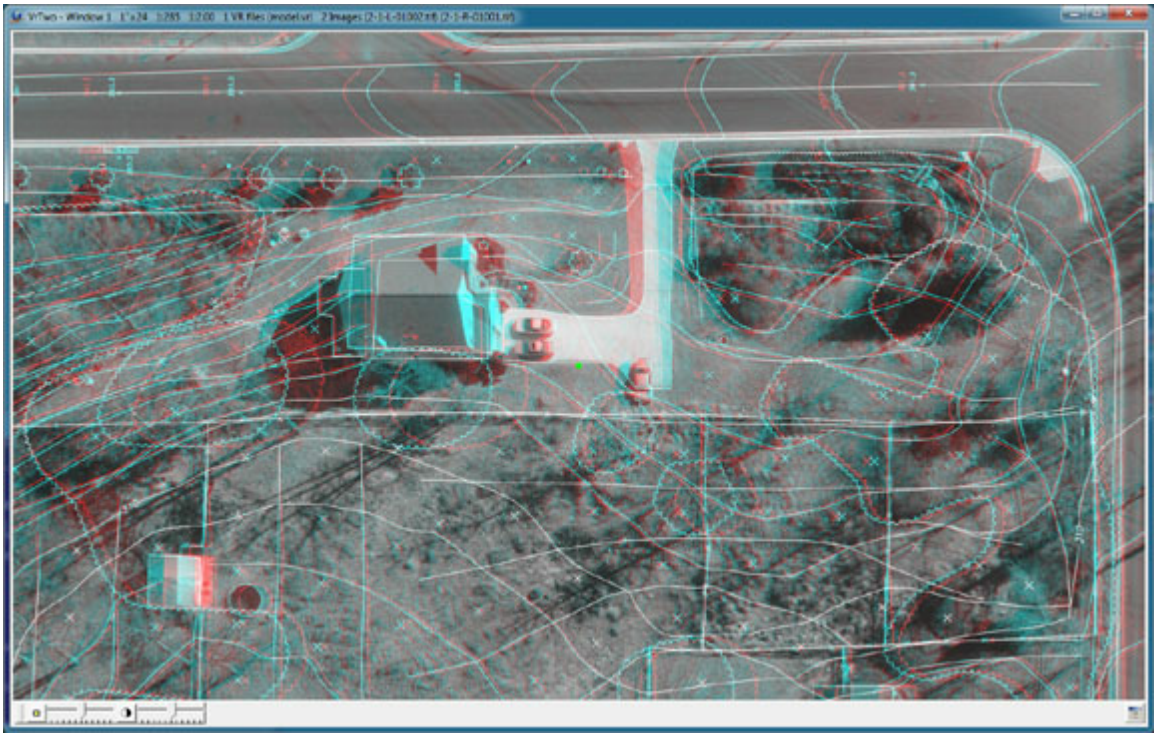

The VrTwo 3D stereo graphics window (Anaglyph)

VrTwo seamlessly integrates stereo viewing with the highly successful VrOne editing and data capture package. It maintains VrOne's power, flexibility and ease of use. VrTwo, in either static or roaming mode, serves as a photogrammetric workstation as well as a 3D CAD station.

VrTwo is comfortable both to the eyes and the wallet. It is able to run on standard PCs, keeping user hardware costs to a minimum.

The Power of Two! Maintain the easy, flexible, and powerful mapping of VrOne in a stereo softcopy.

List of Commands
Python Programming

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2.1.1 List Of Commands

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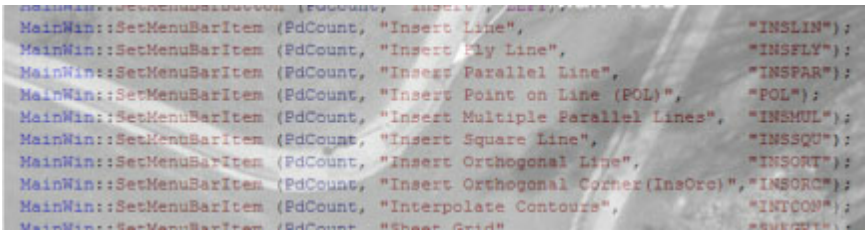
Vr Mapping

List of Commands



Following is a list of all global key-ins available in VrOne and VrTwo. These may be keyed-in at any time.

Management

Application Stack Management
Beep Management
Cursor Management
Display Management
Drive File Management
Elevation Management
Environment Management
File Operations
Input Management
Layer Management
Pen Management
Viewing Window Management
Stereo Model Management

Graphics

Graphics
Graphics – Grid Display and Grid Snapping
Graphics Shortcut Buttons

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Image Graphics
Videomap

Applications

Batch Applications
CoGo – Coordinate Geometry
DTM – Digital Terrain Modeling
Edit Applications
Insert Applications
VrThree (VrLiDAR)

Miscellaneous

Cursor Masking
Macros
Edit Toolbars
System Keyboard VrOne Key Assignments
Translators
Version

Application Stack Management

Name	Key-in	Arguments	Description
Pop Application	Pop		Pops (terminates) current application.
Pop Application	Pop	1-20	Pops (terminates) a number of applications.
Pop Application	Pop	All	Pops (terminates) all applications.
Swap Application	Swa		Swaps the top two applications.
Associate Command 1	Ac1		Executes associate command(s) 1.
Associate Command 2	Ac2		Executes associate command(s) 2.
Wait for application exit	Wait		Waits until the current application has terminated before processing any more commands. Should be used from Vr Macros only.
No Overlay	NoOverla		Turns off application overlay mode. Allows

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	y NoOve		only one application to be added to stack and then waits for that application to end before starting a new one. Normally used in the OnEnd argument inside function keys. Should always be paired with the Overlay command.
Overlay	Overlay Ove		Turns on application overlay mode after it has been turned off by NoOverlay.

Beep Management

Name	Key-in	Arguments	Description
Edit Beep	EdiBee		Edits beep parameters using dialog box.
Beep Set	Bee	Button (0-11) Value (0-1)	Sets the beep parameter for one button. Example: Bee 1 0 – Would turn the beep off for button 1
Beep All On	Bee +		Turns on beep for all buttons.
Beep All Off	Bee -		Turns off beep for all buttons

Cursor Management (VrTwo only)

Name	Key-in	Arguments	Description
Set Cursor	SetCur		Sets cursor parameters in dialog.
Set Cursor Type	SetCur Typ	Cro, Dot	Sets cursor type.
Set Cursor Size	SetCur Siz	Size	Sets cursor size in pixels.
Set Cursor Color	SetCur Col	Whi, Bla, Red, Gre, Blu, Yel	Sets cursor color.
Set Cursor Mask Size	SetCur MasSiz	Size	Sets the cursor mask size in pixels.
Set Cursor Mask	SetCur	Squ, Cir	Sets the cursor mask shape for square or

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Shape	MasSha		circle.
Set Cursor Track Plane	SetCur Tra	Vie, Gro	Sets the cursor track plane for View plane or Ground plane.

Display Management

Name	Key-in	Arguments	Description
Set Display	SetDis		Sets display parameters using dialog box.
Reset Display	ResDis		Resets display parameters to default values.
Lines On	LinOn		Displays lines.
Lines Off	LinOff		Hides lines.
Splined Lines On	SplOn		Displays splined lines with spline.
Splined Lines Off	SplOff		Displays splined lines without spline.
Line Fonts On	LfOn		Displays line fonts.
Line Fonts Off	LfOff		Displays fonted lines as solid.
Construction Lines On	ConOn		Displays construction lines.
Construction Lines Off	ConOff		Hides construction lines.
Line Points On	LpOn		Displays line points.
Line Points Off	LpOff		Hides line points.
Line Elevations On	LeOn		Displays line elevations.
Line Elevations Off	LeOff		Hides display line elevations.
Symbols On	SymOn		Displays symbols.
Symbols Off	SymOff		Hides symbols.
Text On	TexOn		Displays text labels.
Text Off	TexOff		Hides text labels.
Interactive Lines On	IlinOn		Displays interactive lines.
Interactive Lines Off	IlinOff		Hides interactive lines.

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Interactive Symbols On	IsymOn		Displays interactive symbols.
Interactive Symbols Off	IsymOff		Hides interactive symbols.
Interactive Text On	ItexOn		Displays interactive text.
Interactive Text Off	ItexOff		Hides interactive text.
Set Coordinate Display Decimals	CooDis	0-10	Sets the number of decimal places for Xyz display in the Main Window.
Open Coordinate Display	CooDia		Opens the Coordinate Display window.
Point (LiDAR) Display Parameters	PoiDis PO		Sets Point display filters, clipping planes and Point coloring parameters.
Point Set Z	PoiSetZ		Sets Z Slice display parameters.
Window Clip View	WinCli		Rotates VrThree view to user defined base line.

Drive File Management

Name	Key-in	Arguments	Description
Open Drive File	OpeDri		Opens drive file using dialog box.
Open Drive File	OpeDri	File name	Opens drive file using the file name passed. File name many be: LinCor – Line Cross drive file BatJoi – Batch Join drive file BatNod – Batch Node drive file
Drive	Dri		Drives to next point in drive file.
Drive and Set Complete	DriAndSet		Sets current point as complete and drives to next point in drive file.
Drive Set Complete	DriSet		Sets current point as complete.
Drive Clear Complete	DriCle		Sets current point as incomplete.
Drive Reset Complete All	DriResCom		Resets all complete markers to incomplete.

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Drive Toggle Skip Completed	DriTog		Toggles skipping completed points when driving to next or previous point.
Re-drive	ReDri		Re-drives to current point in drive file.
Drive Previous	DriPre		Drives to previous point.
Show Drive Points	ShoDri		Shows all drive points in the graphics window.
Show Drive Points Fit	ShoDri	Fit	Shows all drive points in the graphics window and zooms the graphics window to the extents of the drive points.
Reset Drive File	ResDri		Resets drive file to first point.
Close Drive File	CloDri		Closes drive file.
Export Drive File	ExpDri		Translates a drive file to an XYZ formatted ASCII file.
Import Drive File	ImpDri		Imports an XYZ formatted ASCII file to a drive file.
Drive to Control Point	ConDri Cd	H	Displays Control Drive help.
Drive to Control Point	ConDri Cd		Drives to the next point (no argument).
Drive to Control Point	ConDri Cd	-	Drives to previous point.
Drive to Control Point	ConDri Cd	P	Prompts for point.
Drive to Control Point	ConDri Cd	L	Drives to model load point.
Drive to Control Point	ConDri Cd	R	Re-drives to current point.
Drive to Control Point	ConDri Cd	PointNumber	Drives to point by sequence number.
Drive to Control Point	ConDri Cd	“PointName”	Drives to point by name.
Drive KML	DriKml DriGoo		Drives to a point in a KML program such as Google Earth after being digitized in VrOne, VrTwo or VrThree (VrLiDAR).

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Elevation Management

Key-in	Arguments	Description
Z	Value	Sets current elevation to Value.
Z	=Value	Sets current elevation to Value.
Z	+	Increments current elevation by contour interval.
Z	-	Decrements current elevation by contour interval.
Z	+Value	Increments current elevation by Value.
Z	-Value	Decrements current elevation by Value.
Z	R	Rounds to the closest contour interval.
Z	Dtm	Sets current elevation to DTM surface if active.
XYZ	X Y Z	Drives to value specified. Supports the same operators as Z A key-in of XYZ with no arguments will bring up a dialog box in which coordinates may be entered.

Environment Management

Name	Key-in	Arguments	Description
Set Active Workspace	Aws	WsNum	Sets the active workspace (1-256).
Workspace Control	WsCon		Displays list of open workspaces and allows visibility to be controlled in each graphics window.
Set Parameters	SetPar		Set current window parameters.
Set Display Parameters	SetDis		Sets display parameters.
Point Density	PoiDen PD		Sets point density.
Edit Configuration	EdiCon		Edits Vr configuration.
Edit Toolbars	EdiToo		Edits toolbars.

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Display Toolbar	DisToo	ToolBar Name, On|Off	Displays (On) or hides (Off) a single toolbar using a key-in. Example: DisToo "LiDAR Data" Off
Search Radius	SeaRad	Ground	Sets current entity search radius.
Snap Set	SnaSet		Sets snap parameters.
Snap Toggle	SnaTog		Toggles snap on/off.
Snap On	SnaOn F11		Turns snap on.
Snap Off	SnaOff		Turns snap off.
Snap Workspace Current	SnaWsCur		Snaps to entities in current workspace only.
Snap Workspace All	SnaWsAll		Snaps to entities in all open workspaces.
Snap All	SnaAll		Snaps to all entities.
Snap Lines	SnaLin		Snaps to only lines.
Snap Symbols	SnaSym		Snaps to only symbols.
Snap Text	SnaTex		Snaps to only text.
Snap Point	SnaPoi SnaPnt		Returns line point.
Snap Intersect	SnaInt		Returns line intersection.
Snap End	SnaEnd		Returns line endpoint.
Snap Search Line	SnaSeaLin		Snaps Search Mode Lines.
Snap Search Line Point	SnaSeaPoi		Snaps Search Mode Line Points.
Snap 2D	Sna2d		Snaps 2-dimension.
Snap 3D	Sna3d		Snaps 3-dimension.
Snap Verify Off	SnaVOff		Turns snap verify off.
Snap Verify On	SnaVOn		Turns snap verify on.
Snap After Off	SnaAOff		After snap, turns it off.
Snap After On	SnaAOn		After snap, leaves it on.
Snap Ignore Fail On	SnaIOn		Ignores failed snaps allowing retries.

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Snap Ignore Fail Off	SnaIOff		Failed snaps return digitized position.

File Operations

Name	Key-in	Arguments	Description
Set Default Directory	DefDir	Directory	Sets the default (project) directory.
Close All Open Files	CloAll		Closes all open VrOne and image files.
New VrOne file	NewVr	[-p][-w][-t value][-u value][-c value][-s value][-z value][-d value] [Filename]	Creates new VrOne file using optional arguments. -p = Prompt for header -w = Don't change active workspace -t value = Set target scale to value -u value = Set units to value (0=feet,1=meters) -c value = Set coordinate format to value (0=State Plane, 1=UTM) -s value = Set state plane zone to value -z value = Set UTM zone to value -d value = Set description to value Filename = Create file with this name. Will prompt for filename if not given.
Open VrOne file	OpeVr		Opens VrOne files from dialog box.
Open VrOne file	OpeVr	File name	Opens VrOne file.
Close VrOne File	CloVr		Closes VrOne files.
Close VrOne File	CloVr	All	Closes all VrOne files.
Save As	SavAs		Saves the Active Workspace file with the ability to rename.
Pack VrOne File(s)	PacVr	All | Cur	Packs VrOne file(s). All – Packs all open workspaces Cur – Packs the current workspace only
Sort VrOne File(s)	SorVr		Sorts and packs VrOne file(s) by the layer and the X or Y axis.
Backup VrOne File (s)	BacVr		Backs up open VrOne file(s).
Backup Parameters	BacPar	Format Time	Defines/edits backup VrOne file(s) options Format - Backup file format (0-2)

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			Time - Timed backup interval (minutes) If no arguments are provided, a dialog will be displayed.
Edit VrOne Header	EdiVr		Edits Vr file header.
Set Passwords	SetPas		Sets Open and Read-Only access passwords that apply to VrLite only.
List Layer	LisLay		Lists Layers and modes used in Vr files.
List Workspaces	LisWs		Lists Workspaces currently open. Displays workspace number, file size, entity counts, and filename.
List Images	LisIma		Lists detailed information about Images currently open.
Open Image	OpeIma		Opens image files from dialog box.
Open Image	OpeIma	File name	Opens image file.
Close Image	CloIma		Closes image files.
Close Image	CloIma	All	Closes all image files.
Open Model	OpeMod		Opens two images that make up a model from a dialog box.
Open Model	OpeMod	File name	Opens two images that make up a model based on the model orientation (.vmo) file.
Load Symbols	LoaSym	File name	Loads VrOne symbol file.
Copy File	Copy	File1 File2	Copies disk File1 to File2.
Delete File	Delete	File	Deletes disk File.
Spawn	Spa	Argument List	Runs a command from the operating system.
Change Units	ChaUni		Changes file units (Meters<->Feet).
Range Xy	RanXy		Shows Xy range of all open workspaces.
Undo	Undo		Undoes last operation in current workspace.
Undo All Workspaces	UndoAllWs		Undoes last operation in all workspaces.
Redo	Redo		Redoes last operation in current workspace.
Redo	RedoAllWs		Redoes last operation in all workspaces.

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List Undo Information	LisUnd		Lists all undo information details.
Exit	Exi		Exits VrOne.
Quit	Qui		Exits VrOne.
End	End		Exits VrOne without confirmation.
File Information	FilInf		Displays information about open files.
Count Points	CouPoi		Counts the number of VrPoints (LiDAR) in a user defined area, at a user defined location.

Input Management

Name	Key-in	Arguments	Description
Edit Toolbars	EdiToo		Allows creation and editing of toolbars and toolbar items.
Digitizer XY	DigXy		Sets input device to XY digitizer.
Digitizer XYZ	DigXyz		Sets input device to XYZ digitizer.
Digitizer Mouse	DigMou		Sets input device to mouse.
Toggle Digitizer Math	TogDig		Toggles between scratch and least squares input.
Load XY Transformation	LoaXy		Loads XYZ transformation parameters.
Z Offset	Zoff		Sets a Z offset that is applied when using XYZ input.
Index ORP	IndOrp		Allows an x,y,z offset to be applied to a VrTwo Orientation Parameter (.orp) file.
Preset Encoders	Preset		Presets Analog instrument encoders at index point.
Device Controls	DevCon		Sets device dependent controls.
Device Mouse	DevMou		Sets device dependent controls for the Mouse/Stealth Mouse.
Device P3	DevP3		Sets device dependent controls for the Zeiss P1/P2/P3.

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Device Hand Wheels	DevHan		Sets device dependent controls for VrTwo Hand Wheels.
Device TopoMouse	DevTop		Sets device dependent controls for the LH TopoMouse.
Device Stealth Z-Mouse	DevSzm		Sets device dependent controls for the Stealth Z-Mouse
Device Stealth Handwheels	DevSha		Sets device dependent controls for the Stealth Handwheels
Device Immersion Mouse	DevImm		Sets device dependent controls for the Immersion, Stealth E-Mouse, and Stealth V-Mouse
Device Z/I Mouse	DevZim		Sets device dependent controls for the Z/I Mouse
Device Joystick	DevJoy		Sets device dependent controls for Joysticks.
Device Softmouse 3D	DevSof		Sets device dependent controls for the Softmouse 3D
Device XY Scale Factor	DevSfXy	Scale factor 1=none	Sets the XY input scale factor for the active VrTwo 3D input device. (see note below)
Device Z Scale Factor	DevSfZ	Scale factor 1=none	Sets the Z input scale factor for the active VrTwo 3D input device. (see note below)
Z Source	Zsou	ActZ | Dtm | ForZ | HL | Tri	Sets elevation source. No arguments will bring up a dialog box.
Digitize Scratch	DigScr		Digitizes scratch orientation origin.
Digitizer Menu Board	DigMen		Digitizes menu board location.
Edit Menu Board	EdiMen		Edits menu board commands.
Edit Key Pad	EdiKey		Edits key pad commands.
Function Key Starter	FunKey		Starts function key starter.
Edit Function Keys	EdiFun		Edits function keys.
Load Cm Fkeys	LoaCad		Loads and translates CADMAP function keys to ASCII file.

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Edit Macros	EdiMac		Edits macros.
Begin Macro	BegMac		Begins recording a macro.
End Macro	EndMac		Ends recording a macro.
Func Keys to Key Pad	CopKey		Copies function key assignments to key pad.
Func Keys To Layer Names	FunLay		Copies function key descriptions to layer names.
Write Kork Macros	WriKp3		Writes Kp300 file.
Read Kork Macros	ReaKor		Reads KORK macro file.
Convert Microstation Color Table	ConMic		Converts a Microstation Color Table (.tbl) to a Vr Mapping Color Table.

NOTE: Device Scale Factors (DevSfXf and DevSfZ) - Supported devices for the scale factor commands.
TopoMouse, Stealth Z-Mouse, Stealth Hand-wheels, Immersion Mouse, ZI Mouse and DAT/EM Hand-wheels

Layer Management

Name	Key-in	Arguments	Description
Edit Layer Names	EdiLay		Edits layer names.
Set Layers On/Off	SetLay		Conditions layers using dialog box.
Change Layer	ChaLay		Allows interactive layer changing.
Layer Off	LayOff	NumLine	Turns off layers specified in number line.
Layer On	LayOn	NumLine	Turns on layers specified in number line.
Layer Off Plus	LayOff+	NumLine	Turns only layers specified in number line off.
Layer On Plus	LayOn+	NumLine	Turns only layers specified in number line on.
Layer Reset	LayRes		Turns all layers on.
Snap Layer Off	SnaLayOff	NumLine	Turns snapping off for the layers specified.

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Snap Layer On	SnaLayOn	NumLine	Turns snapping on for the layers specified.
Snap Layer Off Plus	SnaLayOff+	NumLine	Turns snapping off for only the layers specified.
Snap Layer On Plus	SnaLayOn+	NumLine	Turns snapping on for only the layers specified.
Snap Layer Reset	SnaLayRes		Turns snapping on for all layers.
Delete Layers	DelLay	NumLine	Deletes layer(s).
Copy Layers	CopLay	NumLine TarLayer	Copies layer(s).
Move Layers	MovLay	NumLine TarLayer	Moves layer(s).
Layer Control	LayCon		Displays layer control dialog.

Pen Management

Name	Key-in	Arguments	Description
Change Pen	ChaPen		Allows interactive pen entity changing.
Load Pen Table	LoaPen		Loads pen table. Prompts with dialog box.
Load Pen Table	LoaPen	File name	Loads pen table.
Load Alternate Pen Table	LoaAltPen		Loads alternate pen table. Prompts with dialog box.
Load Alternate Pen Table	LoaAltPen	File name	Loads alternate pen table.
Reset Pen Table	ResPen		Resets all pen numbers to 1 in the current pen table.
Reset Alternate Pen Table	ResAltPen		Resets all pen numbers to 1 in the alternate pen table.
Random Color File	RanCol		Loads a random color file by changing pen numbers.

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Stereo Model Management

Name	Key-in	Arguments	Description
Model Manager	ModMan		Prompts for a VrTwo Orientation project and opens a Model Manager window displaying the models in the project.
Model Manager	ModMan	VrTwo orientation project file name	Opens a Model Manager window displaying the models in the specified project.
Auto Switch Configuration	AutSwi		Displays configuration dialog for Model Manager auto switching
Auto Switch	AutSwi	0 or 1	Turns Model Manager auto switching off/on.
Auto Switch	AutSwi	2-40	Sets Model Manager auto switch percent.
Model, Center	ModCen		If model manager is in use, the stereo model that the cursor is furthest from the edge of, is opened. The cursor location is unchanged.
Model, Next	ModNex		If model manager is in user, it moves through all models that observe the current cursor location without moving the cursor.
Model Precision	ModPre		A tool to measure the precision of feature measurements in all the models that observe it.
Model, Drive Control	ModDrC		Drives to all control points in all models. Measurements of the control points are compiled into a report.

Graphics

Name	Key-in	Arguments	Description
Buffer XY/XYZ Input During Replot	BufXy	0=Off 1=On	Sets the buffering of XY or XYZ input during screen re-plotting. Digitizing may continue

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			but re-plotting will be slower.
Replot	Rep		Re-plots graphics to all windows.
Replot Off	RepOff		Turns off graphics replot in macros.
Open Window	OpeWin		Opens new 2D window.
Close Window	CloWin		Closes the last opened graphics window if there is more than one open window.
Points On in VrOne/ VrThree windows	PoiOn	1-8	The argument is the target window number. If the argument is omitted then PoiOn will be applied to all open windows
Points Off in VrOne/ VrThree windows	PoiOff	1-8	The argument is the target window number. If the argument is omitted then PoiOff will be applied to all open windows
Toggle Roaming	TogRoa		Toggles between static and roaming modes in VrTwo.
Roaming On	RoaOn		Switches VrTwo from static mode to roaming mode.
Roaming Off	RoaOff		Switches VrTwo from roaming mode to static mode.
Toggle Roaming Cursor	TogRoaCur		Toggles whether main graphics window roams in VrTwo when cursor is in an overview window.
Toggle Window Shift	TogWin		Toggles window shift.
Set Window Origin	WinOrg	X Y Z	Sets the origin of the active window. Z is optional.
Set Window Scale	WinSca	Scale	Sets the scale of the active window. SetSca 1200 SetSca 1=100 SetSca 1:1200
Window Rotation	WinRot		Digitizes window rotation about Z axis.
Vectors On in VrOne/VrThree windows	VecOn	1-8	The argument is the target window number. If the argument is omitted then VecOn will be applied to all open windows
Vectors Off in VrOne/VrThree windows	VecOff	1-8	The argument is the target window number. If the argument is omitted then VecOff will be applied to all open windows

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Window Rotation X	RotX	Rotation value	Rotates current window about the X axis.
Window Rotation Y	RotY	Rotation value	Rotates current window about the Y axis.
Window Rotation Z	RotZ	Rotation value	Rotates current window about the Z axis. This value is expressed as Direction of North.
Window Align	WinAli		Aligns Z rotation of current graphics window with window 1. Useful in VrTwo.
Zoom Filter Pixel Smooth	ZooFil PixSmo		Engages zoom filter mode. Used to smooth pixels when zoomed below 1:1. Without any arguments, toggles between Nearest Neighbor and Bilinear, or can be set directly as shown below. ZooFil 0 = Nearest neighbor ZooFil 1 = Bilinear (**VrTwo** roaming only)
Zoom Center	ZooC ZooCen	App (optional)	Centers the window at the current cursor location. The App argument will start the Window Center application.
Zoom Window	ZooW ZooWin		Zooms by user-defined window.
Zoom All	ZooA ZooAll	1-8 (optional)	Places all open data into window.
Zoom Fit	ZooF ZooFit	1-8 (optional)	Places all open and non-deleted data into window.
Zoom Previous	ZooP ZooPre		Displays previous zoom.
Zoom Last	ZooL ZooLef		Shifts the window left.
Zoom Right	ZooR ZooRig		Shifts the window right.
Zoom Up	ZooU ZooUp		Shifts the window up.
Zoom Down	ZooD ZooDow		Shifts the window down.

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Zoom In	Zoo	Scale_factor window (1-8, optional)	Zooms in by user-defined scale factor. Prompts for window selection if no window number given.
Zoom Out	Zoo	Scale factor	Zooms out by user-defined scale factor.
Zoom Visible	ZooV ZooVis	1-8 (optional)	Zooms to the extents of the visible vector graphics and images.
Plot	Plo		Hard copy plotting.
Set Display Flags On	SetAll		Sets all entities' display flag to ON.
Max Model Radius	ModRad	0.0-100.0% default =100	Percent of the image radius (distance from the center to the corner) to display for on-the-fly stereo models. This is used to force compilers to remain in the clean model area.

NOTE: Care must be taken when using Window Scale (WinSca), Window Rotation X,Y,Z (WinRot), and Window Origin (WinOrg) in sequence without a screen replot. Since these key-ins are likely to be in a macro they do not redraw the graphics window. A replot (Rep) must be done to accomplish this. If two or more are used without a replot (which is likely in a macro) they must be in the following order as this example shows:

```
WinSca 1=20
RotZ 80
WinOrg 3563188 232820
```

Viewing Window Management

Name	Key-in	Description
2D Window	OpeWin	Displays the 2D window.
2.5D VrThree Window	3DC	Displays the 2.5D VrThree window.
3D Stereo VrThree	3DSC Vr3 VrThree	Displays the 3D VrThree window in stereo.
3D Viewing Window	3DS	Displays the 3D viewing window in stereo.
Save Window	SavWin	Saves graphics window to a file.

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Capture Window	CapWin	Captures graphics window to the clipboard.
Close Window	CloWin	Closes the last opened graphics window.

Graphics – Grid Display and Grid/Cursor Snapping

There are three user-alterable conditions dealing with grid points on the screen:

- Grid display, which controls the display of grid points;
- Grid snapping, in which the cursor moves only between grid points;
- Cursor snapping, in which the cursor will snap to a grid point only when that point is digitized. Grid snapping must be turned on for cursor snapping to occur.

Name	Key-in	Arguments	Description
Grid Set	GriSet		Sets grid display and snapping using a dialog box.
Grid Display On	GriOn		Turns grid point display on.
Grid Display Off	GriOff		Turns grid point display off.
Grid Display Toggle	GriTog		Toggles grid point display.
Grid Resolution Set	GriRes	Distance	Sets grid point display resolution in ground units.
Grid Type	GriTyp	0 | 1	0 = Shows grid as points. 1 = Shows grid as lines.
Grid Snap if Displayed	GriSnaDis		Turns on grid snapping only if the grid display is on. (see Grid On)
Grid Snap On	GriSnaOn		Turns on grid snapping. The behavior of the cursor depends on the Cursor Snap setting.
Grid Snap Off	GriSnaOff		Turns off grid snapping.
Grid Snap Toggle	GriSnaTog		Toggles between the three grid snapping modes shown above.
Cursor Snap On	CurSnaOn		Sets the cursor to move only between grid points.
Cursor Snap Off	CurSnaOf		Sets the cursor to move with the current input

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	f		device and snap to a grid point only when a point is digitized.
Cursor Snap Toggle	CurSnaTog		Toggles between Cursor Snap On and Cursor Snap Off.

Graphics Shortcut Buttons

The following keyboard key presses may be used for graphics window changes while the mouse is in the graphics window.

Name	Shortcut
Zoom Center	Home Key
Reload Graphics	Home Key (**VrTwo** roaming only)
Zoom Last	Left Arrow Key
Zoom Right	Right Arrow Key
Zoom Up	Up Arrow Key
Zoom Down	Down Arrow Key
Zoom In	Page Down (2x)
Zoom Out	Page Up (2x)
Disengage Roaming	Insert Key (**VrTwo** roaming only)
Shift->PgUp	Zoom up two pyramid levels (**VrTwo** roaming only)
Shift->PgDn	Zoom down two pyramid levels (**VrTwo** roaming only)
Ctrl->PgUp	Zooms to top pyramid level (**VrTwo** roaming only)
Ctrl->PgDn	Zooms to bottom (1:1) pyramid level (**VrTwo** roaming only)
Toggle Cursor Mask	Delete Key (**VrTwo** only)
Disengage Mouse to Stereo Motion	Shift Key (**VrTwo** static only)
4x Z Motion Multiplier	Shift Key (**VrTwo** only)

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Name	Key-in	Arguments	Description
Display Image	DisIma	0.5	Displays image at .5 to 1 pixel resolution.
Display Image	DisIma	1	Displays image at 1 to 1 pixel resolution.
Display Image	DisIma	2	Displays image at 2 to 1 pixel resolution.
Display Image	DisIma	4	Displays image at 4 to 1 pixel resolution.
Display Image	DisIma	8	Displays image at 8 to 1 pixel resolution.
Pixel Compute	PixCom		Computes image pixel size and file size.
Image Control	ImaCon		Sets contrast/brightness of image to file or plotter.
Image Flicker	ImaFli		Alternately displays two images (image flicker).
Toggle Image Edges	TogImE		Toggles the display of image information such as edges and image names.
Image Display Mode	ImaDis	0-2	Sets the display mode for images. 0–Draw 1-XOR 2-OR
Image Clean	ImaCle		Removes scratches from images.
Image Levels	ImaLev		Displays Image Levels dialog allowing color levels to be adjusted on open images.
Image On in VrOne windows	ImaOn	1-8	The argument is the target window number. If the argument is omitted then ImaOn will be applied to all open windows
Image Off in VrOne windows	ImaOn	1-8	The argument is the target window number. If the argument is omitted then ImaOff will be applied to all open windows
Set Brightness	SetBri	Brightness (0-100, 50 = default)	Sets brightness level of images.
Set Contrast	SetCon	Contrast (0-100, 50 = default)	Sets contrast level of images.
Set Brightness and Contrast	SetBriCon	Brightness Contrast	Sets brightness and contrast level of images.

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		(0-100, 50 = default)	

Videomap

Name	Key-in	Description
Replot	VidRep VmRep	Replots vectors from workspace 1 to Videomap.
Test	VidTes VmTes	Tests Videomap by drawing a cross at graphics origin.
Videomap On	VmOn	Turns Videomap on.
Videomap Off	VmOff	Turns Videomap off.

NOTE: Videomap must be configured in the Vr Configuration program (VrCfig) for Videomap commands to be recognized.

Batch Applications

Name	Key-in	Description
Batch Attach	BatAtt	Attaches source line end segments to target lines.
Batch Areas	BatAre	Changes layer and graphic pointer of line entities based on the line's area.
Batch Common	BatCom	Processes common and orphaned node points between lines.
Batch Depression Contour	BatDep	Identifies depression contours based on raw DTM data.
Batch Direction	BatDir	Changes direction of lines.
Batch Filter	BatFil	Filters lines with tube, distance.
Batch Flow	BatFlo	Forces lines to flow in one direction.
Batch Grid	BatGri	Creates grid points based on existing VrOne data.
Batch Join	BatJoi	Joins lines within and between workspaces.

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Batch Node	BatNod	Nodes lines in workspaces.
Batch Walls	BatWal	Clears lines from retaining walls.
Batch Offset	BatOff	Offsets lines.
Batch Smooth	BatSmo	Smooths lines and places points in file.
Batch Trim	BatTri	Trims lines to lines or text.
Bump Elevations	BumEle	Changes points within contour intervals.
Change Text Elevations	ChaTez	Changes text elevations.
Clear Polygons	ClePol	Clears or modifies lines inside polygons.
Clean Lines	CleLin	Searches for duplicate points on lines.
Classify Points Bare Earth	ClaPoi BarEar	Classifies VrPoints (LiDAR) from aerial sources into bare earth (ground) and non-ground classifications.
Delete Arc Flags	DelArc	Deletes line arc flags.
Drape	Drape	Drapes entities over DTM or lines with wall ability.
Delete Node Flags	DelNod	Deletes line node flags.
Delete Close Points	DelClo	Deletes points within a distance of lines.
Delete Close Lines	DelCloLin	Deletes or re-layers lines that fall within a user specified distance of other lines.
Delete Crossing Lines	DelCroLi n	Deletes or re-layers lines that cross other lines.
Delete Contours	DelCon	Deletes contour intervals.
Delete Duplicates	DelDup	Deletes duplicate entities.
Delete Duplicate Segments	DelDupS eg	Deletes duplicate segments.
Delete Points In Polygons	DelPoi	Deletes points in polygons.
Delete Outside Boundary	DelOut	Deletes entities outside boundary line.
Delete Short Lines	DelSho	Deletes short line segments.
Fix Arcs	FixArc	Places arc flags on lines.
Gap Lines	GapLin	Places gaps where lines touch.

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Global Change	Glob	Globally changes lines, symbols, text and VrPoints in single or multiple workspaces.
Image Merge	ImaMer	Merges multiple images into a single file.
Keypoint	KeyPoi	A point thinning method that generates keypoints by identifying existing VrPoints (LiDAR/point cloud) as keypoints.
Label Symbol Elevations	LabSym	Labels elevations on symbols.
Line Cross	LinCro	Finds crossing lines.
Line Cross Z	LinCrz	Checks the Zs of common points on crossing lines.
Line Close	LinClo	Closes or checks for closure of lines.
Line Point Inside	LinPoi	Checks for the existence of symbols and (or) points within lines
Segment Lines	SegLin	Convert lines into individual 2 point segments.
Make Polygons	MakPol	Makes closed polygons using existing line segments and centroids.
Merge Files	Merge	Merges multiple VrOne files into current workspace.
Load DTM Parameter File	ParFilDtm	Loads DTM parameter file from key-in which will be in effect for subsequent DTM processing.
Place Symbols	PlaSym	Places symbols on entities.
Round Elevations	RouEle	Rounds the elevations of entities to an even multiple of a user-defined value.
Run Dtm	RunDtm	Runs Dtm.
Search Elevation	SeaEle	Searches elevation range and changes entities' layer.
Set Dtm	SetDtm	Sets Dtm parameters.
Set Elevation	SetEle	Sets the elevation of entities in specified layer(s).
Sheet Layout	SheLay	Sheet Layout.
Shift Workspace	ShiWs	Shifts workspace(s) in XY and/or Z.
Swap Axis	SwaAxi	Swaps coordinate axis.
Tile Points	TilPoi	Tiles VrPoints (LiDAR) from multiple VrOne files and creates new VrOne files.

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Transform Workspace	TraWs	Performs 2D transformation of workspace(s).
Transform Vr Files	TraVr	Transforms Vr workspaces from one coordinate system to another

CoGo – Coordinate Geometry Applications

Name	Key-in	Description
Bearing Bearing	BeaBea	Bearing Bearing Intersection
Bearing Distance	BeaDis	Bearing Distance Intersection
Distance Distance	DisDis	Distance Distance Intersection
Distance Offset	DisOff	Distance Offset Computation
Inverse	Inv	Inverse between two digitized points
Label Bearing	LabBea	Label Bearing Distance on line segments
Point to Plane	PoiPla	Computes a distance from a point to a plane
Strike and Dip	StrDip	Strike and Dip 3 point solution

DTM – Digital Terrain Modeling

Name	Key-in	Arguments	Description
Load DTM Parameters	LoaDtm	File name	Loads DTM parameter file which will be used for the next RunDtm.
Run DTM	RunDtm		Runs DTM based on current parameters.
Manage DTM	ManDtm		Manages multiple DTM surfaces and perform volume calculations.
Free DTM	FreDtm	Surface #	Frees DTM surface from memory.
Quick DTM	QuiDtm		Runs contours from last saved surface file.
Load Surface	LoaSur	File name	Loads a DTM surface into memory.
Clear Surface	CleSur		Clears active DTM surface from memory.
Set User DTM Area	SetUdt		Allows user to select new User-Defined

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			Area.
Show User DTM Area	ShoUdt		Displays temporary white line on the graphics window showing current User-Defined area shape.
Drape	Dra Drape		Drapes entities to current DTM surface.
Isolate DTM Layers	IsoDtm		Turns off all layers except those specified in the current DTM points and break lines' parameters.

Edit Applications

Name	Key-in	Description
Break Line	BreLin	Breaks line.
Change Elevations	ChaEle	Changes elevations to Z Source elevations.
Change Graphic Pointer	ChaGra	Changes graphic pointer.
Classify 3D	Cla3D	Classifies, changes layer, or deletes VrPoints (LiDAR) based on shapes in a 3D stereo environment.
Copy Window	CopWin	Copies window.
Copy Polygon	CopPol	Copies from user-defined polygon.
Cut Polygon	CutPol	Cuts from a user-defined polygon.
Cut Sheet	CutShe	Cuts vector/image data against sheet lines.
Cut Window	CutWin	Cuts from a user-defined window.
Delete Window	DelWin	Deletes window.
Drape Polygon	DraPol	Drapes VrPoints (LiDAR) against DTM created from user defined polygon.
Drape To Points	DraPoi	Drapes line points and (or) symbols to existing VrPoints (LiDAR).
Edit Elevations	EdiEle	Edits elevations.
Edit Line	EdiLin	Edits line.
Edit Vertex	EdiVer	Interactively edits line point positions.
Edit Point	EdiPoi	Interactively edits a single VrPoint (LiDAR) in a VrOne workspace.

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Edit Symbol	EdiSym	Edits symbol.
Edit Text	EdiTex	Edits text.
Explode Line	ExpLin	Explodes fonted line(s) into individual lines.
Explode Symbol	ExpSym	Explodes symbol(s) into lines.
Explode Text	ExpTex	Explodes text into lines.
Fast Delete	FasDel	Fast deletes.
Grid Line	GriLin	Grids line(s).
Hack Line	HacLin	Hacks line.
Hatch Line	HatLin	Hatches line or layer(s)
Inherit	Inh	Copies entity properties.
Join Lines	JoiLin	Joins lines.
Line Lines Intersect	LinLin	Line to lines intersection.
Move Polygon	MovPol	Moves from user-defined polygon.
Move Vertex	MovVer	Interactively moves line points.
Move Window	MovWin	Moves window.
Polygon Elevation	PolEle	Changes elevation of symbols inside polygons.
Reverse Line	RevLin	Reverses line(s).
Slope Line	SloLin	Slopes lines based on two existing points.
Square Existing Lines	SquExi	Squares existing line(s).
Tick Line	TicLin	Ticks line(s).
Trim Lines	TriLin	Trims lines which considers more than two crossing points
Trim Lines1	TriLi1	The original trim lines interactive application

Insert Applications

Name	Key-in	Description
Correlate Area	CorAre	Places points on the ground in user-defined area.
Create Symbols	CreSym	Creates symbol.
Manage Symbols	ManSym	Displays and manages symbols and line fonts.
Drive Grid	DriGri	Drives to grid and places points.
Insert Catenary	InsCat	Inserts lines along power line catenaries from LiDAR

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		data
Insert Edge	InsEdg	Inserts lines along feature edges from LiDAR data
Insert Fly Line	InsFly	Inserts fly line.
Insert Line	InsLin	Inserts line.
Insert Line Text	InsLte	Inserts line text.
Insert Paint Line	InsPai	Inserts lines along paint lines from LiDAR data
Insert Parallel Line	InsPar	Inserts parallel line.
Insert Road	InsRoa	Inserts up to nine parallel or offset lines from a digitized base line.
Insert Multiple Parallel Line(s)	InsMul	Inserts multiple parallel line(s).
Insert Squared Line	InsSqu	Inserts squared line.
Insert Orthogonal Line	InsOrt	Inserts orthogonal line by reading line segments.
Insert Orthogonal Corner	InsOrc	Inserts orthogonal line by reading polygon corners.
Insert Symbol	InsSym	Inserts symbol.
Insert Text	InsTex	Inserts text.
Interpolate Contours	IntCon	Interpolates contours between two existing contours.
Label Point	LabPoi	Labels point with XY and/or Z
Digitize Control	DigCon	Digitizes coordinate points into a control file.
Plot Control	PloCon	Enables plot control.
Point On Line	Pol	Places a point on line on an existing line.
Scan P3	ScaP3	Drives the Zeiss P-Series stereoplotters along profile lines.
Sheet Grid	SheGri	Enables sheet grid.
Symbol Fill	SymFil	Fills polygon with symbols with drape option.
Insert File	InsFil	Inserts a VrOne file into the current workspace.

VrThree (VrLiDAR)

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VrThree (VrLiDAR) is the integration of LiDAR data and processing into the Vr Mapping software, specifically VrOne and VrTwo.

VrThree (VrLiDAR) consists of:
- Vr data base (.vr) support for LiDAR data including LiDAR point attributes.
- The import and export of LiDAR data.
- The integration of LiDAR processing into existing mapping application where applicable.
- The implementation of LiDAR specific applications such as VrThree (VrLiDAR).

Please see VrThree (VrLiDAR) for more information.

Macros

Although any key-in may be placed the a macro, the following commands are useful when programming macros.

Name	Key-in	Arguments	Description
Wait for application exit	Wait		Waits until the current application has terminated before processing any more commands. Should be used from Vr Macros only.
Sleep	Sleep	Microseconds 1000=1second	Pauses the program for a user specified time.
Print	Print	String	Prints message to Command Window.
Verbose	Verbose	Off| On	When on, all commands received echo to the Command Window.

System Keyboard VrOne Key Assignments

Name	Key-in	Arguments	Description
Function Keys F1-F12			F1-F9 – VrOne Keys 1-9 F10 – VrOne Key * F11 – VrOne Key 0 F12 – VrOne Key #
Keypad			0-9 – VrOne Keys 0-9 Del (.) – VrOne Key *

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			Enter – VrOne Key # **NOTE**: These VrOne Keys are active when Num Lock is OFF
Number Lock control	NumLoc	On | Off | 1 | 0	Conditions the system keyboard number lock.

Translators

Name	Key-in	Description
ASCII Out	AscOut	VrOne to ASCII list
ASCII In	AscIn	ASCII list to VrOne
Dxf In	DxfIn	Drawing Exchange Format to VrOne
Dxf Out	DxfOut	VrOne to Drawing Exchange Format
Cm2Vr	Cm2Vr	CADMAP to VrOne (External program)
Vr2Cm	Vr2Cm	VrOne to CADMAP (External program)
KML Out	KmlOut	VrOne to KML (Google Earth)
MicroStation Out	MstOut	VrOne to MicroStation
MicroStation In	MstIn	Microstation to VrOne
Shape Out	ShpOut	VrOne to ArcView Shape file
Shape In	ShpIn	ArcView Shape file to VrOne
Survey Points Out	SurOur	VrOne to Survey Points format
DSFL Out	DsfOut	VrOne to Danish DSFL format
DSFL In	DsfIn	Danish DSFL format to VrOne
LAS Out	LasOut	VrOne Points to LAS format (VrThree (VrLiDAR))
LAS In	LasIn	LAS format to VrOne Points (VrThree (VrLiDAR))
Points Out	PoiOut	VrOne Points to ASCII Points files (.pts) (VrThree (VrLiDAR))
Points In	PoiIn	ASCII Points files (.pts) to VrOne Points (VrThree (VrLiDAR))
XML In	XmlIn	LandXML schema based surface XML files into VrOne data files
XML Out	XmlOut	VrOne lines and symbols into a LandXML schema based

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		XML file

Version

Name	Key-in	Description
Global Help	Ghelp	Displays this page.
Local Help	Help	Displays information about the current running application.
Release Notes	RelNot	Displays the release notes.
Help Index	HelInd	Displays the help main page.
About	Abo	Displays information about VrOne including version.

2.1.1.1 Application Stack Management

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Application Stack Management

Name	Key-in	Arguments	Description
Pop Application	Pop		Pops (terminates) current application.
Pop Application	Pop	1-20	Pops (terminates) a number of applications.
Pop Application	Pop	All	Pops (terminates) all applications.
Swap Application	Swa		Swaps the top two applications.
Associate Command 1	Ac1		Executes associate command(s) 1.
Associate Command 2	Ac2		Executes associate command(s) 2.

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Wait for application exit	Wait		Waits until the current application has terminated before processing any more commands. Should be used from Vr Macros only.
No Overlay	NoOverlay NoOve		Turns off application overlay mode. Allows only one application to be added to stack and then waits for that application to end before starting a new one. Normally used in the OnEnd argument inside function keys. Should always be paired with the Overlay command.
Overlay	Overlay Ove		Turns on application overlay mode after it has been turned off by NoOverlay.

2.1.1.2 Batch Applications

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Applications

Name	Key-in	Description
Batch Attach	BatAtt	Attaches source line end segments to target lines.
Batch Areas	BatAre	Changes layer and graphic pointer of line entities based on the line's area.
Batch Common	BatCom	Processes common and orphaned node points between lines.
Batch Contour	BatCon	Generate contours for large volumes of data in multiple VR files.
Batch Depression Contour	BatDep	Identifies depression contours based on raw DTM data.

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Batch Direction	BatDir	Changes direction of lines.
Batch Filter	BatFil	Filters lines with tube, distance.
Batch Flow	BatFlo	Forces lines to flow in one direction.
Batch Grid	BatGri	Creates grid points based on existing VrOne data.
Batch Join	BatJoi	Joins lines within and between workspaces.
Batch Node	BatNod	Nodes lines in workspaces.
Batch Walls	BatWal	Clears lines from retaining walls.
Batch Offset	BatOff	Offsets lines.
Batch Smooth	BatSmo	Smooths lines and places points in file.
Batch Trim	BatTri	Trims lines to lines or text.
Bump Elevations	BumEle	Changes points within contour intervals.
Change Text Elevations	ChaTez	Changes text elevations.
Clear Polygons	ClePol	Clears or modifies lines inside polygons.
Clean Lines	CleLin	Searches for duplicate points on lines.
Classify Points Bare Earth	ClaPoi BarEar	Classifies VrPoints (LiDAR) from aerial sources into bare earth (ground) and non-ground classifications.
Delete Arc Flags	DelArc	Deletes line arc flags.
Drape	Drape	Drapes entities over DTM or lines with wall ability.
Drape Control	DraCon	Drapes the x,y,z points in a control file to a point cloud and creates a report.
Delete Node Flags	DelNod	Deletes line node flags.
Delete Close Points	DelClo	Deletes points within a distance of lines.
Delete Close Lines	DelCloLin	Deletes or re-layers lines within a distance to other lines.
Delete Crossing Lines	DelCroLi n	Deletes or re-layers lines that cross other lines.
Delete Contours	DelCon	Deletes contour intervals.
Delete Duplicates	DelDup	Deletes duplicate entities.
Delete Duplicate Segments	DelDupS eg	Deletes duplicate segments.

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Delete Points In Polygons	DelPoi	Deletes points in polygons.
Delete Outside Boundary	DelOut	Deletes entities outside boundary line.
Delete Short Lines	DelSho	Deletes short line segments.
File Index	FilInd	Creates file extents as lines an places them into workspace 1.
Fix Arcs	FixArc	Places arc flags on lines.
Gap Lines	GapLin	Places gaps where lines touch.
Global Change	Glob	Globally changes lines, symbols, text and VrPoints in single or multiple workspaces.
Image Merge	ImaMer	Merges multiple images into a single file.
Label Symbol Elevations	LabSym	Labels elevations on symbols.
Line Cross	LinCro	Finds crossing lines.
Line Cross Z	LinCrz	Checks the Zs of common points on crossing lines.
Line Close	LinClo	Closes or checks for closure of lines.
Line Point Inside	LinPoi	Checks for the existence of symbols and (or) points within lines
Segment Lines	SegLin	Convert lines into individual 2 point segments.
Make Polygons	MakPol	Makes closed polygons using existing line segments and centroids.
Merge Files	Merge	Merges multiple VrOne files into current workspace.
Load DTM Parameter File	ParFilDtm	Loads DTM parameter file from key-in which will be in effect for subsequent DTM processing.
Place Symbols	PlaSym	Places symbols on entities.
Round Elevations	RouEle	Rounds the elevations of entities to an even multiple of a user-defined value.
Run Dtm	RunDtm	Runs Dtm.
Search Elevation	SeaEle	Searches elevation range and changes entities' layer.
Set Dtm	SetDtm	Sets Dtm parameters.

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Set Elevation	SetEle	Sets the elevation of entities in specified layer(s).
Sheet Layout	SheLay	Sheet Layout.
Shift Workspace	ShiWs	Shifts workspace(s) in XY and/or Z.
Symbols to/from VrPoints	SymPoi	Converts Symbols to/from VrPoints
Swap Axis	SwaAxi	Swaps coordinate axis.
Tile Points	TilPoi	Tiles VrPoints (LiDAR) from multiple VrOne files and creates new VrOne files.
Transform Workspace	TraWs	Performs 2D transformation of workspace(s).

2.1.1.2.1 Batch Areas

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Batch Areas (BatAre)

Type: Batch Application

Changes the layer and graphic pointer of lines that meet a user-defined search criteria. Lines will be chosen for change based on each line's area and layer. Lines that are open can still be considered.

Detailed Description

Batch Areas is useful for identifying lines that fall within an area range. Multiple passes may be taken on the VrOne data, with each pass using a different search criteria and different target parameters. Search criteria includes a layer number lines and minimum and maximum area values. Target parameters include layer number and graphics pointer number. For each pass, any line that falls in a search layer and has an area equal to or within the minimum and maximum area values will be changed to the target parameters. It is also possible to delete lines that meet the search criteria by specifying a -1 as the target layer.

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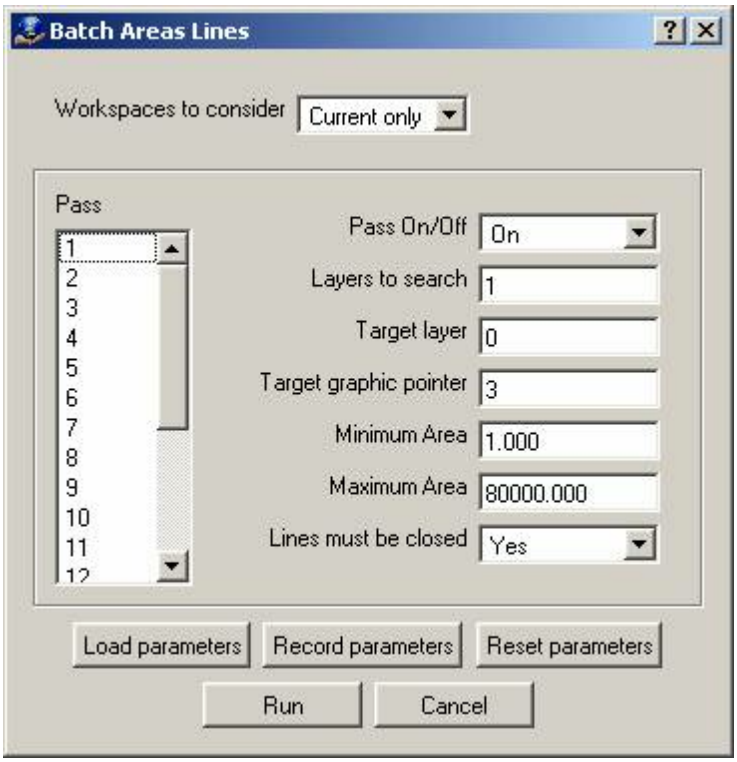
Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Area parameter file name (.baf)
RUN	Run Batch Areas	

Parameters



Workspaces to consider

Defines the workspaces to consider when running batch areas. This may be set to "Current only", or "All Open". NOTE: This option is not stored for each pass. It is a global setting.

Pass

Lists the available pass numbers. Highlighting a number in this list makes it the current pass number, allowing the settings for the pass to be edited in the fields to the right.

The following parameters apply to the currently selected pass.

Pass On/Off

Sets the currently selected pass on or off.

Layers to search

Sets the layers to search. This may be a number line.

Target layer

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Sets the target layer to be assigned to lines that pass the search criteria. A -1 indicated that the lines should be deleted. If left blank, the layer will not be changed.

Target graphic pointer

Sets the target graphics pointer to be assigned to lines that pass the search criteria. If left blank, the graphic pointer will not be changed.

Minimum Area

Sets the minimum line area. Any lines with areas below this value will not be changed.

Maximum Area

Sets the maximum line area. Any lines with areas above this value will not be changed.

Lines must be closed

If set to Yes, only lines that are closed will be considered for changing. If set to No, all lines will be considered for changing. If a line is open, then the area will be calculated by temporarily closing the line (a segment will be added between the last and first line points).

Load Parameters

Allows parameters to be loaded from a previously saved parameter file.

Record Parameters

Records parameters to a file.

Reset Parameters

Resets all parameters to default values.

Run

Runs the batch areas application.

Cancel

Closes the dialog without running the batch areas application.

2.1.1.2.2 Batch Attach

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Attach (BatAtt)

Type: Batch Application

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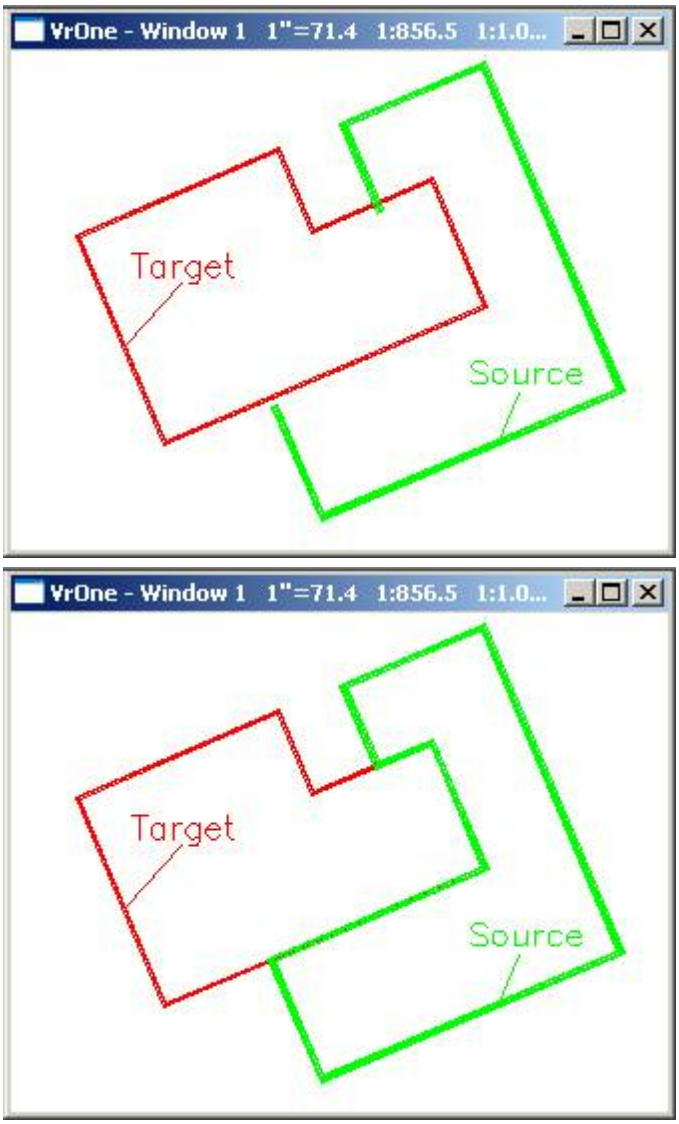
Attaches source line end segments to target lines.

Detailed Description

Batch Attach is useful for attaching certain types of map features such as building decks and pads to buildings. Options include the ability to copy common points from the target lines (buildings) to the source lines (decks). Noding and Z-Rules are supported.



In the above example the red line is the target line and the green line is the source line. The source line under-shoots the target line at the lower node and over-shoots the target line on the upper node. The resulting attach in the second windows shows the attachment of the source line to the target line and the optional "Copy common line segments" and "Node target lines".

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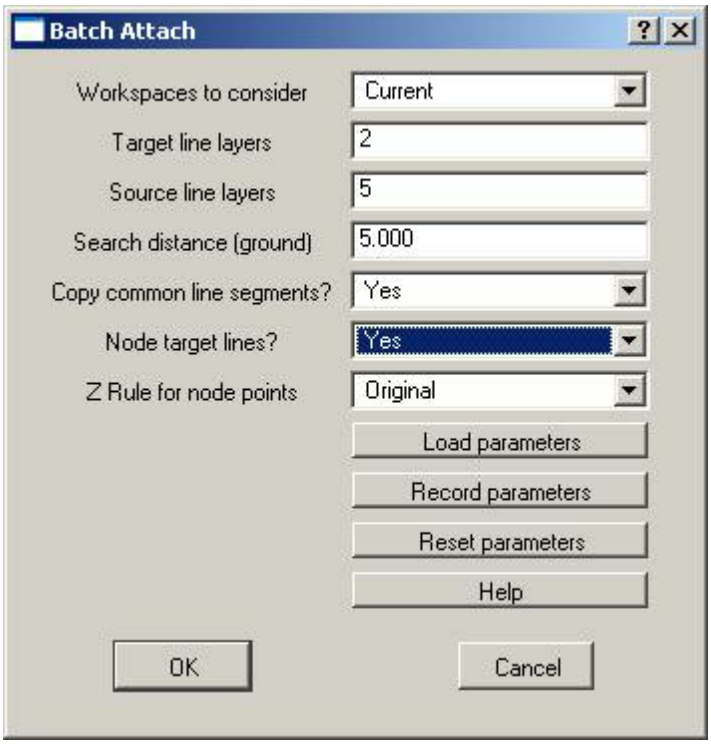
Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Attach parameter file name (.btt)
RUN	Run Batch Node	

Parameters for Batch Attach



Workspaces to consider

Defines the workspaces to consider when running batch node.

Target Layers

Layers containing lines that will be attached to. These lines are considered line 1 for the Z rule. A number line may be used to define the layers.

Source Layers

Defines the layers containing lines to attach to target lines. These lines are considered line 2 for the Z rule. A number line may be used to define the layers.

Search Distance

Defines the distance to search from the target lines for source lines.
This parameter is used to find undershoots and is set in ground units.
NOTE: The Search Distance should be kept as small as possible. Unexpected results may occur if this parameter is unreasonable.

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Copy Common Line Segments

If this parameter is set to "Yes" then common line segments from the target line will be copied to the source line. This will make the source line a closed polygon.

Node Target Lines

If this parameter is set to "Yes" then a common point will be placed on the target line. This common point will be the end points of the source line.

Z Rule

This rule is used for computing the elevation at the intersection of the two lines. During attach, an elevation for each line is computed at the intersection point. These elevations are based on the slope of the line segment as determined by the point before and after the break point. The Z Rule determines the action to be taken on these two elevations as follows:

- **Original elevations** – The elevations of the break points are not modified.
- **Mean node elevations** – The elevations are averaged and stored for both node points.
- **Elevation from line 1** – The elevation from the node point on line 1 is used on both lines.
- **Elevation from line 2** – The elevation from the node point on line 2 is used on both lines.

2.1.1.2.3 Batch Common

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Common (BatCom)

Type: Batch Application

Processes common and orphaned node points between lines.

Detailed Description

Batch Common finds and corrects mismatched node points and finds and corrects orphan node points between lines. The application automatically searches for both common and orphan points from both the source lines to the target lines and from the target lines to the source lines. Options include the ability to specify source and target layers, a minimum distance in which

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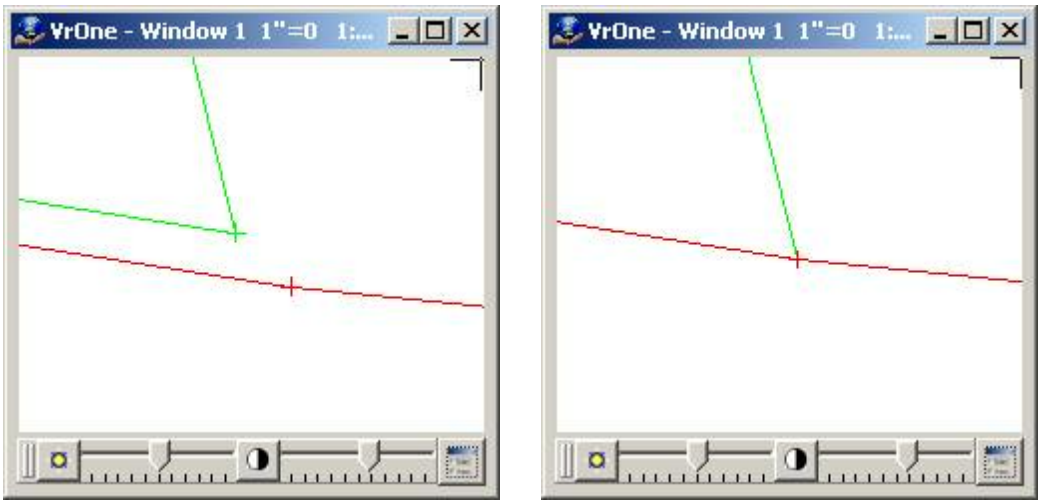
points are considered common, Xy and Z search distances, Xy and Z rules.

Corrective actions include the ability to mean common points, move source points to target points or move target points to source points. These actions may be taken in both the Xy and Z axis. A drive file will be created when running Batch Common so the mismatched points many be viewed.

Common Points

The following is an example of a common point mismatch. In this case the node points exist but are not matched. The example on the left shows the mismatched points and the example on the right shows the corrective action using the mean option.



Orphan Points

The following is an example of an orphan point. In this case the node point exists on only one line. The example on the left shows a node point on the green line and the absence of a corresponding node point on the red line. The example on the right shows the corrective action of placing a node point on the red line and then using the mean option to match the two points.

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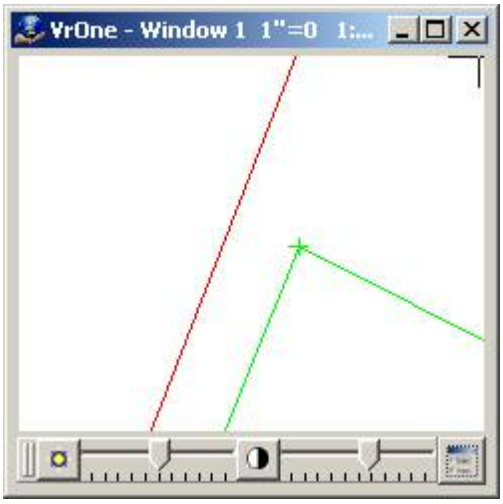
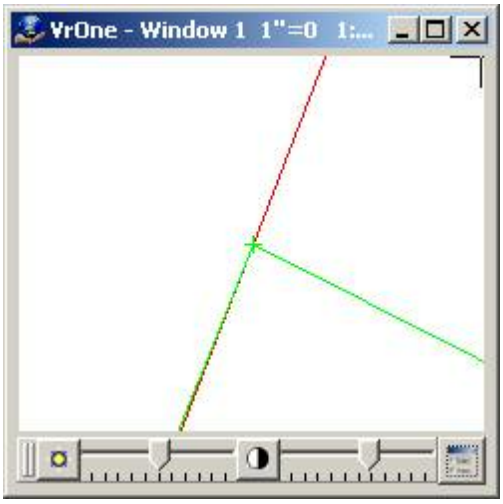
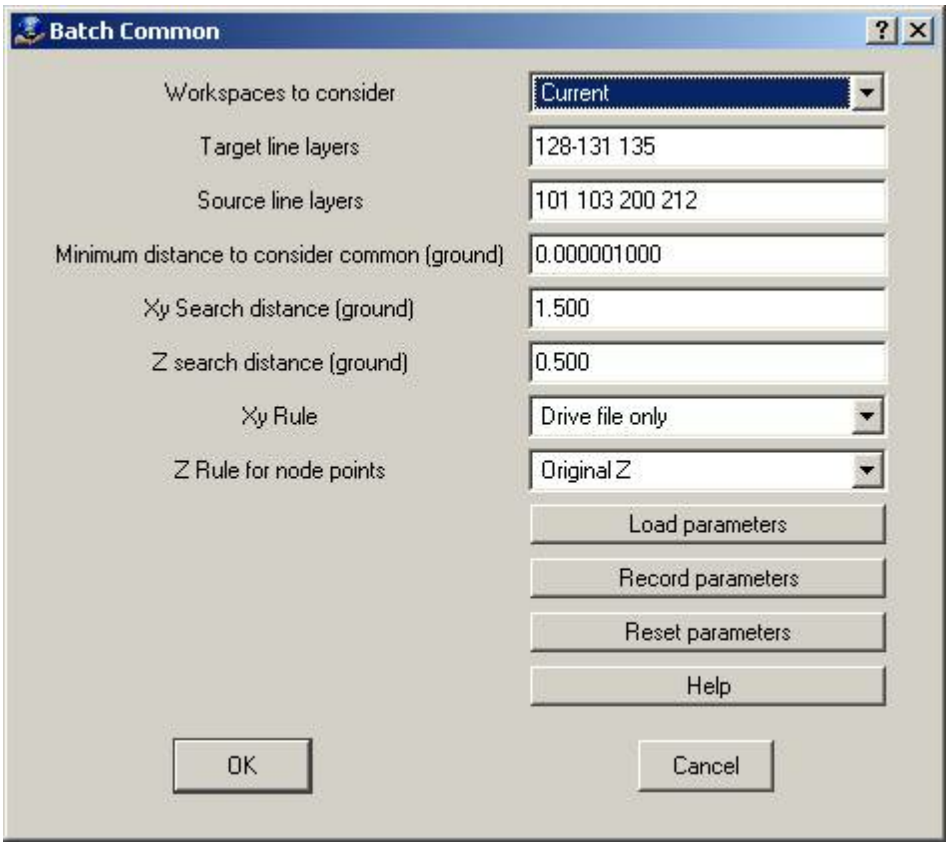




Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Common parameter file name (.btc)
RUN	Run Batch Node	

Parameters for Batch Common



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Workspaces to consider

Defines the workspaces to consider when running batch node.

Target Layers

Defines the layers containing the target lines, which will be checked against source lines. A number line may be used to define the layers. When running Batch Common, points on the source lines are compared to the points on the target line then points on the target lines are compared to the points on the source lines.

Source Layers

Defines the layers containing lines to attach to target lines. A number line may be used to define the layers. When running Batch Common, points on the source lines are compared to the points on the target line then points on the target lines are compared to the points on the source lines.

Minimum Distance To Consider Common

When testing points for commonality this distance is used to determine if two points are common. If the computed distance between two points is less than this value then the points will be considered common. This value should be very small and is expressed in ground units.

Xy Search Distance

If the computed Xy distance between two points is greater than the Minimum Distance and less than the Xy Search Distance then the points will be considered mismatched in the Xy direction. If the points are also mismatched in the Z direction then the Xy and Z Rules will be applied to the two points. This value is expressed in ground units.

Z Search Distance

If the computed Z distance between two points is greater than the Minimum Distance and less than the Z Search Distance then the points will be considered mismatched and the Z direction. If the points are also mismatched in the Xy direction then the Xy and Z Rules will be applied to the two points. This value is expressed in ground units.

Xy Rule

This rule is used for computing the position of the node points in the Xy direction.

- **Drive file only** – The node points are not changed in either the Xy or Z directions and only a drive file is created.
- **Original Z** – The elevations of the common points are not modified.
- **Mean points** – The points are placed at the mean Xy location between the two points.
- **Move source point to target point** – The Xy position from the source line will be used for both points.
- **Move target point to source point** – The Xy position from the target line will be used for both points.

Z Rule

This rule is used for computing the elevation of two node points.

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- **Original Z** – The elevations of the common points are not modified.
- **Mean Z** – The elevations are averaged and stored for both node points.
- **Move source Z to target Z** – The elevation from the source line will be used for both points.
- **Move target Z to source Z** – The elevation from the target line will be used for both points.

2.1.1.2.4 Batch Contours

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Contours (BatCon)

Type: Batch Application

Generates contours for massive amounts of data split among multiple VR files. The data is tile into managable pieces and optionally can be smoothed to create more aesethically pleasing contours.

Detailed Description

This application takes multiple VR files as input, and generates a combined set of contours for the whole. It is able to use vast amounts of data because it automatically tiles the data into manageable pieces and then merges the contour lines together. Optionally, users can smooth the data in a preprocessing step. The smoothing process thins the data to an approximate grid by using the point in each grid cell nearest the median elevation. Hence, smoothing does eliminate extreme highs and lows. However, break line and symbol data are never smoothed.

Steps

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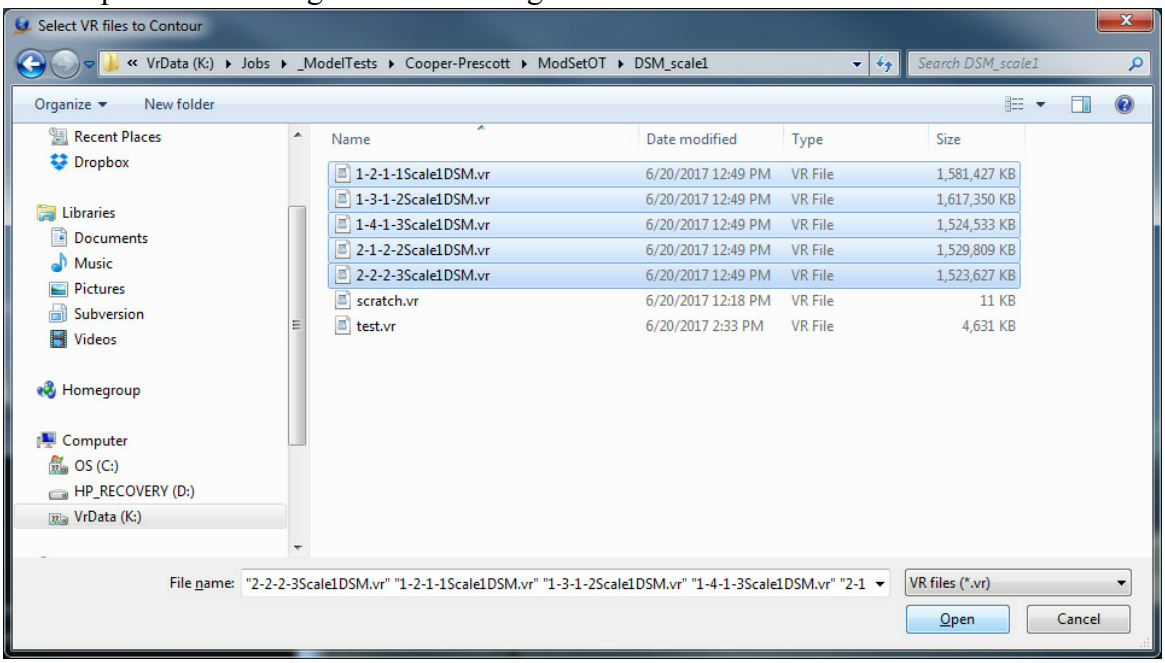
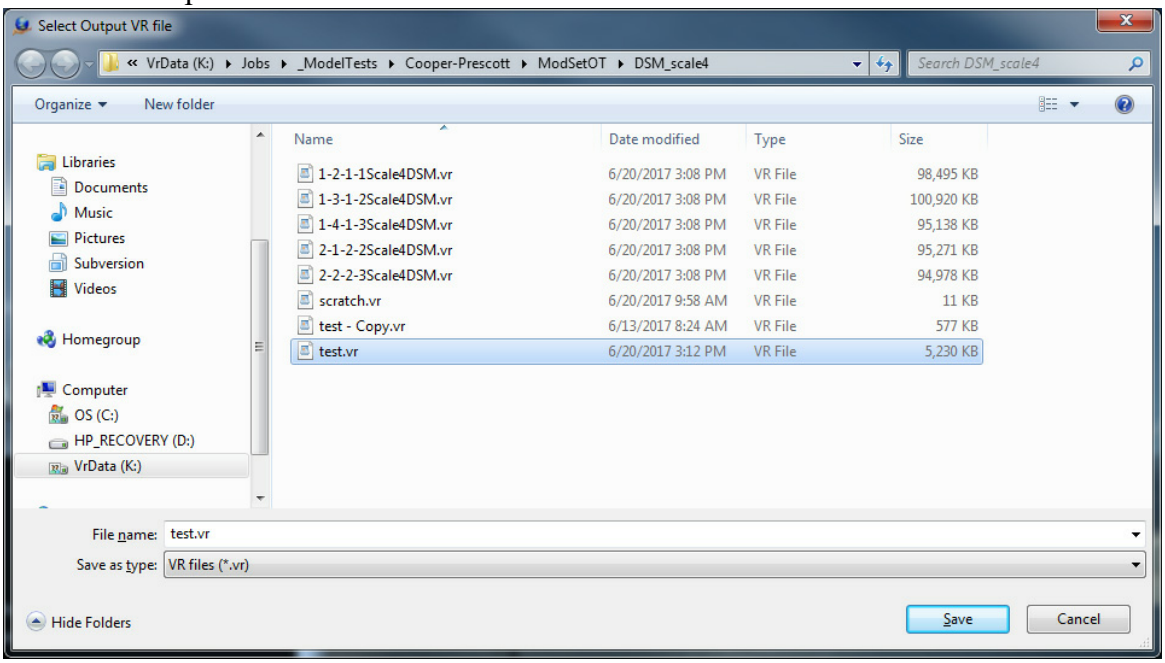
1. User is prompted to identify the VR files containing the data they wish to contour. In the example below five large DSMs are being contoured.



2. User is prompted to identify the VR file where the contours will be recorded. This cannot be one of the input files.



3. User is prompted to input standard DTM parameters. Note that some of the parameters are unavailable. For example, legs and boundary lines are not saved. For more details on DTM parameters see the help file.

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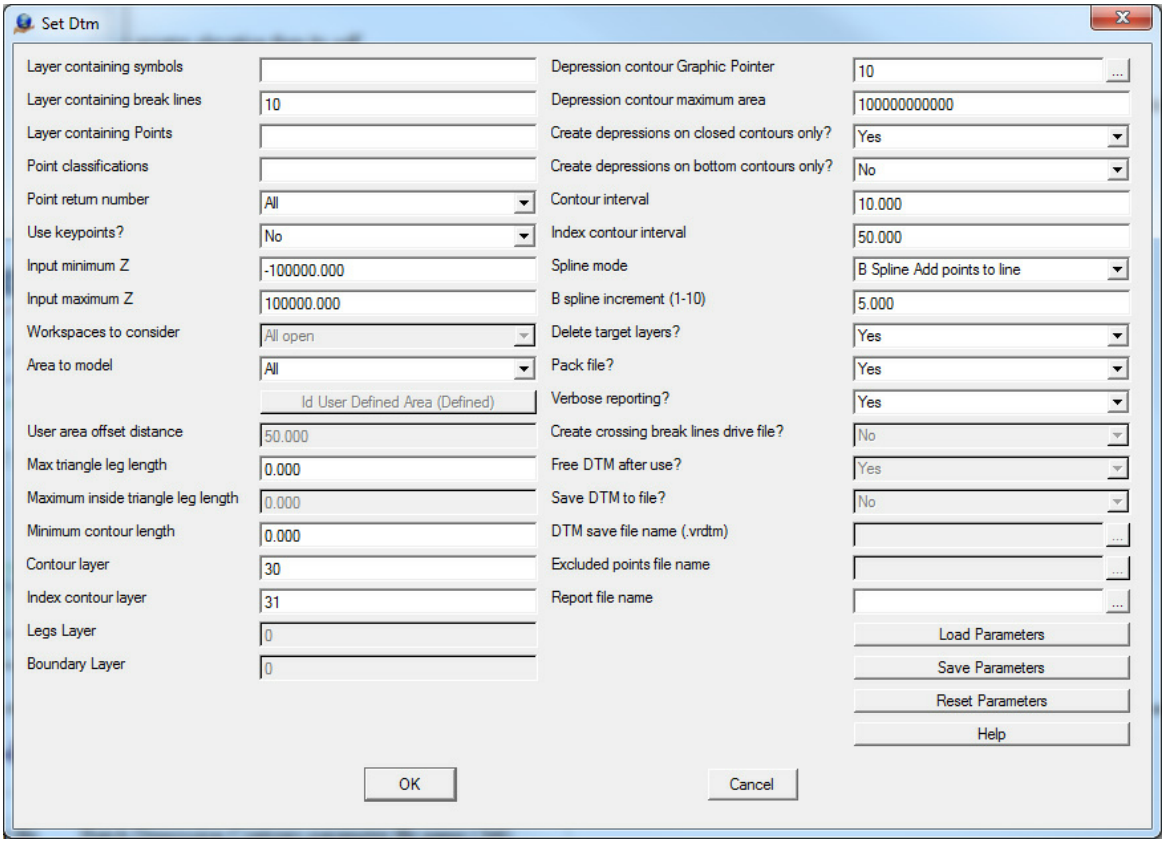
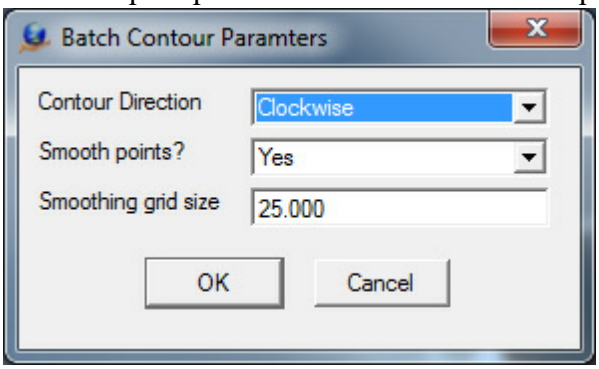


4. User is prompted for some Batch Contours specific parameters.



Contour Direction Contours can be saved as either clockwise or counter-clockwise lines

Smooth Points LiDAR and DSM data are frequently too detailed to produce aesthetically pleasing contours. To correct this the data may be selectively thinned to an approximated grid. The size of the grid is controlled by the next parameter. Symbols and breaklines are not thinned.

Smoothing grid size If smoothing is enabled then this will be the approximate grid spacing of the smoothed points.

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ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Depression Contours (BatDep)

Type: Batch Application

Flags depression contours.

Detailed Description

Batch Depression Contours is used to change the graphics pointer (i.e. line style) of depression contours.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Depression Contours parameter file name (.btt)
RUN	Run Batch Node	

Parameters for Batch Depression Contours

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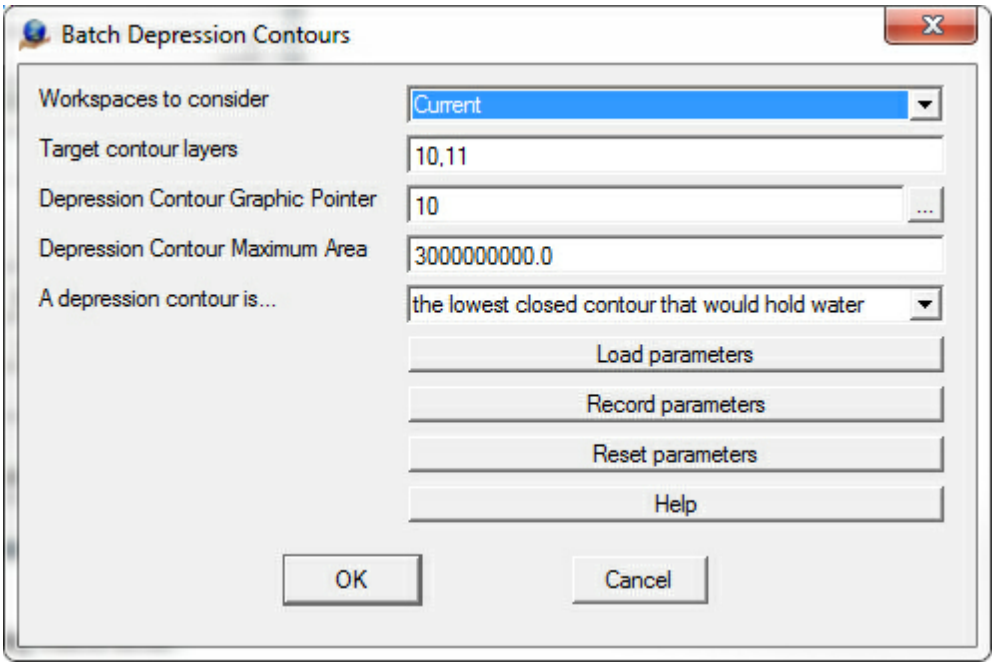

Workspaces to consider

Defines the workspaces to consider when running batch node.

Target Contour Layers

Defines the layers containing the contours lines to be flagged. A number line may be used to define the layers.

Depression Contour Graphics Pointer

Defines the graphics pointer to assign to depression contours. 10 is the default and produces tick marks that point downhill.

Depression Contour Maximum Area

Defines the maximum area that contours may contain in order to be considered for depression flagging. If this number is 0 then it will be ignored. This option is useful if all contours are being flagged (not just bottom contours).

A depression contour is...

Choose the definition of a depression contour that meets you needs. We have not been able to get our customer base to agree on definition of depression contour. Hence, the key processing parameter is a choice among the definitions. If you don't find a definition that meets you needs contact support@cardinalsystems.net to request a custom definition. Each of the definitions is described and presented with an example. The example data that will be used is shown below. In the left top is a straight forward pit and mound. In the bottom left is feature with elevation direction changes. On the right is settlement pond surrounded by a low berm. The surface inside the settlement pond alternates above and below the 100' contour.

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Definition 1: A depression contour is "a closed contour that would hold water inside it"

This is the most straight forward definition, and the results are shown below. Notice:

- Not all the contours in the pond on the right are depression contours because the surface is most probably alternating above and below the 100' level.
- The large 100' contour in the bottom left is a depression contour even though there is some area inside it that is higher--there is still some area that would hold water.
- The smaller 80' contour in the lower left is not a depression contour because it is most probably a slight rise at the bottom of that hole.
- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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Definition 2: A depression contour is "a closed contour inside a higher closed contour"

This definition makes any contour that is inside a higher closed contour a depression contour. Using this definition, the inside of a depression contour might not hold water. See the results below, note that

- All the contours in the pond are depression contours, but the tick marks alternate directions to show the downhill direction.
- The large 100' contour in the bottom left is not a depression contour because it is not inside a larger contour.
- The smaller 80' contour in the lower now a depression contour and the tick mark directions indicate that it is most probably a slight rise at the bottom of that hole.
- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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Definition 3: A depression contour is "any closed contour"

This definition is admittedly an abuse of the term 'depression contour', but it was requested. When used with graphic pointer (line style) 10 it marks closed contours with ticks that point downhill. See the example below, Note:

- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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Definition 4: A depression contour is "the lowest closed contour that would hold water"

Using this definition contours on the way down are not marked; only the bottom contour is marked. See the example below. Note:

- In the top right there are two 'bottom' contours one inside the other. This is because the ground rises some between alternating 100' contours, and hence there are two separate 'depressions' in that basin.
- Only the larger 80' contour in the lower left marked a depression because the ground has most probably started to rise and the other 80' contour marks the boundary of a somewhat higher area.
- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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Definition 4: A depression contour is "the lowest contour(s) in a depression"

This is an alternative way to view contours at the bottom of a basin. All of the lowest contours are marked as depression contours. See example below. Note:

- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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Definition 5: A depression contour is "the lowest empty closed contour that would hold water"

Using this definition a contour must not only hold water it must also be the lowest contour in a basin and contain no other contours (higher, lower, or equal elevation). See example below. Note:

- The bottom left basin has no depression contour. This is because the inside contour does not hold water (it is most probably a slight rise at the bottom of the sink).
- The tick marks point downhill. Use graphic pointer (line style 10) for this effect.

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2.1.1.2.6 Batch Direction

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Direction (BatDir)

Type: Batch Application

Changes direction of lines.

Detailed Description

Batch Direction is used to change the direction of lines based on layers or graphic pointers. Multiple passes may be taken on the VrOne data, with each pass using a different search criteria and different target parameters. Search criteria includes a layer number lines, and graphics pointer number lines. There is one target parameter, allowing the lines to be changed to run

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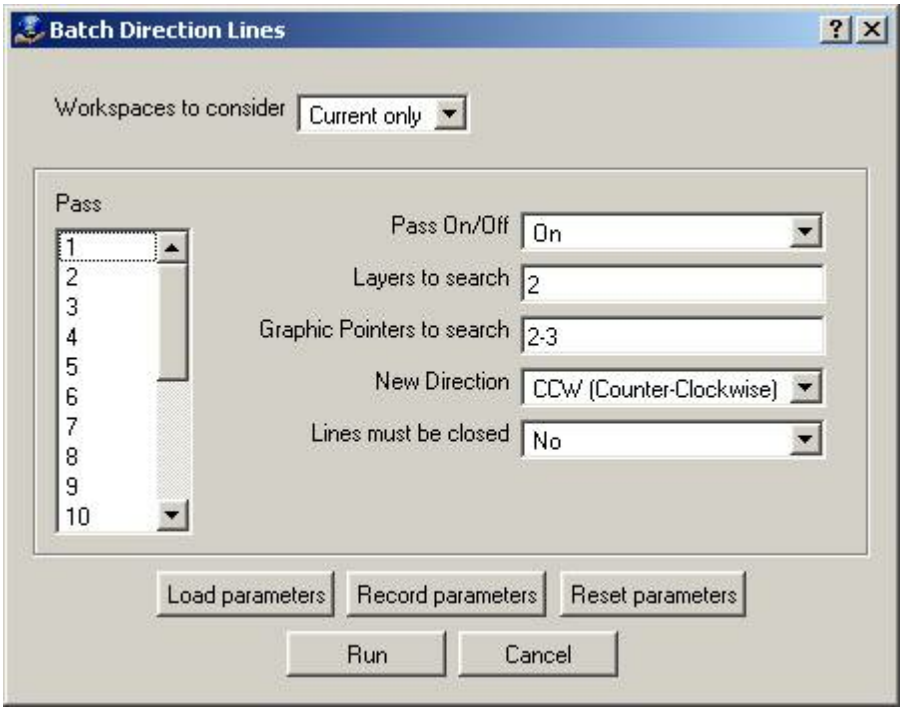
clockwise or counterclockwise. For each pass, any line that falls in the search layer, or matches the search graphic pointer will be forced to run in the direction specified. The layer or graphic point search parameters may be left blank to allow searching by only one parameter.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Direction parameter file name (.bdf)
RUN	Run Batch Direction	

Parameters



Workspaces to consider

Defines the workspaces to consider when running batch areas. This may be set to "Current only" or "All Open". NOTE: This option is not stored for each pass; it is a global setting.

Pass

Lists the available pass numbers. Highlighting a number in this list makes it the current pass number, allowing the settings for the pass to be edited in the fields to the right.

The following parameters apply to the currently selected pass.

Pass On/Off

Sets the currently selected pass on or off.

Layers to search

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Sets the layers to search. This may be a number line.

Graphic pointers to search

Sets the graphic pointers to search. This may be a number line.

New direction

If set to CW (clockwise), all lines that pass the search criteria will be forced to run in a clockwise direction. If set to CCW (counterclockwise), all lines that pass the search criteria will be forced to run in a counterclockwise direction.

Lines must be closed

If set to Yes, then only lines that are closed will be considered for changing. If set to No, then all lines will be considered for changing. If a line is open, then the direction will be determined by temporarily closing the line (a segment will be added between the last and first line points).

Load Parameters

Allows parameters to be loaded from a previously saved parameter file.

Record Parameters

Records parameters to a file.

Reset Parameters

Resets all parameters to default values.

Run

Runs the batch areas application.

Cancel

Closes the dialog without running the batch areas application.

2.1.1.2.7 Batch Flow

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Flow (BatFlo)

Type: Batch Application

Forces lines to flow in one direction.

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Detailed Description

This batch application can be used to make the elevations of existing lines flow in a single direction, either with increasing elevations or decreasing elevations as specified by the user. This is useful if project requirements call for a feature to always flow in a consistent direction, such as when collecting streams for hydro graphic enforcement. Any single point or series of points that do not flow in the required direction will be replaced by interpolated elevations using the point preceding the incorrect point(s) and the point following the incorrect point(s).

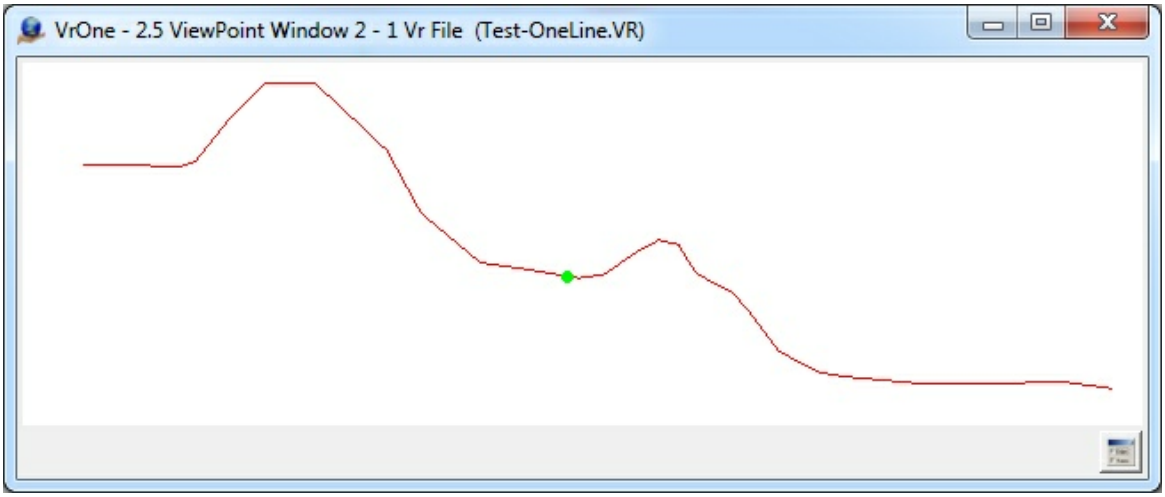
Batch Flow uses the first and last points on the line to determine the desired flow direction. Lines that are flowing backwards based on these two points will not be modified and an entry will be made into a Drive File so they may be corrected manually. Please see Drive File Management for more information on Drive Files.

The direction of flow can be specified as increasing or decreasing according to the ascending point order of the line, Batch Flow may be applied to multiple workspaces and multiple layers.

Layers that are turned off will not be considered even if they are specified.

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Flow parameter file name (.bfl)
RUN	Run Batch Flow	

Example



Cross section view of flow line before running Batch Flow

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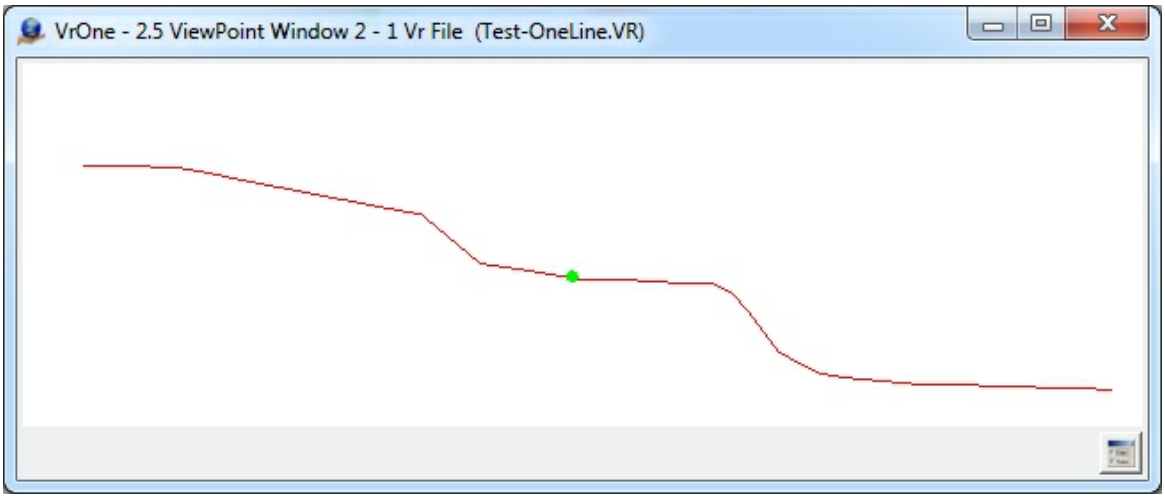
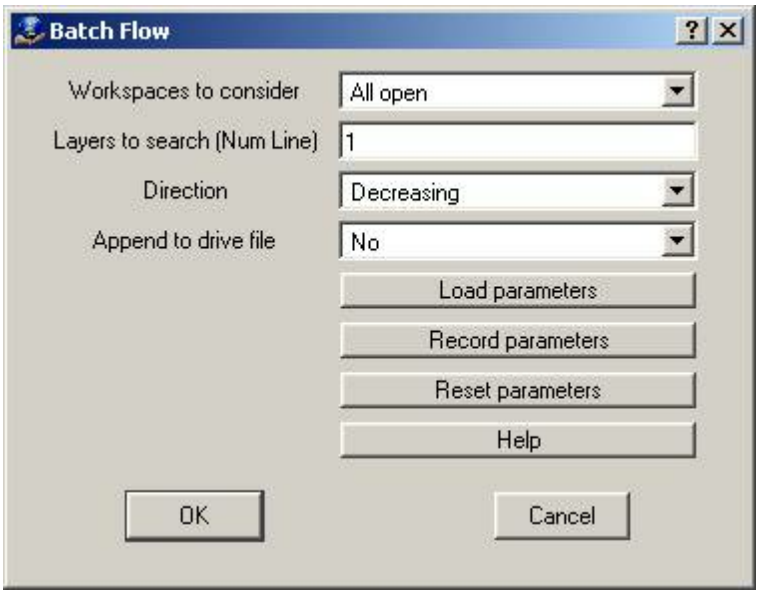


Cross section view of flow line after running Batch Flow

The exaggerated cross section view above illustrates a line before and after running Batch Flow. The line points are ascending from left to right and the slope direction parameter was set to Decreasing.

Parameters for Batch Flow



Workspaces to consider

Defines the workspaces to consider when running Fix Arcs. Options are Current workspace or All open workspaces.

Layers to search

Defines the layers to search that contain lines in which the arcs are to be re-defined. This parameter may be entered as a number line.

Direction

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Specifies the direction the lines should be flowing according to the ascending point order of the line. Either with decreasing elevations or increasing elevations.

Append to drive file

If set to yes, points are added to the existing Batch Flow drive file. If set to No, then any old points in the Batch Flow drive file will be cleared.

2.1.1.2.8 Batch Smooth

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Batch Smooth (BatSmo)

Type: Batch Application

Smooths existing lines by placing Spline or B-Spline points on the lines.

Detailed Description

Searches for lines within the layers specified, smooths the lines using a Spline or B-Spline method with user specified smoothing parameters.

Layers that are turned off will not be considered even if they are specified.

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Smooth parameter file name (.bsm)
RUN	Run Batch Flow	
WSTC=	Workspaces to consider	0=Current 1=All open
SEALAY=	Layers to search	Num Line
SMOMOD=	Smoothing mode	0=Spline 1=B-Spline)
SPLSHO=	Spline chord length (in|mm)	
BSPLMOD=	B-Spline increment	1-10

Example

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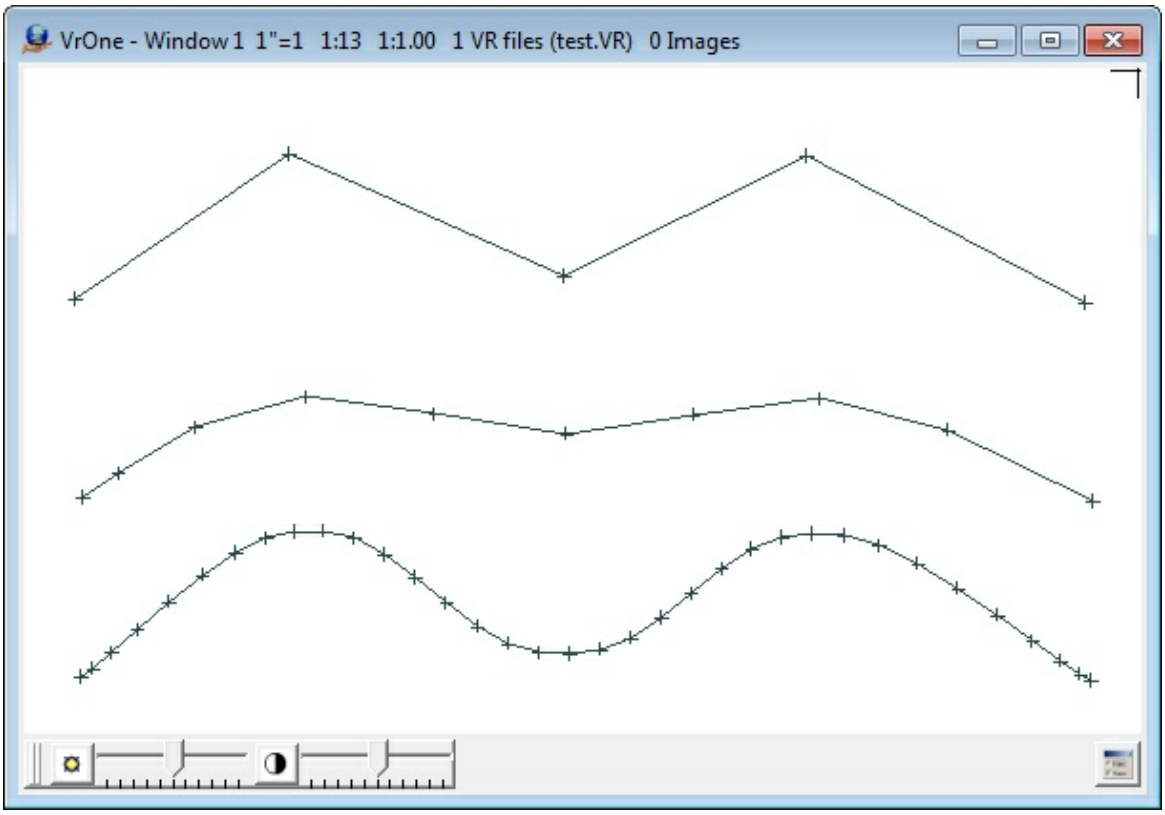

This illustrates a line before and after running Batch Smooth. The top line is the original line with four points. The middle line was processed using a Smoothing method of B-Spline and a B-Spline increment of 2.0. The bottom line was processed using a Smoothing method of Spline and a Spline chord length of 0.06.

Parameters for Batch Smooth

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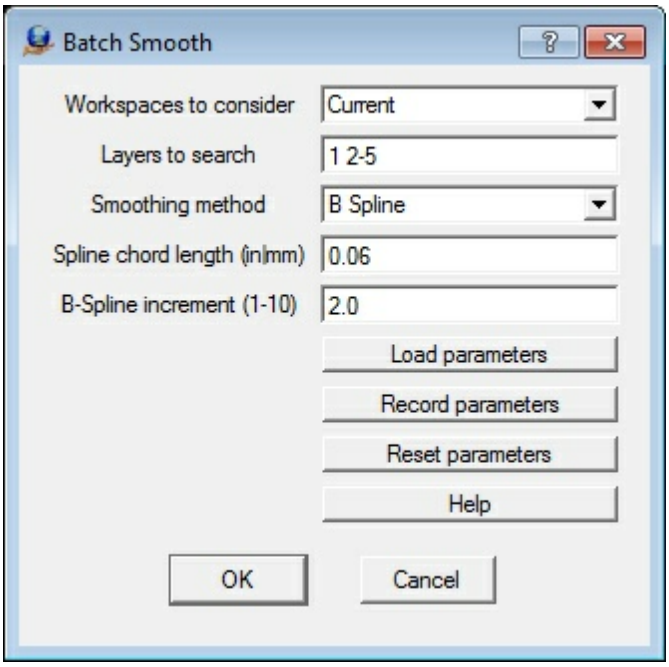

Workspaces to consider

Defines the workspaces to consider. Options are Current workspace or All open workspaces.

Layers to search

Defines the layers to search that contain lines to be processed. This parameter may be entered as a number line.

Smoothing method

Specifies the smoothing method to apply to the lines. This can be either B-Spline or Spline.

Spline chord length (in|mm)

If Spline smoothing method is chosen, this specified the chord length to use when placing spline points.

B-Spline increment (1-10)

If B-Spline smoothing method is chosen, this specified the B-Spline increment to use when placing B Spline points.

2.1.1.2.9 Batch Grid

Vr Mapping

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Batch Grid (BatGri)

Type: Batch Application

Interpolates points on a grid from existing VrOne data and writes the grid points as symbols to the current file or to a user specified output file.

Detailed Description

Batch Grid is useful for creating sparse datasets from dense datasets such as LiDAR points. When Batch Grid is started, it presents the user with a parameter dialog box. This box has several processing settings and displays a list of all files to be processed (file cross-reference table). By pressing the Add Files button, the user can add multiple files to the file cross-reference table. Each time Add Files is used, files are appended to the list. Output file names are automatically generated based on the prefix and postfix parameters specified by the user. Any output file name may be edited directly in the file cross-reference table. After files and parameters have been specified, the Run button is used to begin processing. For each input VrOne file, a DTM is generated in memory using the vector data in the input file. Points are then interpolated at even grid locations within the DTM boundary area, with the active DTM being used to determine the point elevations. The grid points are written as symbol entities either to the current VrOne file or to a new VrOne output file, depending on how the file cross-reference is set up. Because Batch Grid can potentially run for a very long time, making it more likely that something could cause the process to be interrupted, it has been designed with a built in method to restart the batch process where it last finished. This is accomplished by using the Log file and "Skip existing file" options, and is explained in the detailed documentation section for "Log File Name."

NOTE: This program can be operated without any files open in VrOne.

Local Commands

None

Parameters

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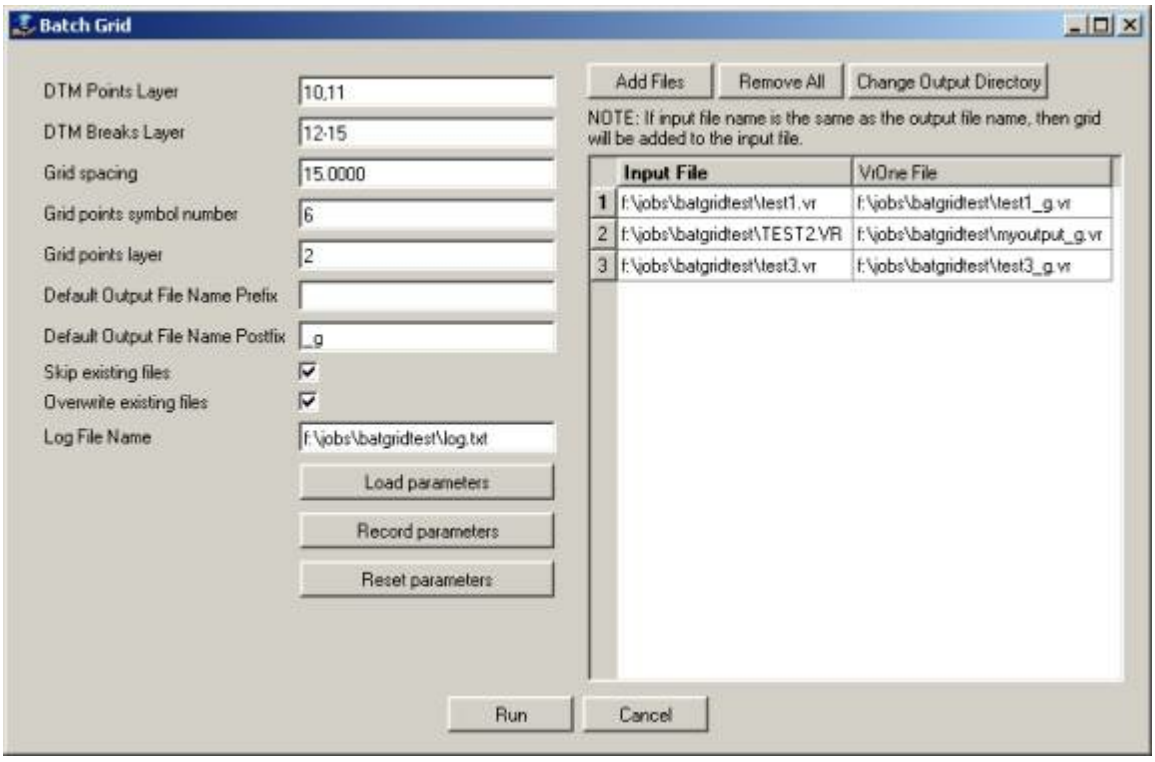

DTM Points Layer

Defines the layers to search for points (VrOne symbols) to use for DTM processing. A number line may be used.

DTM Breaks Layer

Defines the layers to search for break lines to use for DTM processing. A number line may be used.

Grid Spacing

Points are created on even grid points using this spacing interval.

Grid Points Symbol Number

Grid points are written to the output VrOne file using this symbol number (graphic pointer).

Grid Points Layer

Grid points are written to the output VrOne file on this layer.

Default Output File Name Prefix

When files are added to the file cross-reference table (using the "Add Files" button), the default output file name has this prefix string appended to the beginning.

Default Output File Name Postfix

When files are added to the file cross-reference table (using the "Add Files" button), the default output file name has this postfix string appended to the end.

Skip existing files

If this is checked, then processing is skipped for input files that have an existing output file. This

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only applies if the output file names are different than the input file names. If this is off, then grid points is appended to any existing VrOne files. This option is useful if restarting a batch run and want to skip existing files.

Overwrite existing files

If this is checked and "Skip existing files" is not checked, any existing output VrOne files are deleted. This only applies if the output file names are different than the input file names. If this is off, then grid points are appended to any existing VrOne files.

Log File Name

Logging information is written to this file. If left blank, no log file is created. NOTE: The log file is appended to with each run, so it may be necessary to periodically delete the file to keep it from growing to an unreasonable size. If the Batch Grid operation is unexpectedly interrupted for any reason, the log file can be examined to determine the last successfully completed file. If a file was in progress, it can be deleted, and the Batch process can be started again with the option to "Skip existing files" turned on.

Load Parameters

Allows parameters to be loaded from a previously saved parameter file.

Record Parameters

Records parameters to a file.

Reset Parameters

Resets all parameters to default values.

Add Files

Displays a standard VrOne file selection dialog box, allowing multiple VrOne files to be added to the cross-reference table.

Remove All

Clears all files in the cross-reference table.

Change Output Directory

Changes the output directory of all output file names in the cross-reference table.

2.1.1.2.10 Batch Join

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Batch Join (BatJoi)

Type: Batch Application

Joins and/or matches lines.

Detailed Description

Tries to join lines within the parameters specified. Options include limiting the lines to be joined by Layer, Mode, Graphic Pointer, horizontal distance and elevation. Many lines may be joined together as a single entity. This results in a cleaner and more contiguous data base. Batch join has the ability to join lines into a single entity if they exist in the same workspace and the ability to match the lines if they reside in separate workspaces. This avoids joining entities such as fence lines to entities such as road edges. There is also an option to match lines such that the lines are graphically joined but remain as separate entities in the data base. In this case, the lines will retain their original properties. When lines are joined into a single entity the properties from the first line will be used.

Batch Join creates a Drive File and there are several options to define what coordinates are placed in the file.

NOTE: Due to the recursive nature of this batch program, it is not undoable. Files should be backed up before running Batch Join.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Join parameter file name (.bjo)
RUN	Run Batch Join	

Parameters for Batch Join

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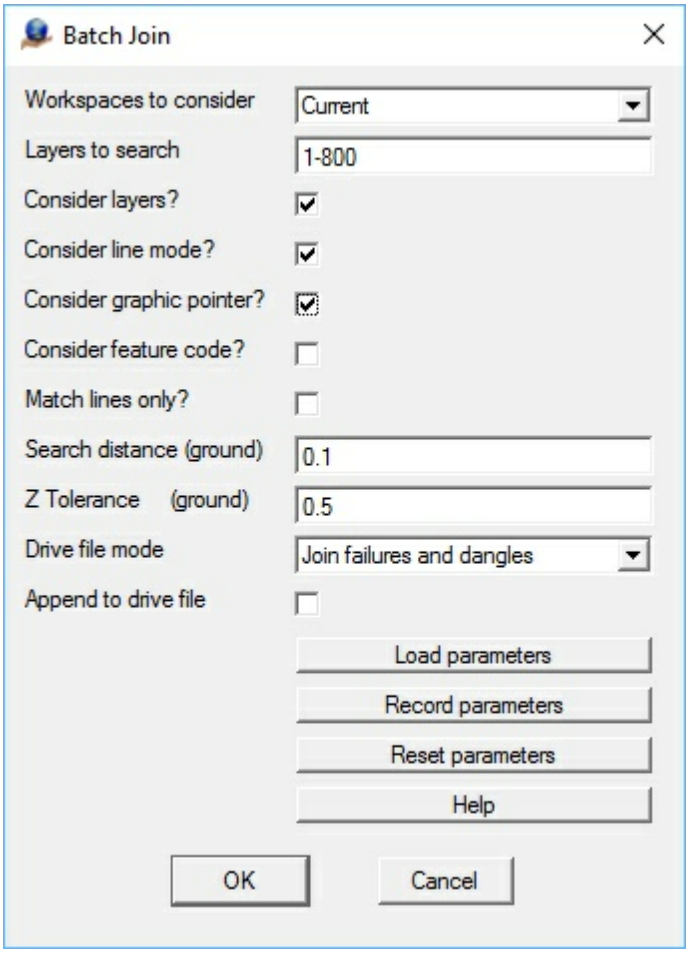

Workspaces to consider
Defines the workspaces to consider when running batch join. Lines that qualify for joining but are in separate workspaces will be matched only.

Layers to Search
Defines the layers to search. Lines within the same layer may be joined if they qualify. Layers that are not defined here are not considered when joining lines. Layers that are turned off are not considered even if they are defined here. A number line may be used to define the layers.

Consider Layers
When searching for lines to join, this parameter indicates if lines from different layers may be joined. If this parameter unchecked and two lines are joined, the line properties from the first line are used.

Consider Line Mode
When searching for lines to join, this parameter indicates if lines of different modes (Lines or Splines) may be joined. If this parameter unchecked and two lines are joined, the line properties from the first line are used.

Consider Graphic Pointer
When searching for lines to join, this parameter indicates if lines of different graphic pointers may

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be joined. If this parameter is unchecked and two lines are joined, the line properties from the first line are used.

Match Lines Only
If this parameter is checked, lines that qualify for joining will be matched only. The resulting lines will remain as separate entities and will retain their previous line properties.

Search Distance
For two lines to qualify for joining, their end points must be within this XY distance. This parameter is entered as ground units. NOTE: Care should be taken when setting this parameter. Undesirable joins may occur if this parameter is too large.

Z Tolerance
For two lines to qualify for joining, their end points must be within this elevation range. This parameter is entered as ground units. NOTE: Care should be taken when setting this parameter. Undesirable joins may occur if this parameter is too large.

Drive file mode
Determines what coordinates will be placed in the drive file. Options include:

- **Join failures** - Lines that qualify to join but fail to join.
- **Join failures and dangles** - Lines that qualify to join but fail to join and line end points that are outside of the search distance parameters.
- **Review** - End points that qualify to be joined. No line joining is performed when the Drive File Mode is set to Review.

Append to drive file
If checked, new coordinates will be appended to the existing drive file. If unchecked, then the drive file will only contain coordinates resulting from the current Batch Join run.

Warning:
Due to the recursive nature of this batch program, it is not undoable. Files should be backed up before running Batch Join.

Revised - June 2017 - Release 05.09.00

2.1.1.2.11 Batch Node

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Batch Node (BatNod)

Type: Batch Application

Nodes lines.

Detailed Description

Nodes lines in VrOne workspaces. A node is the intersection of two lines. Options include:

- Ability to node line only, which places a common point on each line at the intersection;
- Ability to node and break lines at intersections;
- Support for Z Rules.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Node parameter file name (.bno)
RUN	Run Batch Node	

Parameters for Batch Node

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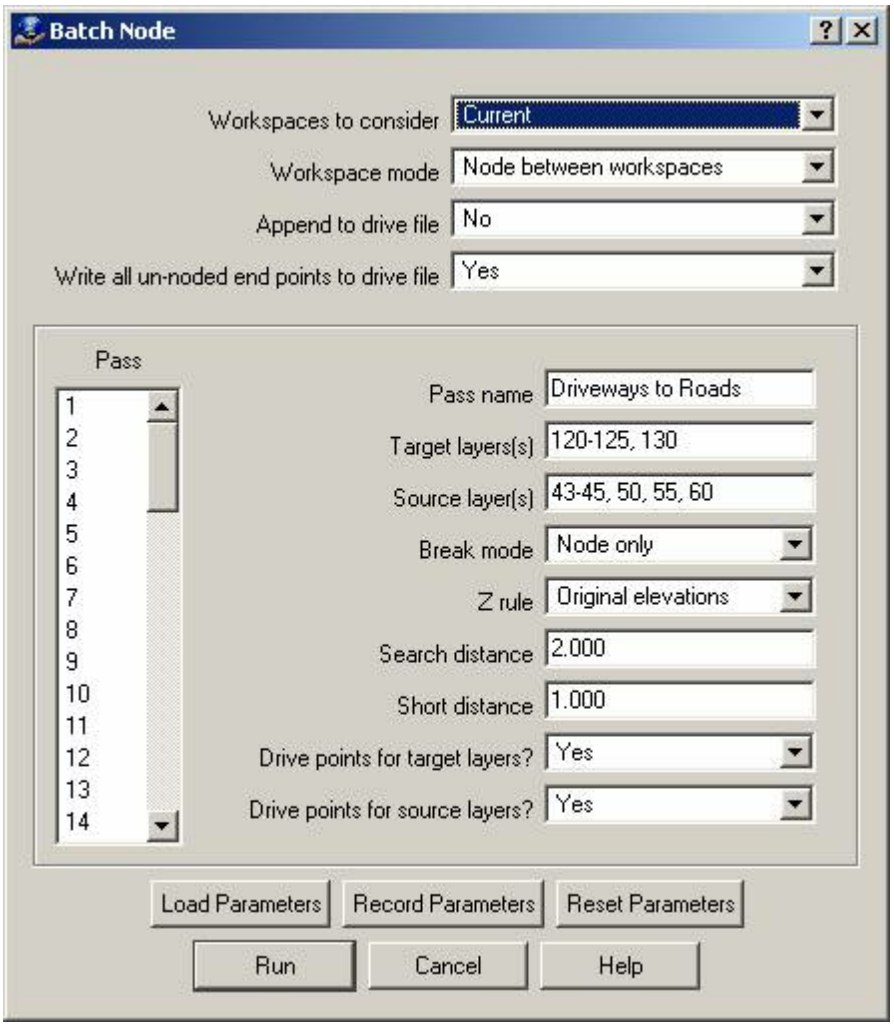

Workspaces to consider

Defines the workspaces to consider when running batch node.

Workspaces mode

Can be set to "Node Between Workspaces" or "Do Not Node Between Workspaces". When working on multiple workspaces, this determines whether or not lines that cross between workspaces are considered for noding.

Append to drive file

When set to Yes, new entries into the drive file will be appended which allow multiple sessions of Batch Node.

Write all un-noded end points to drive file

When this parameter is set to Yes, all un-noded points from the source layers will be added to the drive file(s). This will include un-noded points that did not qualify for noding by the Search and Short distances.

Pass

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This batch application allows up to twenty passes on the workspace(s). For example, this would allow one session to node driveways to buildings, driveways to road edges, sidewalks to buildings and fences to buildings.

Pass name

User-defined pass name for information only.

Target layers

Layers containing lines to be noded with source layers. These lines are considered line 1 for the Z rule. A number line may be used to define the layers.

Source layers

Layers containing lines to be noded with source layers. These lines are considered line 2 for the Z rule. A number line may be used to define the layers.

Break mode

Specifies the break mode when two lines are noded. Options are "Node only" in which a node point is placed on each line at the intersection and "Break and node" in which the lines are broken at the intersection.

Z Rule

The rule for computing the elevation at the intersection of the two lines. During noding an elevation for each line is computed at the break point. These elevations are based on the slope of the line segment as determined by the point before and after the break point. The Z Rule determines the action to be taken on these two elevations as follows:

- **Original elevations** – The elevations of the break points are not modified.
- **Mean node elevations** – The elevations are averaged and stored for both node points.
- **Elevation from line 1** – The elevation from the node point on line 1 is used on both lines.
- **Elevation from line 2** – The elevation from the node point on line 2 is used on both lines.

Search distance

Defines the distance to search from the target lines for source lines.
This parameter is used to find undershoots and is set in ground units.
NOTE: The Search Distance should be kept as small as possible. Unexpected results may occur if this parameter is unreasonable.

Short distance

Any clipped line segment that is shorter than this distance will be deleted.
If the clipped line segment is longer than this distance, it will be left in the file.
This parameter is used to delete overshoots and is set in ground units.
NOTE: The Short Distance should be kept as small as possible. Unexpected results may occur if this parameter is unreasonable.
NOTE: The Short Distance should always be smaller than the Search Distance.

Drive points for target layers?

A target line end that is not noded during this process may have its coordinate stored in the

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Batch Node Drive File. These un-noded points may be visited and corrected by using the VrOne drive file functions.

Drive points for source layers?

A source line end that is not noded during this process may have its coordinate stored in the Batch Node Drive File. These un-noded points may be visited and corrected by using the VrOne drive file functions.

NOTE: Drive files will only be created when the Break Mode is set to "Break and Node".

Warning:

Even though Batch Node is undoable, VrOne files should be backed up before use.

2.1.1.2.12 Batch Walls

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Batch Walls (BatWal)

Type: Batch Application

Searches for polygons, single lines and (or) two lines that make up a retaining wall and trims (clears) lines out of the wall polygon.

Detailed Description

Batch Walls searches for polygons, single lines and (or) pairs of lines that make up retaining walls and clears or re-layers the lines that are within the walls. The lines clears from retaining walls are typically contour lines. The layers that define the wall lines along with the lines to trim to the walls are user defined. When searching for polygons, one end may be open. When searching for two lines that make up a retaining wall the ends do not need to be capped. Batch Walls will add a temporary end cap lines during processing. Multi line walls may be capped for cartographic purposes where there are two common end points between the two wall lines. The retaining wall lines should be approximately the same in length. Constraining parameters such as maximum search distance and maximum cap distance help identify wall line pairs.

Batch Walls creates a drive file which contains coordinates of each wall or pairs of walls that

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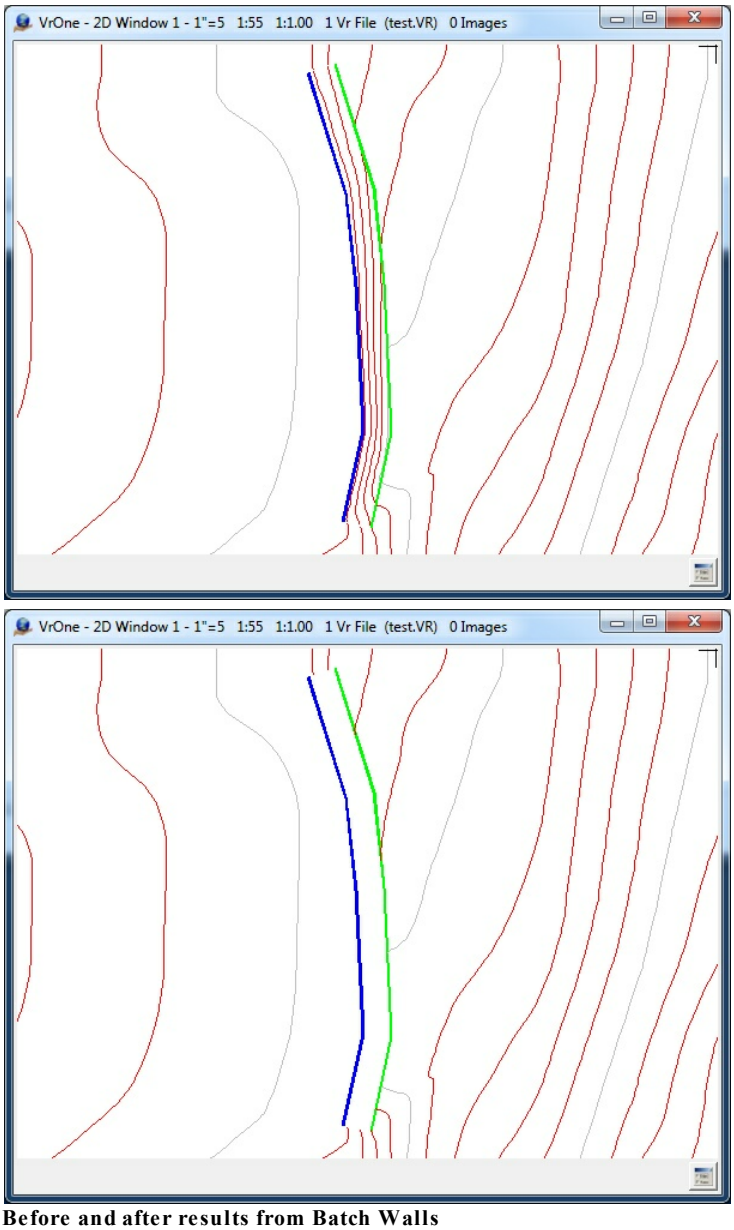
were trimmed to. This may be used to drive to the completed walls for quality control purposes. See Drive File for more information on drive files. It is recommended that the Vr files are backed up with the Backup Vr (BacVr) command before running Batch Walls.

Retaining walls that are a single, closed polygon will not be considered by Batch Walls and the application Batch Trim (BatTri) should be used to clear the contents of these type of lines.



Before and after results from Batch Walls

Above is displayed the results of Batch Walls when searching for multi lines. The screen shot on the left shows contours inside a retaining wall and the screen shot on the right shows the contour lines clipped from the retaining wall. The blue and green lines that make up the retaining wall are in different layers and are approximately the same length. The blue wall line is in layer 503, the

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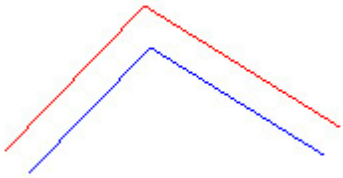
green wall line is in layer 510 and the contour lines which are the red and grey lines are in layers 300 and 310. The elevations that make up the wall lines and the lines to be trimmed to the walls are not considered. Batch Walls is a two-dimensional batch application.

Wall Types

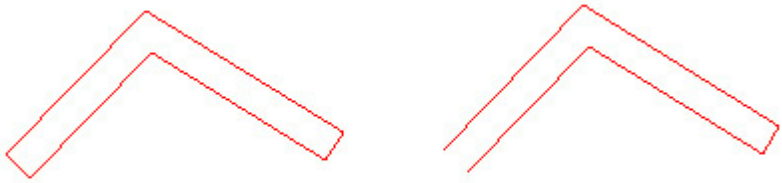
Batch Walls has the ability to search for three types of walls. When processing, multiple line walls are processed first, followed by polygon walls then single line walls. Wall types that are not checked in the dialog box will not be processed

Multi Line Walls



A multi line wall is represented by two lines on different the same layer or on another layer. The "Maximum search distance" is used to find matching wall line pairs and the "Maximum cap distance" is used to minimize mismatches.

Polygon Walls



Polygon walls are single line polygons that are typically closed. One end of the polygon may be open and will be considered if the distance between the first and last points on the line is less than the "Maximum cap distance". If the polygon wall is closed then "Maximum cap distance" is not considered and the polygon will be trimmed against regardless of the wall width.

Single Line Walls



Single line walls are represented by a multi point single line. The "Single line wall width" is used to give the wall a temporary width to compute a closed polygon and is typically a small value.

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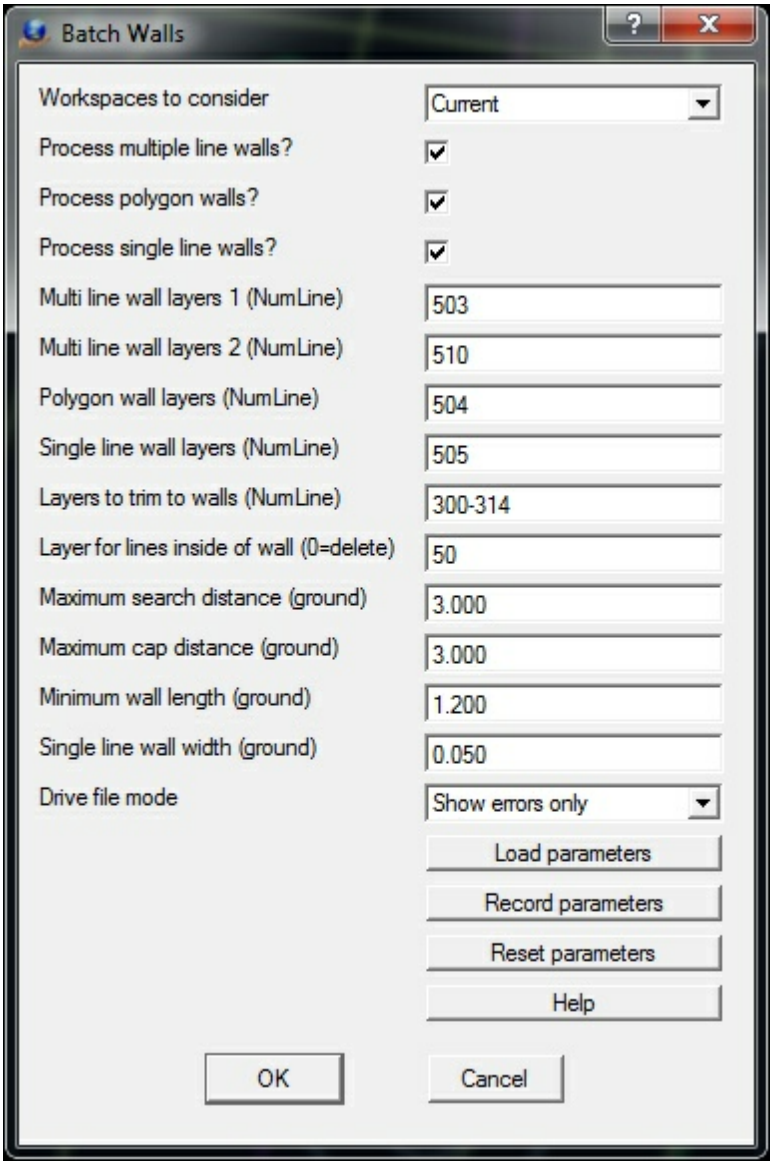
The overall length of a single line wall must be larger than the "Maximum search distance" for it to be considered.

Parameters for Batch Walls



The Batch Walls dialog

Workspaces to consider

Defines the workspaces to consider when running Batch Walls. Options are Current workspace or All open workspaces. The two wall lines that make up a single retaining wall and the lines that to be trimmed into this wall must be in the same workspace.

Process multiple line walls?

If checked, multiple line walls will be processed. If unchecked, multiple line walls will not be considered even if the parameters for this type of wall are set.

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Process polygon walls?
If checked, polygon walls will be processed. If unchecked, polygon walls will not be considered even if the parameters for this type of wall are set.

Process single line walls?
If checked, single line walls will be processed. If unchecked, single line walls will not be considered even if the parameters for this type of wall are set.

Multi line wall layers 1 (NumLine)
The layers that define one of the two lines that make up a wall are specified as a single layer number or a Number Line.

Multi line wall layers 2 (NumLine)
The layers that define the other of the two lines that make up a wall are specified as a single layer number or a Number Line.

Polygon wall layers (NumLine)
The layers that define wall polygons are specified as a single layer number or a Number Line.

Single line wall layers (NumLine)
The layers that define single line wallsl are specified as a single layer number or a Number Line.

Layers to trim to walls (NumLine)
Lines to trim to the walls are specified as a single layer or a Number Line. The contents of these trim layers are typically contour lines.

Layer for lines inside of wall (0=delete)
The resulting line segments that are trimmed against the edges of a wall and fall within the polygon that makes up a wall can be deleted or placed in another layer. Specifying a layer number of zero in this field will delete these line segments.

Maximum search distance (ground)
In order to construct wall line polygons from two wall lines, two lines in must be found. One of these line's layers must be defined in "Multi line wall layers 1" and the other line's layer must be defined in "Multi line wall layers 2". A maximum search distance helps identify these line pairs. This parameter should be slightly larger than the width of the widest wall to be processed. This maximum distance is specified in ground units.

Maximum cap distance (ground)
To further assist in the search for wall line pairs, the "Maximum Cap Distance" is used to minimize misidentification of line pairs. The distance from the two end points of line pair candidates must be below this distance. This parameter should be larger than the "Maximum search distance" but not too large were a line might be found that is not the other side of a wall. This maximum distance is specified in ground units.

Minimum wall length (ground)
Walls that are shorter than this parameter will not be considered even if they are specified by layer. A setting of zero will disable this parameter.

Single line wall width (ground)
This parameter is used to give the wall a temporary width to compute a closed polygon and is

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typically a small value. the single line wall width is specified in ground units.

Drive file mode

Defines the coordinates to be placed in the Batch Walls drive file. Determining if a multiple wall line is invalid may be difficult. In an effort to identify all errors, there are situations when false failures may be placed in the drive file. Following are the options for the "Drive file mode".

- **Show all** - All walls that were successfully trimmed against will be placed in the file.
- **Show errors only** - Only walls that could not be trimmed against will be placed in the file.

Layer Conflicts



Batch Walls Warning

If a layer or layers are defined for multiple wall types, undesirable results may occur. It is possible to use the same layers for multiple wall types but the results should be checked. When processing, multiple wall lines are processed first followed by polygon walls and finally single line walls. If a wall line is used to successfully trim against, it will not be considered for subsequent line types. For example, if a line specified as a multiple wall line is used then that line will not be considered when processing polygon line and single line walls, even if it's layer is specified as a polygon line or single line wall.

If a layer is defined for multiple wall types, the warning above is issued. Pressing No will terminate Batch Walls. Pressing Yes will continue Batch Walls processing. If processing is performed after this warning it is recommended that the results be reviewed using Drive File.

Batch Walls added August 2015 - Version 05.07.30 - Revised January 2016

2.1.1.2.13 Bump Elevations

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Mapping

Bump Elevations (BumEle)

Type: Batch Application

Detailed Description

Searches symbol elevations against a contour interval and changes points that fall within a user-defined delta elevation from the contour interval. This batch application is useful in identifying and changing points that fall on a contour interval, especially in LiDAR data. This process avoids zero or small area contour lines that may be generated when points fall on a contour interval. For example, point elevations of 123.02 and 122.98 could be identified if the contour interval was 1 and changed. Options for changing points include applying a delta elevation shift to the points, changing their layer, and deleting them. Searching options include the definition of the contour interval, delta search elevation, and searching only for points above the contour interval.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Batch Node parameter file name (.bno)
RUN	Run Bump Elevations	

Parameters for Bump Elevations

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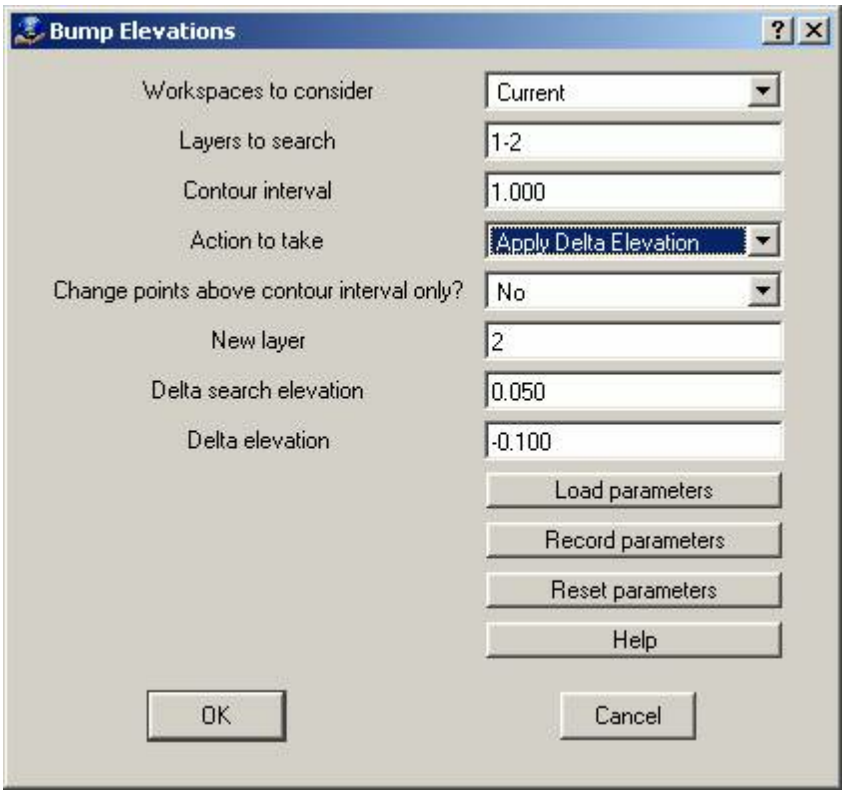

Workspaces to consider

Defines the workspaces to consider when running Bump Elevations.

Layers to search

Defines the layers to search and look for symbols whose elevations fall with the Delta search elevation.

Contour interval

Defines the contour interval to use when searching.

Action to take

When a point's elevation falls within the Delta search elevation of a contour interval one of three actions may be taken on the point:

- **Apply Delta Elevation** – A user-defined Delta elevation will be applied to these points. First the point is rounded to the nearest contour interval then the Delta elevation is applied.
- **Change Layer** – The points are moved to another user-defined layer.
- **Delete** – The points are deleted.

Change points above contour interval only?

If this parameter is set to "Yes" then only the points whose elevation falls between the contour interval and the contour interval plus the Delta search elevation will be changed. If this parameter is set to "No" then points from the contour interval minus the Delta search elevation to the contour interval plus the Delta search elevation will be changed. Since Bump Elevations is

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normally used to avoid the generation of contour lines from points falling on or slightly above the contour interval, the setting of this parameter to "Yes" is useful.
For example, if the contour interval is 1.0 and the Delta search elevation is 0.05 and this parameter is set to "Yes" then an elevation of 122.98 would not be changed while an elevation of 123.02 would. Using the same parameters with this parameter set to "No" would change both elevations.

New layer

If the Action to take is set to "Change Layer", this parameter is the new layer to place points into that fall within the Delta elevation.

Delta search elevation

This defines the delta elevation from the contour interval when searching for points. This range is affected by the Change points above contour interval only parameter.

Delta elevation

If the Action to take parameter is set to "Apply Delta Elevation", this value will be applied to the elevations of the points that fall with the contour interval range. It can be used to shift the elevation of points that fall on or slightly above a contour interval to below the contour interval to ensure that zero area or small area contours are not generated by the DTM process.

Warning:

Even though Bump Elevations is undoable, VrOne files should be backed up before use.

2.1.1.2.14 Catenary To POA

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Catenary to POA (Point of Attachment) (CatPoi)

Type: Batch Application

Extends or hacks existing catenary (power line) lines to existing POA (Point of Attachment) symbols.

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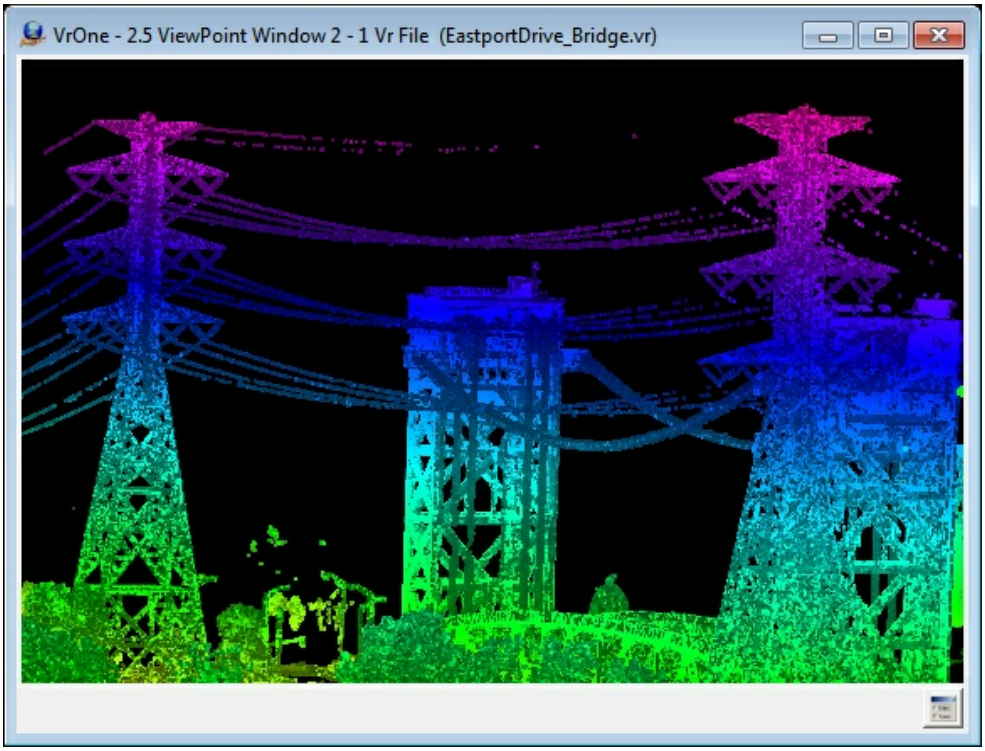
Detailed Description

Power lines are typically represented as catenaries. A catenary is the curve that an idealized hanging chain or cable assumes under its own weight when supported only at its ends. The curve has a U-like shape and mathematically, the curve is the graph of the hyperbolic cosine function.



Power line catenaries

The function Insert Catenaries (InsCat) is used to place lines on power line catenaries and these lines may fall short or overshoot the intended POAs (Points of Attachments). If the POAs are represented in the VrOne file as symbols then Catenary to POA can be used to attach these lines to their POAs in a batch mode. The catenaries do not need to be edited before running this batch application.

Please see also Insert Catenaries (InsCat)

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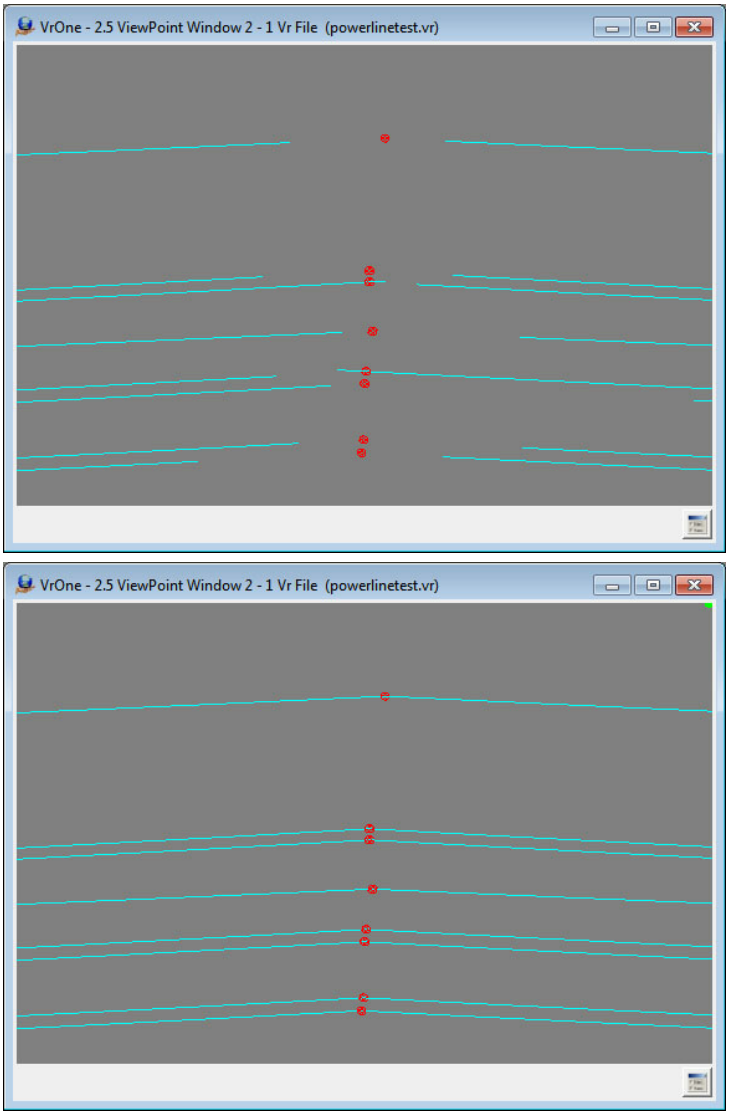

Power line catenaries before (left) and after (right) running Catenary to POA

Method

The catenary lines are identified by layer numbers and the POA symbols are identified by layer numbers and optional Graphic Pointers. During processing, the catenary lines are used to determine the POA symbol for each end of the line. A catenary formula is used to determine the distance each POA symbol is from the line so the symbols do not need to physically overlap the original catenary line.

The catenaries are then recomputed using the POAs and original catenary lines. The POA coordinate positions become the first and last coordinate position for each catenary line. If a line does not have a corresponding POA symbol within a user defined tolerance then the coordinate position of that end of the catenary remains unchanged.

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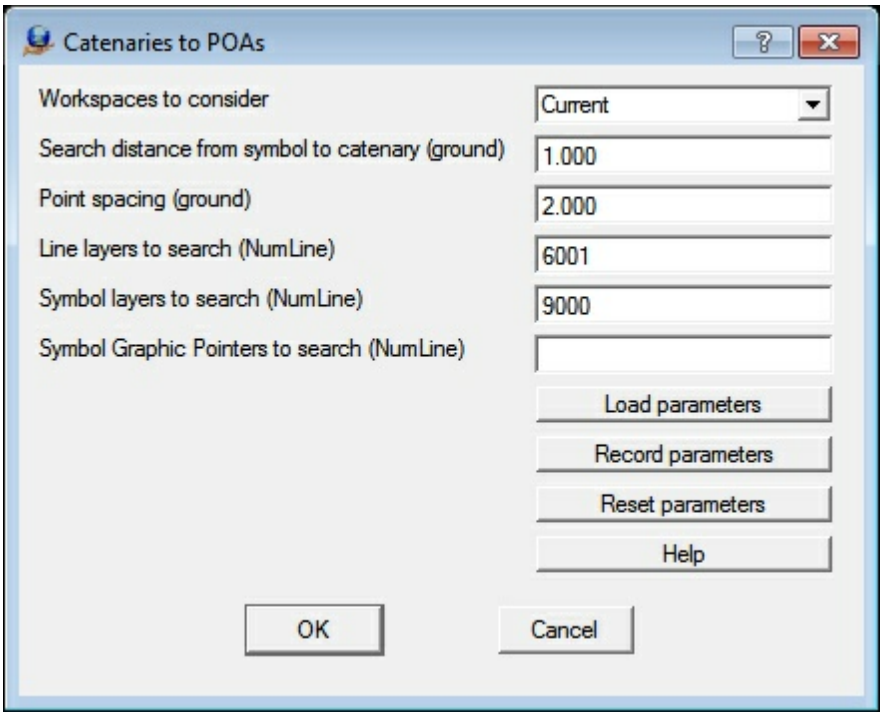
Parameters for Catenary to POA



Parameters for Catenary to POA

Workspaces to consider

Defines the workspaces to consider when running Catenary to POA. Options are Current or All open.

Search distance from catenaries to POA symbols (ground)

The search distance from existing line catenaries to existing POA symbols. POA symbols that are within this offset distance from a catenary will be considered and the closest one will be used. This parameter is entered as ground units.

Point spacing (ground)

Approximate distance between the points on the final catenary curve in ground units.

Line layers to search (NumLine)

The layers containing the existing line catenaries are defined with this parameter and a Number Line may be used to specify multiple layers.

Symbol layers to search (NumLine)

The layers containing the existing POA symbols are defined with this parameter and a Number Line may be used to specify multiple layers.

Symbol Graphic Pointers to search (NumLine)

Along with symbol layers, symbol graphic pointers may also be searched. A Number Line may be used to specify multiple graphic pointers.

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Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Catenary to POA parameter file name (.ctp)
RUN	Run Catenary to POA	

2.1.1.2.15 Change Text Elevations

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Change Text Elevations (ChaTez)

Type: Batch Application

Changes the label of a text entity representing an elevation.

Detailed Description

Each entity in VrOne stores a double precision elevation. In the case of a text entity, in which the text label represents the elevation of the entity, it is possible to redefine the text label based on the entity elevation. This is normally used when modifying the labels for spot elevations. There may be cases in which the number of places to the left or the right of the decimal point may need to be changed. It is also useful when re-labeling spot elevations after a Z datum shift. Since the elevation of the text entity is copied to the text label it is possible to run this operation many times, overwriting the results of the last run.

Any text labels encountered that contain non-numeric characters will be skipped. Layers that are turned off will not be considered even if they have been specified. Change Text Elevations is undoable.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Change Text Elevations parameter file name

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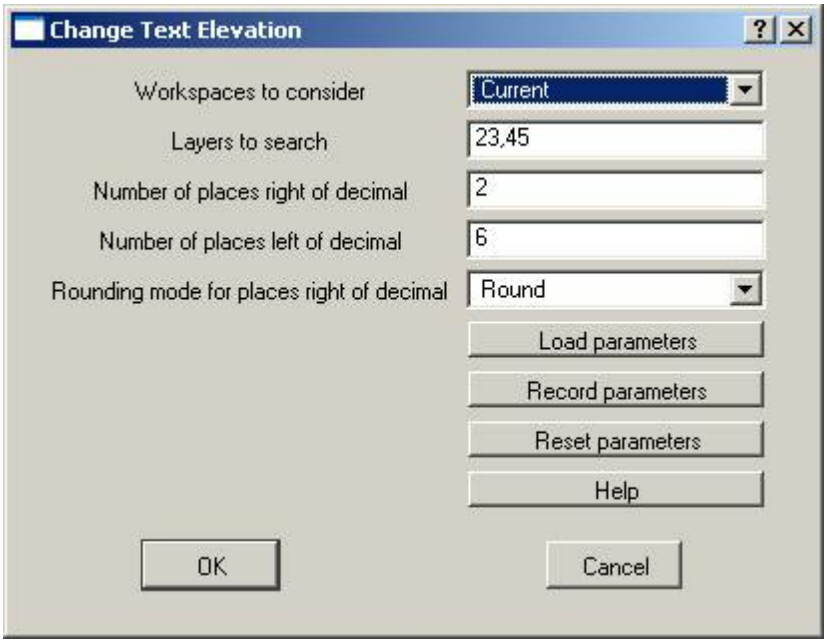
		(.ctz)
RUN	Run Clear Polygons	

Parameters for Change Text Elevations



Workspaces to consider

Defines the workspaces to consider when running Clear Polygons.

Layers to search

Specifies layers to search for text elevations. Layers that are turned off will not be considered even if specified.

Number of places right of decimal

Defines the number of digits to the right of the decimal point. Trailing zeroes will be added. 0 is allowed in this field.

Number of places left of decimal

Defines the number of digits to the left of the decimal point. Leading zeroes will not be added.

Rounding mode for places right of decimal

Defines the action to take when setting the number of digits to the right of the decimal point. Options are Round, which rounds the number, or Truncate in which the number is truncated and digits further to the right are not considered. For example, if the "Number of places to the right of decimal" is 2 and the elevation of the text entity is 12345.9999 then Round would result in 12346.00 and Truncate would result in 12345.99.

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ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Clear Polygons (ClePol)

Type: Batch Application

Clears or modifies lines inside polygons.

Detailed Description

Clears or modifies source lines that pass through or are contained inside target polygons. The target lines may be nested in the case of a tree line within a tree line. The target line nesting is unlimited. The most common use for Clear Polygons is the handling of contour lines through buildings or tree lines.

The direction of the target lines is very important to Clear Polygons as it is used to determine if a source line is considered inside a target line. If a target line direction is backward the source line will be clipped to the target line edge but the layer and graphic pointer assigned will be incorrect.

NOTE: Due to the recursive nature of this application it is not undoable. VrOne file should be backed up before using Clear Polygons.

Before:

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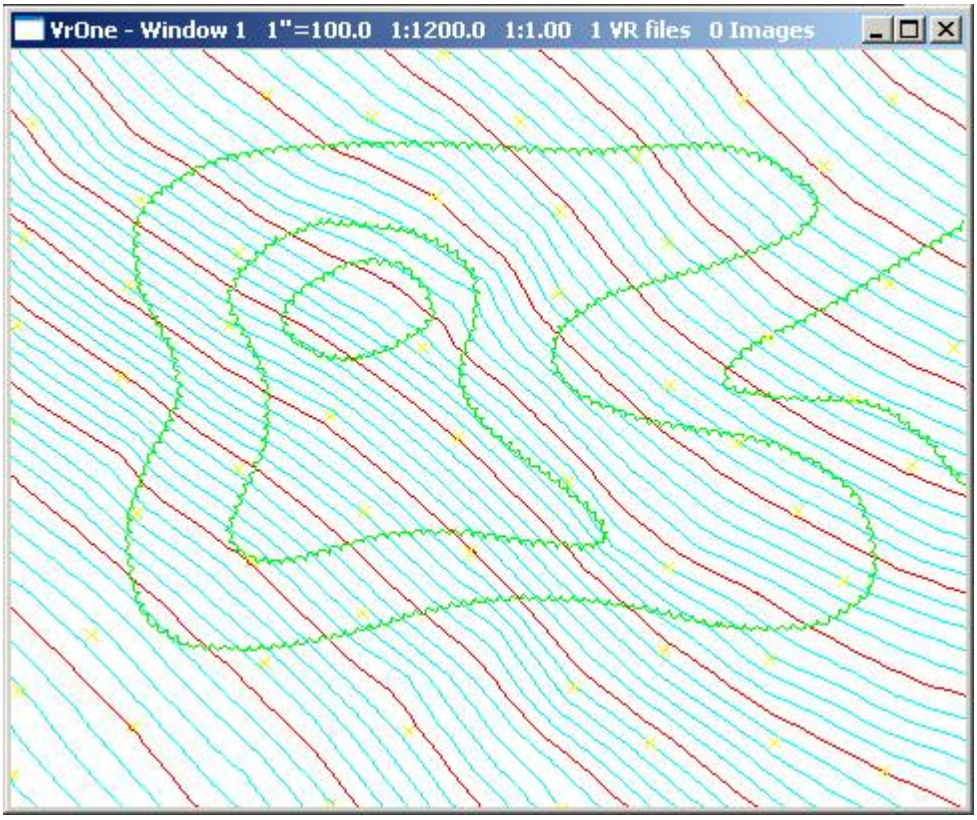
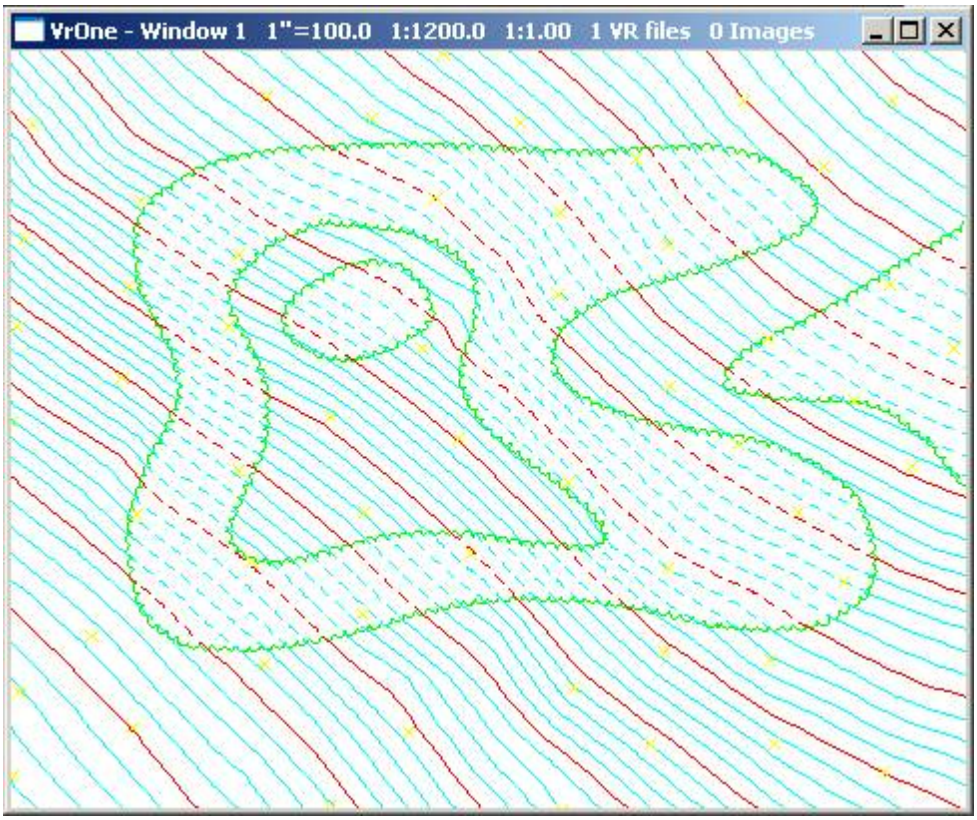


After:



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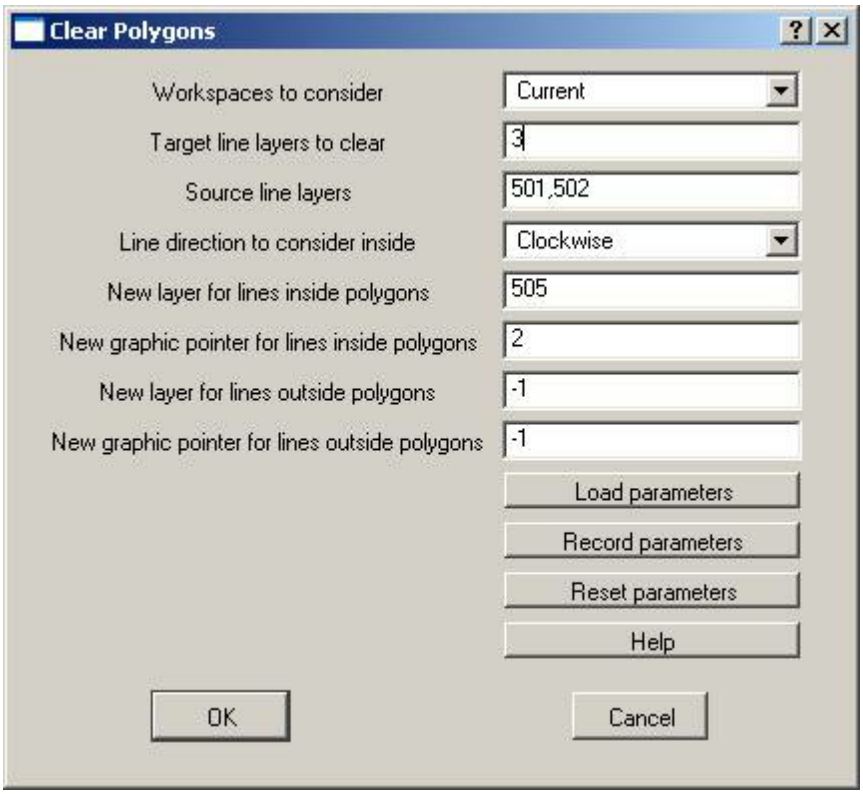
Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Clear Polygons parameter file name (.clp)
RUN	Run Clear Polygons	

Parameters for Clear Polygons



Workspaces to consider

Defines the workspaces to consider when running Clear Polygons.

Target line layers to clear

Defines the layers that contain lines to clear. These layers are considered target layers. In the case of dashing contour lines that are inside tree lines, the target layers would contain the tree lines. **NOTE**: Do not include the same layer number on both "Target line layers to clear" and "Source line layers".

Source line layers

Defines the layers that contain lines to clip and modify against the target layers. In the case of dashing contour lines that are inside tree lines, the source line layers would contain the contour lines. **NOTE**: Do not include the same layer number on both "Target line layers to clear" and "Source line layers".

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Line direction to consider inside

Defines the target line direction to consider inside. This parameter may be Clockwise or Counter clockwise. This parameter determines whether to assign the "inside" layer/graphic pointer or the "outside" layer/graphic pointer to source lines inside target lines.

New layer of lines inside polygons

Defines a new layer for source lines that are inside target lines. An entry of –1 will keep the original layer and an entry of 0 will delete the line.

New graphic pointer for lines inside polygons

Defines a graphic pointer for source lines that are inside target lines. An entry of –1 will keep the original graphic pointer.

New layer of lines outside polygons

Defines a new layer for source lines that are outside target lines. An entry of –1 will keep the original layer and an entry of 0 will delete the line.

New graphic pointer for lines outside polygons

Defines a graphic pointer for source lines that are outside target lines. An entry of –1 will keep the original graphic pointer.

2.1.1.2.17 Classify Points

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Classify Points (ClaPoi) / Bare Earth (BarEar)

Type: Batch Application

Classifies VrPoints (LiDAR) from aerial sources into bare earth (ground) and non-ground classifications.

Detailed Description

The identification of LiDAR points that make up the ground surface has many practical

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application in the processing of this type of data. Bare Earth generation is normally the first step when generating a Digital Terrain Model (DTM) surface and then contours from LiDAR data. After the Bare Earth points have been identified, the Keypoint (KeyPoi) batch application is run on the Bare Earth points to identify the most efficient points to use for the DTM surface.

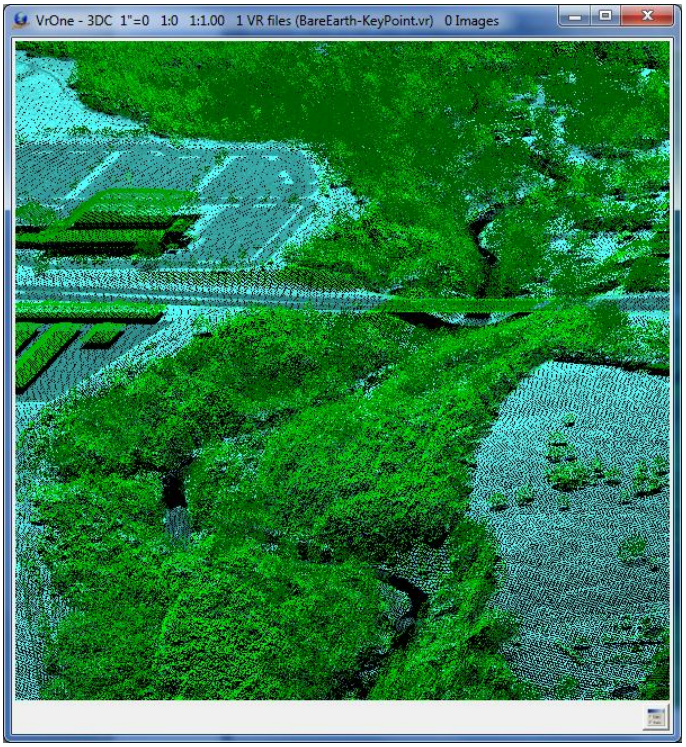
The process of classifying LiDAR points based on this criteria is also referred to as Bare Earth generation. The Classify Points / Bare Earth batch application may be started from the ClaPoi key-in or the BarEar key-in. The names Classify Points and Bare Earth along with the key-ins are interchangeable.

Configuration Considerations

Since the classification of LiDAR points is a memory intensive application it is recommended that Classify Points be run from VrOne only without the use of 3D VrThree. Although possible, it is not recommended running Classify Points from VrTwo. The use of the 64-bit version of VrOne if using Windows 7 64-bit is also recommended for this application since this configuration offers a significant increase in available memory to the software.

History and Status

Classify Points was first introduced in VrOne version 05.05.22. This version is considered a beta version and the results should be checked carefully. It is suggested that the target VrOne files be backed up before using Classify Points.



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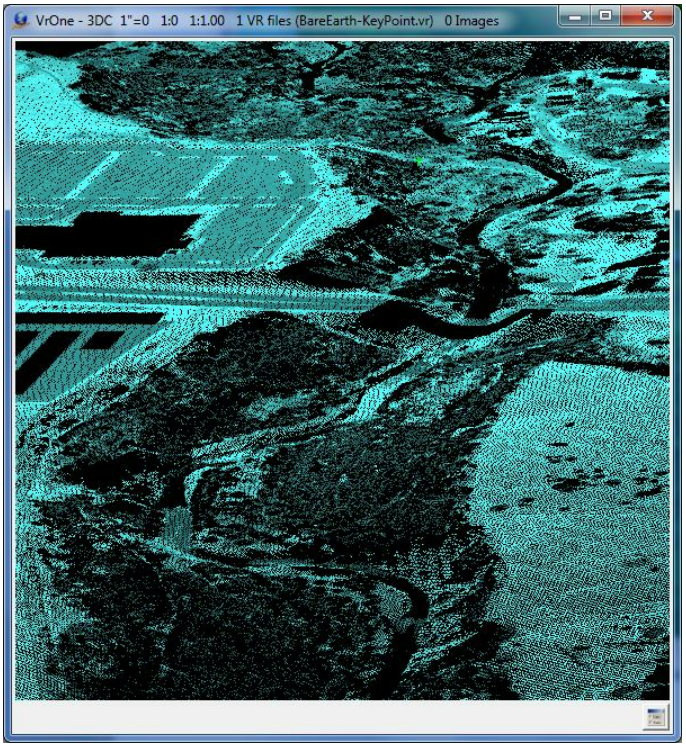

Two examples showing all classifications (left) and bare earth classified points (right)

Available Key-ins

Key-in	Description	Range
RUN	Run Classify Points	

Starting Classify Points with a key-in of "ClaPoi RUN" or "BarEar RUN"will run the batch application without prompting for parameters. The previous parameters will be used. It is possible to set the initial parameters by starting Classify Points (ClaPoi) with no arguments, entering parameters then pressing Cancel. The parameters will be saved as the previous parameters.

Parameters for Classify Points / Bare Earth

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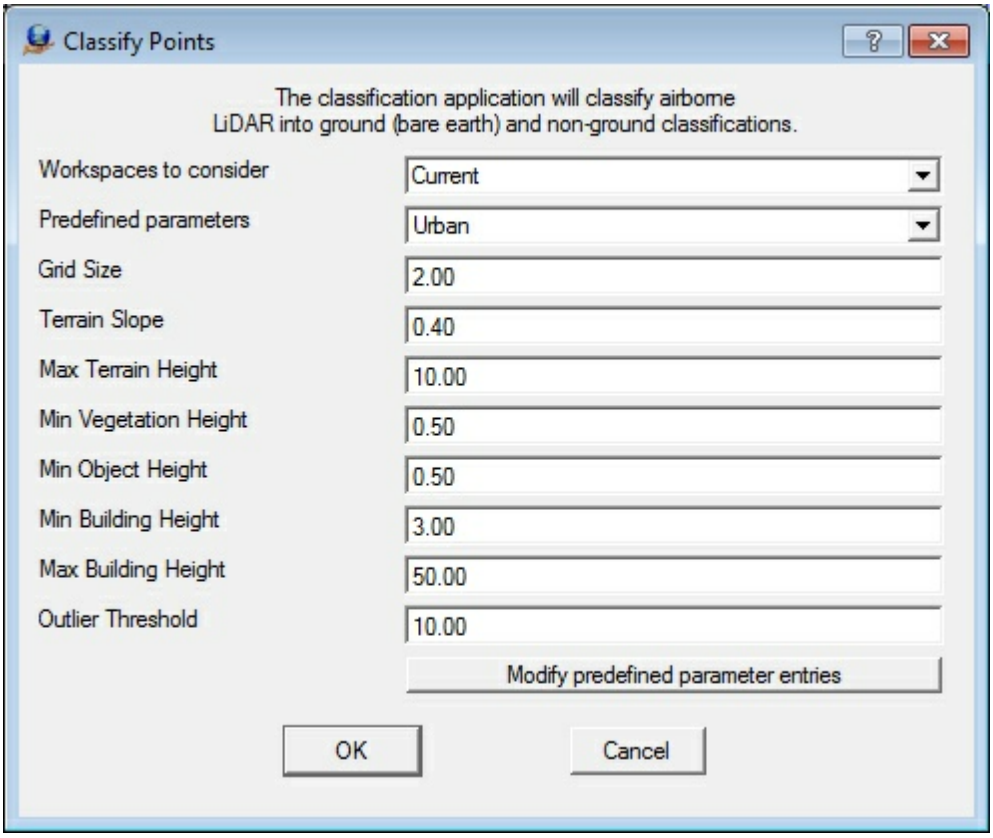

Classify Points / Bare Earth parameters dialog

Workspace to Consider

Defines the workspaces to consider when running Classify Points. Options are Current workspace or All open workspaces. When running, you can process the current workspace or all loaded workspaces. If similar settings are expected to be used for all open workspaces, processing them in a single session by specifying all open workspaces is optimal. For testing or for initial parameter setup, using a single (current) workspace may be desirable. (default: current)

Predefined parameters

Allows the eight parameters (Grid Size to Outlier Threshold) to be saved and recalled by a user defined selection. For example, predefined parameters for terrain types such as urban, suburban, forested, and hilly can be stored. A terrain type's parameters may be recalled by selecting it from this combo box. The "Modify predefined parameter entries" button allows the addition and deletion of predefined parameters.

Grid Size

Specifies, in ground units, the resolution of the grid (or cell) size used by the classification algorithm. Smaller cell size will improve results on varied terrain but will take longer to process. A larger grid size will process much quicker, use less memory, but may have more false vegetation (or non-bare earth) detections. (default: 2 meters / 6 feet)

Terrain Slope

Average or representative slope in the area (for example, sloping land in the direction of water). For flatter areas, a value of 0.15 might be used. For a hilly area, a value of 0.35 might be used.

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(default: 0.2)

Max Terrain Height
Assumed maximum elevation of the bare earth surface or ground, in ground units. Any point above this height is classified as non-bare earth. (default: 10–15 meters / 32-50 feet)

Min Vegetation Height
The lowest vegetation, of any significance, that would be expected to find in the area in ground units. (default: 0.5-1 meter / 1-3 feet)

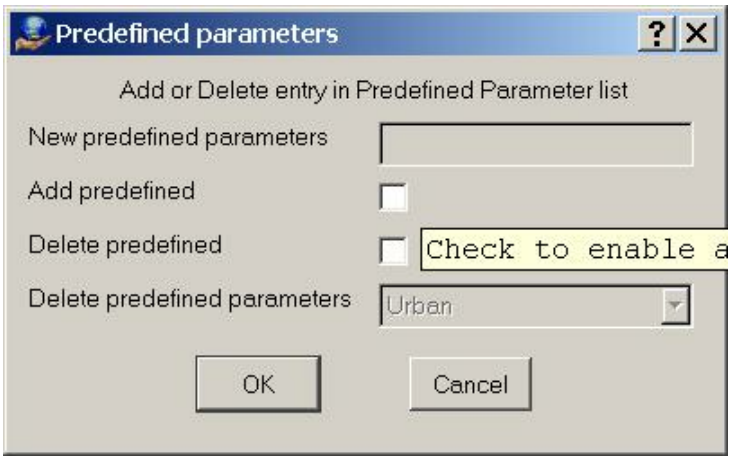
Min Object Height
Minimum height, in ground units, above the ground layer that points must be to be classified as non-bare earth. (default: 1 meter / 3 feet)

Min Building Height
Lowest terrain height, in ground units, that is could be found in the local buildings in the area being classified. (default: 3 meters / 10 feet)

Max Building Height
Maximum height, in ground units, that can be covered by a building. For example, if the height covered by a mass of points exceeds this value, then the area is probably a plateau or a change in
elevation such as a steppe, shoreline or hilltop. In a city setting, a value of 150 meters or 500 feet would help find the larger buildings. In a country setting where the buildings are smaller, a value of 50 meters (150 feet) or less could be used. (default: 50-150 meters / 150-500 feet)

Outlier Threshold
Specifies the threshold in ground units outside of which data points are disregarded in the classification calculations so as to maintain and improve the accuracy of the classification results. (default: 10 meters / 30 feet)

Modify predefined parameter entries
Allows the creation of new predefined parameters or the deletion of existing predefined parameters. Both actions may be done simultaneously, the only constraint being that adding and deleting the same entry simultaneously will yield in no action taken.



Predefined parameters dialog

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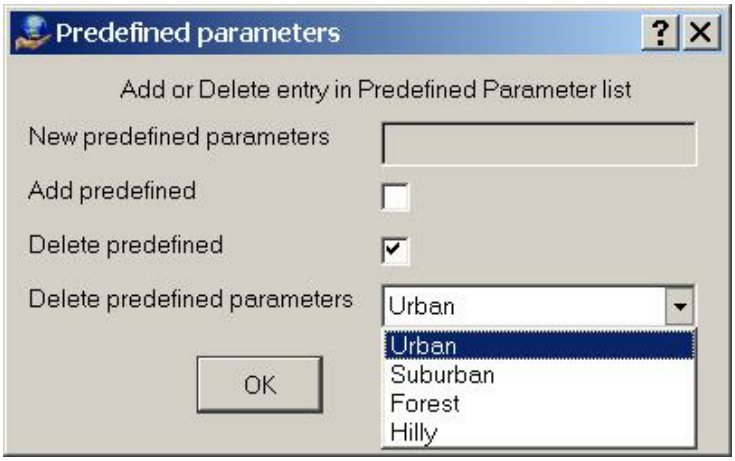
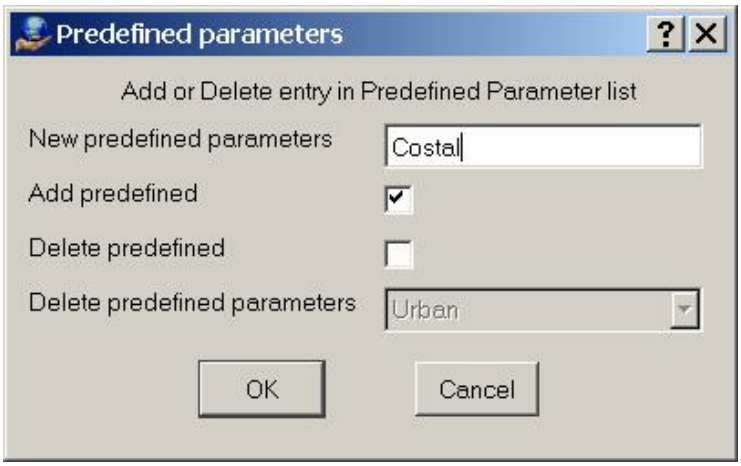


Predefined parameters dialog deleting parameter definition



Predefined parameters dialog adding parameter definition

Once a new entry is entered and/or an existing one selected for deletion and the OK button is clicked, the Predefined parameters field of the Classify Points prompt box will be populated with the new entry and corresponding fields will automatically be set to the following default values:

Grid Size = 2.0
Terrain Slope = 0.4
Max Terrain Height = 10.0
Min Vegetation Height = 0.5
Min Object Height = 0.5
Min Building Height = 3.0
Max Building Height = 50.0
Outlier Threshold = 10.0

If an entry has been selected to be deleted, a message box will ask the user to confirm this. Please note that the last entry in the list cannot be deleted. However, the last one can be deleted if a new one is also created concurrently.

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If changes are made to any parameters in the Classify Points prompt box, being the default values of a new entry or an existing one, a message box will be displayed asking to save the parameters prior to launching the classification.

When run for the first time, a single entry being "Urban" with the default parameters specified above will be created.

2.1.1.2.18 Clean Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Clean Lines (CleLin)

Type: Batch Application

Searches for duplicate points on lines.

Detailed Description

Clean Lines searches for duplicate points on lines within user specified layers. The search parameter include separate xy and z search tolerances. This allows the searching of points that may have the same xy coordinates but different elevations. Duplicate point actions include the ability to delete the first or last occurrence of the duplicate points or to place the duplicate point positions into a Drive File. If the points are placed in a drive file then the duplicate points are not deleted.

Options include the ability to search for duplicate sequential and(or) non-sequential duplicate points on lines. The ability to place all duplicate points or one duplicate per line is available also.

Whenever a line is saved into the VrOne database duplicate points in which the XY and Z coordinates are the same are removed. Clean Lines differs in the it searches for line points with duplicate XY coordinates but different elevations. Also, the XY and Z tolerances that define a duplicate point are user defined.

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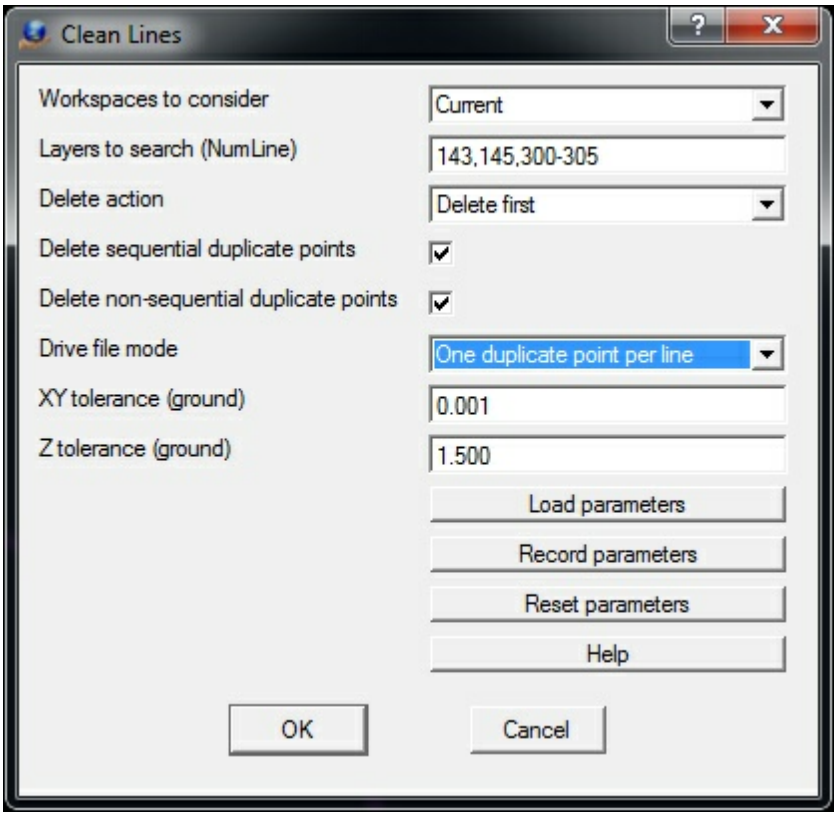
Parameters for Clean Lines



The Clean Lines dialog

Workspaces to consider

Defines the workspaces to consider when running Clean Lines. Options are Current workspace or All open workspaces.

Layers to search (NumLine)

Defines the layers to search for lines with duplicate points. A Number Line may be used to specify multiple layers.

Delete Action

Defines the action to take on duplicate points. The options for Delete Action include the following.

- **Delete first** - Deletes the first occurrence of the duplicate point
- **Delete last** - Deletes the last occurrence of the duplicate points
- **Add to drive file** - Places the duplicate point position in a drive file and does not modify the line.

Delete sequential duplicate points

If checked then points that are within the xy tolerance and are sequential will be considered as duplicates.

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Delete non-sequential duplicate points
If checked then points that are within the xy tolerance and are not sequential will be considered as duplicates. Duplicate points a the beginning and end of a line that close the line will not be considered duplicate.

Drive file mode
This parameter determined what duplicate points are placed in the drive file when the Delete Action is set to "Add to drive file". The options include the following.

- **All duplicate points** - All duplicate points are placed in the drive file.
- **One duplicate point per line** - Only the first duplicate point found on a line will be placed in the drive file. This is useful when lines have many duplicates.

XY Tolerance
Line points must be within this distance in the XY direction to be considered duplicate. The Z tolerance is considered also. This parameter is entered as ground units.

Z Tolerance
Line points must be within this distance in the Z direction to be considered duplicate. The XY tolerance is considered also. This parameter is entered as ground units.

NOTE:
Lines that turn back on themselves may product undesired results. Files should be backed up before running Clean Lines and the results should be checked.

Clean Lines added January 2016

2.1.1.2.19 Delete Arc Flags

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Delete Arc Flags (DelArc)

Type: Batch Application

Deletes arc flags on lines.

Detailed Description

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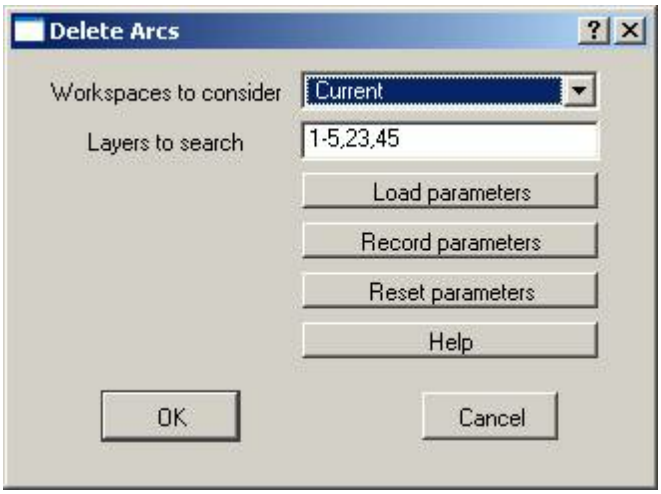
VrOne stores arcs as a line with a series of line segments. This method allows arcs to be embedded in lines and creates a three-dimensional edge when storing the arc. The arc on the line is defined by a series of flags marking the beginning, middle and end points of the arc. These arc flags may be removed with Delete Arc Flags. NOTE: After removing the arc flags, the arc may not be edited as an arc and arcs cannot be generated when translating to AutoCAD or Microstation. The area of arc will be represented as a series of line segments.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Arc Flags parameter file name (.dar)
RUN	Run Delete Arc Flags	

Parameters for Delete Arc Flags



Workspaces to consider

Defines the workspaces to consider when running Delete Arc Flags. Options are Current workspace or All open workspaces.

Layers to search

Defines the layers to search that contain lines in which the arc flags will be removed. This parameter may be entered as a number line.

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Mapping

Delete Close Points (DelClo)

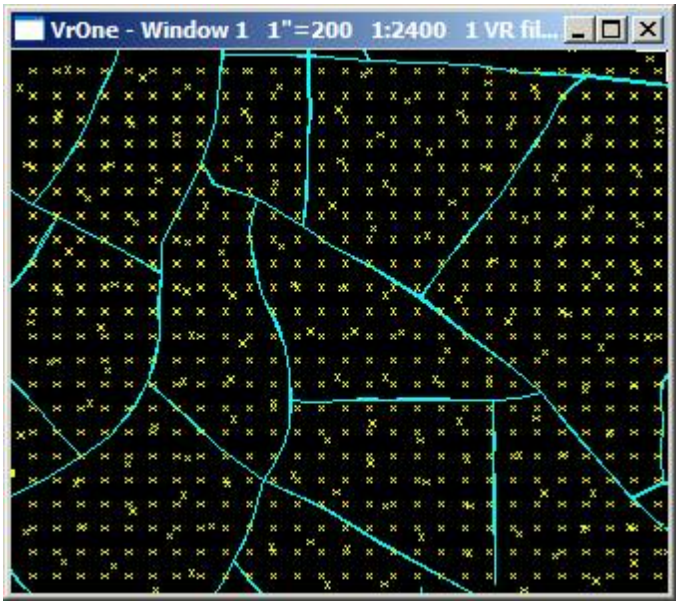
Type: Batch Application

Modifies symbols, text or VrPoints (LiDAR) that fall within a user defined distance from lines, points on lines, symbols and (or) text label origins.

Detailed Description

Searches lines, points on lines, symbols and/or text label origins in user-defined layers and deletes, re-layers, or re-classifies points that are within a user-defined distance to these entities. Points may be symbols, text or Vrpoints (LiDAR), and they may be deleted, moved to another layer or re-classified. Re-classification is considered only when VrPoints are specified. Delete Close Points is useful for deleting DTM and LiDAR points that are too close to DTM break lines.

Layers that are turned off will not be considered even if specified. Delete Close Points is undoable for symbols and text but not for points.



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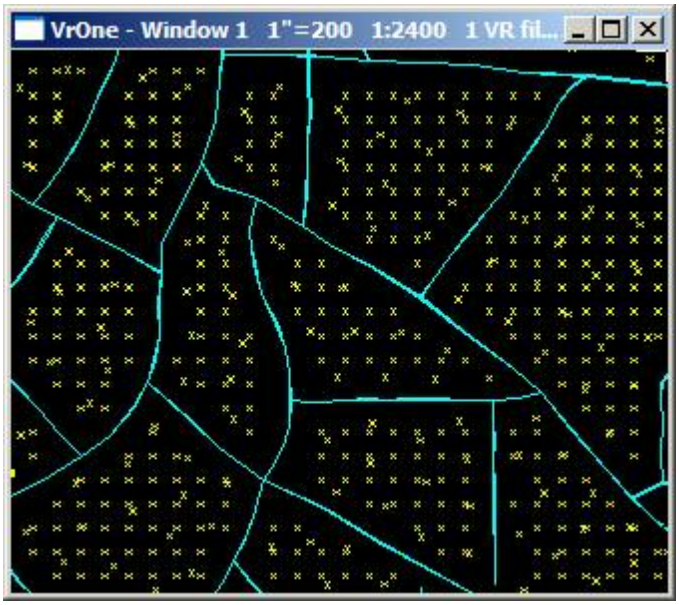

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Close Points parameter file name (.dcp)
RUN	Run Delete Close Points	

Parameters for Line Close Points

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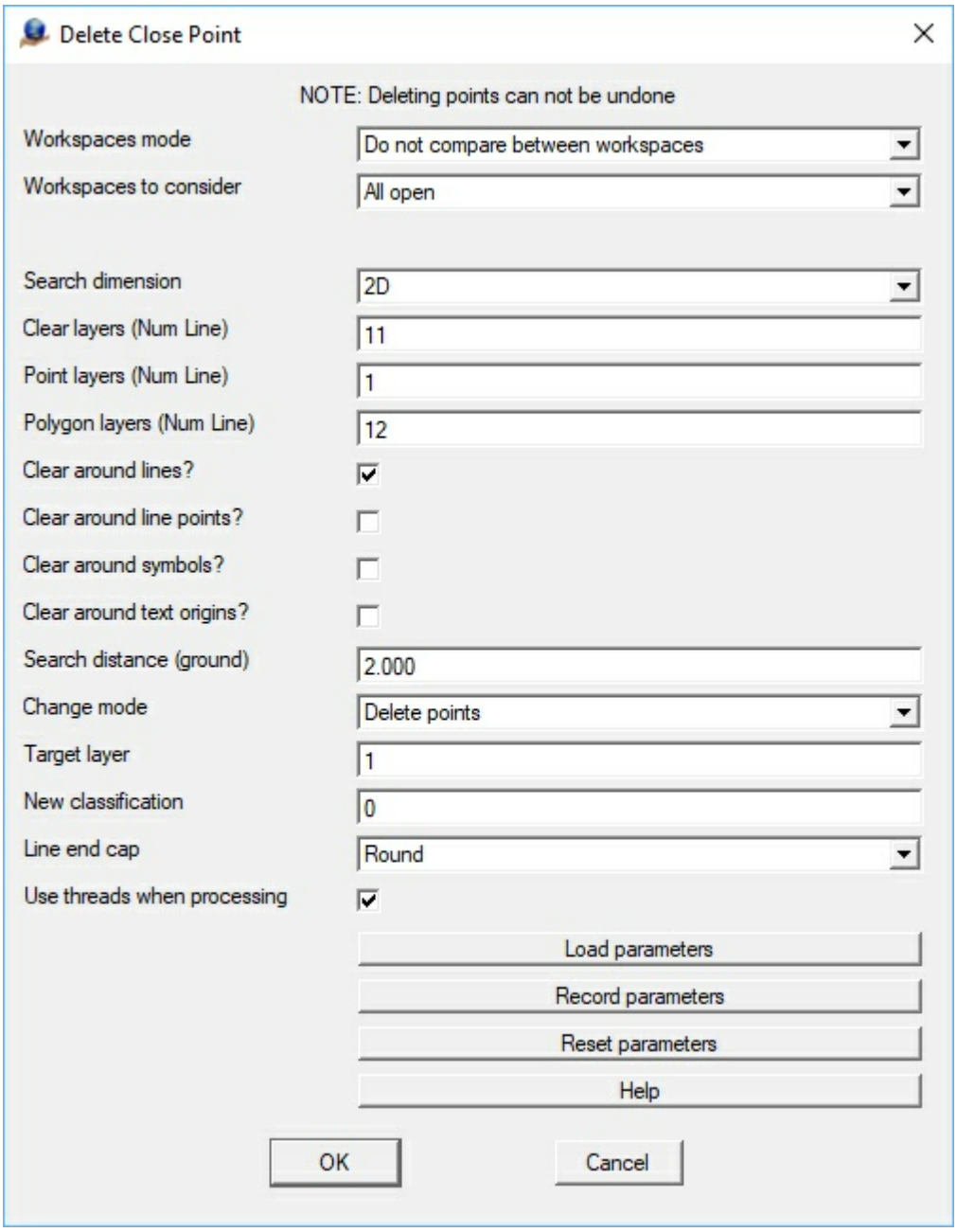

Workspaces mode
Determines if symbols, text or VrPoints should be tested against lines that are not in the same layer.

Workspaces to consider
Defines the workspaces to consider.

Search dimension
Dimension to use when searching for entities to change. The Search Dimension options are 2D or 3D.

Clear layers

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Defines the line layers to check against the points. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Point layers
Defines the point layers to check against the line layers. These layers may contain symbols, text, or VrPoints. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Polygon layers
Defines the layer or layers that contain polygons defined as VrLines and will further filter points to be deleted/modified. If defined, points to be delete/modified must be within the search distance of a line in the "Clear layers" and must fall within one of the user defined polygons. This is an optional parameter and may be left blank to turn off this feature. The Polygon layers may be entered as a number line.

Clear around lines
Deletes, re-layers symbols, text or deletes, re-layers or re-classifies VrPoints that fall within the search distance of any part of a line.

Clear around line points
Deletes, re-layers symbols, text or deletes, re-layers or re-classifies VrPoints that fall within the search distance of any line vertex.

Clear around symbols
Deletes, re-layers symbols, text or deletes, re-layers or re-classifies VrPoints that fall within the search distance of any symbol origin.

Clear around text
Deletes, re-layers symbols, text or deletes, re-layers or re-classifies VrPoints that fall within the search distance of any text origin.

Search distance
Defines the search distance. Symbols, text or VrPoints that fall within this distance from the lines specified will be deleted or moved or re-classified (VrPoints). This value is entered as ground units.

Change mode
Defines the action to take on points that fall within the search distance of the lines specified. Options are “Delete points”, “Move points to target layer”, and "Change classification (VrPoints). If "Move points to target layer" is selected the points will be moved to the target layer as defined by the Target layer field. If "Change classification" is selected, the VrPoints will be re-classified to the classification number defined in the New classification field.

Target layer
If the Change mode is set to “Move points to target layer”, this parameter defines the layer to which to move the points.

New classification
If the Change mode is set to "Change classification (VrPoints), this parameter defines the classification number to which to change the qualifying VrPoints.

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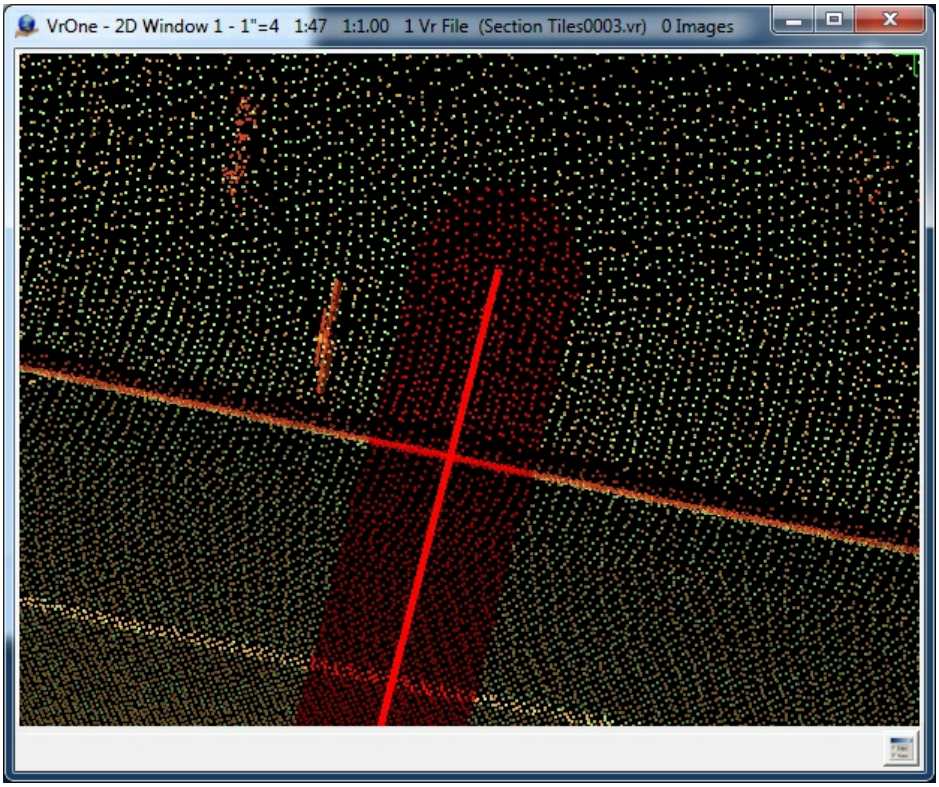
Line end cap

When comparing symbols, text or VrPoints against lines, the end cap parameter determines if points past the ends of the line will be considered. The End Cap options are Round or Flat. In the examples below, VrPoints within 3 feet have been re-classified and the Round end cap option on the left and the Flat end cap option on the right.



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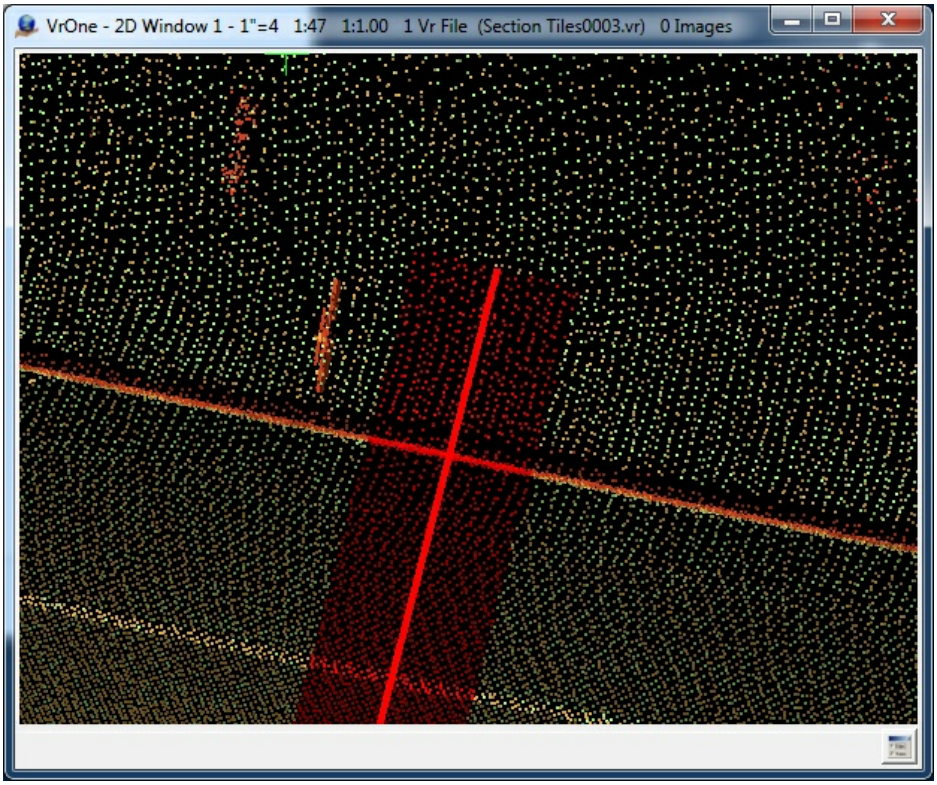

End Cap options. Round end cap is on the left and Flat end cap is on the right.

Use threads when processing

The use of threads can improve processing performance when processing VrPoints against lines. The performance of threading depends on the number of CPUs and (or) number of cores on each CPU that available in the computer.

Version 05.09.03 - 28-Aug-2017 - Added "Polygon layers" option

2.1.1.2.21 Delete Close Lines

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Delete Close Lines (DelCloLin)

Type: Batch Application

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Deletes or re-layers lines that fall within a user specified distance of other lines in single or multiple VrOne files.

Detailed Description

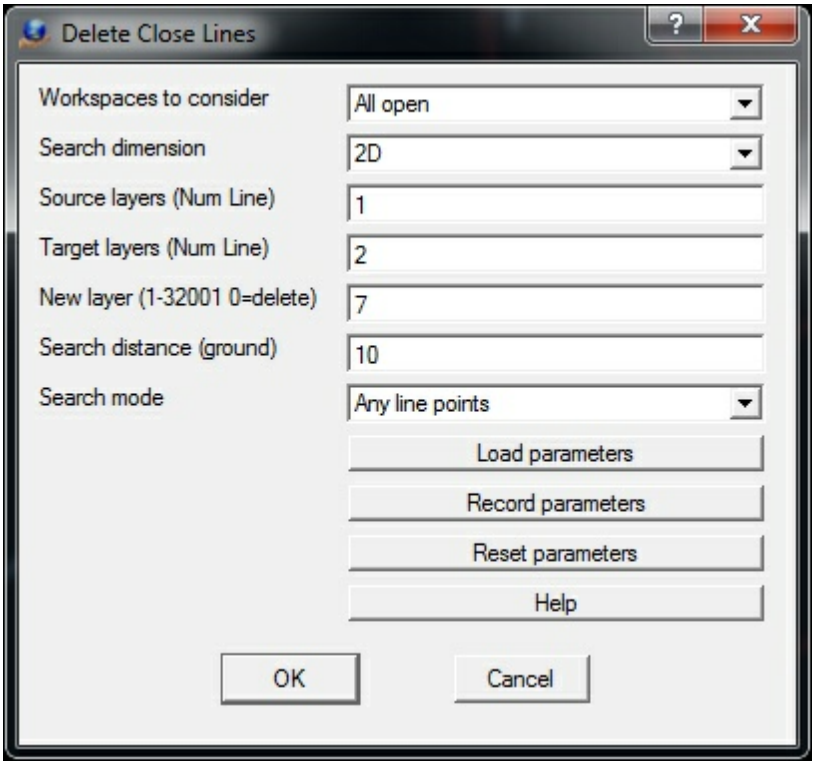
Searches for lines in target layers and compares the distance to lines in source layers. Lines at meet the user specified distance criteria are deleted or re-layered. Lines may be deleted or re-layers if all points or any points or an endpoint falls within the user specified search distance. This is defined by a Search mode.

Layers that are turned off will not be considered even if specified. Delete Close Lines supports undo.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Close Lines parameter file name (.dcl)
RUN	Run Delete Close Lines	

Parameters for Delete Close Lines



Workspaces to consider
Defines the workspaces to consider.

Search dimension

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Dimension to use when searching for lines to delete or re-layer. The Search Dimension options are 2D or 3D.

Source layers (Num Line)
Defines the source line layers. Target lines that fall within the user defined search criteria from these source lines will be deleted or re-layers. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Target layers (Num Line)
Defines the target line layers. Lines in these layers that fall within the user defined search criteria of source lines will be deleted or re-layered. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

New layer (1-32001 0=delete)
Defines a new layer for target lines that meet the user defined search criteria. Entering a layer number of zero will delete these target lines.

Search distance (ground)
Distance from source lines to search for target lines. This parameter combined with the Search Mode (see below) will determine if a source line is to be deleted or re-layered.

Search mode
The Search Mode determines which source line points should be used when determining if the line should be deleted or re-layered. The options for this parameter include:

- **Any line points** - If any source line point is within the search distance then the line will be deleted or re-layered.
- **All line points** - If all source line points are within the search distance then the line will be deleted or re-layered.
- **End line point(s)** - If one or both source line end points are within the search distance then the line will be deleted or re-layered.

2.1.1.2.22 Delete Crossing Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Delete Crossing Lines

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(DelCroLin)

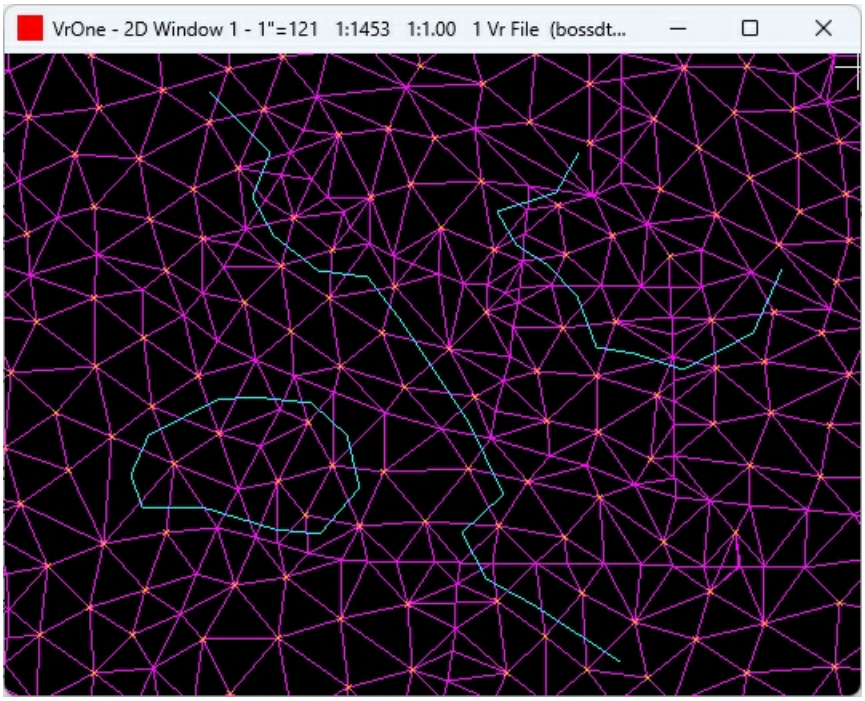
Type: Batch Application

Deletes or re-layers lines (target lines) that cross other lines (source lines) in single or multiple VrOne files.

Detailed Description

Searches for lines in target layers and determines if these lines cross the lines in source layers. Options include the ability to check target lines for closure, meaning they are closed polygons. If this option is selected then source lines that are located within the closed target line without crossing it will be deleted or re-layered.

Layers that are turned off will not be considered even if specified. Delete Crossing Lines supports undo.



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Before and after running Delete Crossing Lines

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Crossing Lines parameter file name (.dxl)
RUN	Run Delete Crossing Lines	

Parameters for Delete Crossing Lines

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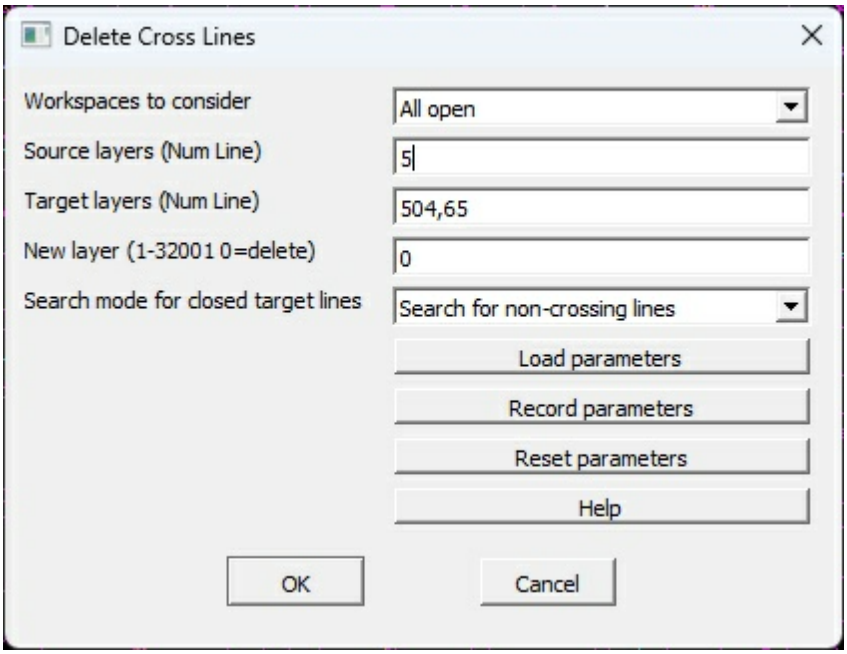

Workspaces to consider
Defines the workspaces to consider.

Source layers (Num Line)
Defines the source line layers. Target lines that fall within the user defined search criteria from these source lines will be deleted or re-layers. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Target layers (Num Line)
Defines the target line layers. Lines in these layers that fall within the user defined search criteria of source lines will be deleted or re-layered. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

New layer (1-32001 0=delete)
Defines a new layer for target lines that meet the user defined search criteria. Entering a layer number of zero will delete these target lines.

Search mode for closed target lines
Options include "Don't search for non-crossing lines" and "Search for non-crossing lines".
If a target line is closed, then it's possible that there could be source lines within the target line that do not cross it. A setting of 'Search for non-crossing lines' will delete or re-layer these lines.

Below is shown examples of the use of the two options. In theses examples, the cyan line which is a closed polygon is the target line and the purple triangles are four point lines that are in the source layers. A closed line, or closed polygon is a Vr line with more than two points (vertices) in which the first point is at the same coordinate position as the last point on the line.

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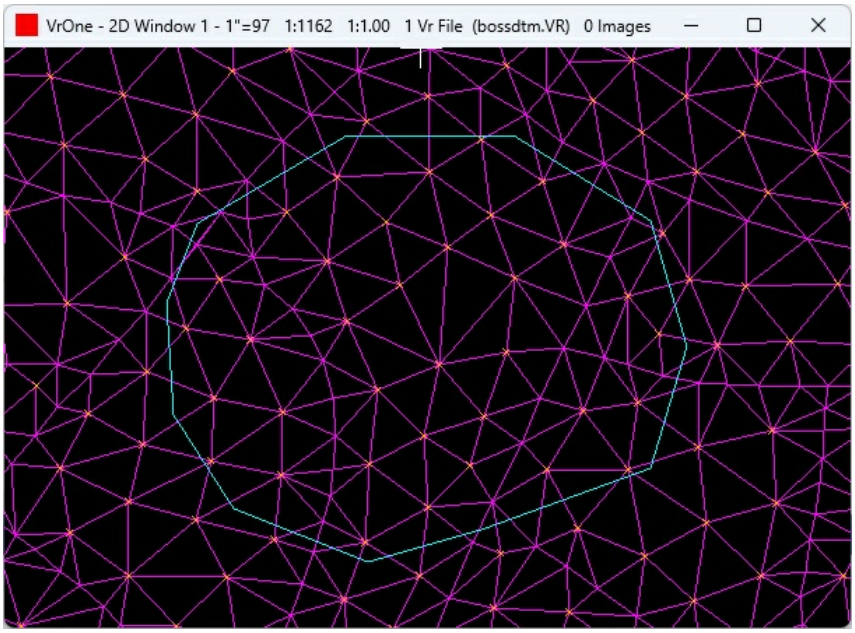
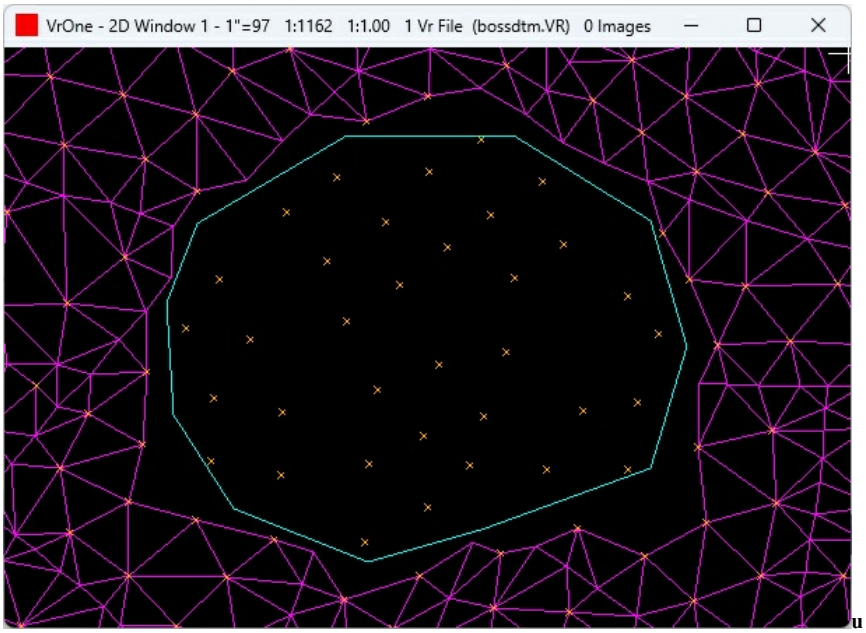


Original lines before running Delete Crossing Lines



u

Result of Delete Crossing Lines using the "Search for non-crossing lines" option.

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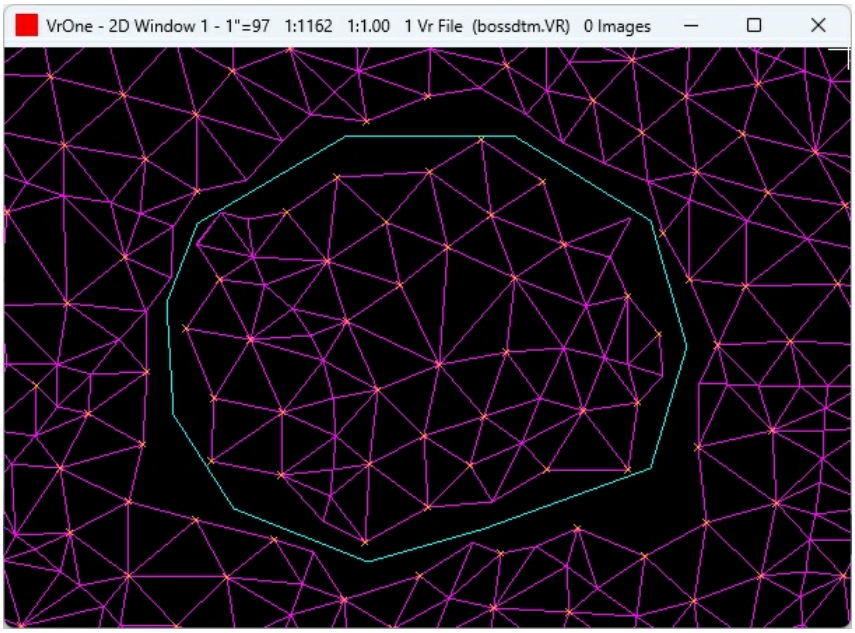

Result of Delete Crossing Lines using the "Don't search for non-crossing lines" option.

Delete Crossing Lines (DelCroLin)
- Added January 2024 - Version 07.01.23

2.1.1.2.23 Delete Duplicate Segments

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Delete Duplicate Segments (DelDupSeg)

Type: Batch Application

Deletes all duplicate and overlapping segments.

Detailed Description

Searches for all 2 point lines and eliminates any overlap between them. Only lines with 2 points are considered. If a segment is an exact duplicate of another segment, one segment will be

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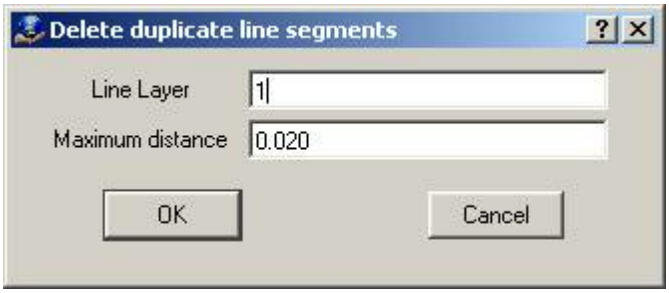
deleted. If a segment partially overlaps another segment, then one of the segment's end points will be moved so they no longer overlap. This routine does not look for crossing segments; a portion of one segment must lie directly on top of a portion of another segment in order for them to be considered overlapping

NOTE: This batch application is undoable.

Parameters for Delete Duplicate Segments



Line Layer

Layer to search for duplicate line segments.

Maximum distance

Specifies the maximum distance that one segment can be from another and still be considered overlapping.

2.1.1.2.24 Delete Node Flags

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Delete Node Flags (DelNod)

Type: Batch Application

Deletes node flags on lines.

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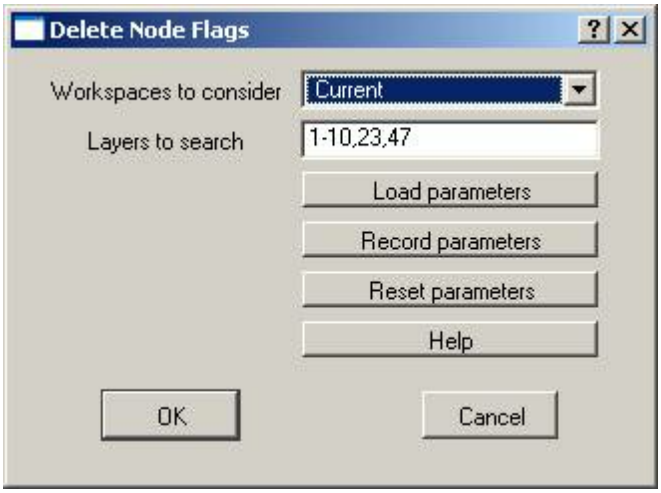
Detailed Description

When lines are noded using Batch Node (BatNod), the noded end points are flagged. The node flag is stored in bit 4 (ASCII 16) in the line point flag parameter. When this flag is set subsequent runs of Batch Node ignore these end points. Delete Node Flags remove these node points from the lines in the layers specified.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Node Flags parameter file name (.dar)
RUN	Run Delete Node Flags	

Parameters for Delete Node Flags



Workspaces to consider

Defines the workspaces to consider when running Delete Node Flags. Options are Current workspace or All open workspaces.

Layers to search

Defines the layers to search that contain lines in which the node flags will be removed. This parameter may be entered as a number line.

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Mapping

Delete Outside Boundary (DelOut)

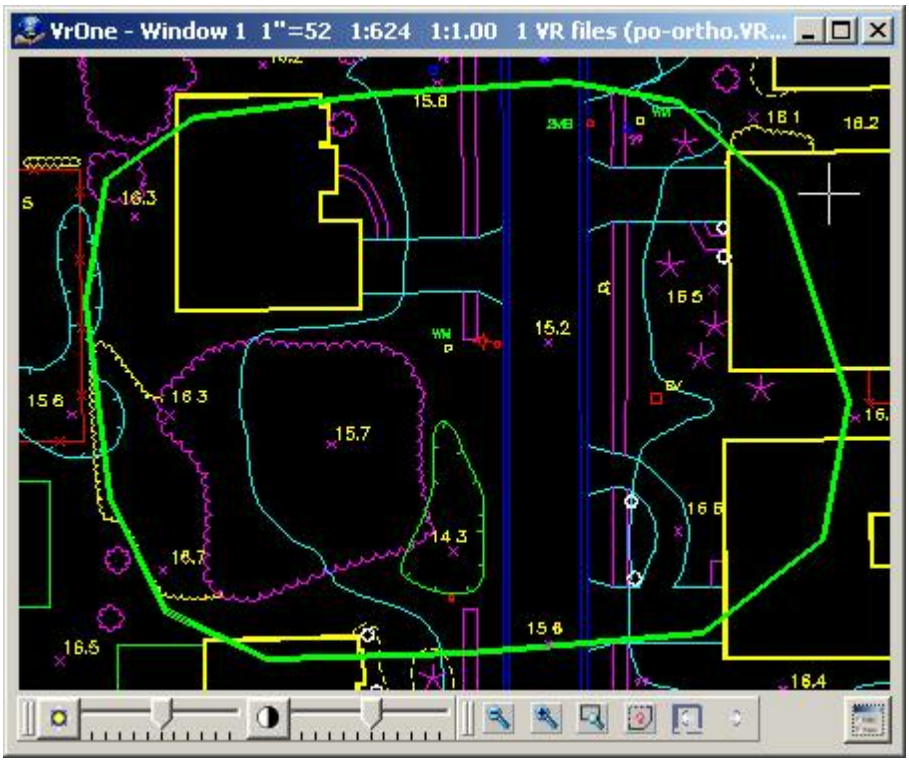
Type: Batch Application

Deletes all entities outside a boundary line. Lines are trimmed to edge of boundary.

Detailed Description

Searches for polygon in the user-defined boundary layer, and deletes all entities that fall outside the polygon. Lines that pass through the boundary line are trimmed to the boundary, and only the inside portion of the lines are kept. There is also a mode that will change graphic pointers on lines and symbols rather than delete entities.

Layers that are turned off will not be considered even if specified. **NOTE:** This batch application is undoable.



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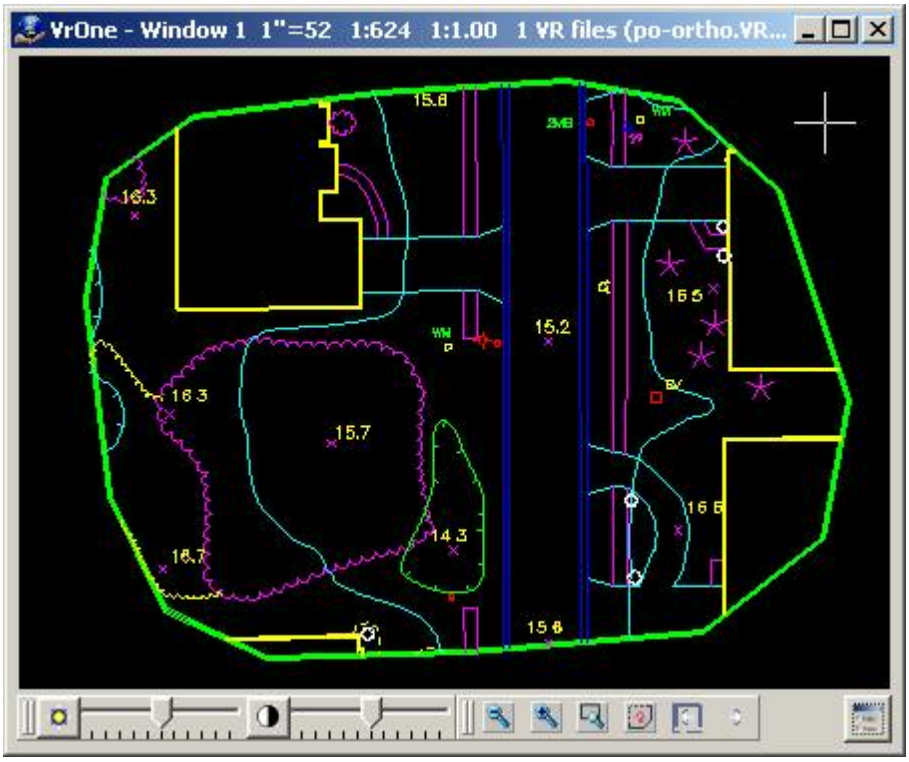

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Outside Boundary parameter file name (.dob)
RUN	Run Delete Points in Polygons	

Parameters for Delete Points Inside Polygons

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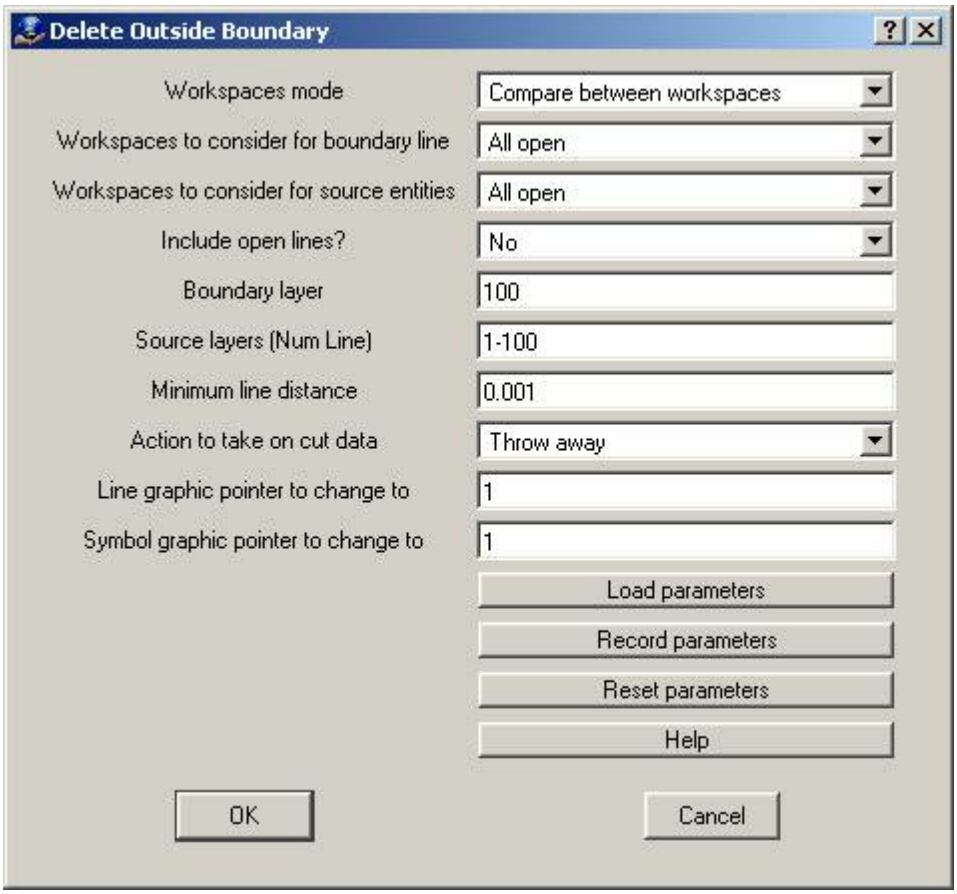

Workspaces mode

Defines the workspace compare mode.

Do not compare between workspaces	Source entities are only compared against boundary lines in the same workspace.
Compare between workspaces	Source entities are compared to boundary lines in other workspaces.

Workspaces to consider

Defines the workspaces to consider. If workspaces mode is set to "Do not compare…", then this option is displayed and applies to the boundary line and source entities.

Workspaces to consider for boundary line

Defines the workspaces to consider when searching for the boundary line. If workspaces mode is set to "Compare between…", then this options is displayed. This allows the workspaces to consider for the boundary line to be set separately from the workspaces to consider for source entities. For example, you may want to only search the current workspace for the boundary line, but delete entities outside the boundary in all open workspaces.

Workspaces to consider for source entities

Defines the workspaces to consider for source entities. If workspaces mode is set to "Compare between…", this options is displayed. This allows the workspaces to consider the boundary line

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to be set separately from the workspaces to consider for source entities.

Include open lines

Determines if open lines in the boundary layer should be treated as polygons.

Yes	Open lines will be considered polygons by assuming a closing segment between the last and first points.
No	Only existing polygons (closed lines) will be considered.

Boundary layer

Defines the layer to search for boundary lines. Normally there should only be one line in the boundary layer. Layers that are turned off will not be considered even if specified.

Source layers

Defines the layers to search for entities outside the boundary line. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Line graphic pointer to change to

Defines the graphic pointers to set lines to if the Change mode is "Set graphic pointer".

Symbol graphic pointer to change to

Defines the graphic pointers to set symbols to if the Change mode is "Set graphic pointer".

Change mode

Defines the action to take on symbols that fall within the polygons.

Delete	Delete the source entities (lines that cross boundary will be trimmed).
Change graphic pointer	Change the graphics pointer of the entity as defined by "Line graphic pointer to change to" and "Symbol graphics to change to" options. Text entities will not be changed if this mode is used.

2.1.1.2.26 Delete Points In Polygons

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Delete Points in Polygons

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(DelPoi)

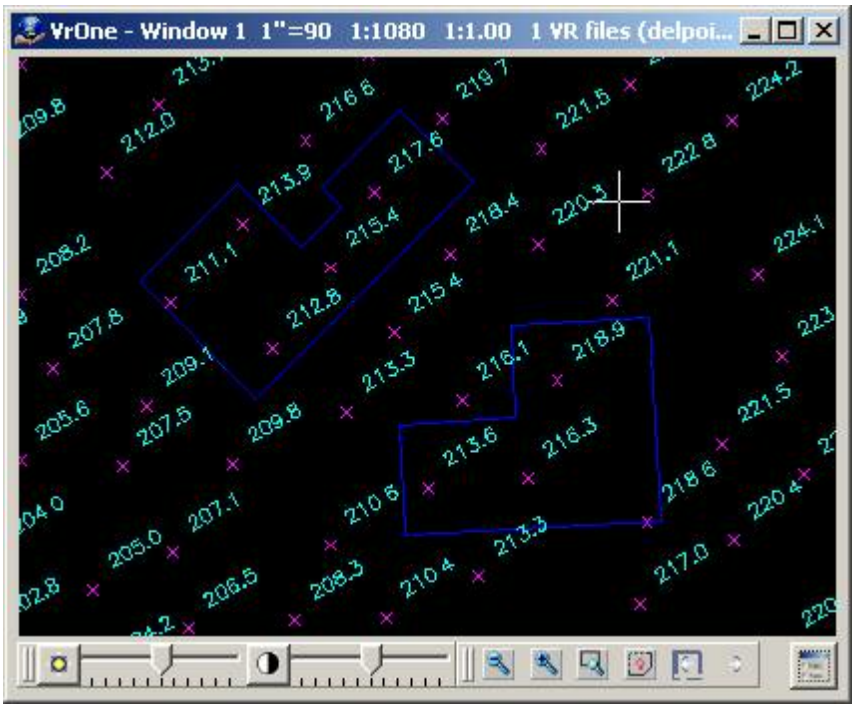
Type: Batch Application

Deletes or changes layers of points (symbols and text entities and VrPoints (LiDAR)) that are inside polygons.

Detailed Description

Searches polygons in user-defined layers and deletes points that fall inside the polygons. Points may be symbols, text labels, and VrPoints (LiDAR). Points may be deleted or moved to another layer.

Layers that are turned off will not be considered even if specified. Delete Points in Polygons is undoable.



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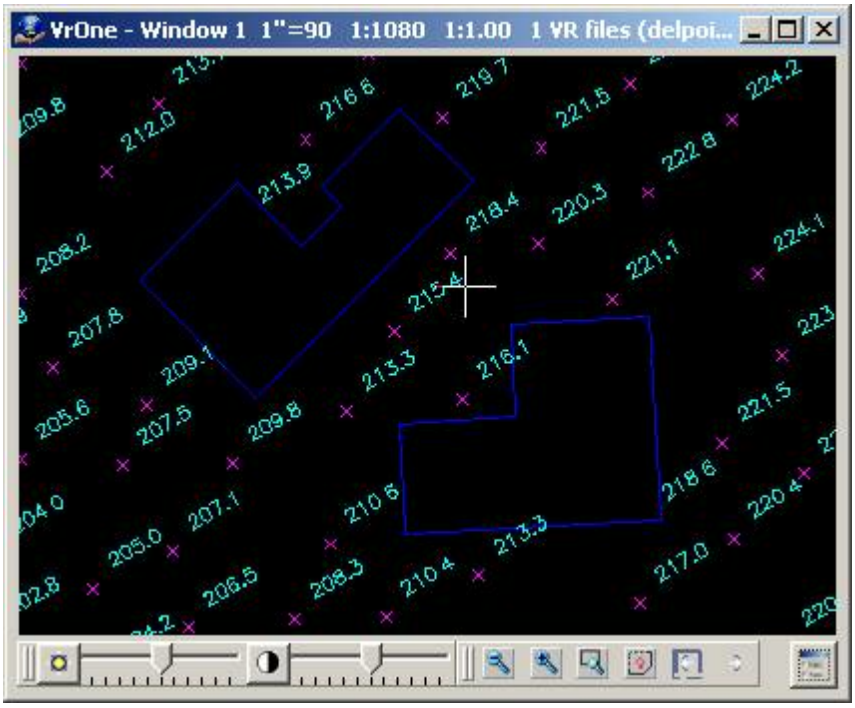

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Delete Points in Polygons parameter file name (.dpp)
RUN	Run Delete Points in Polygons	

Parameters for Delete Points Inside Polygons

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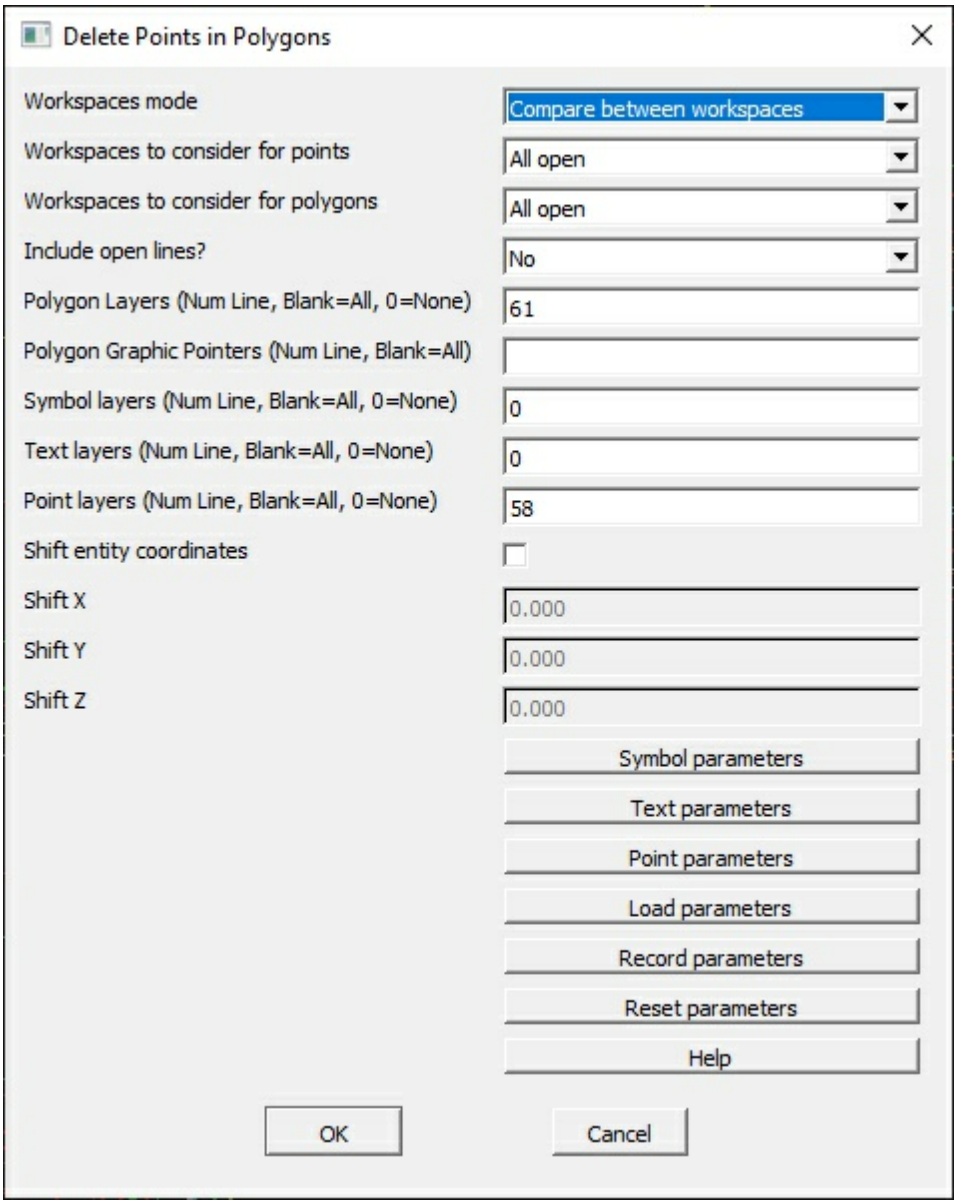

Workspaces mode

Defines the workspace compare mode.

Do not compare between workspaces	Points are only be compared against polygons in the same workspace.
Compare between workspaces	Points are compared to polygons in other workspaces.

Workspaces to consider

Defines the workspaces to consider. If workspaces mode is set to “Do not compare…”, this option is displayed, and applies to points and polygons.

Workspaces to consider for points

Defines the workspaces to consider for points (symbols, text). If workspaces mode is set to

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"Compare between…", this options is displayed. This allows the workspaces to consider for points to be set separately from the workspaces to consider for polygons. For example, the user may want to only search the current workspace for points, but compare the points to polygons in all open workspaces.

Workspaces to consider for polygons
Defines the workspaces to consider for polygons. If workspaces mode is set to "Compare between…", this options is displayed. This allows the workspaces to consider for polygons to be set separately from the workspaces to consider for points. For example, the user may want to only search the current workspace for points, but compare the points to polygons in all open workspaces.

Include open lines
Determines if open lines should be treated as polygons.

Yes	Open lines are considered polygons by assuming a closing segment between the last and first points.
No	Only existing polygons (closed lines) are considered.

Polygon layers (Num Line, Blank=All, 0=None)
Defines the polygon layers against which to check points. This may be entered as a number line. If left blank, all layers are considered. If set to zero, no layers are considered. Layers that are turned off are not considered even if specified.

Polygon graphic pointers (Num Line, Blank=All)
Defines the polygon graphic pointers against which to check points. This may be entered as a number line. If left blank, lines with any graphic pointer are considered.

Symbol layers (Num Line, Blank=All, 0=None)
Defines the layers in which to search for symbols inside the polygons. This may be entered as a number line. If left blank, all layers are considered. If set to zero, no layers are considered. Layers that are turned off are not considered even if specified.

Text layers (Num Line, Blank=All, 0=None)
Defines the layers in which to search for text inside the polygons. This may be entered as a number line. If left blank, all layers are considered. If set to zero, no layers are considered. Layers that are turned off are not considered even if specified.

Point layers (Num Line, Blank=All, 0=None)
Defines the layers in which to search for VrPoints (i.e. LiDAR) inside the polygons. This may be entered as a number line. If left blank, all layers are considered. If set to zero, no layers are considered. Layers that are turned off are not considered even if specified.

Symbol parameters [Button]

Symbol graphic pointers (Num Line, Blank=All)
Defines the symbol graphic pointers to search for. This combined with the Symbol layers specified above will define the symbols to consider. The Graphic Pointers may be entered as a Number Line. If left blank, all Graphic Pointers will be considered

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Shift entity coordinates
If checked and an entity type (symbols, text, and/or points) is has its change mode set to "Move to target layer" or "Don't change layer" then these entities will be shifted by the amount defined by Shift X, Shift Y, and Shift Z.

Change mode for symbols
Defines the action to take on symbols to be considered that fall within the polygons.

Delete	Delete the symbols.
Move to target layer	Move the symbols to the target layer as defined by “Target Layer for Symbols” and “Target layer mode for Symbols”.
Don't change layer	If the symbols are to be shifted only then this item should be selected.

Target layer mode for symbols
Determines how the target layer for symbols is used when “Change mode for symbols” is set to “Move to target layer”.

Set to target layer	The symbol layer is changed to the “Target layer for symbols”.
Add to target layer	The “Target layer for symbols” is added to the existing symbol layer to compute a final target layer for the symbol. The symbol layer is changed to the computed target layer.

Target layer for symbols
If the Change mode for symbols is set to “Move to target layer”, this parameter defines the layer to which to move symbols. The Target layer mode for symbols determines how this number is used to determine the final target layer.

Text parameters [Button]

Change mode for text
Defines the action to take on text that falls within the polygons.

Delete	Delete the text.
Move to target layer	Move the text to the target layer as defined by “Target Layer for Text” and “Target layer mode for Text”.
Don't change layer	If the text labels are to be shifted only then this item should be selected.

Target layer mode for text
Determines how the target layer for text is used when “Change mode for text” is set to “Move to target layer”.

Set to target layer	The text layer is changed to the “Target layer for text”.
Add to target layer	The “Target layer for text” is added to the existing text layer to compute a final target layer for the text. The text layer is changed to the computed target layer.

Target layer for text
If the Change mode for text is set to “Move to target layer” this parameter defines the layer to which to move text. The Target layer mode for text determines how this number is used to

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determine the final target layer.

Text parameters [Button]

Change mode for points

Defines the action to take on points (LiDAR) that falls within the polygons.

Delete	Delete the points.
Move to target layer	Move the points to the target layer as defined by “Target Layer for points" and “Target layer mode for points".
Add to target layer	The “Target layer for points is added to the existing text layer to compute a final target layer for the point. The point layer is changed to the computed target layer.

Target layer mode for points

Determines how the target layer for points (LiDAR) is used when “Change mode for points” is set to “Move to target layer”.

Set to target layer	The points layer is changed to the “Target layer for points”.
Add to target layer	The “Target layer for points” is added to the existing points layer to compute a final target layer for the point. The points layer is changed to the computed target layer.

Target layer for points

If the Change mode for points (i.e. LiDAR) is set to “Move to target layer” this parameter defines the layer to move points to. The Target layer mode for points determines how this number is used to determine the final target layer.

Load parameters [Button]

Loads the parameters from a previously recorded parameter file.

Record parameters [Button]

Records the current parameters to a parameter file. This file will automatically be loaded when Delete Points in Polygons (DelPoi) is started again.

Reset parameters [Button]

Resets the current parameters to default values. NOTE: Parameters that have not been recorded (saved) will be lost.

Help

Displays this help page.

Revised October 2022

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DOCUMENTATION
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Vr Mapping

Drape (Drape)

Type: Batch Application

Drapes entities along the ground Z axis onto the existing entity data.

Detailed Description

Searches for entities within layers specified and drapes over existing DTM surface and/or the intersections of lines or onto VrPoints (LiDAR).

Some of the draping options include:

- Line points may be draped to the existing DTM surface and intersect those same lines against lines in other layers.
- Line points may be draped to the existing VrPoints and/or automatically add additional points at breaks in the surface.
- Lines, symbols and text may be duplicated when draping, leaving the original entity unmodified.
- Wall lines or wall polygons may be added that connect duplicate entities.
- The interpolated elevation may be added or subtracted to the existing elevation.

To Drape Entities onto the DTM Surface:

- 'Free DTM after use' must be set to No in SetDtm.
- A DTM surface must be active by running RunDtm.
- The Z source must be set to 'DTM surface' if active.

The DTM does not need to be active if only intersecting lines to other lines in the file(s) or if draping to VrPoints.

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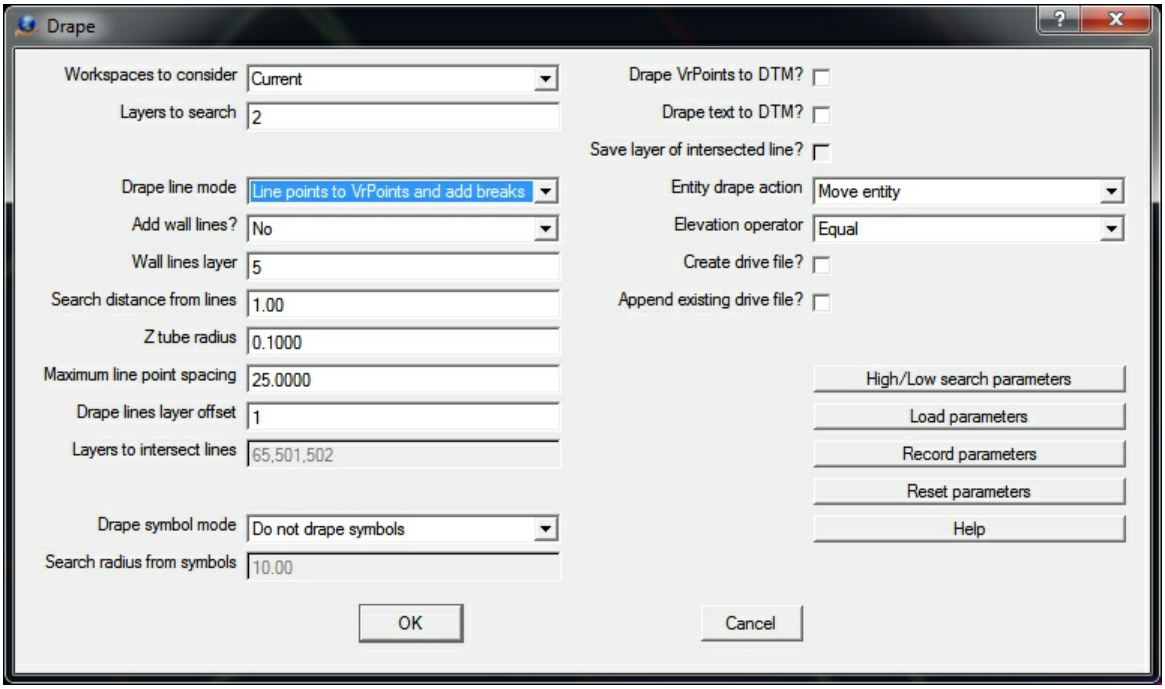
Layers that are turned off will not be considered when searching.

Parameters for Drape



Workspaces to consider

Defines the workspaces to consider when running Drape.

Layers to search

Defines the layers that are to be searched to be draped against the current DTM surface or other lines. A number line may be used to define the layers.

Drape line mode

Defines the mode to use when draping lines. The modes are as follows:

- Do not drape lines
- Drape line points to DTM surface only
- Drape line points to DTM surface and intersect lines to other lines
- Intersect lines to other lines
- Drape line points to VrPoints and add breaks
- Drape line points to VrPoints

Add wall lines?

If the Entity drape action is set to “Duplicate”, it is possible to draw lines that represent the wall between the original entity and the new draped entity. It is also possible to place the walls defined by the original and draped polygons as closed polygons. This parameter has the following options:

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- No;
- Add wall lines;
- Add wall polygons.

Wall lines layer
Specifies the layer into which to place wall lines.

Search distance from lines
Specifies the search distance from lines when draping lines to VrPoints. This parameter will be used when "Drape line mode" is set to "Drape line points to VrPoints and add breaks" or "Drape line points to VrPoints". The search distance is entered in ground units.

Z tube radius
When a line is draped to VrPoints and breaks are added, an optional line filter may be run on the lines. This filter is based on a Z tube filter and reduces the number of points on the resulting line. Sequential line points that fall within this Z tube distance will be filtered. This parameter is entered in ground units. An entry of zero will turn off line filtering.

Maximum line point spacing
This parameter is used during line filtering when lines are draped to VrPoints and breaks are added. The maximum point spacing specifies that one or more points will exist on the filtered line within this distance along the line. This parameter is entered in ground units.

Drape lines layer offset
When assigning a layer to the draped lines, this offset will be added to the original layer.

Layer to intersect lines
If the Drape line mode is set to intersect lines then this parameter specifies the layers to intersect to. For example if the roads were to be draped to the contour lines then the layers containing contour lines would be specified here.

Drape symbol mode
Defines the mode when draping symbols. Options are:

- Do not drape symbols;
- Drape symbols to DTM;
- Drape symbols to VrPoints.

Search radius from symbols
If the "Drape symbol mode" is set to "Drape symbols to VrPoints", this parameter specifies the radius from a symbol's xy coordinates to search for VrPoints. This parameter is entered in ground units.

Drape VrPoints to DTM?
Specifies whether VrPoints will be draped onto the DTM surface.

Drape text to DTM?
Specifies whether text labels will be draped onto the DTM surface.

Save layer of intersected line?

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When a line is intersected to another line, the source line's layer is saved in the target line point's M flag if this parameter is checked. This layer number can be used by another application, such as a translator, to assign these intersected points to items such as cross section point codes.

Entity drape action
Lines that are draped may be moved or copied and this action is specified by this parameter. Options are:

- Move entities to DTM or other lines;
- Duplicate entities to DTM or other lines.

Elevation operator
When a line, symbol, VrPoint or text label is draped, a drape elevation is computed. This elevation is based on the target surface which is either the DTM surface, other lines in the file, or an elevation from VrPoints. Normally, the entity to be draped is placed on this surface, which is an elevation operator of equal. It is possible to add or subtract the draped elevation from the original elevation. This is useful when applying a delta surface to existing entities. Options are:

- Equal;
- Add;
- Subtract.

Create drive file?
Specifies whether a drive file containing points that could not be draped will be created or appended.

Append to drive file?
If checked and a drive file exists, it will be appended with points that could not be draped.

High/Low search parameters
When draping line points or symbols, the High/Low search parameters are used to determine elevations. See High/Low Point Search for more information.

Load parameters
Loads previously recorded Drape parameters from a user defined (.dra) file name.

Record parameters
Records the current Drape parameters to a user defined (.dra) file name.

Reset parameters
Resets the Drape parameters to default values.

Help
Displays this help page.

Available Key-ins

Key-in	Description	Range
WsTc=	Workspaces to consider	0 - Current

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		1 - All
SeaLay=	Layers to search	Number line
DraLin=	Drape line mode	0 - Do not drape lines 1 - Line points to DTM only 2 - Line points to DTM surface and intersect lines to other lines 3 - Intersect lines only 4 - Line points to VrPoints and add breaks 5 - Line points to VrPoints
AddWal=	Add wall lines on duplicate entities	0 - Do not add wall lines or polygons 1 - Add wall lines 2 - Add wall polygons
WalLay=	Layer for wall lines	1-32001
SeaDis=	Search distance from lines for VrPoints	Distance in ground units
TubRad=	Sequential line points that fall within this Z tube distance will be filtered. Used when draping lines to VrPoints and adding breaks.	Z tube distance in ground units. 0 - Do not filter lines
MaxDis=	Sets maximum point spacing when draping lines to VrPoints and adding breaks.	Maximum distance in ground units
LayOfs=	Offset to add to layer of draped lines	1-32000
IntLay=	Layer(s) containing lines to intersect drape lines with	Number line
DraSym=	Drape symbols mode	0 - Do not drape symbols 1 - Drape symbols to DTM 2 - Drape symbols to VrPoints
SymRad=	Search radius from symbols for VrPoints	Radius in ground units
DraPoi=	Drape VrPoints to DTM?	0 - No 1 - Yes
DraTex=	Drape text to DTM surface?	0 - No 1 - Yes
DraAct=	Drape action	0 - Move entities to DTM or other lines 1 - Duplicate entities to DTM or other lines
EleOpe=	Elevation operator	0 - Equal 1 - Add 2 - Subtract

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DriFil=	Create drive file containing points that could not be draped.	0 - No 1 - Yes
App=	Append existing drive file?	0 - No 1 - Yes
ParFil=	Load parameter file	Drape parameter file name (.dra)
Run	Run Drape	

2.1.1.2.28 Drape Control

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Drape Control (DraCon)

Type: Batch Application

Detailed Description

Drapes the x,y,z points in a control file to a point cloud or the active Digital Terrain Model (DTM) surface and creates a report that shows the elevation difference between each elevation in the control file and the computed elevation at the x,y position in the control file. This application does not modify any data but produces a report only. A point cloud surface may be LiDAR and (or) Digital Surface Model (DSM) data or any other x,y,z collection of VrPoints. If draping to a point cloud is selected then the application uses the Vr High/Low point searching to determine the elevation for each control point. Please see High/Low Point Search for more information on this method. If draping to the active DTM surface is selected then a DTM surface must be active. The Set DTM (SetDtm) command can be used to set DTM generation parameters and the surface may be generated using the Run DTM (RunDtm) command.

Following is an example of a Drape Control report. NOTE: The results at the bottom of this report are shown as an example only.

```
DRAPE CONTROL
using High/Mean/Low point searching
25-Jul-2016 00:41:58
Control file: K:\Jobs\ZAccur\GroundControl.cor
```

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```
High/Low parameters
High/Low search             : On
Search mode                 : Mean point
Initial buffer size         : 1000
Adjust x,y                  : No
Classifications (blank=all) :
Search radius (ground)      : 0.200
Z tolerance (ground)        : 1.000
Z offset (ground)           : 0.000

More information on the High/Low search parameters can be found at:
http://www.vrmapping.net/help5/high_low_point_search.htm
```

Name	X	Y	Z	CompZ	DeltaZ
440	6267198.873	2316066.683	417.870	417.873	+0.003
460	6267561.752	2316062.986	413.920	413.923	+0.003
388	6267644.065	2316087.418	412.530	412.533	+0.003
615	6267112.852	2315970.640	418.450	418.452	+0.002
656	6267867.186	2315963.621	409.450	409.452	+0.002
455	6267475.988	2316063.855	414.900	414.902	+0.002
437	6267140.343	2316067.178	418.440	418.442	+0.002
322	6267010.667	2316080.230	419.170	419.172	+0.002
394	6267744.428	2316088.858	411.130	411.132	+0.002
553	6267068.169	2315983.073	418.910	418.911	+0.001
566	6267314.495	2315980.832	416.900	416.901	+0.001
661	6267967.182	2315962.774	408.130	408.131	+0.001
470	6267748.353	2316061.176	411.460	411.460	+0.000
447	6267333.940	2316065.070	416.560	416.560	+0.000
573	6267434.840	2315979.632	415.610	415.610	-0.000
559	6267188.164	2315981.950	418.000	418.000	-0.000
610	6267030.396	2315971.420	418.980	418.980	-0.000
472	6267788.351	2316060.833	410.840	410.840	-0.000
452	6267431.936	2316064.183	415.450	415.449	-0.001
391	6267704.060	2316088.185	411.680	411.679	-0.001
386	6267604.068	2316086.906	413.060	413.059	-0.001
618	6267172.849	2315970.051	417.960	417.959	-0.001
654	6267827.187	2315963.960	410.060	410.059	-0.001
469	6267734.123	2316061.338	411.710	411.709	-0.001
392	6267704.434	2316088.190	411.680	411.679	-0.001
465	6267654.128	2316062.246	412.720	412.718	-0.002

```
Points draped    : 204
Mean delta Z     : +0.001
Minimum delta Z  : -0.002
Maximum delta Z  : +0.003
Root mean square : +0.002
Std deviation    : +0.002
```

Parameters for Drape Control

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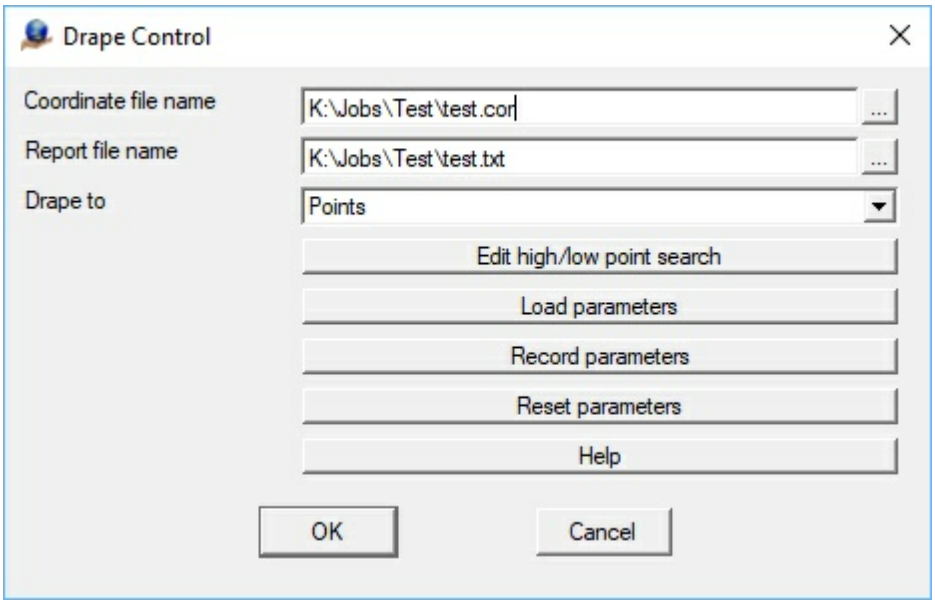

The Drape Control main dialog

Coordinate file name
Defines the Vr coordinate file containing control points to be draped

Report file name
Output file name to place the resulting drape report.

Drape to
Defines the drape mode which is if the control points should be draped to the point cloud or to the active DTM surface. If draping to the active DTM surface is selected then a surface must be active and can be generated using the Run DTM (RunDtm) command.

Edit high/low point search
Defines the high/low point searching parameters to determine the point cloud elevation for each point in the control file. Please see High/Low Point Search for more information. The high/low point search parameters are used if the "Drape to" parameter is set to "Points".

Load parameters

Loads a previously saved parameter file. Drape Control parameter files use the .drc file extension.

Record parameters

Records the current parameters. Drape Control parameter files use the .drc file extension.

Reset parameters

Resets the Drape Control parameters to default values

Help

Displays this help page.

Available Key-ins

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Key-in	Description	Range
ParFil=	Load parameter file	Drape Control parameter file name (.drc)
CooFil=	Defines coordinate file	Coordinate (.cor) file name
RepFil=	Defines report file	Output file name (.txt)
DraMod=	Drape mode	0 = Drape to point cloud (VrPoints) 1 = Drape to active DTM surface
HL_OffOn=	Turns on/off high, mean or low point searching	0=Off 1=On
HL_Mod=	Specifies the search mode	0=Low point 1=Mean point 2=High point
HL_BufSiz=	Initial buffer size	Number of points
HL_XyAdj=	Copy XY of point found to current location	0=No 1=Yes
HL_SeaCla=	Classifications to search	0-31, Number line may be used
HL_SeaRad=	XY search radius	Ground units
HL_ZTol=	Z tolerance above and below source point	Ground units
HL_ZOff=	Offset to add to Z result	Ground units
Run	Runs Drape Control	

Running Drape Control From a Macro

Since Drape Control supports key-ins, it is possible to run the application, unattended, from a Vr Macro. When running in this mode, dialog boxes other than the main dialog will not be displayed unless there is an error.
Following is an example of a Vr Macro that loads Drape Control (DraCon), sets the desired parameters then runs the application. When the application starts, previously saved parameters will be loaded. If some parameters are not set then the previous or default values will be used. Parameters that are set in this configuration are not saved when the application exits.

```
DraCon
CooFil=K:\Jobs\ZAccur\GroundControl.cor
RepFil=K:\Jobs\ZAccur\GroundControlReport.txt
DraMod=0
Hl_OffOn=1
HL_Mod=1
HL_XyAdj=0
HL_SeaRad=0.2
HL_ZTol=1.0
Run
```

July 2016- Drape Control added
August 2017 - Added drape to active DTM surface (05.09.03)

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DOCUMENTATION
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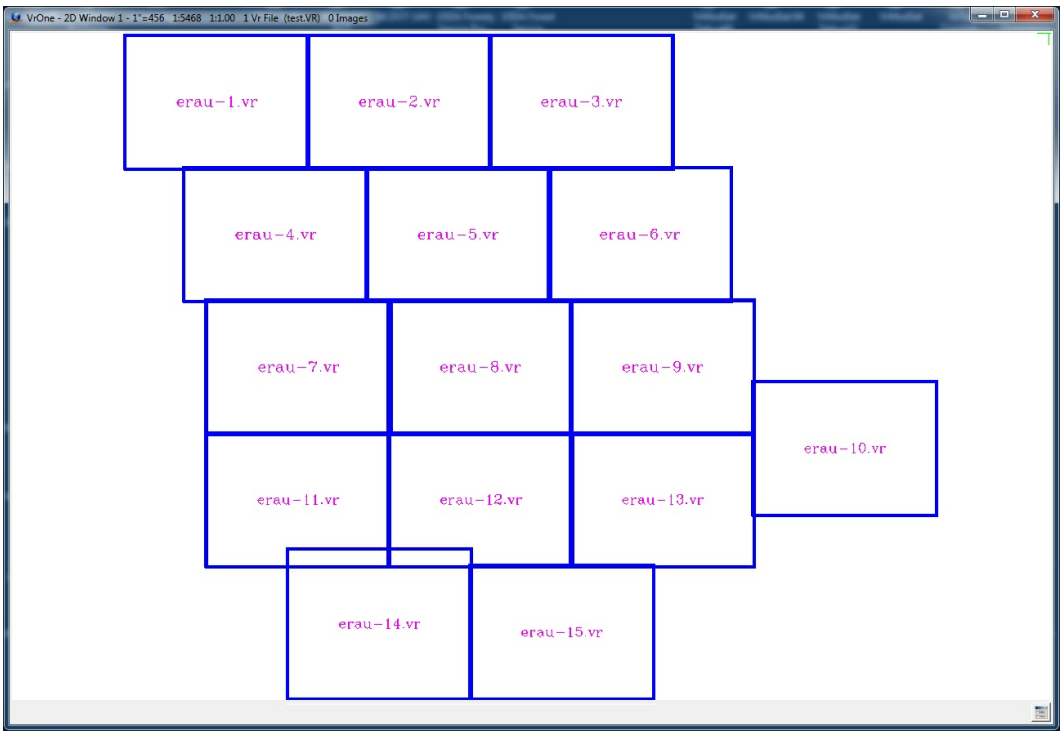
Vr Mapping

File Index (FilInd)

Type: Batch Application

Creates file extents as lines an places them into workspace 1.



File Index created file extents lines

Detailed Description

File Index reads the coordinate file extents of multiple VrOne files that are specified by the user and not currently open. The coordinate file extents are drawn as lines and placed into workspace 1. Typically workspace 1 is open and does not contain any entities before running File Index.

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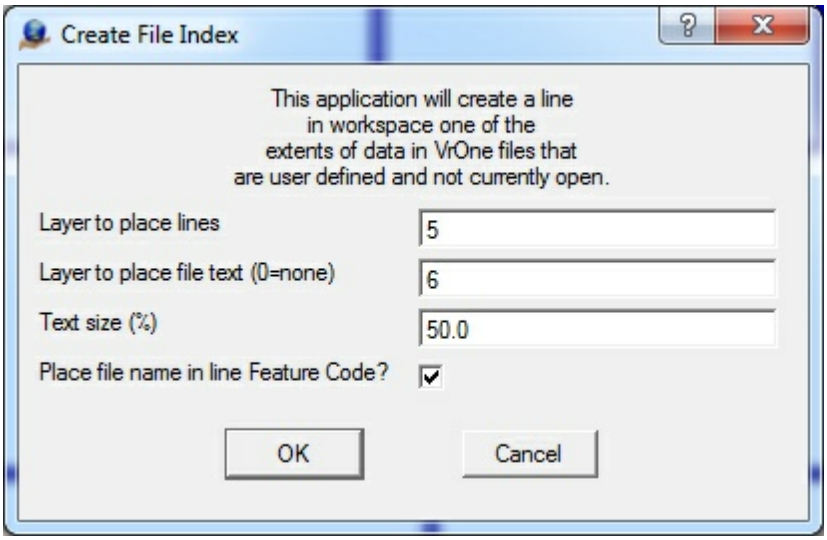
Options include user the ability to place the file name as text in each extents line and placing the file name as the line Feature Code. The layers for the lines and text may be specified along with the text size as a percentage of the with of each line rectangle. Defined parameters are remembered between runs.

File Index should be run from the VrOne environment with a single workspace open.

Available Key-ins

None

Parameters for File Index



Layers to place lines
When lines are created they are placed in this layer in Workspace 1.

Layer to place file text
When text labels are created consisting of the file names they are placed in this layer in workspace 1. A layer number of zero will suppress the creation of text labels

Text size (%)
Defines the text size as a percentage of the line rectangle width. The range of this parameter is 10 to 100.

Place file in in line Feature Code
If checked, the VrOne file name will be placed in the line's Feature Code. Edit line may used to identify a line and it's file name will be displayed in the Menu Keys dialog as the Feature Code.

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Vr Mapping

Fix Arcs (FixArc)

Type: Batch Application

Fixes previously defined arcs.

Detailed Description

VrOne stores arcs as a line with a series of line segments. This method allows arcs to be embedded in lines and creates a three-dimensional edge when storing the arc. The arc on the line is defined by a series of flags marking the beginning, middle and end points of the arc.

During editing, these arc flags may be changed. This would make the definition of the arc impossible. During Vr Pack, File arcs that do not have the correct flags have the entire arc's flags removed. Fix Arcs searches for arcs that have lost their arc point codes then tries to fix the arcs by assigning correct arc codes to the points. Any series of four or more points that can be fitted with an arc will have the arc code flags set.

A drive file containing all changed arcs will be created.

Layers that are turned off will not be considered even if they are specified.

More than one run may be done with Fix Arcs to set the best parameters. After each run the batch application Delete Arcs (DelArc) may be run to remove arc flags placed by Fix Arcs.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Fix Arcs parameter file name (.far)
RUN	Run Fix Arcs	

Parameters for Fix Arcs

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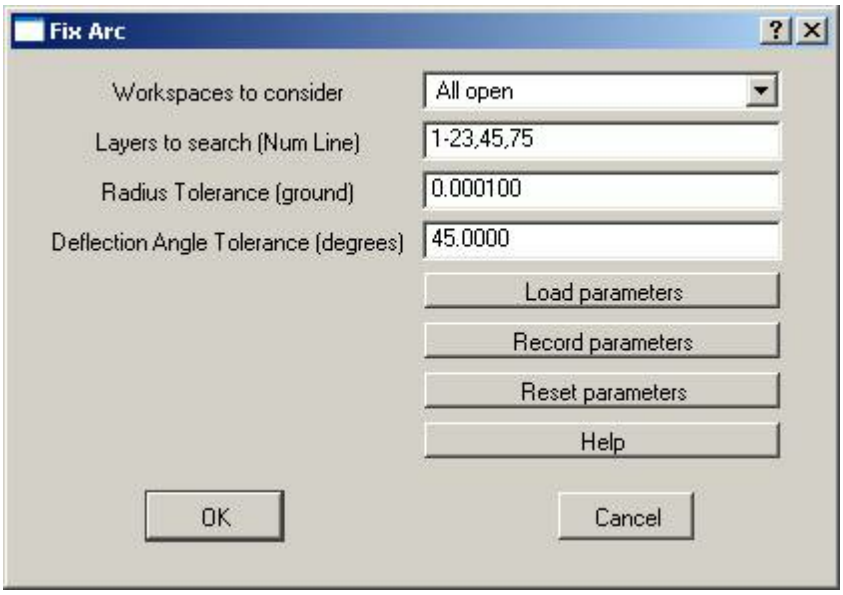

Workspaces to consider

Defines the workspaces to consider when running Fix Arcs. Options are Current workspace or All open workspaces.

Layers to search

Defines the layers to search that contain lines in which the arcs are to be redefined. This parameter may be entered as a number line.

Radius tolerance

When searching for an arc, three points are used to determine an arc radius. Each subsequent point is then added to the arc. If the new arc radius is within this tolerance then it is considered an arc point. This parameter is expressed in ground units. The larger the number, the more points will be included in an arc. A good start value for this parameter on a large-scale map is 0.001 feet.

Deflection angle tolerance

If a new point for an arc is greater than this angle from the last two points, it will be considered a non-arc point. This is to avoid arcing items such as squares. This parameter is entered as degrees. A good start value for this parameter is 45 or 90 degrees.

2.1.1.2.31 Gap Lines

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Mapping

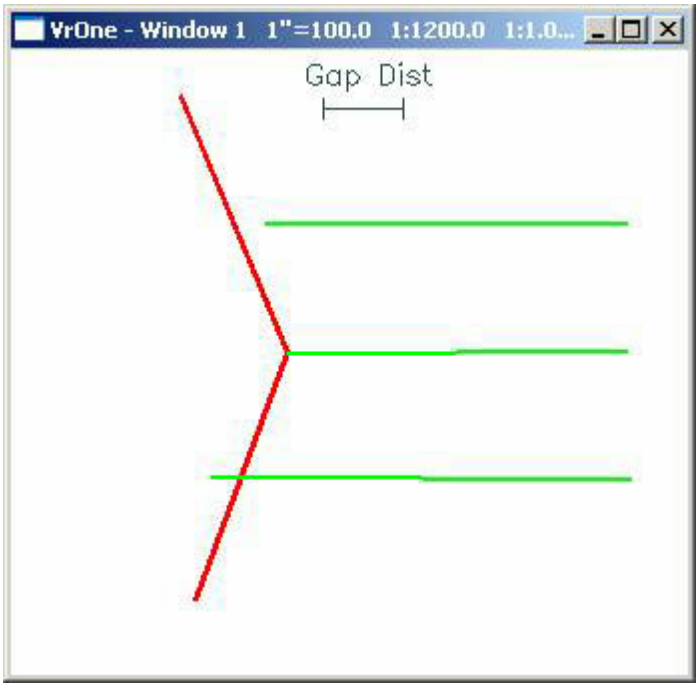
Gap Lines (GapLin)

Type: Batch Application

Looks for touching lines and creates gaps between them.

Detailed Description

Some Digital Terrain Modeling (DTM) engines require that break lines cannot cross, touch, or be located at a node point. Gap Lines searches line end points that fall within a user specified distance to other lines and creates a gap by hacking the end or ends of the line.



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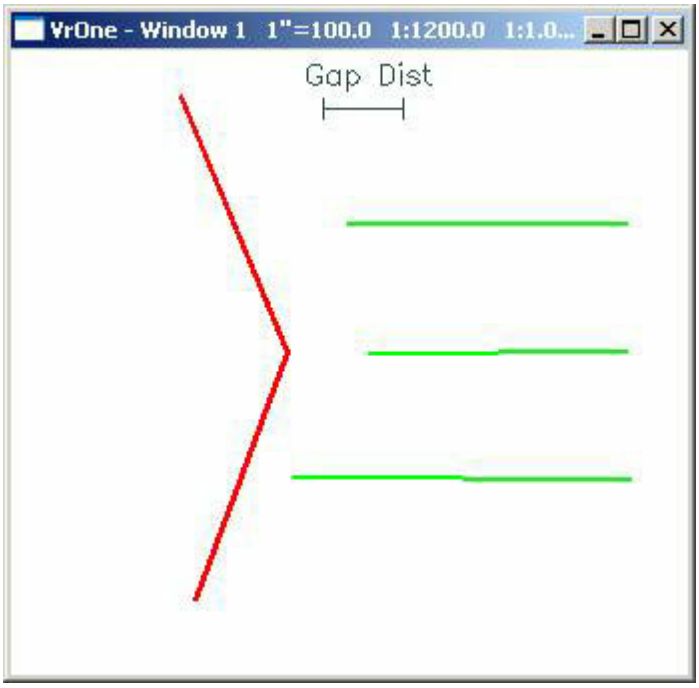

In the above example the red and green lines represent break lines. All three green lines whose end point was within the distance defined by the Gap Distance of the red line were shortened. Each line was shortened by the same amount. Even though the top green line did not touch the red line, its endpoint was within the Gap Distance of the red line.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Gap Lines parameter file name (.gap)
WSTC=	Workspaces to consider	0=Current 1=All open
SEALAY=	Layers to search	1-10001 – May be a number line
GAPDIS=	Gap distance	Ground units
RUN	Run Gap Lines	

Parameters for Gap Lines

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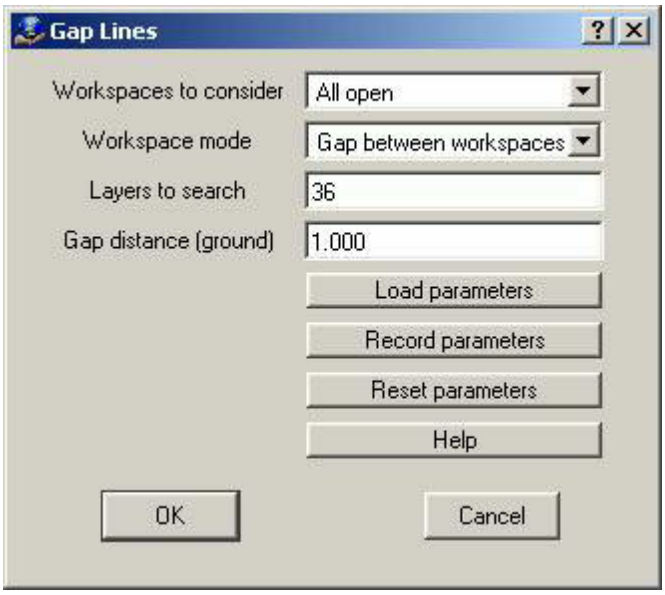

Workspaces to consider

Defines the workspaces to consider when running Gap Lines.

Workspaces mode

Can be set to "Gap Between Workspaces" or "Do Not Gap Between Workspaces". When working on multiple workspaces, this determines whether or not line end points that meet from one workspace to another are considered for gapping.

Layers to Search

Defines the line layers to search. Lines to be gapped may be in the same layer. This parameter may be entered as a Number Line. Layers that are turned off will not be considered even if they are defined.

Gap Distance

Defines the search distance between line end points and lines they may be crossing or touching. It also defines the distance to shorten line ends that need to be gapped. The Gap Distance is entered in ground units.

2.1.1.2.32 Global Change

Vr Mapping

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Global Change (Glob)

Type: Batch Application

Globally changes lines, symbols, text and VrPoints in single and multiple workspaces.

Available Key-ins	Global Change Dialog	Argument Types
Arguments for Entity Parameters		

Detailed Description

With Global Change it is possible to setup up 'search for' and a 'change to' criteria for modifying the VrOne database such as:

Look for all the lines in symbols in layers 1 through 10 or 23 or 24 that are circles and have a radius between 10 and 23 ground units. The non-graphic point, link and rotation may be any value. When an entity is found move it to layer 55 and multiply its radius by 2. Do not change its graphic pointer or any other attribute.

Global Change offers six argument formats to make the task of searching for and changing VrOne entities very powerful. For example, it is possible to search for text that is rotated between 10 and 20 degrees with a range argument and then add 5 degrees to the existing text rotations using the operator argument.

For an explanation of the fields when changing Points, please see click here.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Global Change parameter file name (.glo)
RUN	Run Global Change	

Global Change Dialog

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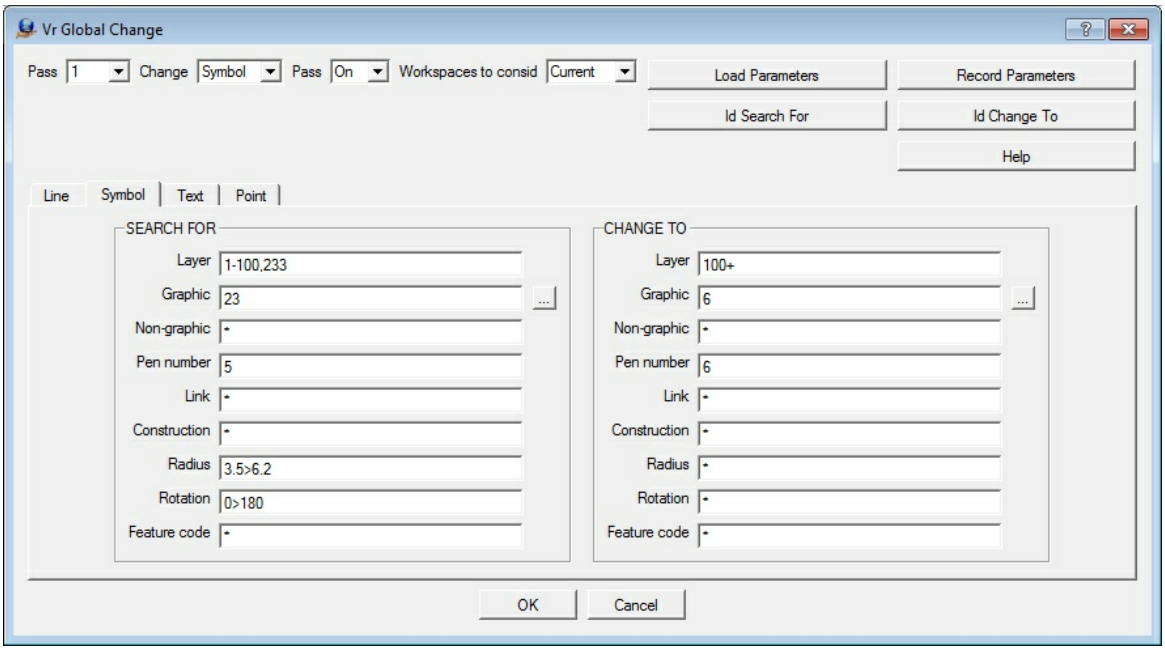

Pass

This is the current pass number. There may be up to 60 passes.

Change

Defines the entity type to change for the current pass. Options are Line, Symbol and Text. Clicking the Line, Symbol or Text tabs have the same effect. NOTE: Only one of the three entity types (Line, Symbol, Text) may be changed for each pass.

Pass On/Off

Defines the mode of the current pass as On or Off.

Workspaces to consider

Specifies whether global change can operate only on the current workspace or on all open workspaces.

Load Parameters

Loads a previously recorded parameter file and changes them to the current Global Change parameters.

Record Parameters

Records the current Global Change parameters.

Id Search For

Allows the identification of an existing entity in the active VrOne workspace and places those entity parameters in the SEARCH FOR parameters.

Id Change To

Allows the identification of an existing entity in the active VrOne workspace and places those entity parameters in the CHANGE TO parameters.

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SEARCH FOR

These entity parameters will be searched for the current VrOne workspace(s). (See Arguments for Entity Parameters)

CHANGE TO

When entities are found that match the SEARCH FOR criteria they will be changed to these entity parameters. (See Arguments for Entity Parameters)

Argument Types

Global Change allows seven types of argument formats to make the searching and changing of data easier and more powerful. Not all argument types may be used in all cases.

Single Number

A single number which may represent an integer or real number.

Example: 23

Number line

A range of numbers normally used to specify a group of layers. A number line may consist of a group of numbers or a range of numbers. A comma separates each number or range of numbers. The number line is used only for searching.

Example: 1-10,23,25

In the above example the group of numbers specified would be 1,2,3,4,5,6,7,8,9,10,23 and 25.

Range

Specifies a range from a minimum number to (and including) a maximum number. This argument is normally used to specify real number ranges for items such as symbol radius or text height. The range argument is used only for searching.

Example: 10.0>23.5

The above example would specify a number from 10 to 23.5.

Operator

Specifies a value and operation to be applied to an existing value. The operator argument is used only during the changing of an entity. Valid operator argument operations are:

=	Equals (default)
+	Addition
-	Subtraction
*	Multiplication
/	Division

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Example: SROT 20.0+

The above example would add 20 degrees to the existing symbol rotation.

Wildcard

The meaning of a wild card depends on where it is used. When used in the SEARCH FOR area it means all values for that field. When used in the CHANGE
TO area it means do not change the existing value.

Example: *

Text

The text argument is used only when searching for or changing VrOne text entities and Feature Codes.

Example: This is some text

Units

Specifies the units of the value at target scale. The units argument is only valid for symbol radius and text width/height values and should always follow the value itself. Valid units arguments are:

in	Inches
mm	Millimeters
ft	Feet
pr	Prompt Units. This will use whatever units are currently configured as the current VrOne prompt units (in or mm).

Symbol change example: Search radius: 0.2in, Change radius: 0.4in

The above example would find all symbols with a radius of 0.2 inches at the target scale of the workspace and change them to 0.4 inches at the target scale of the workspace. So if the target scale is set to 1:1200 and the units for the file are feet, then it would search for symbols with a radius of 200 and change them to a radius of 400. The same parameters applied to a file with a target scale of 1:600 would search for symbols with radius of 100 and change them to a radius of 200.

Symbol change example: Search radius: 0.1pr, Change radius: 2.5

The above example would find all symbols with a radius of 0.1 in the configured prompt units and at the target scale of the workspace, and change them to 2.5 ground units.

Arguments for Entity Parameters

Following is the list of available fields and the argument formats that may be used.

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Layer	Line Mode	Graphic Pointer
Non-graphic Pointer	Link	Feature Code
Construction Flag	Line Width	Symbol Rotation
Symbol Radius	Character Font	X Character Justification
Y Character Justification	Character Height	Character Width
Character Rotation	Character Slant	Character Text

Layer

Range: 1 to 10,001

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Line Mode

Range: 1, 2

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Graphic Pointer (Gpoint)

Range: 1-60

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Non-graphic Pointer (Npoint)

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Range: -2,147,483,647 to 2,147,483,647

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	Yes
Operator	23+	No	No
Wildcard	*	Yes	Yes

Link

Range: -2,147,483,647 to 2,147,483,647

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	Yes
Operator	23+	No	No
Wildcard	*	Yes	Yes

Feature Code

Range: Up to 48 characters

Format	Example	SEARCH FOR	CHANGE TO
String	Man Hole	Yes	Yes
Single Number	23	No	No
Number line	1-10,23	No	No
Range	10>23	No	No
Operator	23+	No	No
Wildcard	*	Yes	Yes

Construction Flag

Range: 0 or 1

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes

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Wildcard	*	Yes	Yes

Line Width

Range: 0-255

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Symbol Rotation

Range: Real number 0.0 to 360.0 degrees

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Symbol Radius

Range: Real number in ground units

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Operator	23+	No	Yes
Units	0.2in	Yes	Yes
Wildcard	*	Yes	Yes

Character Font

Range: 1-12

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No

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Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

X Character Justification

Range: 1 to 4

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Y Character Justification

Range: 1 to 3

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	Yes	No
Range	10>23	No	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Character Height

Range: Real number in user units.

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Operator	23+	No	Yes
Units	0.2mm	Yes	Yes
Wildcard	*	Yes	Yes

Character Width

Range: Real number in user units.

Format	Example	SEARCH FOR	CHANGE TO

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Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Units	0.2pr	Yes	Yes
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Character Rotation

Range: Real number 0-360 degrees.

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Character Slant

Range: Real number -180-180 degrees.

Format	Example	SEARCH FOR	CHANGE TO
Single Number	23	Yes	Yes
Number line	1-10,23	No	No
Range	10>23	Yes	No
Operator	23+	No	Yes
Wildcard	*	Yes	Yes

Character Text

Range: Up to 512 characters

Format	Example	SEARCH FOR	CHANGE TO
String	Man Hole	Yes	Yes
Single Number	23	No	No
Number line	110,23	No	No
Range	10>23	No	No
Operator	23+	No	No
Wildcard	*	Yes	Yes

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Vr Mapping

Image Merge (ImaMer)

Type: Interactive Application

Merges multiple images into single image or cuts areas out from a single image.

Detailed Description

Merges multiple images into a single image and cuts areas out from a single image. A window may be placed around any portion of the images that are open in VrOne and a new image will be created that fills the selected area. The output file size and pixel dimensions are displayed as the merge area is selected. A new TIFF world file (.tfw) is written with the output image to maintain the image real world coordinate system. Images may be written as 24-bit color or 8-bit grayscale, regardless of the type of images that are being merged. Downsampled images may be created by selecting different pyramid levels. Output of compressed images is also supported with user control of the compression quality setting. If any portion of the output area contains multiple images, the image pixels will be taken from the last opened image. If multiple images are opened at once, the image whose pixels are used for that portion depends on the order that the images are selected in the open file dialog box. Edit Image (EDIIMA) may also be used to change the display order of the images, which will also affect the output order.

Local Commands

Key-in	Description	Range
COMP=	Compress Images?	0=No 1=Yes
COMPQUAL=	Compression quality	0-100
OUTFIL=	Output filename	128 characters
PYRALEVEL=	Pyramid Level	0-6
OUTTYPE=	Output type	0=Same,1=Color,2=Grayscale
WRITEPYRA=	Set image pyramid writing on or off.	0=Off - Don't write image pyramids when writing mosaic images (old image pyramids will still be deleted)

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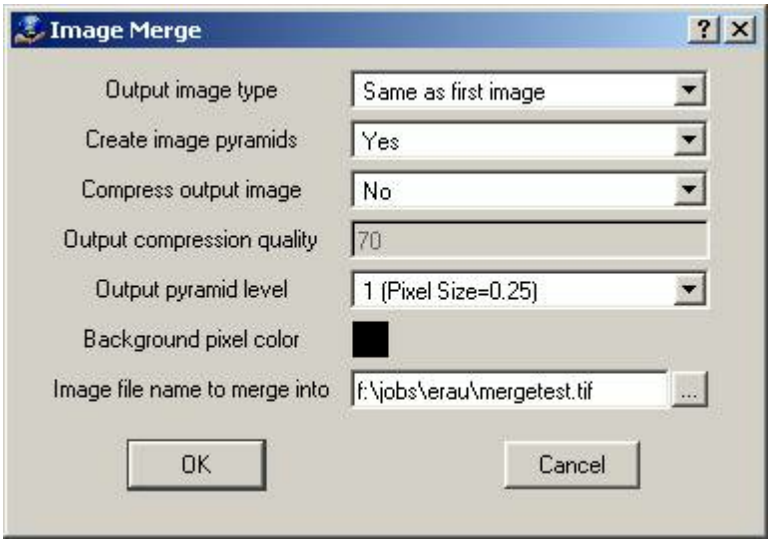
		1=On - Write image pyramids when writing mosaic images
BACKCOLOR=	Background color	An integer value representing an RGB color value. Using r,g,b to represent the desired red, green, and blue values, the following formula will calculate the number required for this parameter: (255 << 24) | ((r & 255) << 16) | ((g & 255) << 8) | (b & 255) For example, if solid green is the desired background color, then use the number 4278255360. This is calculated using the above formula with r=0,g=255,b=0.

Parameters



Output image type (OUTTYPE=)

Specifies the output file color type. Files may be written as one of the following types:

Same as first image	File is written as a color (24-bit) image if the first opened image in VrOne is color, and it will be written as greyscale (8-bit) if the first image in VrOne is greyscale.
Color	File is written as a color (24-bit) image regardless of the image types that are being merged.
Greyscale	File is written as a greyscale (8-bit) image regardless of the image types that are being merged.

Create image pyramids

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If set to Yes, image pyramids will be created as the output image is written. This will result in a slightly longer processing times but will eliminate the need for VrOne to create image pyramids the first time the image is opened. If set to No, old image pyramid files will be deleted but new ones will not be created until the output image is opened.

Compress output image (COMP=)

If set to Yes, then the output image will use JPEG compression. If set to No, the output image will not use compression. The output image will use this setting regardless of the file format of the images being merged. The Output compression quality parameter should be set accordingly if this parameter is Yes.

Output compression quality (COMPQUAL=)

This is a value from 0 to 100 that determines how much the output image will be compressed. Lower numbers result in greater compression but more loss of image quality. Higher numbers achieve greater image quality with larger file sizes. A good default value is 70, providing a compression ratio around 8 to 1 for color images with a minimal loss of quality.

Output pyramid level (PYRALEVEL=)

This option allows the output image to be written out at different pixel size than the images being merged. The output file sizes and image quality will decrease by powers of 2 for each higher pyramid level that is chosen. This option is useful for creating composite images of very large areas that would require too much space if written out at full quality (pyramid level 1). This also provides a quick way to create “thumbnail” images of large areas. When selecting the output pyramid level, the resulting pixel size is displayed for informational purposes only. The pixel size computation is always based in the pixel size of the first opened image in VrOne. The pixel size is read from the TIFF world file (.tfw).

Background pixel color (BACKCOLOR=)

Sets the color to use for pixels that do not fall within an existing image area.

Image filename to merge into (OUTFIL=)

Defines the name of the output image file. This file will be overwritten if it already exists. An extension of .tif will be added to the filename if it is not specified.

Button Assignments

Image Merge – Main

	Button	Description	Displays Menu
1	Dig lower lt	Digitizes the lower left corner of the output image area.	Dig Corner
2	Merge All	Merges all open images to create output image. Displays confirmation box first.	
3			
4			
5			

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6			
7	Enter params	Enter parameters from dialog box.	
8			
9			
*			
0	Toggle snap	Toggle snap on and off.	
#	End	Ends application.	

Image Merge – Dig Corner

	Button	Description	Displays Menu
1	Dig upper rt	Digitizes the upper right corner of the output image area.	Verify
2	Abandon	Abandons the current output window and returns to the Main menu.	Main
3			
4			
5			
6			
7			
8			
9			
*			
0	Toggle snap	Toggle snap on and off.	
#	End	Ends application.	

Image Merge – Verify

	Button	Description	Displays Menu
1	Accept	Accepts output window area and writes the output image.	Main
2	Reject	Cancels the current output window and returns to the Main menu.	Main
3			
4			
5			
6			
7			
8			
9			
*			
0			
#	End	Ends application.	

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2.1.1.2.34 Keypoint

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Vr Mapping

Keypoint (KeyPoi)

Type: Batch Application

A LiDAR point thinning method that generates keypoints by identifying existing VrPoints (LiDAR) as keypoints.

Detailed Description

Keypoints or model points are used to thin LiDAR datasets by identifying points in flat areas that represent other LiDAR points nearby that are within the same user defined elevation tolerance. In the process of generating keypoints, new points are not created but existing points have their keypoint flag conditioned.

The resulting keypoint data along with optional break-line data is better suited to the creation of Digital Terrain Models (DTM) due to the reduction of the amount of input points and better point spacing for improved cartographic contour generation.

The keypoint process should be run on LiDAR points that have been classified as ground points. Keypoint generation does not produce favorable results when features such as vegetation and buildings are considered in the input data. The display and definition of ground points as input to Keypoint (KeyPoi) can be defined by setting the display of Ground points in the Classification Filter in Point Display (EdiPoi or PO). The display of only keypoints can also be defined in Point Display.

Keypoint considers and modifies the keypoint attribute of the VrOne database entity type VrPoint (LiDAR).

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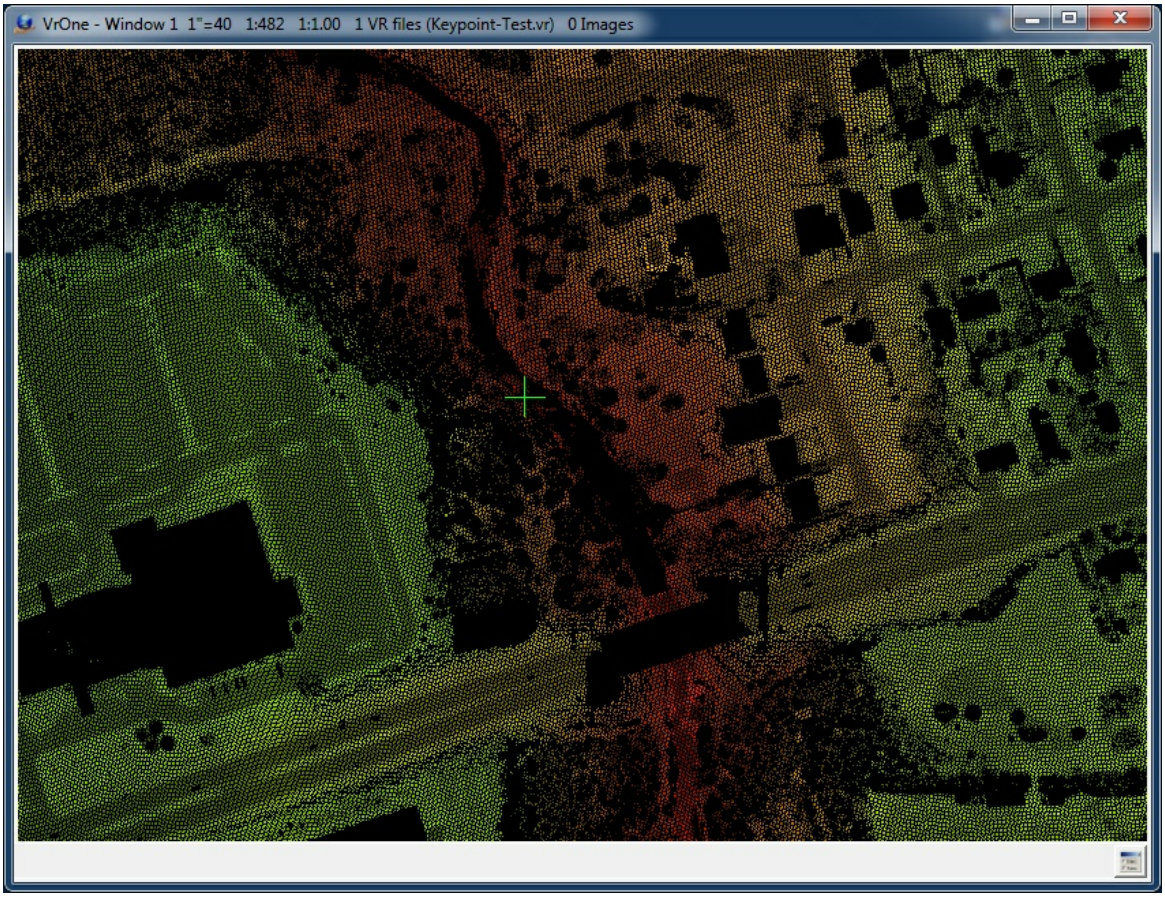

Original bare earth (ground) LiDAR point data

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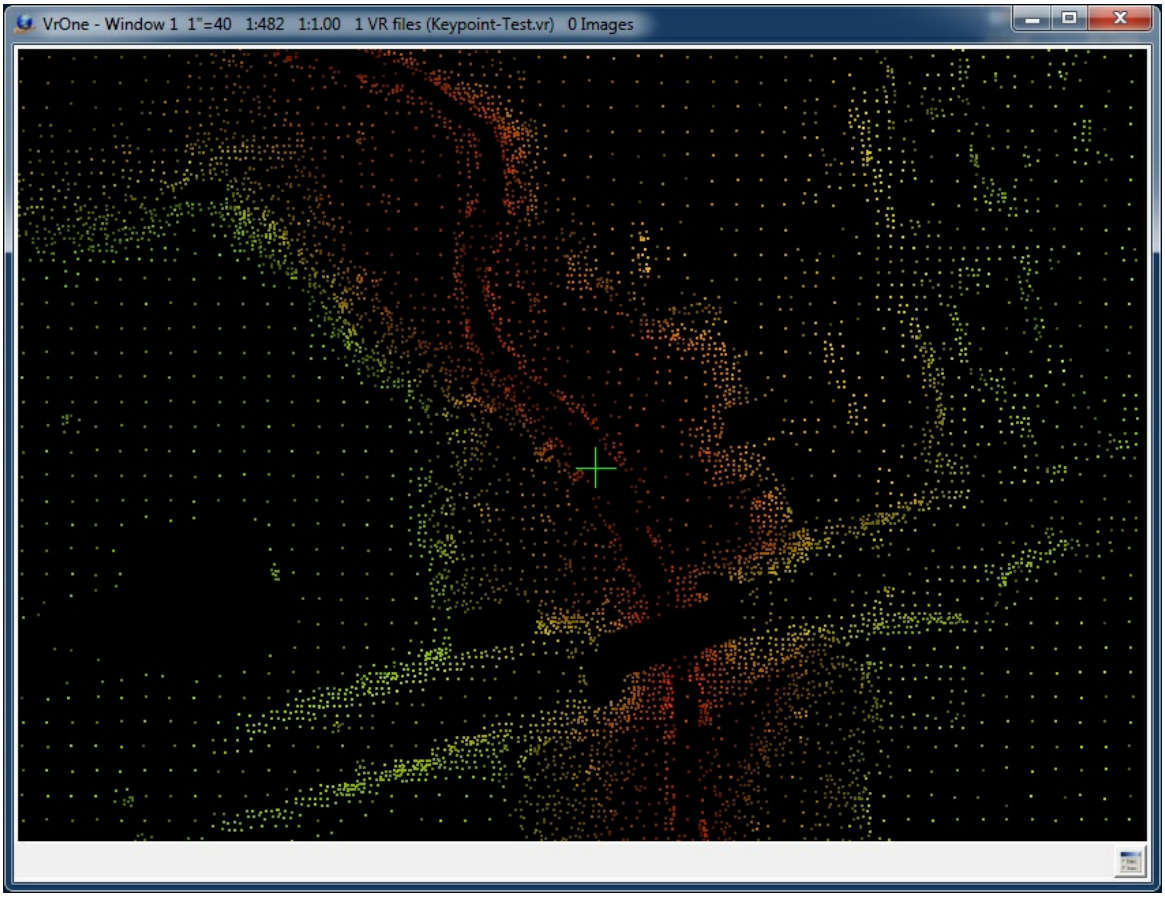

Results of keypoint generation using bare earth (ground) as input

Available Key-ins

Key-in	Description	Range
RUN	Run Keypoint	

Starting Keypoint with a key-in of "KeyPoi RUN" will run the batch application without prompting for parameters. The previous parameters will be used. It is possible to set the initial parameters by starting Keypoint (KeyPoi) with no arguments, entering parameters then pressing Cancel. The parameters will be saved as the previous parameters.

Method

A user defined grid increment, called a zone, is iterated over the LiDAR point data and up to four passes are made per grid increment. The points that fall within this area are examined. If the elevation range of these points are within a user defined elevation tolerance, the LiDAR point nearest to the center of the zone has it's keypoint flag set and processing stops for that zone.

If the elevation range of the points within the current zone is out of range then the zone is

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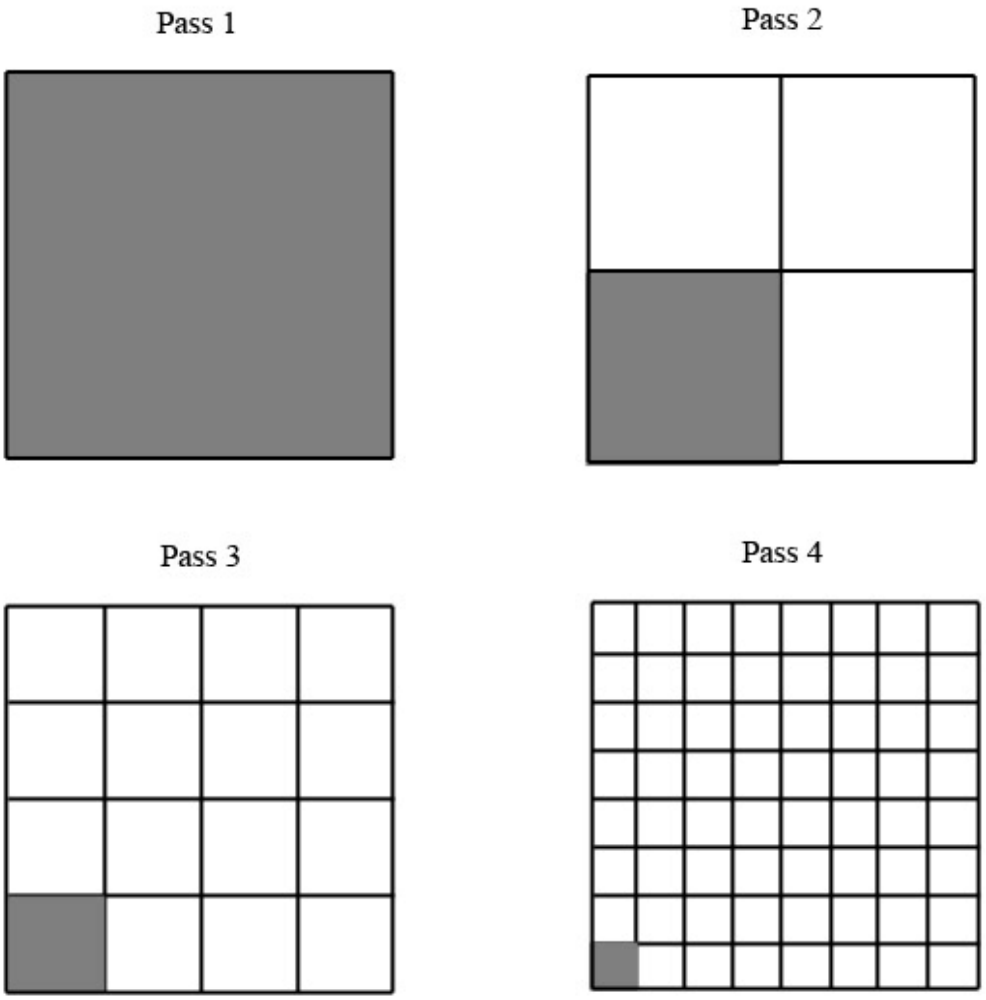
subdivided into four zones and the smaller zone is analyzed. This process continues until the elevation range of the zone falls within the tolerance or four passes are complete. If four passes are completed and the elevation tolerance is not met then a user defined action is taken for the pass 4 zone. This process continues until all zones are processed. Depending on the user defined parameters and the type of terrain, as few as one pass or as many as 64 passes are used.



Parameters for Keypoint

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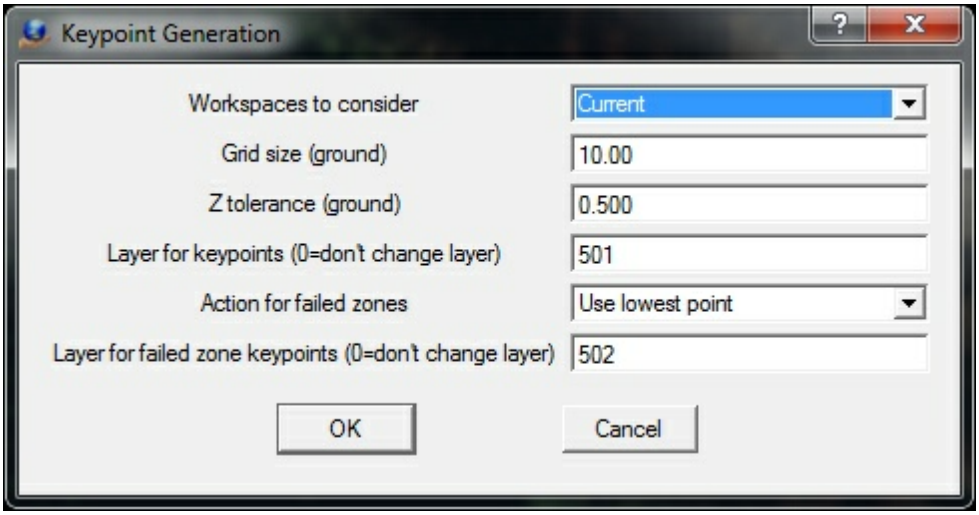

Parameters for keypoint generation

Workspaces to consider
Defines the workspaces to consider when running Keypoint. Options are Current or All open.

Grid size (ground)
Defines the grid size for the zone for pass 1. This parameter is entered in ground units.

Z tolerance (ground)
If the elevation range of the current zone is within this tolerance, the closest point to the center of the zone will have it's keypoint attribute set. This parameter is entered in ground units.

Layer for keypoints (0=don't change layer)
Points that are defined as keypoints may be placed in the layer defined by this parameter. If the layer is set to 0 then the layer of the keypoints is not changed.

Action for failed zones
Up to four passes are made to attempt to determine a keypoint as defined by the Grid size and Z tolerance. If the elevation range of the final pass (pass 4) is outside the Z tolerance then the action defined by this parameter is taken. Options are:

- **Nothing** - A keypoint is not defined;
- **Use lowest point** - The lowest point in the zone is defined as the keypoint;
- **Use highest point** - The highest point in the zone is defined as the keypoint;
- **Use mean point** - The point closest to the mean elevation of the zone is defined as the keypoint.

Layer for failed zone keypoints (0=don't change layer)
Points that are defined as keypoints as a result of the Z tolerance being less than the pass 4 zone elevation range may be placed in the layer defined by this parameter. If the layer is set to 0, the layer of the keypoints is not changed.

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Vr Mapping

Line Close (LinClo)

Type: Batch Application

Closes or checks for closure of lines in user-defined layers.

Detailed Description

Searches lines in user-defined layers and checks for line closure. Lines that are not closed may be closed by one of the following methods:

- Move the endpoint onto start point;
- Mean the end points;
- Add line segment between the endpoint and the start point;
- Intersect the end segments;
- Report unclosed polygons in drive file only (do not modify line).

A drive file is always created for unclosed lines even if this application closes them. Line Cross is undoable.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Line Close parameter file name (.lcl)
RUN	Run Line Close	

Parameters for Line Close

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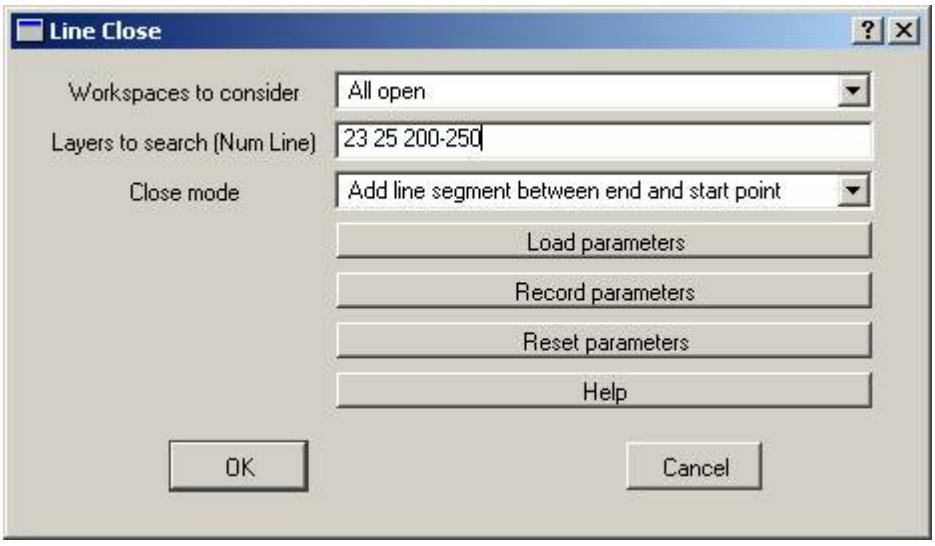

Workspaces to consider

Defines the workspaces to consider when running Line Close.

Layers to search

Defines the layers to search for unclosed lines. Layers that are turned off will not be considered even if they are specified as a search layer.

Close mode

Defines the action to take on the found unclosed lines. One of the following may be done on unclosed lines:

- Move the endpoint onto start point;
- Mean the end points;
- Add line segment between the endpoint and the start point;
- Intersect the end segments;
- Report unclosed polygons in drive file only (do not modify line).

2.1.1.2.36 Line Cross

Vr Mapping

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Line Cross (LinCro)

Type: Batch application

Checks for crossing lines, overlapping lines and three point closed lines.

Detailed Description

Checks for crossing lines in the layers specified. Intersecting coordinates of crossing lines are placed in a drive file and may be visited later for repair. Options include checking common node points, overlapping lines, and three point lines that are closed.

Line Cross has the ability to be run on all open workspaces; however the checking for crossing and overlapping lines does not occur between workspaces, only in each workspace. Typically, lines that overlap into another workspace are clipped and removed against a sheet neat line using one of the clipping batch routines before running Line Cross.

After Line Cross is complete, its drive file may be opened using the Open Drive (OpeDri) command. Once the drive file is opened each point may be driven to using the Drive (Dri) command. Other drive commands may be found on the Drive pull-down menu in VrOne/VrTwo and in the Drive File Management documentation.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Line Cross parameter file name (.lcr)
RUN	Run Line Cross	

Parameters for Line Cross

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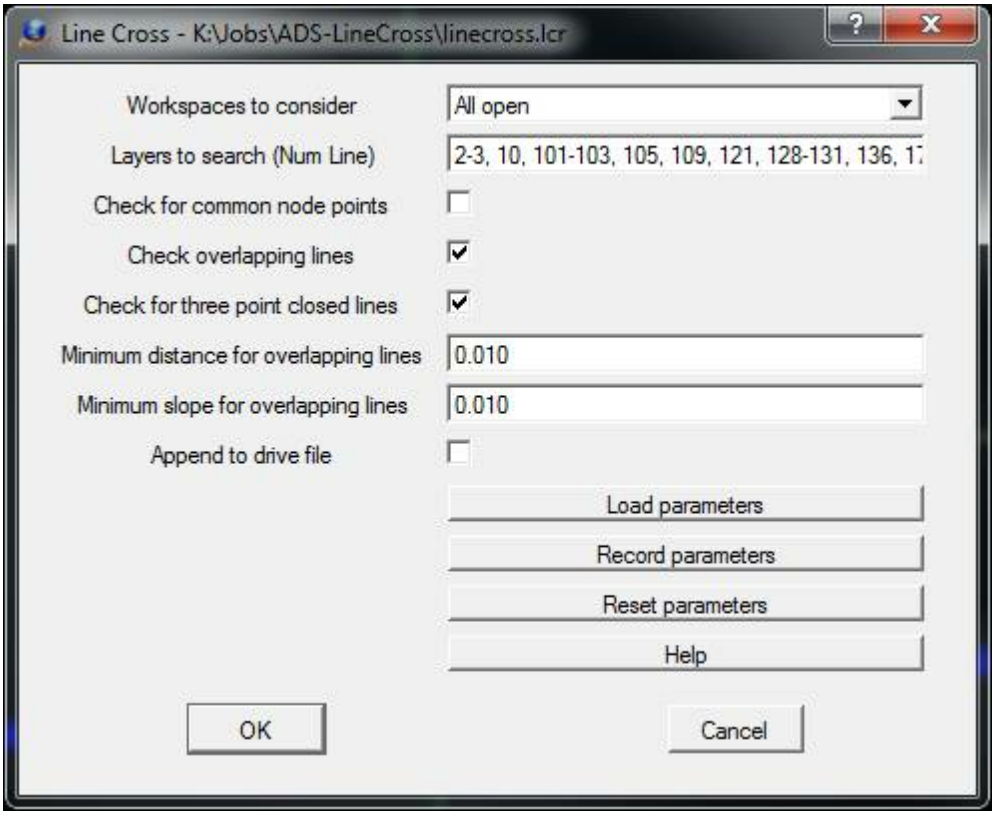

Workspaces to consider
Defines the workspaces to consider when running Line Cross. Options are Current workspace or All open workspaces. Line Cross has the ability to be run on all open workspaces; however, checking for crossing and overlapping lines does not occur between workspaces but only in each workspace. Typically lines that overlap into another workspace are clipped and removed against a sheet neat line using one of the clipping batch routines before running Line Cross.

Layers to search
Defines the layers to search for crossing lines. It is possible to check lines within the same layer and lines in different layers. Layers that are turned off will not be considered even if they are specified as a search layer.

Check for common node points
If checked, then common node points are placed in the drive file. A common node point is a point on both lines that have the same coordinate position.

Check for overlapping lines
If checked, then lines that overlap are placed in the drive file. Overlapping lines share one or more common line segments which may or may not be noded. When checking for overlapping lines the “Minimum distance for overlapping lines” and the “Minimum slope for overlapping lines” parameters are used.

Check for three point closed lines
If checked, then three point lines that are closed will be placed in the drive file. Three point closed lines are lines that consist of three points only and have a common first and third point.

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These three point closed lines will appear as a straight line when displayed in graphics.

Minimum distance for overlapping lines
Line segments that are less than this distance to another line will be considered overlapping. This parameter is expressed in user units and is used when "Check for overlapping lines" is checked.

Minimum slope for overlapping lines
Line segments that have a slope difference less than this value will be considered overlapping. This parameter is expressed as a delta slope value and is used when "Check for overlapping lines" is checked. This parameter should be small and a reasonable value should be between 0.01 and 0.1. The default value is 0.01.

Append to drive file
If checked, then points are added to the existing Line Cross drive file. If unchecked, then any existing points in the Line Cross drive file will be cleared when Line Cross processing starts.

2.1.1.2.37 Line Cross Z

Vr Mapping

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Line Cross Z (LinCrz)

Type: Batch Application

Checks the elevations of common points on crossing lines.

Detailed Description

Searches lines in user-defined layers for common points on intersecting lines. The elevations of these points are compared and if out of range are reported in a drive file. These areas may be revisited later for repair using the drive file commands. When searching for intersections there must be a common point on each line for it to be considered.

Available Key-ins

Key-in	Description	Range

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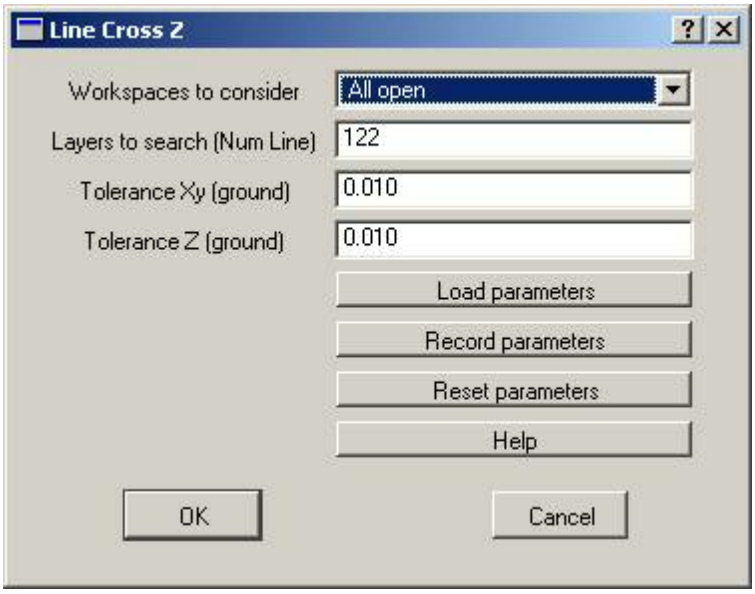
PARFIL=	Load parameter file	Line Cross Z parameter file name (.lcz)
RUN	Run Line Cross Z	

Parameters for Line Cross Z



Workspaces to consider

Defines the workspaces to consider when running Line Cross Z.

Layers to search

Defines the layers to search for crossing lines. It is possible to check lines within the same layer and lines in different layers. Layers that are turned off will not be considered even if they are specified as a search layer.

Tolerance Xy

Line points that fall within this tolerance are considered common. Enter in ground units.

Tolerance Z

Common points with an elevation difference larger than this tolerance are considered mismatched. These mismatched point locations are placed in the drive file. Enter in ground units.

2.1.1.2.38 Line Point Inside

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Mapping

Line Point Inside (LinPoi)

Type: Batch Application

Performs a check for the existence of symbols and/or points within lines.

Detailed Description

Searches lines in user-defined layers and checks for the existence of user-defined symbols and/or text labels within the line polygon. This application is useful for checking items such as building numbers or polygon centroid identifiers. The lines to be searched do not need to be closed; they will be closed for calculations. User options include the definition of line, symbol, and text search layers. Symbols, text labels or both may be searched as points to fall within the lines. Lines found that do not contain a specified symbol or text label will have their centroid coordinate position placed in a drive file. These locations may be driven to later for correction. Layers that are turned off will not be considered even if specified.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Line Close parameter file name (.lpo)
RUN	Run Line Point Inside	

Parameters for Line Close

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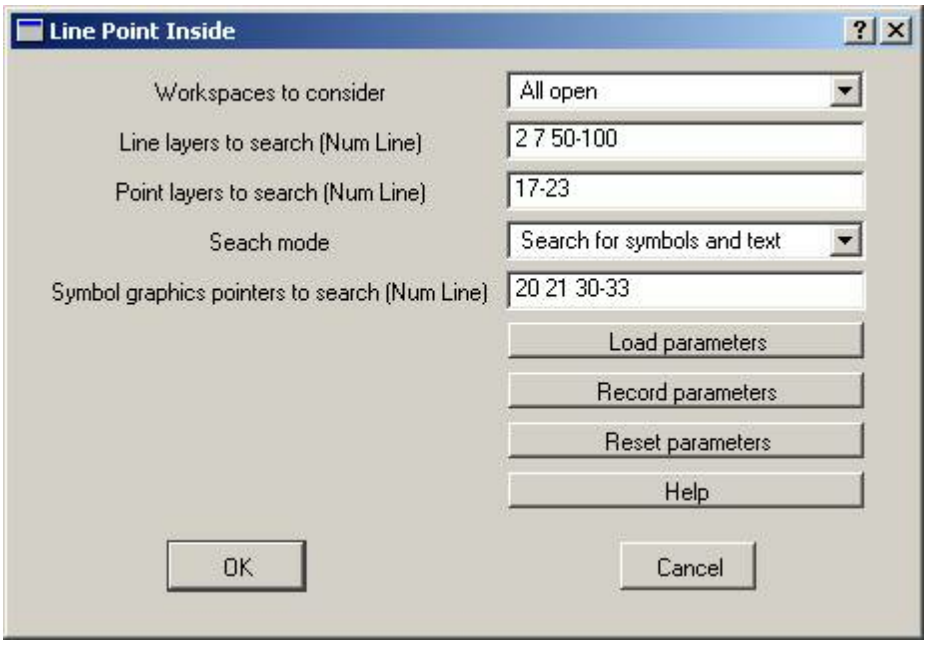

Workspaces to consider

Defines the workspaces to consider when running Line Close.

Line layers to search

Defines the layers to search for lines to check for points inside. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Point layers to search

Defines the layers to search for symbols and/or text that fall within the lines specified. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

Search mode

Defines the point entity types to search for that may fall within the lines. Options are:

- Search for symbols;
- Search for text labels;
- Search for symbols and text.

Symbol graphic pointers to search

If symbols are being searched for in the "Search mode", these symbol graphic pointers are used to refine the search. For example, it would be possible to specify the checking of "X" symbols in layer 23 that fall within the lines. This may be entered as a number line. Layers that are turned off will not be considered even if specified.

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Vr Mapping

Move Lines To Symbols (LinSym)

Type: Batch application

Detailed Description

The Move Lines To Symbols batch application moves the vertices of user defined lines to the origin point of user specified symbols. Lines are identified by layer and symbols are identified by layer and (or) graphic pointer. Line points may inherit the elevation of the symbols they are moved to or may keep their original line point elevation.

Layers that are turned off will not be considered even if they are specified.

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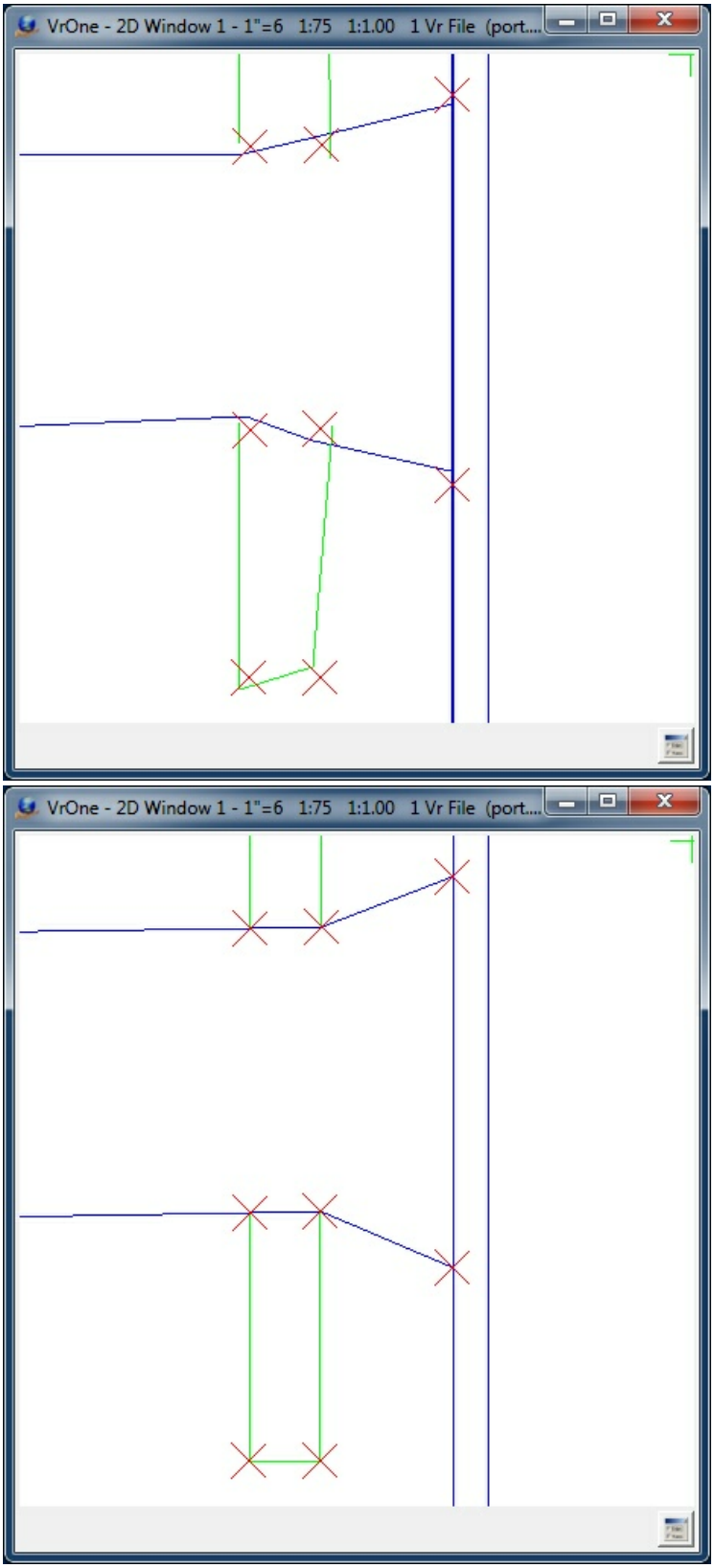

Move Lines to Symbols before and after

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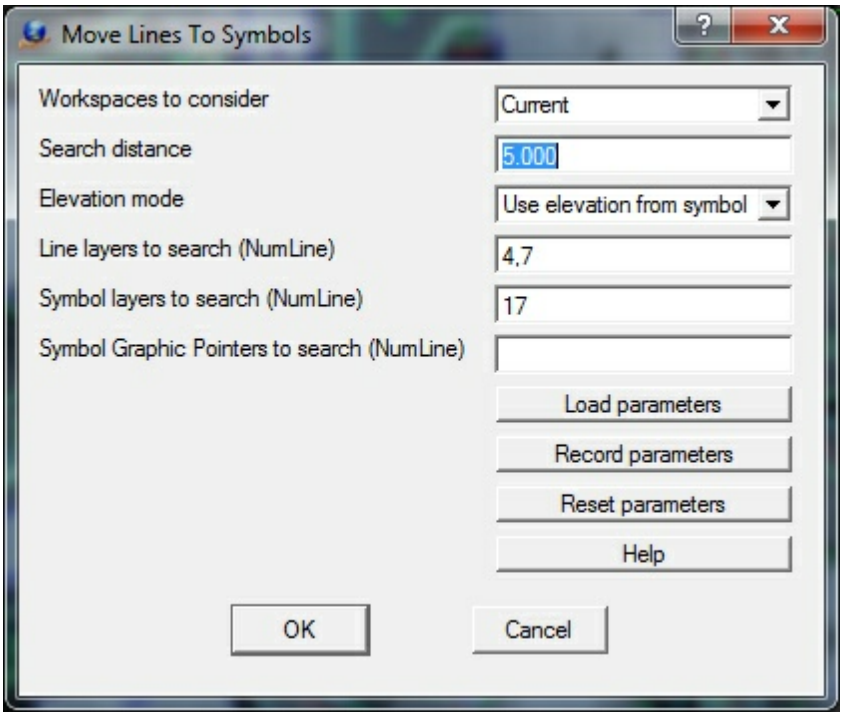
Move Lines To Symbols Parameters



Parameters

Workspaces to consider

Defines the workspaces to consider when running Move Lines To Symbols. Options are Current and All open

Search distance (ground)

Defines the distance from the line points to search for symbols to move to. The search distance is entered as ground units

Elevation move

When moving line points to symbols the points may retain their original line point values (Use elevation from line) or may inherit the elevation of the symbol being moved to (Use elevation from symbol)

Line layers to search (NumLine)

The layers that contain the lines to move to symbols is defined by this parameter. Layers that are turned off will not be considered even if they are specified. A Number Line is used to define these layers.

Symbol layers to search (NumLine)

The layers that contain the symbols to move line points to is defined by this parameter. Layers that are turned off will not be considered even if they are specified. A Number Line is used to define these layers.

Symbol Graphic Pointers to search (NumLine)

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The search for symbols to move lines to can be further refined by defining the symbol graphic pointers to search for. If this field is left blank then all symbol Graphic Pointers will be considered. A Number Line is used to define this parameter.

Available Key-ins

Previously defined parameter files may be loaded and Move Lines to Symbols may be run from key-ins. This allows this application to be run from a Macro.

Key-in	Description	Range
PARFIL=	Load parameter file	Line Close parameter file name (.lpo)
RUN	Run Line Point Inside	

2.1.1.2.40 Make Polygons

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Make Polygons (MakPol)

Type: Batch Application

Makes closed polygons using existing line segments and centroids.

Detailed Description

Make Polygons looks at the spatial relationship of existing line segments and creates enclosing polygons around areas containing centroid symbols. Lines can be collected in any direction, but they must be noded and broken into segments before running Make Polygon. Make polygon first looks for all lines in the user specified feature layers and forms all possible polygon areas from these lines. A polygon is retained only if it has a centroid symbol on the interior. The resulting polygons are placed in user specified layers, along with polygons that represent any holes that were found within the main polygons. A drive file is created so the user can examine any centroids that were not enclosed by a polygon, and also any areas that have more than one centroid. Several centroid layers may be searched for at once. Each layer of centroids will have its own polygon save layer.

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Basic steps for using Make Polygons

- Collect data normally. Undershoots and overlaps are allowed as long as they are within tolerance used in Batch Trim.
- Place centroid symbols (any symbol of choice) inside each closed area. Use a unique layer for each area type (driveways, sidewalks, etc.).
- After all data is collected, run Batch Trim to handle any undershoots or overlaps.
- Make a copy of the file and work on the copy for the remaining steps. This is necessary because the batch node and break will break the original lines into segments at all node locations.
- Run Batch Node and choose the "Node and Break" option. It will be necessary to specify the same layers that will be involved in the Make Polygon process. One requirement of Make Polygon is that all crossing lines are broken at the intersection points.
- Run Make Polygons.

Before attempting to use this on a large scale project, testing on a small subset of data is recommended to make sure the processing steps are correct and the results are as expected.

Make Polygons Tutorial

The video tutorial below demonstrates using Make Polygons on a small sample data set. This is best viewed with the browser in full screen mode (F11 in most browsers).

Local Commands

None

Parameters

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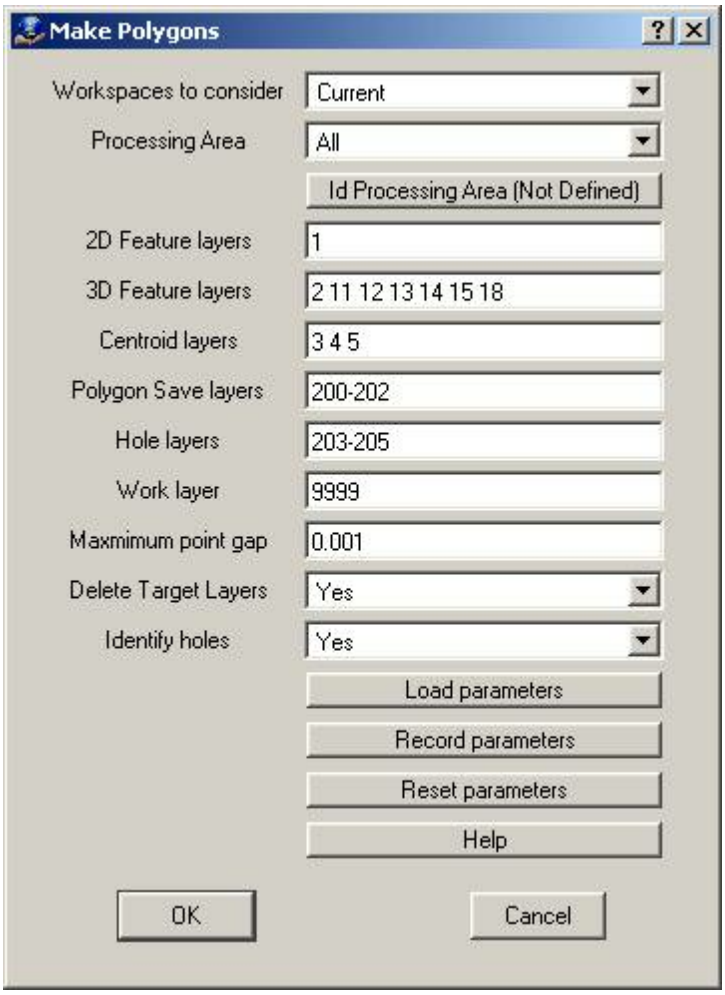

Workspaces to consider

Determines if entities in all workspaces will be considered or only those in the active workspace.

Processing Area

If 'All' is chosen, the entire file will be processed. If 'User defined area' is chosen, only lines that fall completely within a user-defined area will be processed. The user area is defined by using the button below this prompt to select an existing closed VrOne line. This is useful for troubleshooting a small area of a file without having to run the full process. By combining this with the Delete target layers option, it is possible to rerun a small area as many times as needed to ensure the polygons are correct (only target layers within the user-defined area are deleted).

Id Processing Area

Selects a line from any currently open VrOne workspace. Once a line has been selected, it will be used if "User-Defined Area" is selected for the Processing Area option. The button label will change to indicate whether a user-defined area has been selected or not. NOTE: Just selecting a user-defined area does not mean it will be used. The Processing Area option must also be set to "User-Defined Area".

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2D Feature layers

Layers containing features that do not contain valid elevations on the line points. If creating polygons of all parking lots, then this would contain features such as buildings or sheet cut lines that were not collected with a ground elevation. The points along the resulting polygons that are taken from features in these layers will contain interpolated elevations based on the main search line.

3D Feature layers

Layers containing features that do contain valid elevations on the line points. If creating polygons of all parking lots, then this would contain features such as road edges that were collected with a ground elevation. The points along the resulting polygons that are taken from features in these layers will contain the original elevation value of the feature.

Centroid layers

Layers containing the centroids. This can be any valid layer number line. Any symbol found on these layers will be considered a centroid. The location of centroids that do not fall within a polygon will be written to the error drive file. The location of any duplicate centroids within a single polygon will be written to the error drive file.

Polygon Save layers

The final closed polygons will be placed in this layer. This can be any valid layer number line, but it is essential to have the same number of save layers as centroid layers. Each save layer corresponds to a centroid layer.
Example: Layers "3 4" are specified for the Centroid Layers, and layers "200 201" are specified for the save layers. All polygons associated with centroids on layer 3 will be placed on layer 200, and all polygons associated with centroids on layer 4 will be placed in layer 201. Number ranges may also be used. For example: Centroid layers: 3 4 5, and Save layers 200-203.

Hole layers

Polygons that do not contain centroids and are found inside the main polygons will be stored in this layer in a counterclockwise direction. This can be any valid layer number line, but must have the same number hole layers as polygon save layers. Each hole layer corresponds to a save layer.
Example: Layers "200 201" are specified for the save layers, and layers "210 211" are specified for the hole layers. All holes inside polygons on layer 200 will be placed on layer 210, and all holes inside polygons on layer 201 will be placed in layer 211. umber ranges may also be used.

Work layer

This layer will be used to store temporary lines during the polygon generation process. All existing entities in this layer will be deleted when Make Polygon starts, and the layer will be left empty when Make Polygon has finished.

Maximum point gap

This allows the user to specify a tolerance to handle rounding errors between endpoints. Normally, this value can be left at it's default value (0.0001), but it may be necessary to make it larger if some polygons are not being found because endpoints do not match up exactly. Do not

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set this value too high or it can find false point matches.

Delete Target Layers

If set to Yes, all entities on the Polygon Save Layers and Hole Layers will be deleted before processing begins.

Identify holes

If set to Yes, polygon holes will be flagged and placed in the Hole layers. If set to No, only the main Polygons will be saved to the Polygon save layers. When processing a file for the first time, if it is anticipated that there will be some cleanup, this may be turned off to save time. After any problem areas have been fixed, it may be turned on for the final run. On a clean file, this step usually doesn't take too long. Iff dealing with an unclean dataset that is making large polygon regions, a large number of holes may be flagged, leading to a longer run time. If it is noticed that the Identify holes step (last step in the process) is taking a long time, it may be because large invalid polygon regions are being generated.

Examples

This example shows a typical parking lot area with internal islands and outside attachments to road edges and buildings.

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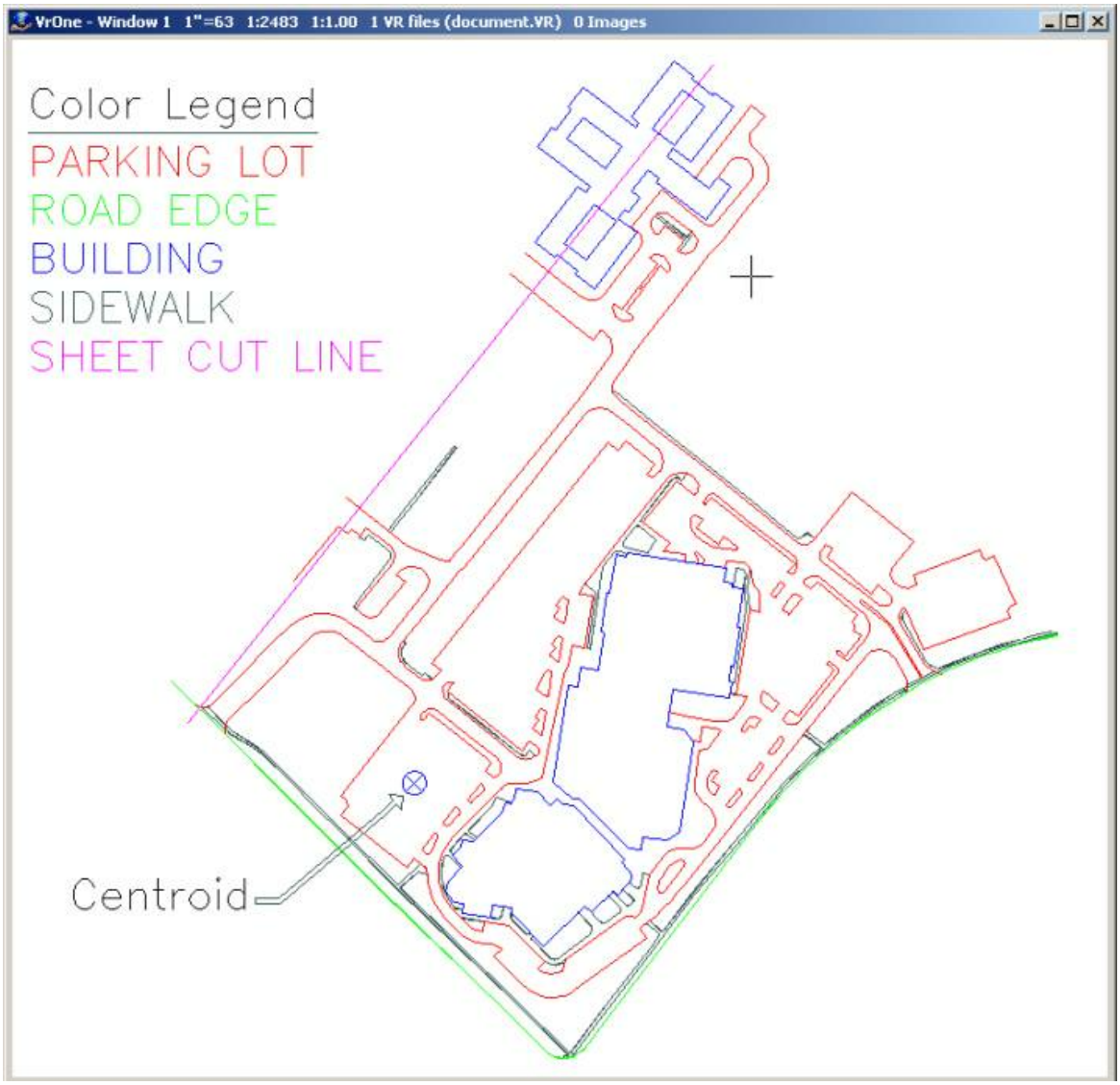

This is the result of running Make Polygon on the above data.

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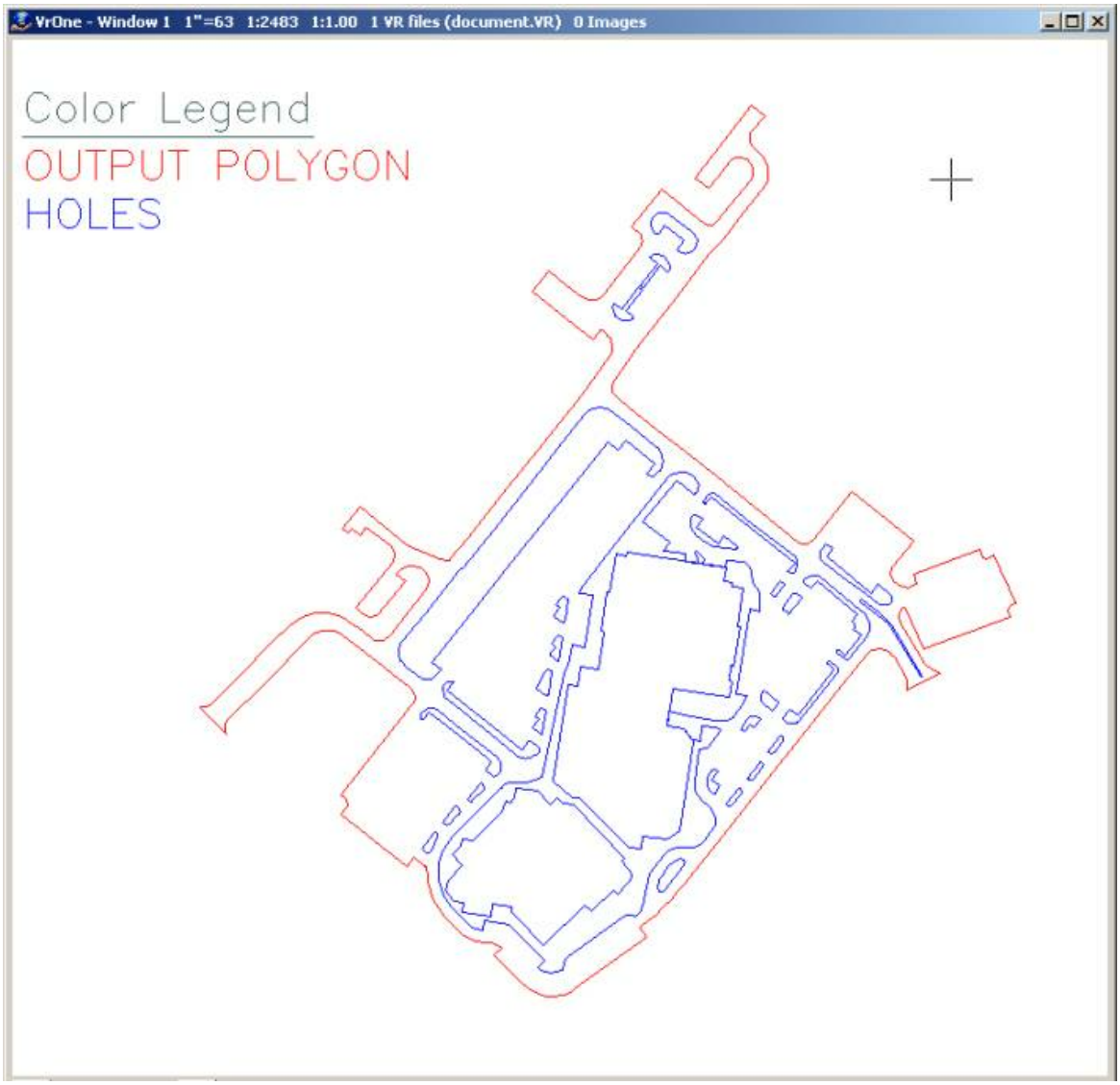

2.1.1.2.40.1 Tutorial Make Polygons Video

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

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Tutorial Make Polygons Video

The video tutorial below demonstrates using Make Polygons on a small sample data set. This is best viewed with your browser in full screen mode (F11 in most browsers).

2.1.1.2.41 Round Elevations

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Round Elevations (RouEle)

Type: Batch Application

Rounds the elevations of entities to an even multiple of a user-defined value.

Detailed Description

Round Elevations rounds the elevation of the lines in the specified layers to the nearest user-defined value. Layers and modes that are turned off will not be considered even if specified. The rounded elevation that repeats itself at least 50% on a line will be used for the whole line. If no rounded elevation repeats itself at least 50% then the line will not be modified. This is intended to remove contour lines with elevation spikes.

WARNING: This is intended for contours and should not be run on layers containing planimetric features.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Round Elevations parameter file name (.roe)

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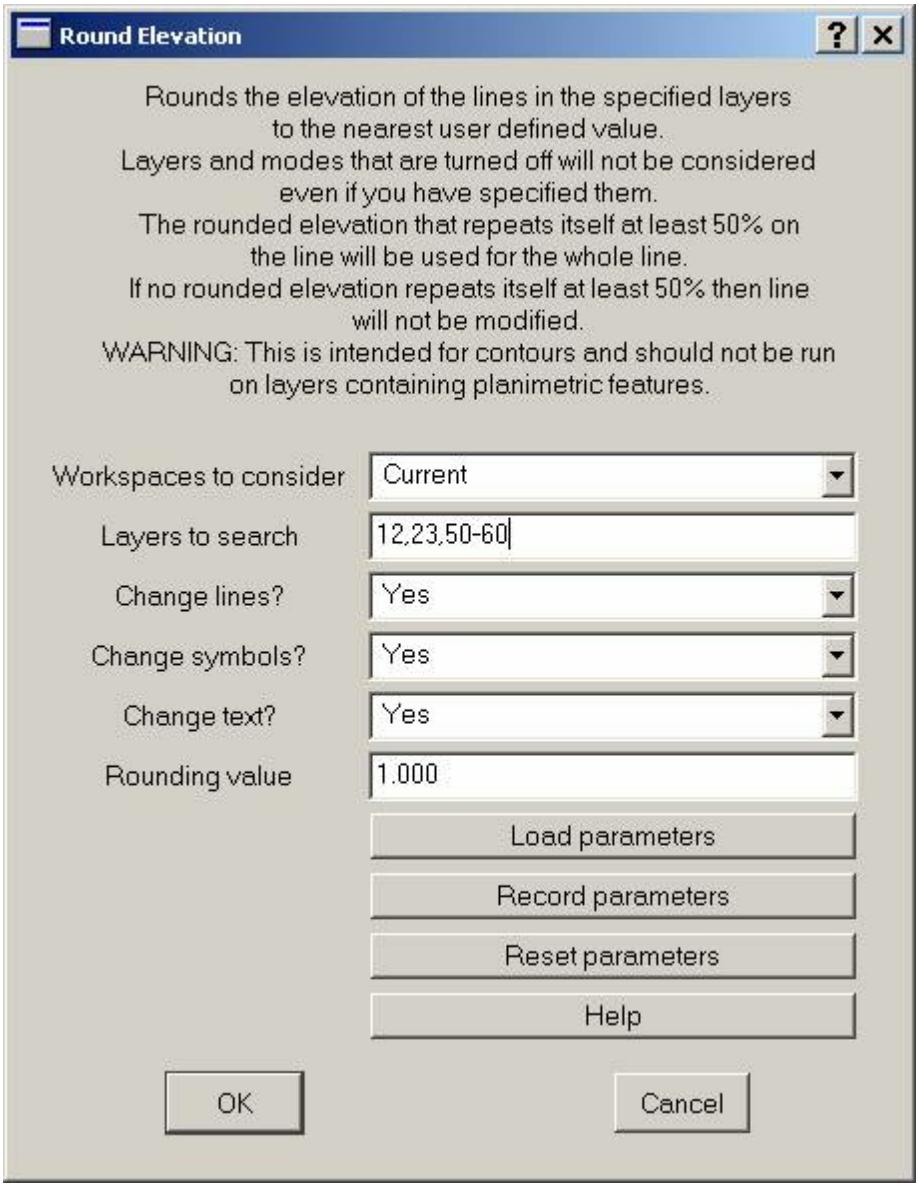
RUN	Run Line Cross	

Parameters for Round Elevations



Workspaces to consider

Defines the workspaces to consider when running Round Elevations.

Layers to search

Defines the layers to search for entities to round. Layers that are turned off will not be considered even if they are specified as a search layer.

Change lines?

Specifies whether lines within the search layers should be rounded.

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Change symbols?

Specifies whether symbols within the search layers should be rounded.

Change text?

Specifies whether text within the search layers should be rounded.

Rounding value

Rounds entity elevations to an even multiple of this parameter. The rounding value is entered in ground units.

2.1.1.2.42 Segment Lines

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Segment Lines (SegLin)

Type: Batch Application

Breaks all lines into two point line segments.

Detailed Description

Searches all lines in the specified layer and breaks them into multiple 2 point line segments. The new segments are saved to a new layer.

NOTE: This batch application is undoable.

Parameters for Segment Lines

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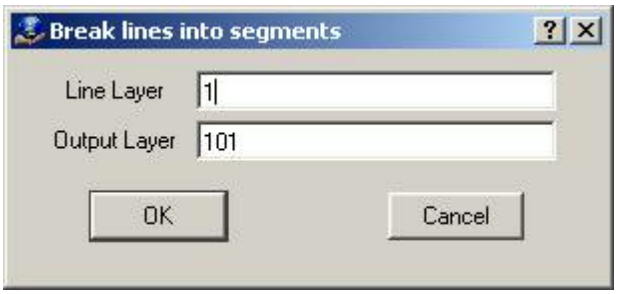

Line Layer

Specifies the layer to search for lines.

Output Layer

Specifies the layer to store segments.

2.1.1.2.43 Set Dtm

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Set DTM Parameters (SetDtm)

Type: Parameter application

Sets parameters for DTM processing.

Detailed Description

Sets the parameters for the DTM (Digital Terrain Modeling) application. These parameters are used by the Run Dtm application. Parameters may be recorded and loaded.

NOTE: The key-in ParFilDTM may be used to load a DTM parameter file from a key-in which will make the saved parameters set here in effect during subsequent DTM processing with RunDtm. Example: `ParFilDTM c:\jobs\BigJob\DtmRun.dtm`

Available Key-ins

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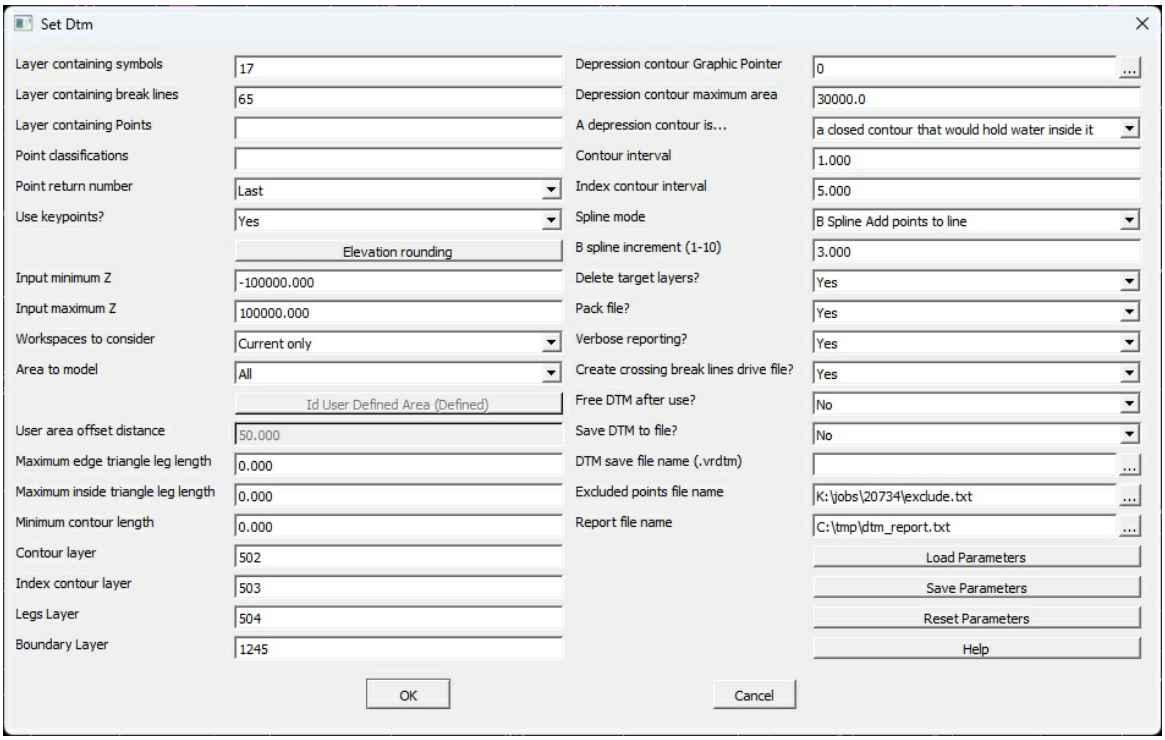
None

Parameters for Set DTM



Set DTM dialog

Layer containing points

Specifies the layers to search for points (VrOne symbols) to use for DTM processing. A number line may be used.

Layer containing break lines

Specifies the layers to search for break lines to use for DTM processing. A number line may be used.

Layer containing Points

Specifies the layers to search for VrPoints (LiDAR) to use for DTM processing. This parameter may be used if the layer number has been set for this type of data. A number line may be used.

Point return number

If VrPoints (LiDAR) are being used as input for DTM processing, this parameter may be used to filter input points based on the LiDAR return number. Typically the LAST return is used when eliminating trees.

Use keypoints?

If VrPoints (LiDAR) are being used as input for DTM processing, this parameter may be used to specify that keypoints are to be used as input. Typically Bare Earth (BarEar) is performed on the VrPoint data, then the bare earth points are thinned using the Keypoint generation application. See Bare Earth and Keypoint for more information on these processes.

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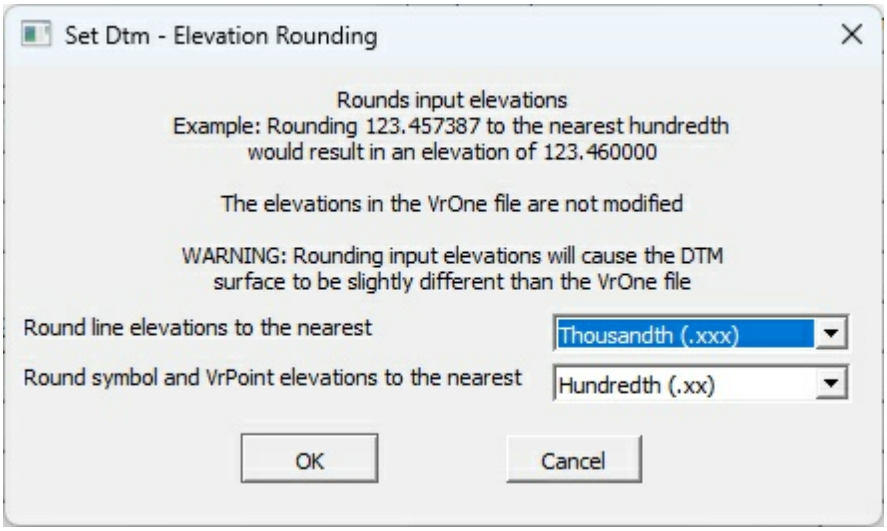
Elevation rounding
Rounds input elevations to 1, 2, or 3 decimal places. Options include the ability to round line elevation and VrPoint/Symbol elevations. Rounding can be to the nearest tenth, hundredth, or thousandth. The elevations in the VrOne file are not modified. Elevation rounding is available when using the FADE DTM engine. WARNING: Rounding input elevations will cause the DTM surface to be slightly different than the VrOne file.



Elevation Rounding dialog

- **Round like elevations to the nearest**
  Round elevation option for lines. Options include Don't round, tenth (.x)", "hundredth (.xx)", or "thousandth (.xxx). For example, rounding 123.457387 to the nearest hundredth would result in an elevation of 123.460000.

- **Round symbol and VrPoint elevations to the nearest**
  Round elevation option for symbols and VrPoints. Options include Don't round, tenth (.x)", "hundredth (.xx)", or "thousandth (.xxx). For example, rounding 123.457387 to the nearest hundredth would result in an elevation of 123.460000.

Input minimum Z
Any points

Input minimum Z
Any points with Z values below this amount will be excluded from the DTM. This does apply when processing existing surface files.

Input maximum Z
Any points with Z values above this amount will be excluded from the DTM. This does apply when processing existing surface files.

Workspaces to consider
Defines the workspaces to consider when searching for DTM points and break lines. Options are Current only and All open workspaces.

Area to model

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The entire data area or a smaller area may be modeled. Options are:

All	All – The entire data area will be modeled.
Current view window	Current view window – Only the current view window will be modeled. This is useful when editing in an area to make regeneration of contours faster.
User-defined area	User-defined area – Models a user-defined polygon. The "Id User-Defined Area" button is used to select the user-defined area.

Id User-Defined Area (Not defined or Defined)
Pressing this button will allow a line to be selected from any currently open VrOne workspace. Once a line has been selected, it will be used if "User-Defined Area" is selected for the Area to model option. The button label will change to indicate whether a user-defined area has been selected or not. NOTE: Just selecting a user-defined area does not mean it will be used, the Area to model option must also be set to "User-Defined Area".

User area offset distance
If using a User-Defined Area, the size of the user-defined area will be increased by this amount. This allows points outside the user-defined area to be used when computing the TIN, which helps when matching one DTM area to another. The resulting contours are always trimmed to the exact user-defined area.

Maximum edge triangle leg length
Triangles will not be created if they contain a leg that is on the edge of the DTM that is longer than this length. This parameter may be set to 0 if all edge triangles should be created.

Maximum inside triangle leg length
Triangles will not be created if they contain a leg that is not on the inside of the DTM that is longer than this length. This parameter may be set to 0 if all inside triangles should be created.

Contour layer
Layer to into which to place intermediate contours. The range of this parameter is 1 to 10001. This parameter may be left blank if intermediate contours are not to be stored.

Index contour layer
Layer into which to place index contours. The range of this parameter is 1 to 10001. This parameter may be left blank if index contours are not to be stored.

Legs layer
Layer into which to place DTM surface triangles. This parameter may be left blank if triangles are not to be stored.

Boundary layer
Layer into which to place DTM boundary line. This line represents the smallest enclosing polygon that contains all of the DTM points. This parameter may be left blank if the DTM boundary is not to be stored.

Depression contour Graphic Pointer
Depression contours will be flagged using this graphic pointer. This parameter may be set to 0 if

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no depression contours should be flagged.

Depression contour maximum area
Depression contours with areas larger than this value will not be flagged.

Create depressions on closed contours only
If set to Yes, only contours that are physically closed will be considered for flagging.

Create depression on bottom contours only
If set to Yes, only contours at the bottom of a depression area will be considered for flagging.

Contour interval
Defines the intermediate contour interval. This parameter is entered in ground units. If zero is entered for this parameter, it will be set to one.

Index contour interval
Defines the index contour interval. This parameter is entered in ground units. If zero is entered for this parameter, it will be set to five times the contour interval.

Spline mode
Contour lines generated by Run Dtm may be splined using this parameter. Options include:

None Set to line mode 1	No splining will be done on contour lines.
Spline Set to line mode 2	Set contour lines mode to Line mode 2, which is the VrOne cubic spline display mode. A cubic spline specifies that the line pass through all data points. This splining mode normally performs well for some planimetric features and manually digitized contours. However, it does not always produce cartographically correct contour lines.
B Spline Add points to line	Fits a B-spline through the contour line. The spline points will be placed on the line and stored in the VrOne file. This algorithm creates a cartographically correct line for contour lines from the DTM.

Notes on the resulting lines from splining:
Spline Set to line mode 2 - This sets the contours to VrLine Mode 2, which displays a line with a cubic spline. This is a spline in which the line passes through all points. The resulting contour lines may be aesthetically pleasing but may not be as statistically correct as no splining.

B Spline Add points to line- This is a spline in which the line is approximated through the triangle edge contour points. The line may not pass through all points. The resulting contour lines may be aesthetically pleasing but may not be as statistically correct as no splining.

B spline increment (1-10)
Defines the smoothness of B-splined lines. For example, if a contour line began with 100 points as an un-splined line a B spline increment of 4 would result in a line of 400 points. A B spline increment of 4 is normally adequate for most contouring.

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Delete target layers?
If this parameter is set to Yes then the Contour, Index contour and Legs layers will be deleted before a new DTM surface is generated.

Pack file?
If this parameter is set to Yes then the active VrOne workspace will be packed before a new DTM surface is generated.

Verbose reporting?
During DTM processing the progress will be reported in detail in a dialog box if this parameter is set to yes.

Free DTM after use?
If this parameter is set to No then the DTM surface generated will be retained in memory for later use. Retaining the surface in memory makes the DTM surface active for draping operations such as determining the DTM surface Z from the current Xy cursor location.

Save DTM to file?
If yes, then Run Dtm (RUNDTM) will save the DTM to the file specified in the "DTM Save file name" parameter. A DTM file contains the exact triangles that were created during DTM processing. After using RUNDTM once, Quick Dtm (QUIDTM) can then be used to create the DTM directly from the previously saved DTM file, resulting in much faster processing on large DTMs. This option is ideal if running the DTM engine multiple times on a large dataset that is not changing.

DTM Save file name
If "Save DTM to file?" is set to Yes, then the file will be saved to this file name. The file will have a default extension of vrdtm.

Excluded points file name
If a filename is specified, then any points that fall outside the minimum and maximum Z range will be written to this file. The format is a space delimited ASCII file with one point per line, in X Y Z order.

Report file name
If a filename is specified, then a list of the current DTM parameters and open Vr file names are written to this file. **NOTE**: This information is appended to the report file specified resulting in a large file over time.

2.1.1.2.44 Sheet Layout

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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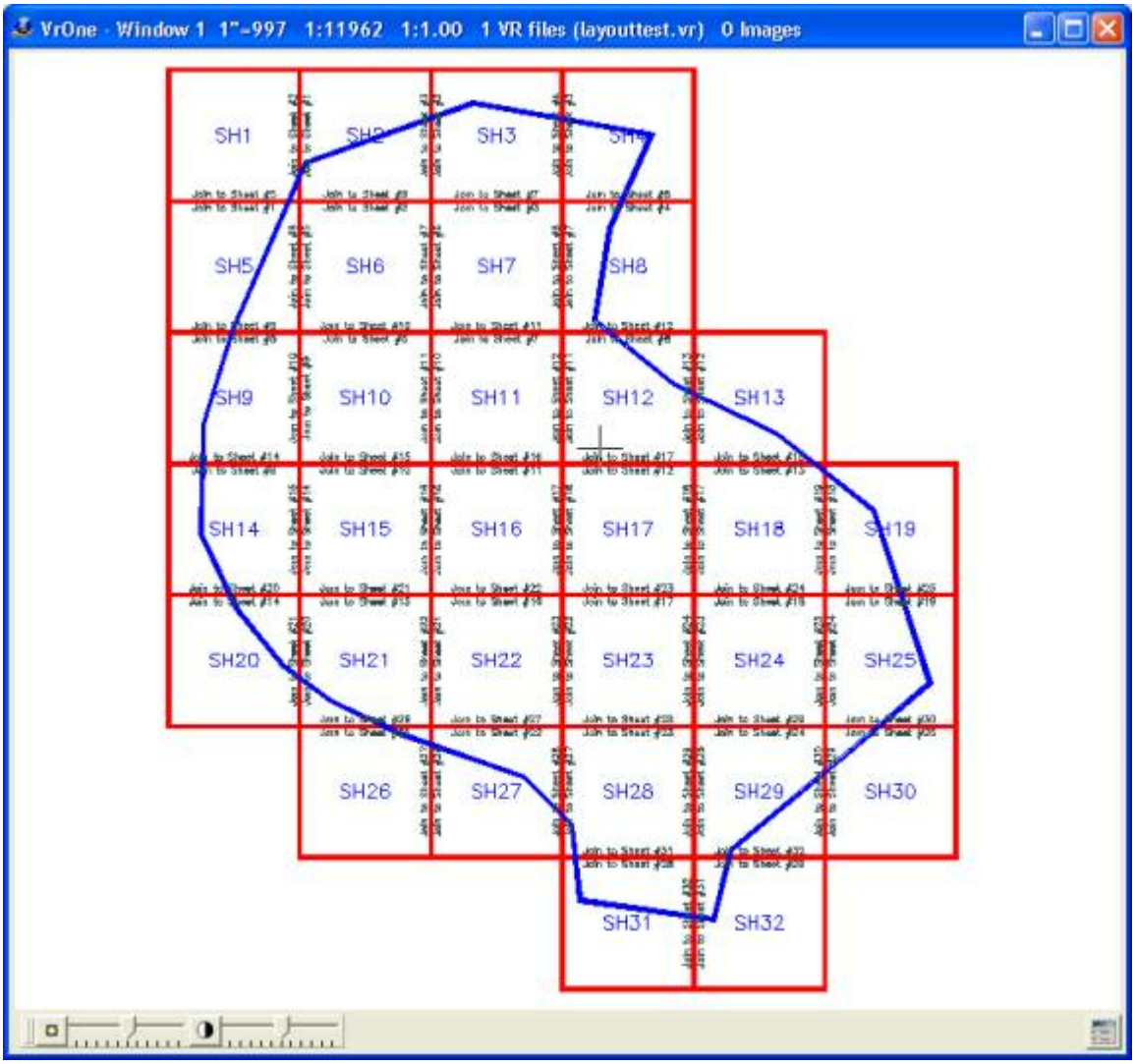
Sheet Layout (SheLay)

Type: Interactive Application

Places rectangular sheet lines with sheet labels over a user selected boundary area. Allows many different layout options and includes ability to overlap sheets and label match lines between sheets. The command starts with a menu keys dialog that allows the user to select a boundary line for layout.

The results of Sheet Layout are shown on the blue boundary line.



Local Commands

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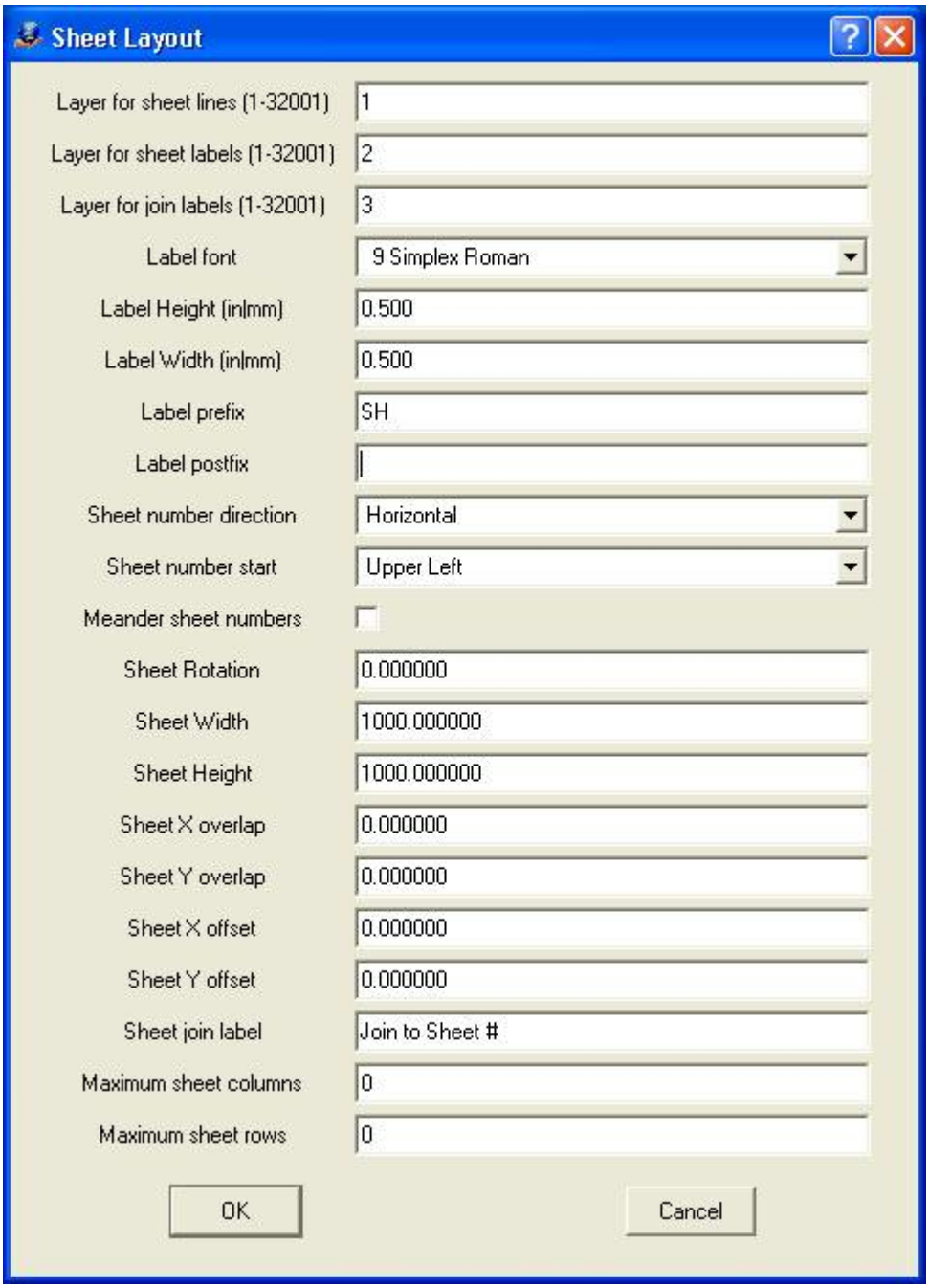
None

Parameters



Layer for sheet lines

Specifies layer into which to place sheet border lines. Range: 1-32001

Layer for sheet labels

Specifies layer into which to place sheet labels. Range: 1-32001

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Layer for join labels

Specifies layer into which to place sheet join labels. Range: 1-32001

Label font

Specifies text font to use for sheet labels. Range: 1-12

Text height

Defines text height for sheet and join labels. Enter as Inches or Mm based on the current file settings.

Text width

Defines text width for sheet and join labels. Enter as Inches or Mm based on the current file settings.

Label prefix

Specifies text string to place before each sheet label.

Label postfix

Specifies text string to place after each sheet label.

Sheet number direction

Controls which way the numbering should run. Horizontal or Vertical may be chosen.

Sheet number start

Controls where the sheet numbering will start. This can be Upper Left, Lower Left, Upper Right, Lower Right.

Meander sheet numbers

If this is on, sheet numbers will reverse direction on each row or column of sheets. If this is off, sheet numbers will stay the same direction on all rows or columns.

Sheet rotation

Defines the rotation angle at which to place the sheets. Enter in degrees.

Sheet width

Defines the width of each sheet in ground units.

Sheet height

Defines the height of each sheet in ground units.

Sheet X overlap

Defines the amount of overlap between each sheet in the X direction. Use negative numbers to create gaps.

Sheet Y overlap

Defines the amount of overlap between each sheet in the X direction. Use negative numbers to create gaps.

Sheet X offset

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Defines the amount to offset the sheets in the X direction from the original starting position.

Sheet Y offset

Defines the amount to offset the sheets in the Y direction from the original starting position.

Sheet join label

Specifies the prefix to use when labeling the join line between each sheet. This will be followed by the sheet number that joins the current sheet.

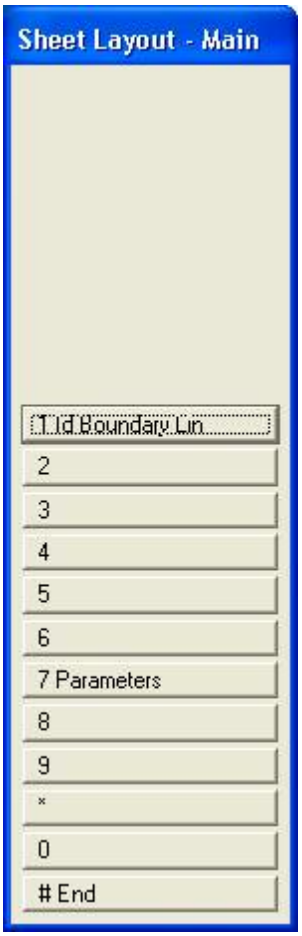
Maximum sheet columns

Sets the maximum number of sheets in each column. When the maximum column is reached the sheets will move to the next column.

Maximum sheet rows

Sets the maximum number of sheets in each row. When the maximum row is reached the sheets will move to the next row.

Button Assignments



	Button	Description

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1	Id Boundary Lin	Identifies the line to cover with the sheet layout
2		
3		
4		
5		
6		
7	Parameters	Enter parameters from a dialog box
8		
9		
*		
0		
#	End	Ends application

2.1.1.2.45 Symbols - Points

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

Vr Symbols to/from VrPoints (SymPoi)

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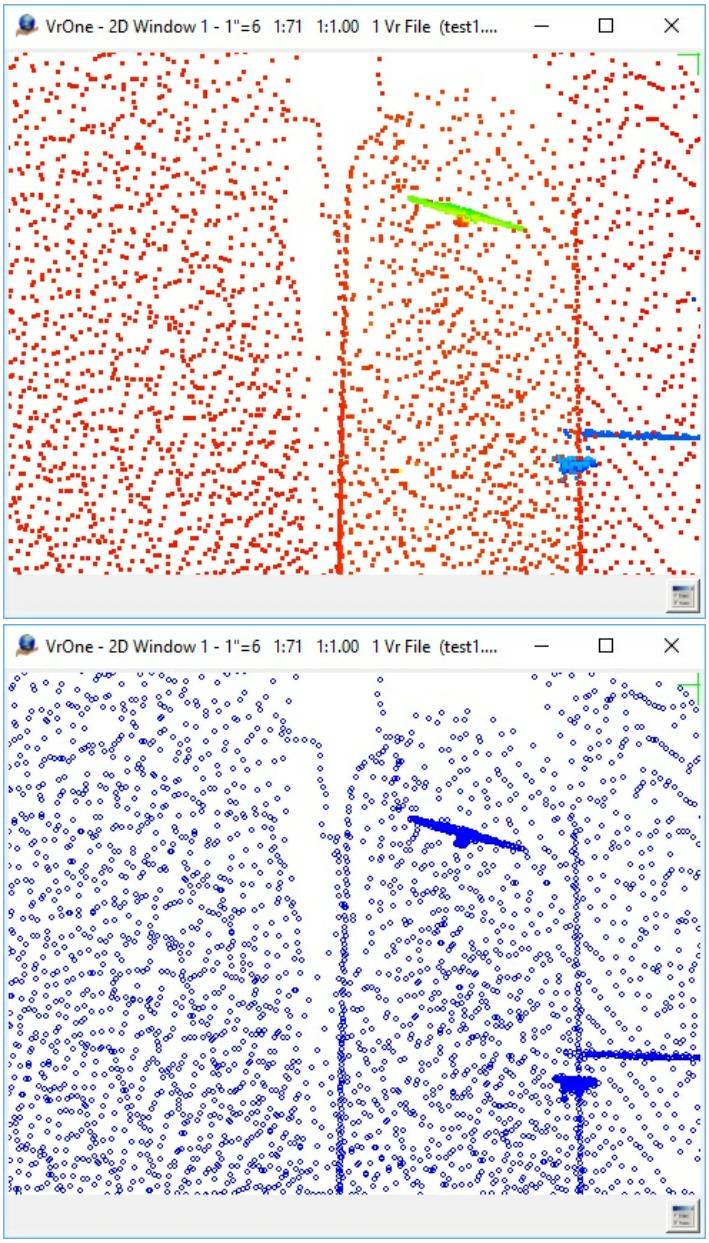

VrPoints (left) converted to Vr Symbols (right)

Type: Batch Application

Converts Symbols to or from VrPoints.

Detailed Description

VrPoints are typically used to define point cloud items such as LiDAR points and DSM (Digital Surface Model) points. For more information about VrPoints, see VrPoints Data Structure. The Symbols to/from VrPoints batch application converts between the two data types.

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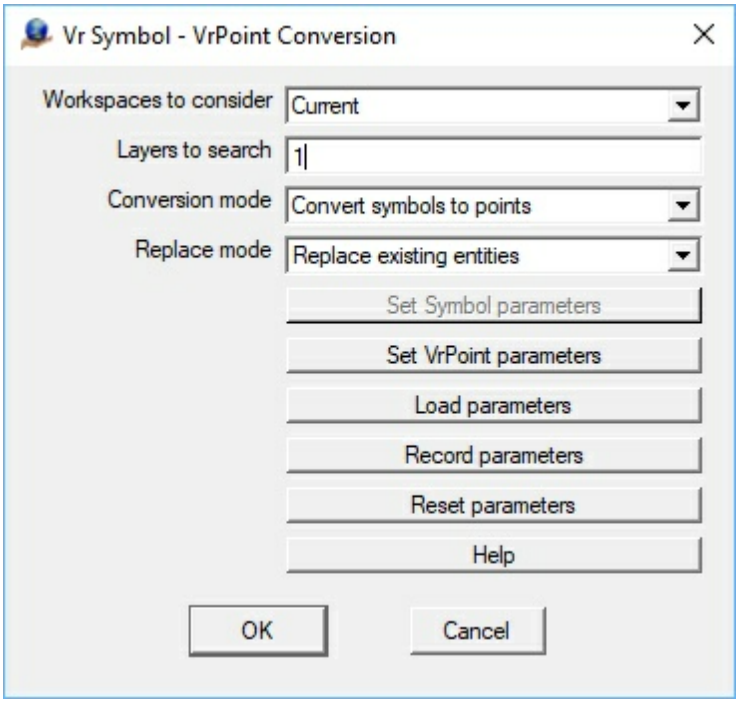
While there are some common attributes between the two data types such as x,y,z, and layer, much of the attribute data is lost in the conversion. Also, Vr Symbols were not intended as mass storage for point cloud data and contain larger attribute data than do VrPoints. Conversions of large amounts of VrPoints to Vr Symbols can cause very large file sizes and slower software run times.

NOTE: It is strongly recommended that the VrOne files to be converted are backed up before running this batch application.

Parameters for Vr Symbols to/from VrPoints



Workspaces to consider

Defines the workspaces to consider when running this batch application.

Layers to search

Defines the layers that are to be searched for Vr Symbols or VrPoints and converted. A number line may be used to define the layers. Layers that are turned off will not be considered even if they are specified.

Conversion mode

Defines the conversion direction from Vr Symbols to VrPoints or VrPoints to Vr Symbols.

- **Convert symbols to points** - Vr Symbols will be searched for and converted to VrPoints.
- **Convert points to symbols** - VrPoints will be searched and converted to Vr Symbols.

Replace mode

When converting between data types, this option defines if the original Vr Symbols or VrPoints will be deleted.

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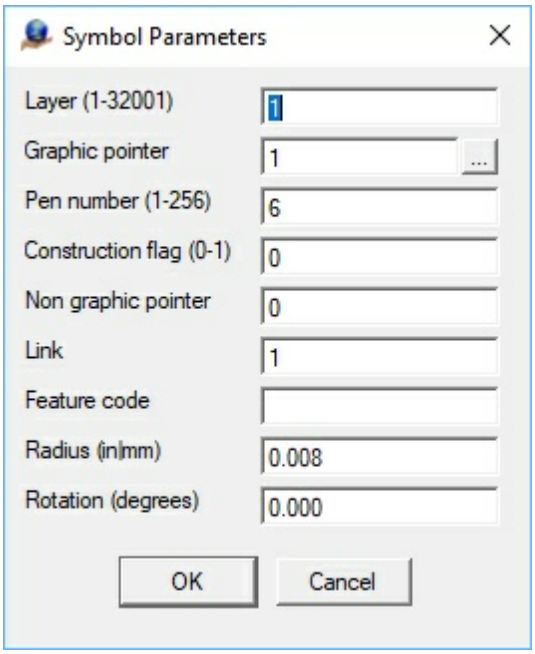
- **Replace existing entities** - The original Vr Symbols or VrPoints, will be deleted.
- **Add as new entities** - The original Vr Symbols or VrPoints will not be deleted and new entities will be added to the VrOne database resulting in a Vr Symbol and a VrPoint at the same location.

Set Symbol parameters

Allows the entry/edit of the Vr Symbol parameters when the "Conversion mode" is set to "Convert points to symbols".



Vr Symbol parameters

Set VrPoint parameters

Allows the entry/edit of the VrPoint parameters when the "Conversion mode" is set to "Convert symbols to points". VrPoints contain up to 16 parameters (attributes) for each point and the conversion to VrPoins allows the definition of only six of these parameters.

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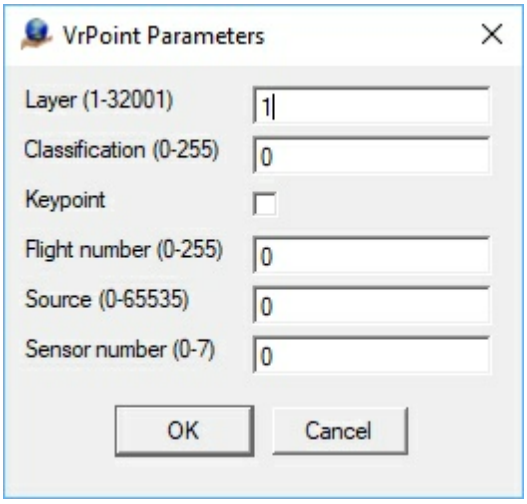

VrPoint parameters (attributes)

Load parameters
Allows the current translation parameters to be recorded to a user defined file.

Record parameters
Loads the translation parameters from a previously recorded parameter file.

Reset parameters
Resets the translation parameters to default values.

Help
Displays this help page.

Available Key-ins

Key-in	Description	Range
WsTc=	Workspaces to consider	0 - Current 1 - All
SeaLay=	Layers to search	Number line
ConMod=	Conversion mode	0 - Convert symbols to points 1 - Convert points to symbols
RepMod=	Replace mode	0 - Replace existing entities 1 - Add as new entities
SymLay=	Symbol Layer	1-32001
SymGp=	Symbol Graphics Pointer	1-1000
SymPen=	Symbol Pen Number	1-256
SymCon=	Symbol Construction Flag	0-1
SymNp=	Symbol Non-Graphic Pointer	0-65535
SymLnk=	Symbol Link	0-65535
SymFc=	Symbol Feature Code	Up to 48 characters
SymRad=	Symbol radius	Symbol radius in ground units
SymRot=	Symbol rotation	Symbol rotation in degrees (counterclockwise,

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		0=X axis)
PoiLay=	VrPoint Layer	0-255
PoiCla	VrPoint Classification	0 - Move entities to DTM or other lines 1 - Duplicate entities to DTM or other lines
PoiKey=	VrPoint Keypoint flag	0-Point is not a Keypoint 1-Point is a Keypoint
PoiFlt=	VrPoint flight number	0-255
PoiSou=	VrPoint source Id	0-65535
PoiSen=	VrPoint sensor number	0-7
ParFil=	Load existing parameter (.syp) file	Parameter file name (i.e. c:\jobs\myjob\convert.syp)
Run	Run this batch application	

Document updated: December 2017

2.1.1.2.46 Swap Axis

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Swap Axis (SwaAxi)

Type: Batch application

Swaps or reverses coordinate axis in VrOne file(s).

Detailed Description

Swaps the X–Y, X-Z or Y-Z axis in one or more VrOne files. The sign of the X, Y or Z-axis may also be reversed. Only one of these operations may be done at a time. For multiple changes Swap Axis can be run multiple times. Swap Axis is undoable.

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Swap Axis Flags parameter file name (.swa)

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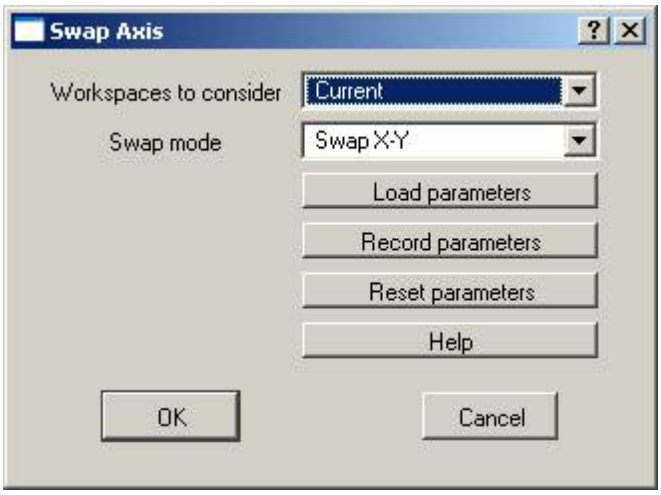
SWAMOD=	Swap mode	0 = Swap X-Y 1 = Swap X-Z 2 = Swap Y-Z 3 = Reverse sign X 4 = Reverse sign Y 5 = Reverse sign Z
RUN	Run Swap Axis	

Parameters for Swap Axis



Workspaces to consider

Defines the workspaces to consider when running Swap Axis. Options are Current workspace or All open workspaces.

Swap Mode

Defines the swap operation to perform. Options include

- Swap X-Y;
- Swap X-Z;
- Swap Y-Z;
- Reverse sign X;
- Reverse sign Y;
- Reverse sign Z.

2.1.1.2.47 TilePoints

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Mapping

Tile Points (TilPoi)

Type: Batch application

Tiles VrPoints (LiDAR) from multiple VrOne files and creates new VrOne files.

Detailed Description

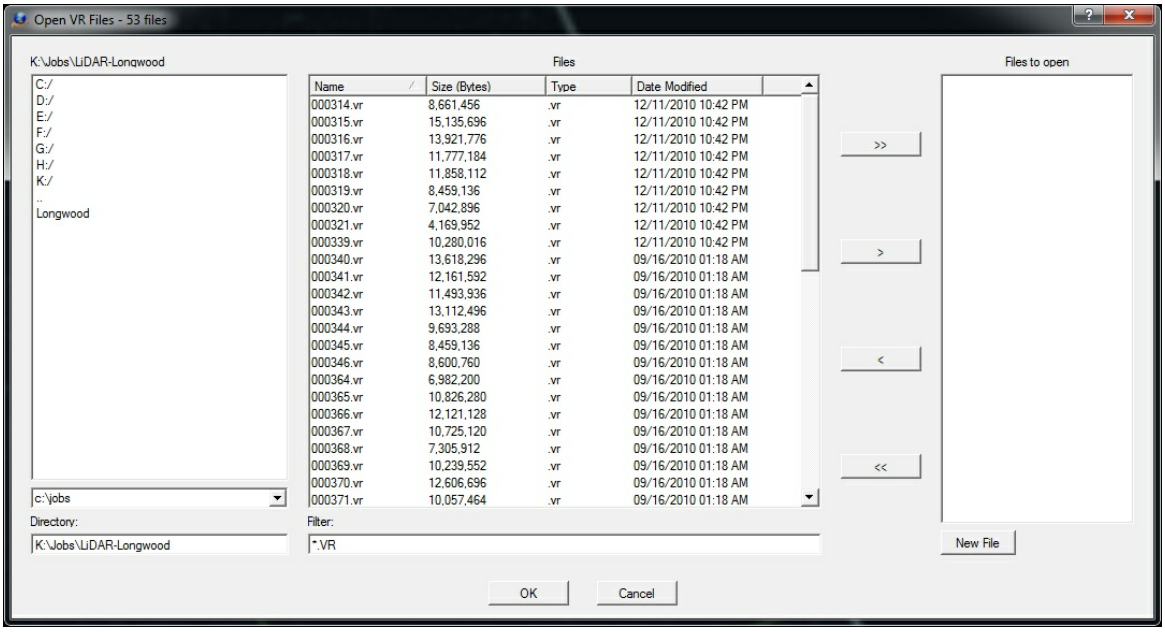
Tile Points is useful when LiDAR data management requires a project or group of files to be arranged in a manageable tile format. Multiple VrOne files containing VrPoints (LiDAR) are used as input and new VrOne files are created with each new file containing one geographic tile of point data.

Available Key-ins

None

Parameters for Tile Points

On starting Tile Points, a dialog is displayed in which the input VrOne files are defined.



VrOne input file selection dialog

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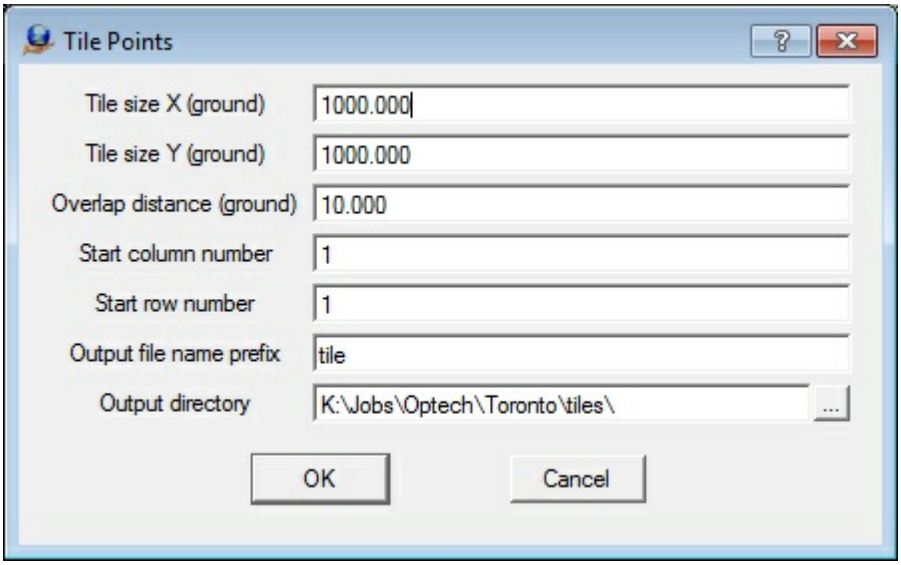
Select the VrOne files to use as input for the tiling process. Multiple files may be selected. Any files that are currently open in VrOne or VrTwo will be closed before the tiling process starts.



The Tile Points parameter dialog

Tile size X (ground)

Defines the tile size for the X axis in ground units.

Tile size Y (ground)

Defines the tile size for the Y axis in ground units.

Overlap distance (ground)

Tiles will overlap adjacent tiles by this amount and the data in the overlap areas will be duplicated.

Start column number

The new VrOne files that are created from this process will contain a file name prefix and the column (X) and row (Y) number for each tile. This parameter defines the start column number.

Start row number

The new VrOne files that are created from this process will contain a file name prefix and the column (X) and row (Y) number for each tile. This parameter defines the start row number.

Output file name prefix

Defines a file name prefix for the output file names.

Output directory

The files created by Tile Points may be placed in a user defined directory. The directory must exist before running this batch application.

Once the parameters are entered and OK is pressed, the tiling process is performed. The start coordinates for the tiling are rounded in the X and Y direction to an even interval of the tile size

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and the results are displayed in the Command Prompt window. The following is an example of the results from Tile Points.

```
Coordinate Range
Minimum              461082.050     3170998.270     10.660
Maximum              469082.040     3177998.260    104.980

Start Tile           461000.000     3170000.000
Number columns 9
Number rows    8
Number tiles   72
```

The output file names consist of the file name prefix and the column and row numbers such as:

```
Tile001001.vr
Tile001002.vr
Tile001003.vr
Tile001004.vr
Tile001005.vr
Tile001006.vr
Tile001007.vr
Tile001008.vr
Tile002001.vr
Tile002002.vr
Tile002003.vr
Tile001004.vr
...
```

2.1.1.2.48 Transform Vr Files

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Transform Vr Files (TraVr)

Type: Batch application

Transforms Vr files (workspaces) from one coordinate system to another

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Detailed Description

The coordinate transformation from one coordinate system to another is based on two coordinate files. A coordinate file typically contains control points that are used to control functions such as model orientations. The two coordinate files contain common points that represent the current, or "from" coordinate system and the new, or "to" coordinate system. The coordinate transformation may be 2D or 3D. Following is an example from a "from" coordinate file and a "to" coordinate file.

"From" coordinates

```
1   634884.088000   1759508.376000   38.374000
2   637131.300000   1760536.069000   28.405000
3   636749.827000   1762981.944000   57.051000
4   634350.036000   1761869.624000   29.464000
```

"To" coordinates

```
1   634984.088000   1759608.376000   38.374000
2   637231.300000   1760636.069000   28.405000
3   636849.827000   1763081.944000   57.051000
4   634450.036000   1761969.624000   29.464000
```

Once the computations are complete between the two coordinate systems, the results are applied to one or more open Workspaces (VrOne files) in VrOne. The results of the computations are displayed when complete. An option to run a test computation without applying the results to the open Vr file(s) is available.

Available Key-ins

Key-in	Description	Range
WSTC	Workspaces to consider	0=Current 1=All open
FROM	From coordinate file name	
TO	To coordinate file name	
TRATYP	Translation type	2=2D 3=3D
REPORT	Results report file name	
RUN	Compute and apply transformation	
RUNTEST	Compute transformation only	
PARFIL	Loads a parameter file	
HELP	Displays this help page	

Parameters for Transform Vr Files

On starting Transform Vr Files, a dialog is displayed in which the parameters are defined.

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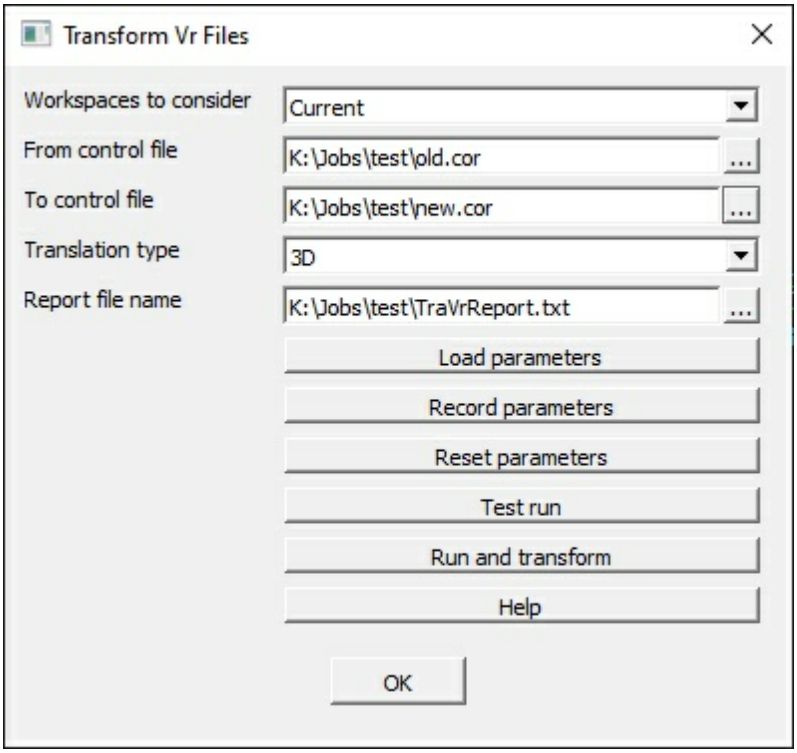

The Transform Vr Files dialog

Workspaces to consider

Defines the workspaces to consider.

From control file

Defines the "from" control (coordinate) file name. This file contains points that are in the current coordinate system.

To control file

Defines the "to" control (coordinate) file name. This file contains common points that are in the new coordinate system.

Translation type

The transformation of the coordinate may be performed in 2D or 3D. If 3D is used then the Z coordinates need to be in the "from" and "to" files

Report file name

The results of the transformation will be displayed in a dialog box and also written to a file specified here.

Load parameters

Loads an existing parameter (.tvf) file. When the Vr Transform Files application starts, the last parameter file is re-loaded.

Record parameters

Records the current parameters to user defined (.tvf) file.

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Reset parameters
Resets the current parameters to initial values.

Test run
Performs the transformation between the "from" and "to" files, displays the results, and writes the Report file. However the Vr files are not modified. This button is used for testing and quality control before modifying the Vr files.

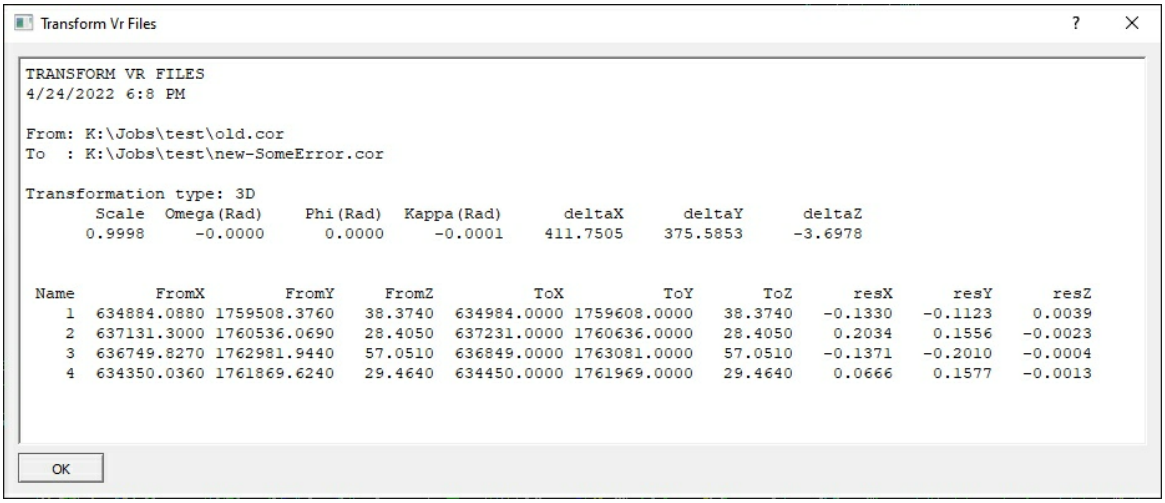
Run and transform
Performs the transformation between the "from" and "to" files, displays the results, and writes the Report file. The Vr files are then modified based on the transformation after a verification dialog is accepted.

Help
Displays this help page.

OK
Prompts for the recording of the current parameters to a .tvf file and exits Transform Vr Files.

Results Dialog

The "Test Run" and "Run and transform" buttons perform the transformation math between the "from" and "to" files, if possible. The results are displayed in an information dialog. Following is an example of the results dialog.



The Results dialog

Document updated: April 2022

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2.1.1.3 Beep Management

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Beep Management

Name	Key-in	Arguments	Description
Edit Beep	EdiBee		Edits beep parameters using dialog box.
Beep Set	Bee	Button (0-11) Value (0-1)	Sets the beep parameter for one button. Example: Bee 1 0 – Would turn the beep off for button 1
Beep All On	Bee +		Turns on beep for all buttons.
Beep All Off	Bee -		Turns off beep for all buttons

2.1.1.4 Coordinate Geometry - CoGo

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Coordinate Geometry - CoGo

Name	Key-in	Description
Bearing Bearing	BeaBea	Bearing Bearing Intersection

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Bearing Distance	BeaDis	Bearing Distance Intersection
Distance Distance	DisDis	Distance Distance Intersection
Distance Offset	DisOff	Distance Offset Computation
Inverse	Inv	Inverse between two digitized points
Label Bearing	LabBea	Label Bearing Distance on line segments
Point to Plane	PoiPla	Computes a distance from a point to a plane
Strike and Dip	StrDip	Strike and Dip 3 point solution

2.1.1.4.1 Point to Plane

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

POINT PLANE (PoiPla)

Type: Interactive Application

Allows the user to define a three-dimensional, flat plane by observing three points then measure distances to that plane by observing an additional point. The result of the computation is a single distance from a point observed to the current base and is displayed in the Main Window.

Local Commands

Key-in	Description	Range
HELP	Shows this help page	

Button Assignments

Point Plane – Dig Base

Button	Description
1 Dig base n	Digitize base point n to define surface (n = 1-3)
2 New base	Allows the definition of a new base surface

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3	
4	
5	
6	
7	
8	
9	
*	
0 Toggle snap	Toggles snapping on/off
# End	Ends application

Point Plane – Dig Point

Button	Description
1 Dig point	Digitize point to compute distance to plane.
2 New base	Allows the definition of a new base surface
3	
4	
5	
6	
7	
8	
9	
*	
0 Toggle snap	Toggles snapping on/off
# End	Ends application

2.1.1.5 Cursor Management

Vr Mapping

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Cursor Management (VrTwo

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only)

Name	Key-in	Arguments	Description
Set Cursor	SetCur		Sets cursor parameters in dialog.
Set Cursor Type	SetCur Typ	Cro, Dot	Sets cursor type.
Set Cursor Size	SetCur Siz	Size	Sets cursor size in pixels.
Set Cursor Color	SetCur Col	Whi, Bla, Red, Gre, Blu, Yel	Sets cursor color.
Set Cursor Mask Size	SetCur MasSiz	Size	Sets the cursor mask size in pixels.
Set Cursor Mask Shape	SetCur MasSha	Squ, Cir	Sets the cursor mask shape for square or circle.
Set Cursor Track Plane	SetCur Tra	Vie, Gro	Sets the cursor track plane for View plane or Ground plane.

2.1.1.6 Digital Terrain Modeling - DTM

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Vr Mapping

Digital Terrain Modeling - DTM

Name	Key-in	Arguments	Description

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Load DTM Parameters	LoaDtm	File name	Loads DTM parameter file which will be used for the next RunDtm.
Run DTM	RunDtm		Runs DTM based on current parameters.
Manage DTM	ManDtm		Manages multiple DTM surfaces and perform volume calculations.
Free DTM	FreDtm	Surface #	Frees DTM surface from memory
Quick DTM	QuiDtm		Runs contours from last saved surface file.
Load Surface	LoaSur	File name	Loads a DTM surface into memory.
Clear Surface	CleSur		Clears active DTM surface from memory.
Set User DTM Area	SetUdt		Allows user to select new User-Defined Area.
Show User DTM Area	ShoUdt		Displays temporary white line on the graphics window showing current User-Defined area shape.
Drape	Dra Drape		Drapes entities to current DTM surface.
Isolate DTM Layers	IsoDtm		Turns off all layers except those specified in the current DTM points and break lines' parameters.

2.1.1.6.1 Manage DTM

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Manage DTMs (ManDtm)

Type: System Management

Allows user to manage DTM surfaces and compute surface volumes.

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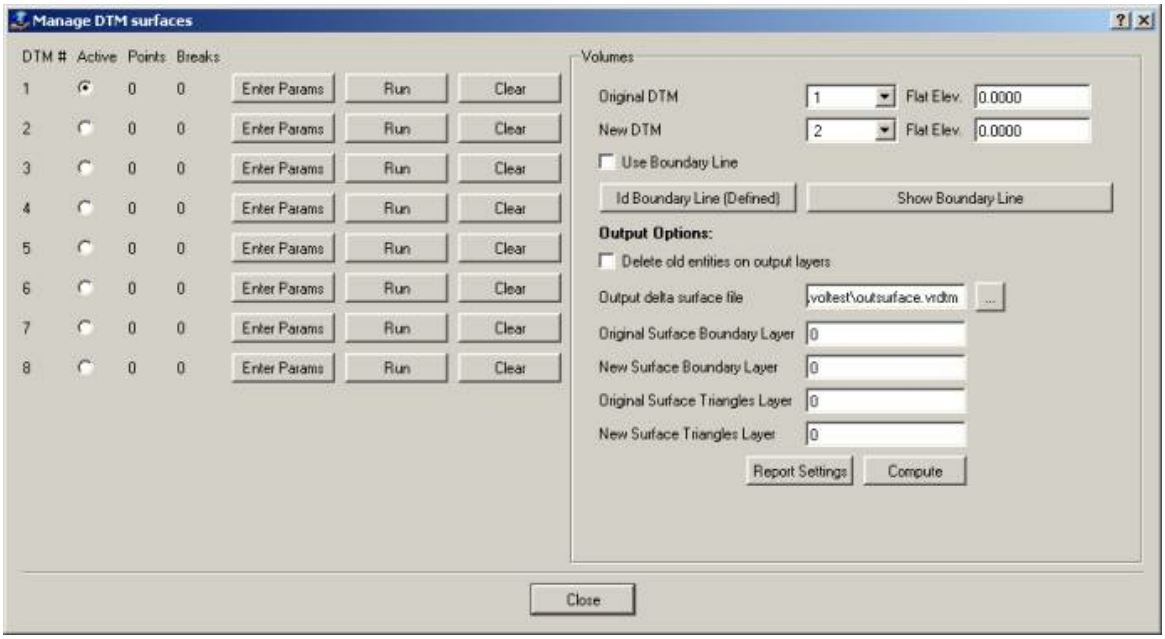
Detailed Description

The DTM Manager dialog displays a list of the 8 possible DTM surfaces that may be used in VrOne. Quickly set the active surface, change the parameters for a surface, or compute the DTM for a surface. If using the VrVolumes module, then the dialog also adds the ability to compute volumes between surfaces or between a surface and a flat plane.

DTM Manager Dialog



The Manage DTM Surfaces dialog box with VrVolumes enabled. Only the left half of the dialog is displayed if VrVolumes is not available.

Each surface is represented by a row in the dialog box.

Surface List

Following is an explanation of each column in the surface list. (The left side of the dialog box.)

Active

Indicates if this surface is active. Only one surface may be active at a time. The user may select the radio button to make the surface active. The ADT command may be also be used to make a surface active.

Points

Displays the number of points making up this surface. Only displayed if the Run command has been used on this surface and free DTM was set to no.

Breaks

Displays the number of break lines making up this surface. Only displayed if the Run command has been used on this surface and free DTM was set to no.

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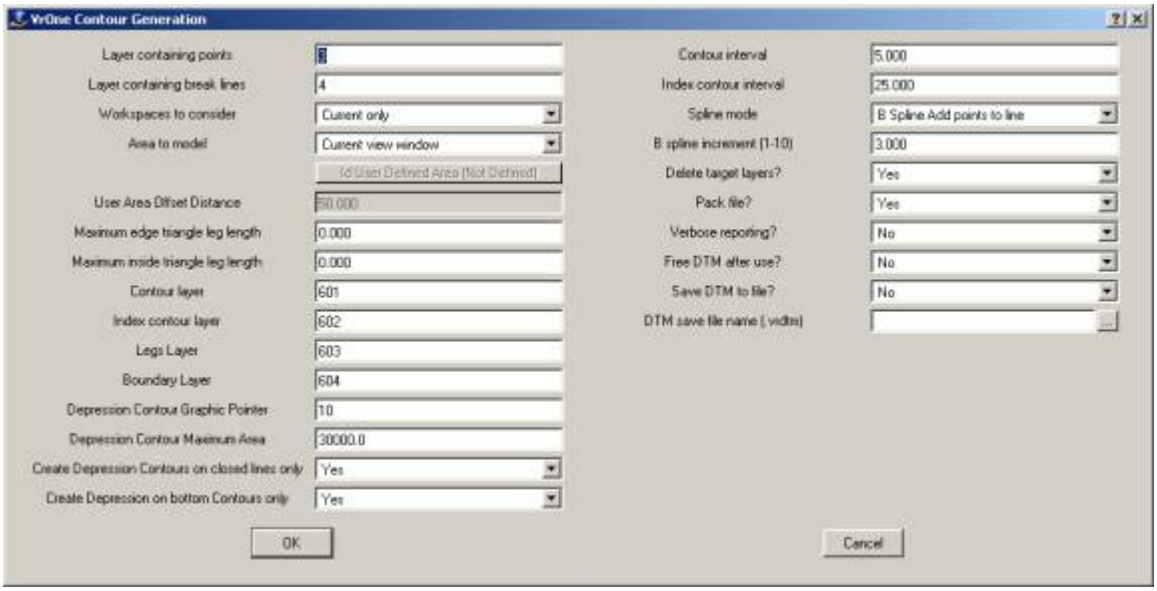
Enter Params
Makes the surface active and displays the parameters dialog box for this surface. Each surface can have its own unique set of parameters.

Run
Makes the surface active and computes the DTM based on the parameters for this surface. This is the same as using the ADT command followed by RUNDTM.

Clear
Clears the surface. Removes the surface from memory but does not affect any surface data in the VrOne file.

Enter Params
Displays the parameters dialog box for this surface. Each surface maintains its own unique set of parameters. See the documentation for SetDtm for a full explanation of the DTM parameters.



Volumes

The volumes section (the right side) of the dialog is displayed if using the VrVolumes module. VrVolumes provides cut and fill results using a prismoidal volume computation method. Volumes are calculated directly from the triangles of the surfaces.

To compute the volume between two surfaces, first define the surfaces by using the “Enter Params” button on two of the 8 available surfaces. Once the surface parameters have been defined (points and break line layers), set the Original and New DTM numbers to the appropriate surface numbers, then press the Compute button to start the volume computation process.

To compute the volume between a surface and a flat plane, at least one surface must be defined in one the 8 available surfaces. Once the surface is defined, set the Original or New surface to

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the appropriate surface number, and set the other surface to use the “Flat Elev”. Press the Compute button to start the volume computation process.

When computing surface to surface volumes, only the overlapping area between the two surfaces is used in the volume computations. Because this overlapping area is not always well defined, it is recommended to provide a specific boundary line for the area to be computed. To do this, use the “ID Boundary Line” button to select a boundary line before starting the volume computation. The “Use Boundary Line” option must also be turned on. This line does not need to be part of either surface, and does not need to have valid elevations. It will be integrated into each surface temporarily during the volume calculations.

During the volume computations, temporary surfaces are created that represent the merging of the two original surfaces and trimming to the boundary line area if one is specified. In order to verify and visualize the data used for volume computations, the boundary line and triangles from the merged surfaces can be saved in the VrOne file. The layers for saving this data are defined under the Output Options section.

After volume computations are complete, the results are displayed as raw Cut and Fill quantities below the compute button. These are displayed in the units of the VrOne file. For example, if working in feet, then the results will be cubic ft. Divide by 27 to get cubic yards.

Original DTM
Specifies the surface number that represents the original surface. If using a flat elevation for the original surface, then select “Flat Elev”, and enter the desired elevation in the adjacent text box.

New DTM
Specifies the surface number that represents the new surface. If using a flat elevation for the new surface, then select “Flat Elev”, and enter the desired elevation in the adjacent text box.

Use Boundary
If this is turned on, then the volume computation will be limited to an area defined by a closed boundary area. This area is defined by selecting a VrOne line using the “Id Boundary Line” button.

Id Boundary Line
This button allows the selection of an existing VrOne line to be used as the boundary of the volume computations.

Show Boundary Line
Helps identify if the correct boundary is being used for the computations. Clicking on this button will result in a white line being displayed in the VrOne graphics window, representing the outline of the currently defined boundary area.

Delete Output Layers
If this is on, then all output layers will be deleted each time volumes are computed. The output layers include the Original boundary line layer, New boundary line layer, Original Triangles layer, and New Triangles layer.

Output delta surface file

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If a filename is specified, then the delta TIN is written to the specified surface file after the volume computations are complete. If the surface file already exists, it will be overwritten. This surface file can be used with the Quick Dtm command to generate contours, drape data, etc.

Original Surface Boundary Layer
Specifies the layer into which to place the boundary line around the merged volume computation area at the elevation of the original surface. Set to 0 to disable.

New Surface Boundary Layer
Specifies the layer into which to place the boundary line around the merged volume computation area at the elevation of the new surface. Set to 0 to disable.

Original Surface Triangles Layer
Specifies the layer into which to place the triangles from the merged volume computation area at the elevation of the original surface. Set to 0 to disable.

New Surface Triangles Layer
Specifies the layer into which to place the triangles from the merged volume computation area at the elevation of the new surface. Set to 0 to disable.

Report Settings

Press this button to set reporting options. The following dialog will be displayed.

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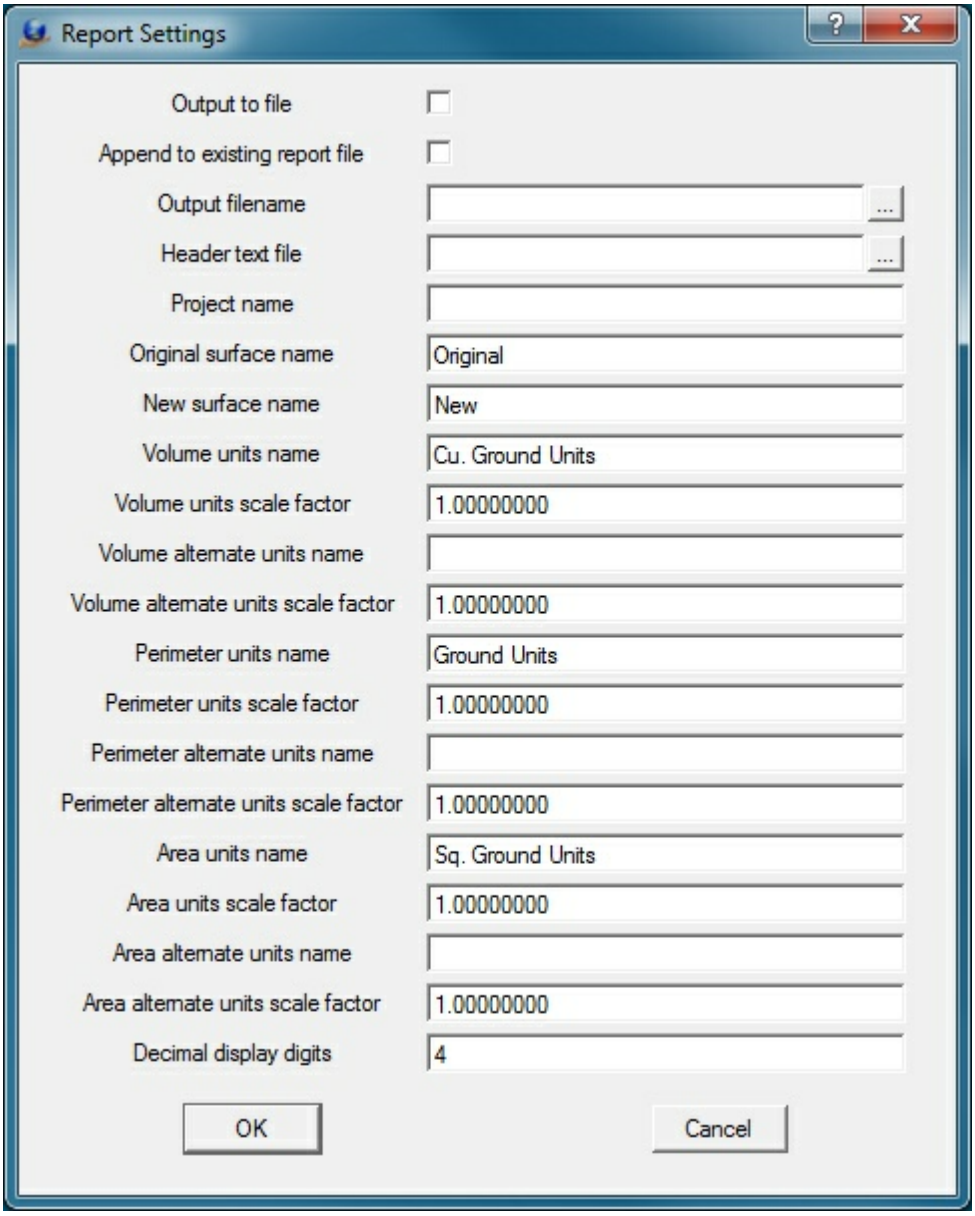

Output to file
If this is checked, volume information is written to a file.

Append to existing report file
If this is checked, and a report file is specified, volume information is appended to the report file if it already exists.

Output filename
Specifies the name of the output report file. Volume information is written in ASCII format to this file if the Output to file option is set.

Header text file
If a filename is specified, its contents will be added at the top of the report data. This must be a plaint text (ASCII) file.

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Project name
Defines the project name to be displayed at the top of the report.

Original Surface name
Defines the name by which the original surface will be referred to in the report.

New Surface name
Defines the name by which the new surface will be referred to.

Volume units name
Specifies the postfix to append to the standard reported volumes.

Volume units
Defines the amount by which to multiply the standard volume. For example, if a job is in feet and the required reporting units are cubic yards, then a value of 0.0370 could be used to convert from cubic feet to cubic yards.

Volume alternate units name
Specifies the postfix to append to the alternate reported volumes. If this is left blank, no alternate volumes will be reported. This is useful if the volume needs to be reported in more than one unit format.

Volume alternate units scale factor
Defines the amount by which to multiply the alternate volumer. For example, if a job is in feet, and the required reporting units are cubic yards, then a value of 0.0370 could be used to convert from cubic feet to cubic yards.

Perimeter units name
Specifies the postfix to append to the standard reported perimeter.

Perimeter units scale factor
Defines the amount by which to multiply the standard perimeter.

Perimeter alternate units name
Specifies the postfix to append to the alternate reported perimeter. If this is left blank, no alternate perimeter will be reported. This is useful if the perimeter needs to be reported in more than one unit format.

Perimeter alternate units scale factor
Defines the amount by which to multiply the alternate perimeter

Area units name
Specifies the postfix to append to the standard reported area.

Area units scale factor
Defines the amount by which to multiply the standard area.

Area alternate units name
Specifies the postfix to append to the alternate reported area.. If this is left blank, no alternate area will be reported. This is useful if the area needs to be reported in more than one unit format.

Area alternate units scale factor
Defines the amount by which to multiply the alternate area.

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Decimal display digits
Specifies the number of digits to display to the right of the decimal point for all reported values.

Compute

Press the button to begin the volume computation process. When processing is complete the results will display beneath this button.

2.1.1.7 Display Management

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Display Management

Name	Key-in	Arguments	Description
Set Display	SetDis		Sets display parameters using dialog box.
Reset Display	ResDis		Resets display parameters to default values.
Lines On	LinOn		Displays lines.
Lines Off	LinOff		Hides lines.
Splined Lines On	SplOn		Displays splined lines with spline.
Splined Lines Off	SplOff		Displays splined lines without spline.
Line Fonts On	LfOn		Displays line fonts.
Line Fonts Off	LfOff		Displays fonted lines as solid.
Construction Lines On	ConOn		Displays construction lines.
Construction Lines Off	ConOff		Hides construction lines.
Line Points On	LpOn		Displays line points.
Line Points Off	LpOff		Hides line points.

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Line Elevations On	LeOn		Displays line elevations.
Line Elevations Off	LeOff		Hides display line elevations.
Symbols On	SymOn		Displays symbols.
Symbols Off	SymOff		Hides symbols.
Text On	TexOn		Displays text labels.
Text Off	TexOff		Hides text labels.
Interactive Lines On	IlinOn		Displays interactive lines.
Interactive Lines Off	IlinOff		Hides interactive lines.
Interactive Symbols On	IsymOn		Displays interactive symbols.
Interactive Symbols Off	IsymOff		Hides interactive symbols.
Interactive Text On	ItexOn		Displays interactive text.
Interactive Text Off	ItexOff		Hides interactive text.
Set Coordinate Display Decimals	CooDis	0-10	Sets the number of decimal places for Xyz display in the Main Window.
Open Coordinate Display	CooDia		Opens the Coordinate Display window.
Point (LiDAR) Display Parameters	PoiDis PO		Sets Point display filters, clipping planes and Point coloring parameters.
Point Set Z	PoiSetZ		Sets Z Slice display parameters.

Name	Key-in	Arguments	Description
Point (LiDAR) Display Parameters	PoiDis or PO		Sets Point display filters, clipping planes and Point coloring parameters.
Point Set Z	PoiSetZ		Sets Z Slice display parameters.

2.1.1.7.1 Point Display

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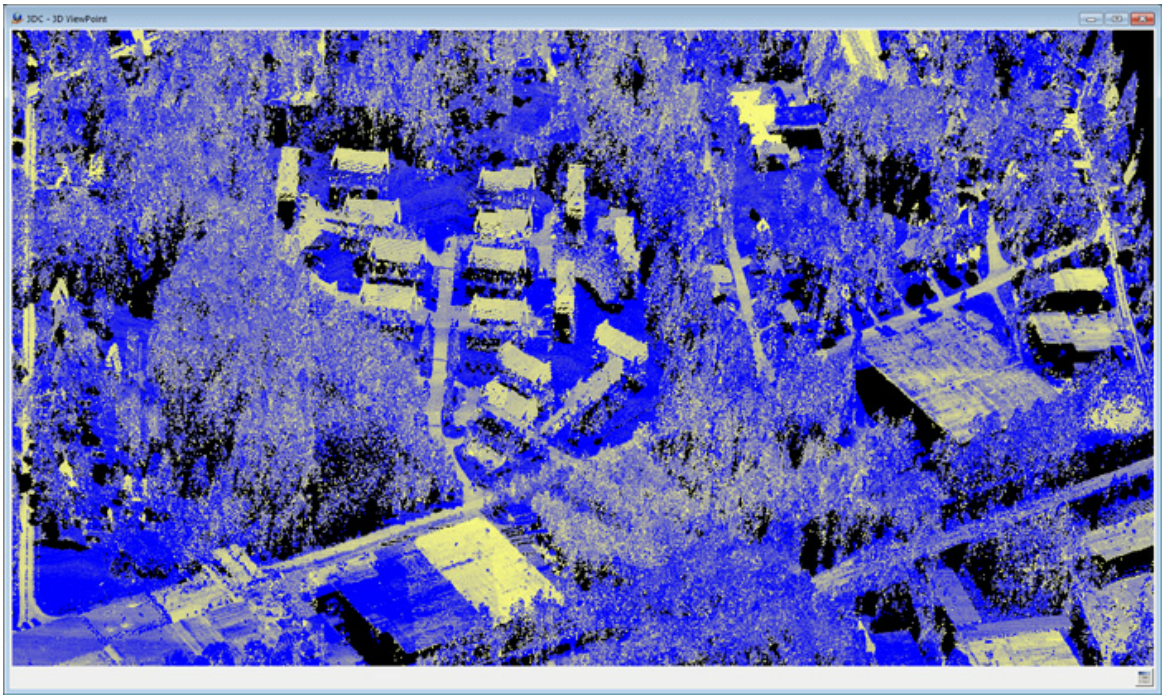
Mapping

Point Display (PoiDis or PO)



LiDAR

Type: Display Management

Allows user to manage the parameters that control the display of Points.

Detailed Description
Point Display Dialog

Point Display Filters
- Z Slice
- Classification
- List Classifications Used
- Return Number
- Sensor Number
- Flight/strip Number
- GPS Time

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Scan Angle
Key-point
Adjust Clip Limits on Recenter
Reset Filters on Startup

Point Color Parameters
Entity
Intensity
Intensity Histogram
Classification
RGB
Elevation
Elevation Histogram
Slice
Sensor Number
Flight/strip Number

Point Display Key-ins

Detailed Description

Several point display criteria may be controlled. Points may be filtered based on Z Slice, classification, return number, sensor number, flight/strip number, GPS time, scan angle and/or keypoint. Any or all of these filters may be selected. When displaying Points in 3D VrThree and 2.5D VrThree, near and far clip limits may be applied to help isolate points within a viewing slice based on the 3D eye point position and direction.

Points may be colored based on layer (entity), LiDAR intensity, classification, RGB color values, point elevations or Z slice, sensor number, or flight/strip number. Many of the color display modes include additional parameter settings. Any of the coloring options such as elevation may be supplemented by draping the Intensity values which offers a dual coloring method in most configurations.

Several reporting applications are available including a LiDAR intensity histogram and the LiDAR classification use.

Other key-in commands that further control Point display include the Point Density (PD) command which allows the skipping of points during display and Point Size (PS) command which controls the size of the Points during display . The parameters defined in Point Display (PoiDis) are used when displaying Points in the VrOne 2D window, VrTwo stereo with images or LiDARgrammetry images and in 3D VrThree.

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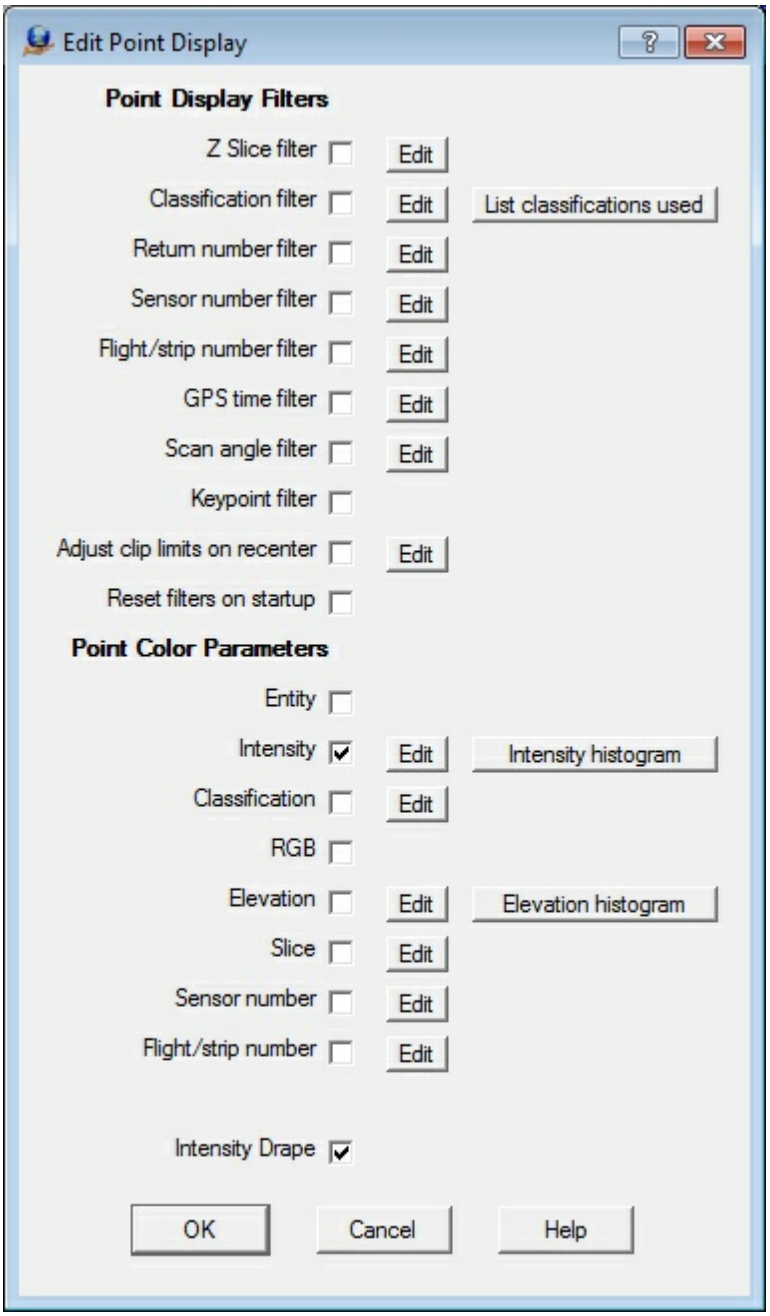
Point Display Dialog



Point Display main dialog box

The Point Display dialog box is divided into the Point Display Filters area and the Point Color Parameters.

- The Point Display Filters display points based on one or more criteria.
- The Point Color Parameters define the coloring scheme when points are displayed. One of the six color options may be active at a time.

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Point Display Filters

Multiple point display filters may be checked. For example, it would be possible to display only points that are classified as vegetation a last return number in the elevation range of 100 to 120 ground units.

Pressing the Edit button to the right of the checkbox will allow the definition of parameters for that point display filter.

Point Display Filters - Z Slice

Displays a slice of Point data that is defined as an elevation range. This filter is useful when some of the point data obscures other data such as decks, tunnels and areas of tree cover. The Z Slice filter may be turned on/off with the check box. The following is an example of a Z Slice applied to an overpass area in which LiDAR data was collected both on a highway overpass and on the roadway under the overpass. By using the Z Slice filter, either the overpass or the roadway may be isolated for viewing and data collection.
Points with an elevation in the Z Slice range will be displayed if the point passes other active point filters also.

The interactive application Point Set Z (PoiSetZ) is also available which allows the definition of the Z Slice parameters with the option to digitize the base elevation.

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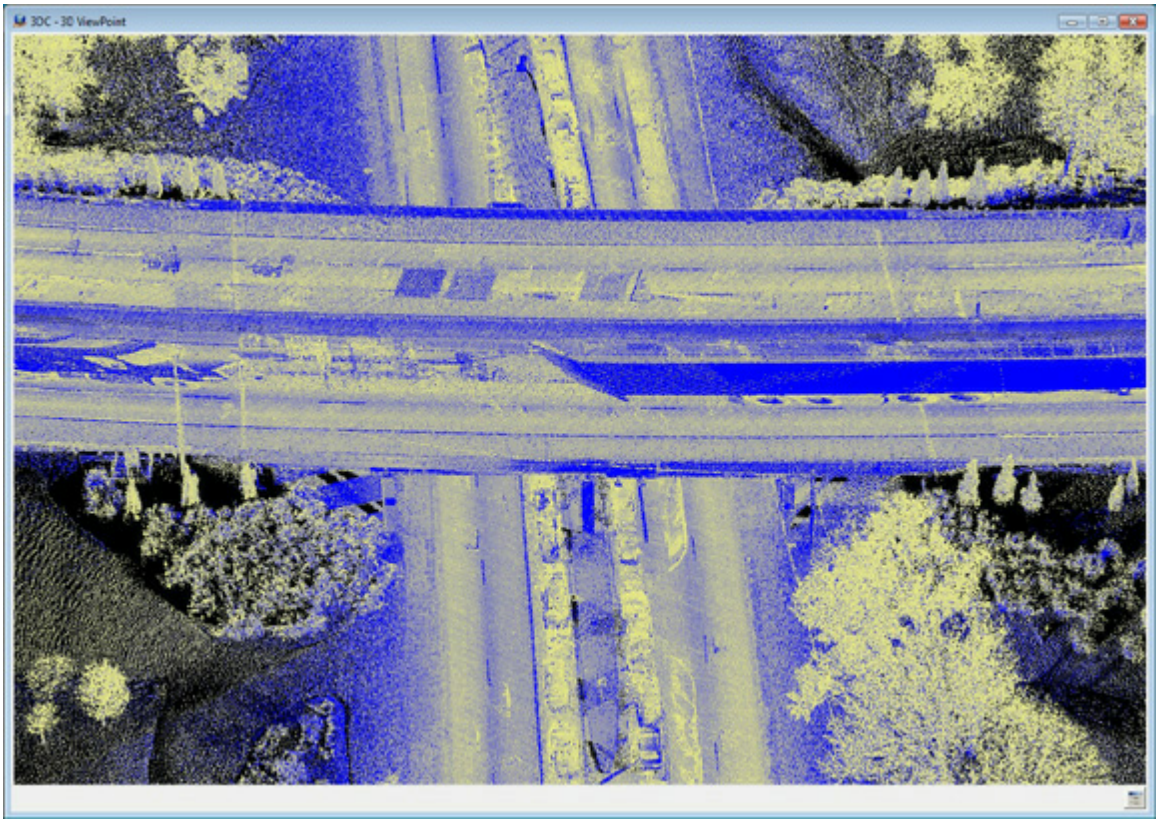
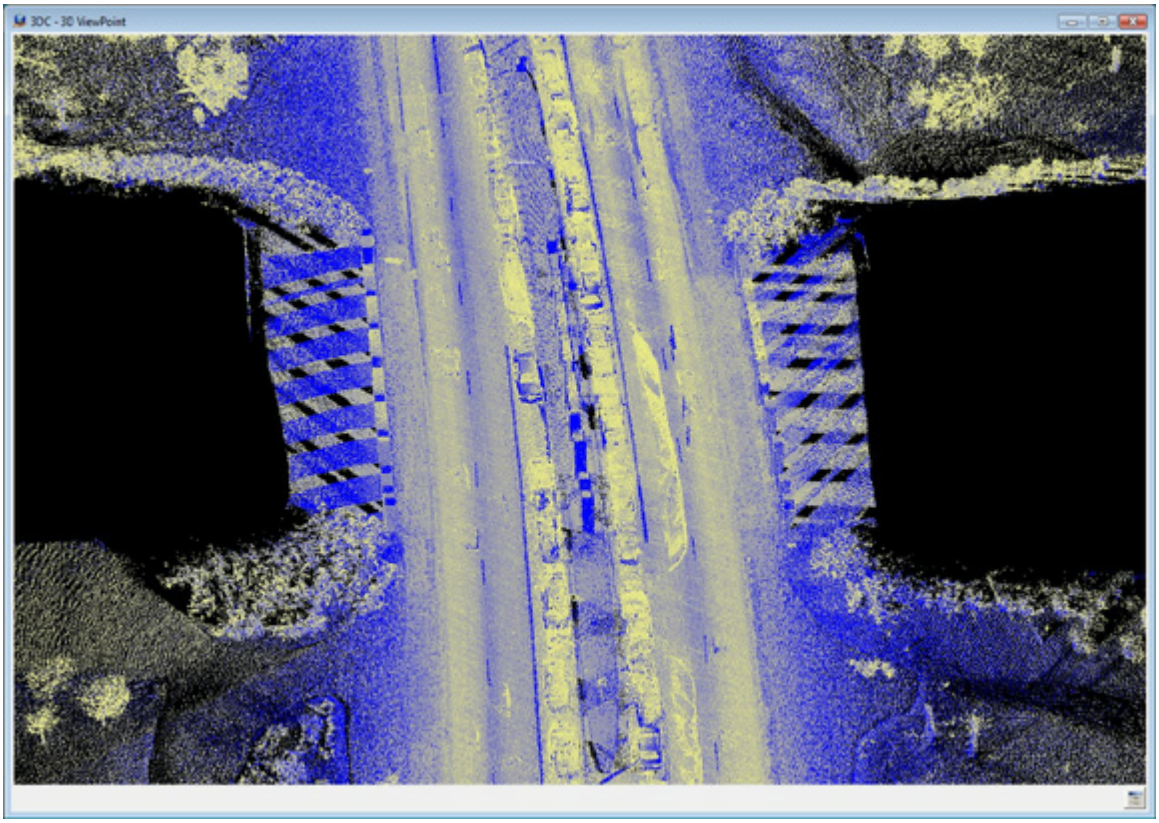


Overpass area with all data displayed



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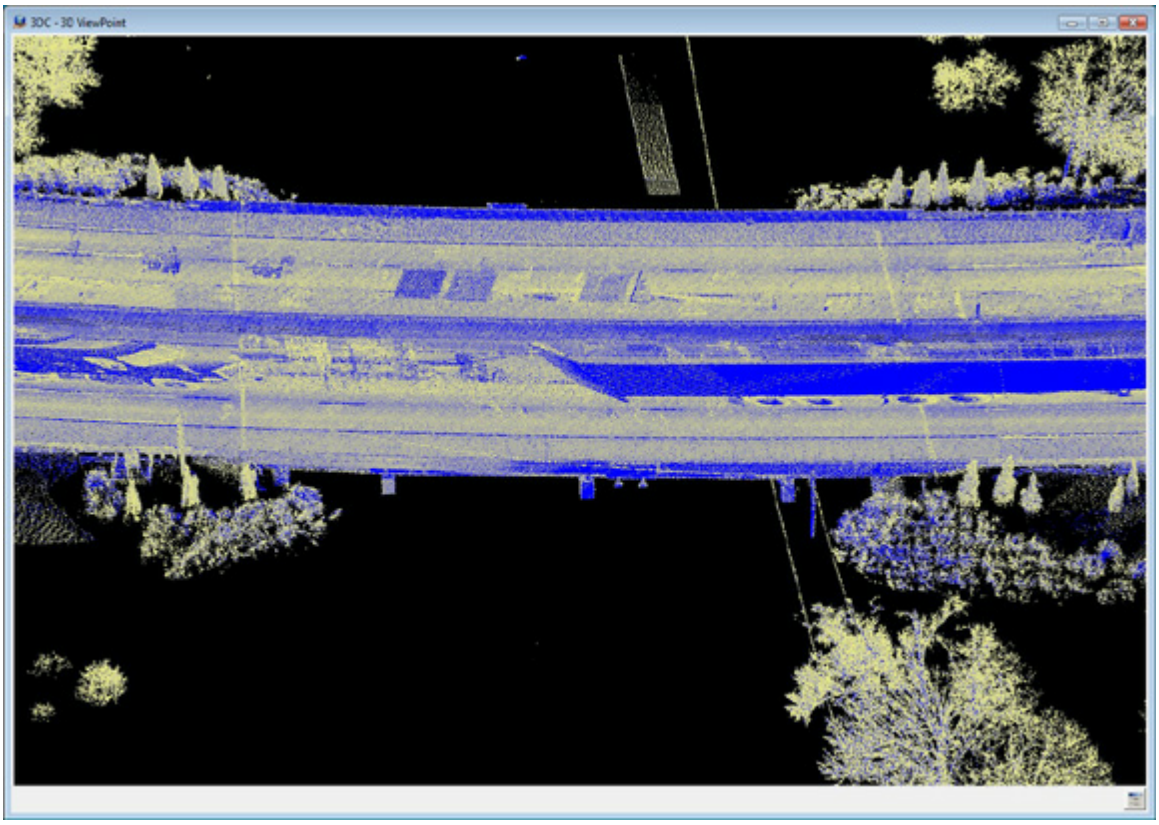
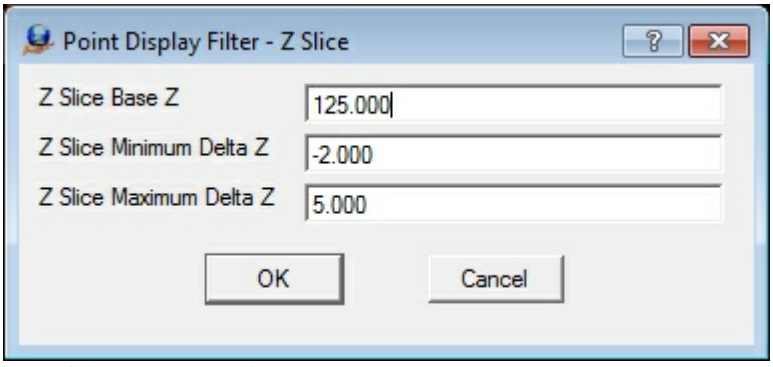
Overpass area with Z Slice showing roadway without bridge deck



Overpass area with Z Slice showing bridge deck without road



The Z Slice parameter dialog

Z Slice Base Z

Defines the elevation base for the Z Slice in ground units.

Z Slice Minimum Delta Z

Defines the lower range of the Z slice using a delta Z from the base Z. This value is typically a negative number. The example in the above dialog would set the Z Slice range from 123 to 130.

Z Slice Maximum Delta Z

Defines the upper range of the Z slice using a delta Z from the base Z. This value is typically a positive number. The example in the above dialog would set the Z Slice range from 123 to 130.

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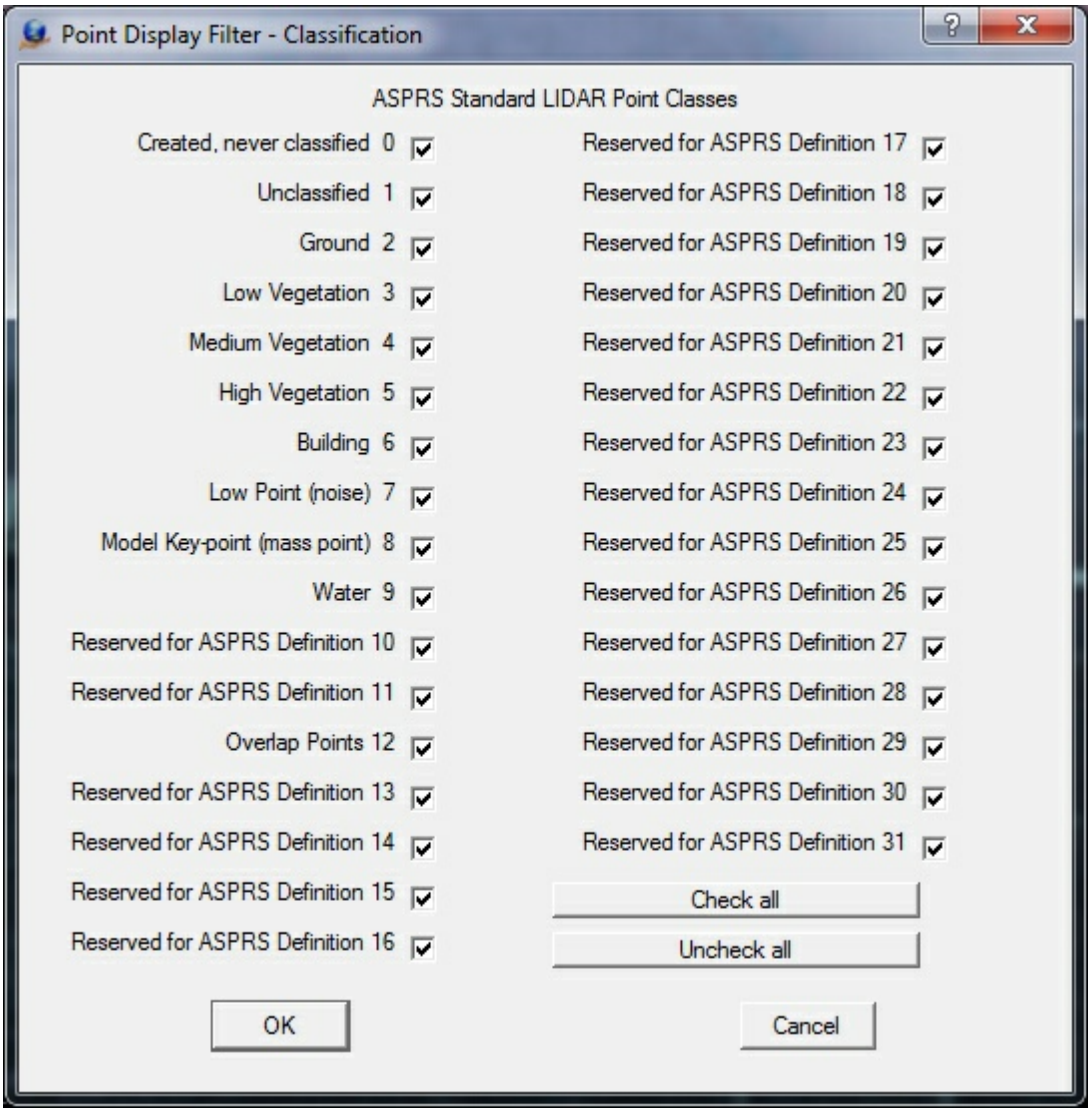
Point Display Filter - Classification

Defines up to 32 LiDAR Classifications to be displayed. Points with these classifications will be displayed if the point passes other active point filters also. The "Check all" button selects all classifications and the "Uncheck all" de-selects all classifications.



The Point Display Filter for Classifications

List Classifications Used - Point Color Parameters

Pressing the "List classifications used" button will display the LiDAR Classifications that are used in the currently opened VrOne files.

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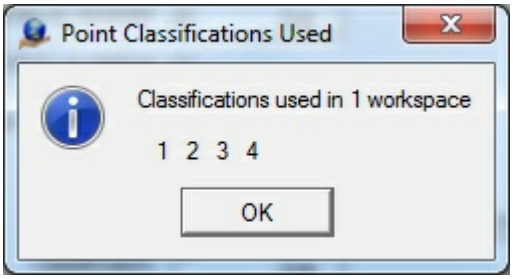


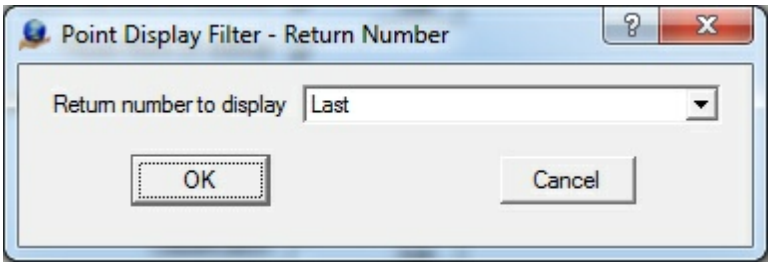
Results of "List classifications used"

Point Display Filter - Return Number

The LiDAR Return Number is the pulse return number for a given output pulse. A given output laser pulse can have many returns. They are marked in sequence of return. A single output pulse may have up to five returns. The Return Number filter defines and displays only the points that match the specified return number.

Points with the user specified return number will be displayed if the point passes other active point filters also.

Pressing the Edit button will display the following dialog and allow the definition of the return number to display.



The Return Number dialog

The Return Number may be from one to five or the last return. Typically the Points with the last return are the lowest points and considered to be on the ground. By selecting the last return, many points in vegetation and trees are not displayed. In the examples below, one scene from 3D VrThree displays LiDAR Point data will all the returns. Another shows only the last returns.

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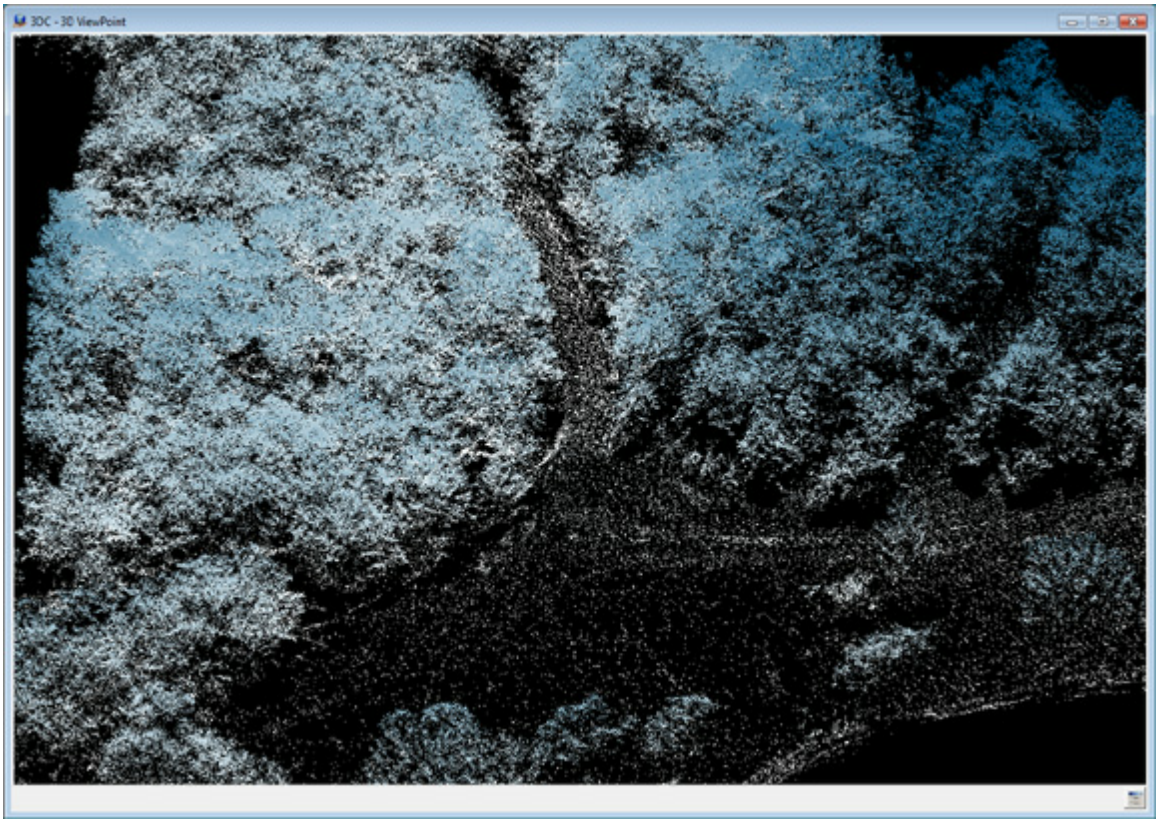
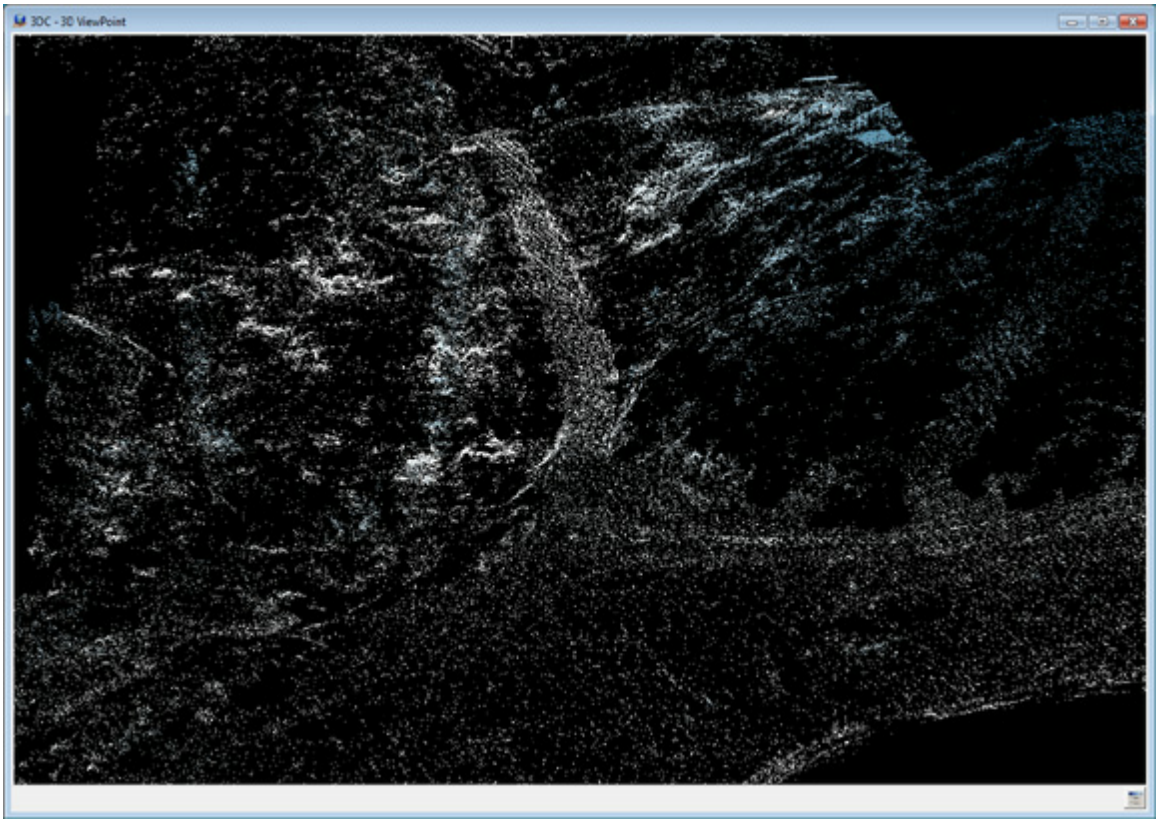


A scene from 3D VrThree showing LiDAR Point data will all returns



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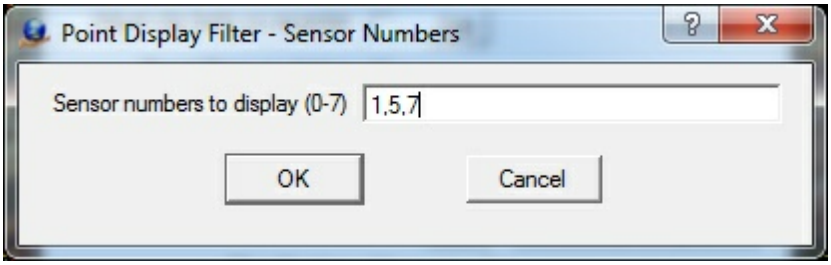
A scene from 3D VrThree showing LiDAR Point data will the last return only

Point Display Filter - Sensor Number

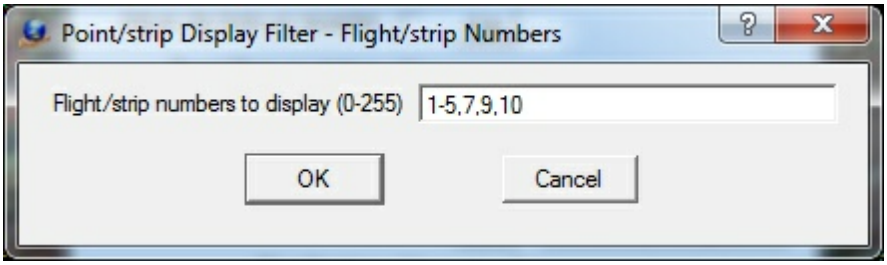
LiDAR collection platforms such as mobile LiDAR may use more than one sensor that work simultaneously. The Sensor Number parameter allows filtering by up to eight sensor numbers. On input, the sensor number may be embedded in the input file name. Starting at LAS version 1.4, the sensor number is a point attribute in this format. A number line may be entered for this parameter.



Sensor number filter dialog

Point Display Filter - Flight/strip number

Each point in the VrPoint (LiDAR) database has an attribute for the storage of the flight or strip number. In aerial applications, this number may indicate a flight line number; in mobile LiDAR collection, it may indicate a pass number. On input the flight/strip numbers may be embedded in the input file name. This attribute is not part of the LAS format. A number line may be entered for this parameter.



Flight/strip number filter dialog.

Point Display Filter - GPS Time

If the VrPoints are saved with the available GPS time, points may be filtered based on a minimum and maximum GPS time. The parameters are typically expressed in seconds from a known start time.

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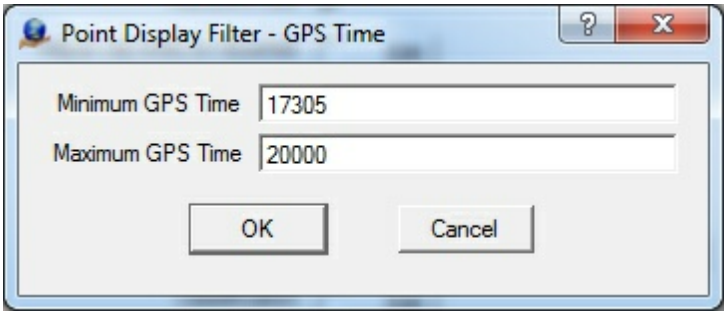
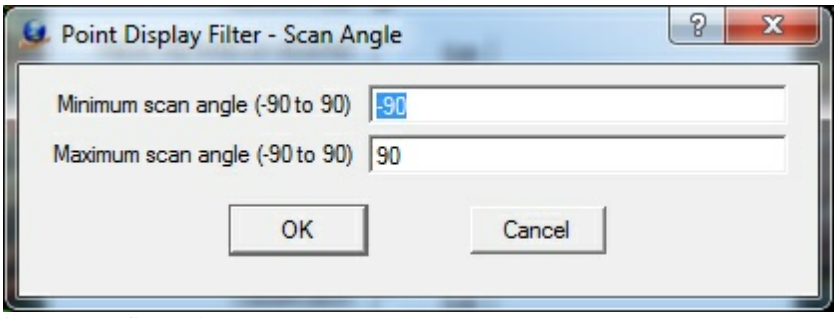


GPS Time filter dialog

Point Display Filter - Scan Angle

VrPoints may be filtered by their scan angle attribute. This may be useful when isolating the points directly under the sensor. The Scan Angle is entered in degrees.



Scan Angle filter dialog

Point Display Filter - Keypoint

Keypoints or model Keypoints are used to thin LiDAR datasets by identifying points in flat areas that represent other LiDAR points nearby to be within the same user defined elevation tolerance. When the keypoint filter is active only VrPoints that are defined as keypoints are displayed.

Point Display Filter - Adjust Clip Limits on Recenter

This parameter is used only by the VrThree (VrLiDAR) 3D VrThree environment. If checked, it adjusts the near and far clip limits each time the screen is re-centered. The Edit button allows the definition of the near and far clip and clip increment values. See Getting Started with 3D VrThree for information for turning on/off and changing the near and far clip limits interactively while in 3D VrThree.

When viewing Point data in 3D VrThree, clipping planes are used to prevent the display of data that is "near to" or "far away" from the viewer's eye point or center of projection. The planes are perpendicular to the camera and set at user definable distances from the 3D center of the current scene. The near clip place is set in front of the 3D center and the far clip plane is set behind it.

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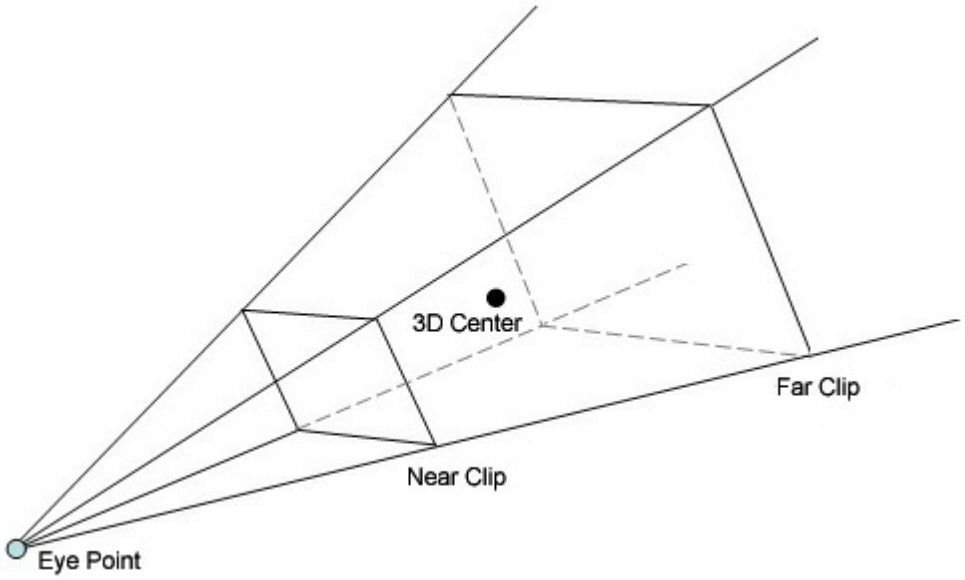
The clipping planes are useful when using ground based LiDAR in situations such as tunnels, roadway overpasses or other data in which data outside the current area of interest obscures or overlays this area. The clip limits are also useful when using aerial LiDAR to help minimize tree cover.



Near and far clip diagram

The following two ground based static LiDAR examples show a 3D scene in which a tree obscures the area of interest then the result of the application of a near clip to remove the tree from the view. Once the near clip is activated and positioned, the user can move the eye point closer to the area for viewing and data collection and measurements. The eye point may also be rotated in any direction in X Y and Z and the near and far clips will remain in effect allowing the area of interest to be viewed from any angle and at any scale.

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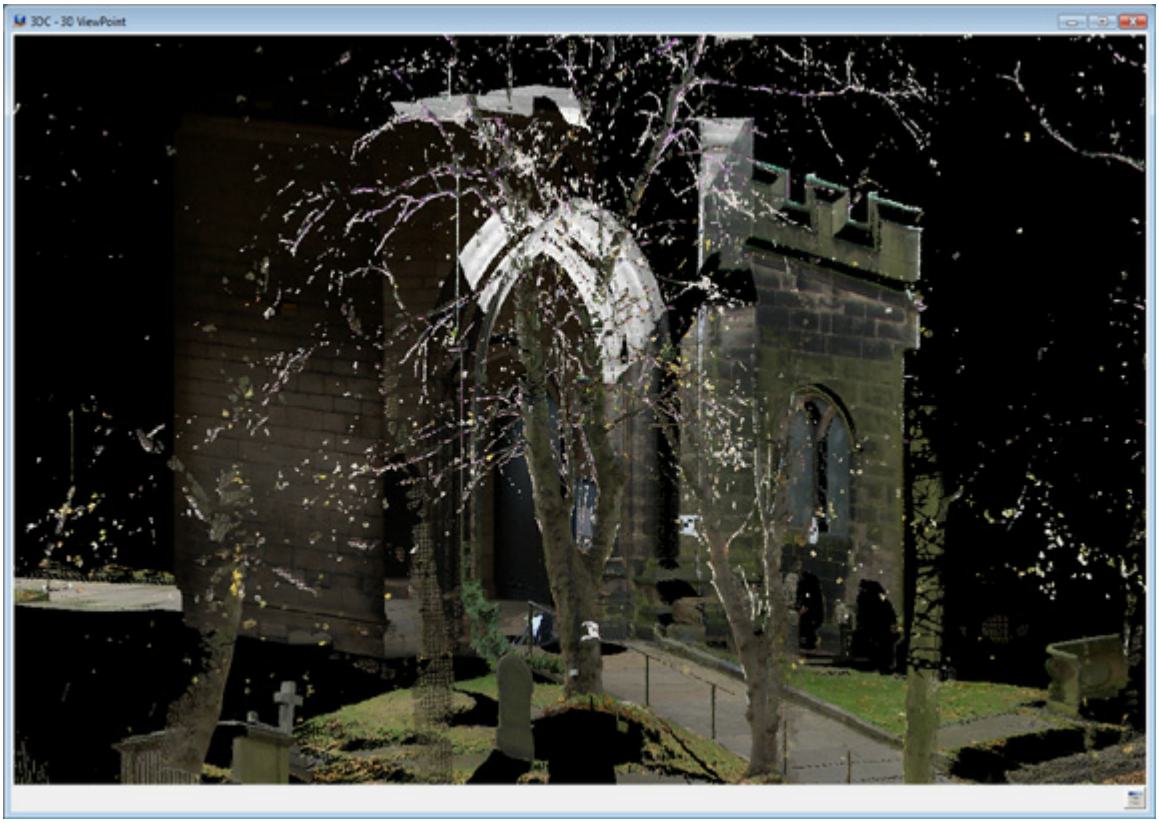

A scene from 3D VrThree showing a tree obscuring the area of interest



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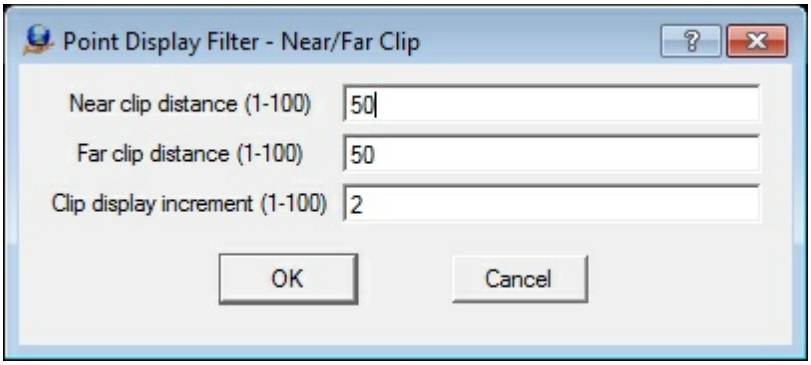
A scene from 3D VrThree showing the result of the application of a near clip

The values entered into the Near/Far Clip dialog are in arbitrary units from 1-100. The near and far clip distances may be edited interactively when clips are on in the 3D VrThree environment. If the "Adjust clip limits on recenter" is checked then the near and far clip distances will be modified when a new 3D center for the view is computed (recentered).



The Near/Far Clip dialog

Near Clip Distance (1-100)
Defines the distance from the 3D center of the view to the near clip plane.

Far Clip Distance (1-100)
Defines the distance from the 3D center of the view to the far clip plane.

Clip Display Increment (1-100)
Defines the near and far clip distance increment to add or subtract from the existing near and far clip distances when editing these values interactively.

Point Display Filter - Reset Filters on Startup

If this parameter is checked, the Z Slice filter, classification filter, return number filter will be unchecked and the Adjust clip limits on re-center will be checked when VrOne or VrTwo is started.

Point Color Parameters

The Point Color Parameters define the coloring scheme when points are displayed. Not all color options are supported by all LiDAR (Point) data sets. For example, RGB is typically not used for aerial based LiDAR.

Only one point color checkbox may be active. Pressing the Edit button to the right of the checkbox will allow the definition of parameters for that point color item.

Point Color Parameters - Entity

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The Entity color option colors VrPoints (LiDAR) by their layer numbers. This method uses the same method lines, symbols and text use to set colors which is with pen numbers. VrPoints are colored using the same color parameters that are used to color Vr Symbols using a pen table.

Point Color Parameters - Intensity

Each point in the database carries an intensity along with many other LiDAR point attributes. Intensity is one of the most popular methods used for coloring points.

In the measurement of light, intensity means irradiance, which is optical power per unit area (watts per square meter). The imprecise definition would be how much light (watts) the instrument received. There are a number of factors that affect the intensity value:

1. How much light was sent out;
2. Range to the target;
3. Attenuation of beam by atmosphere;
4. Reflectance of target (at the appropriate wavelength);
5. Incident angle of light on the target surface;
6. Size of receiver aperture;
7. Efficiency of receiver optics at focusing the return light onto receiver sensor;
8. Specularity reflection of the target surface.

Point Color Parameters - Intensity Histogram

The range of intensity vary between different LiDAR sensors and manufacturers. The Intensity histogram button displays a dialog containing the intensity range and point counts of the intensity values in the currently opened VrOne files.

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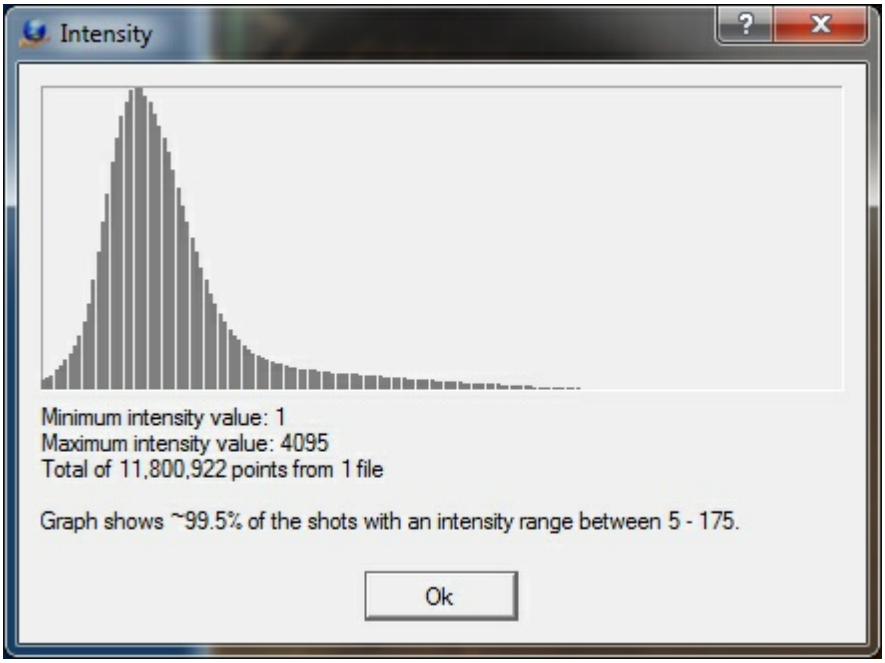
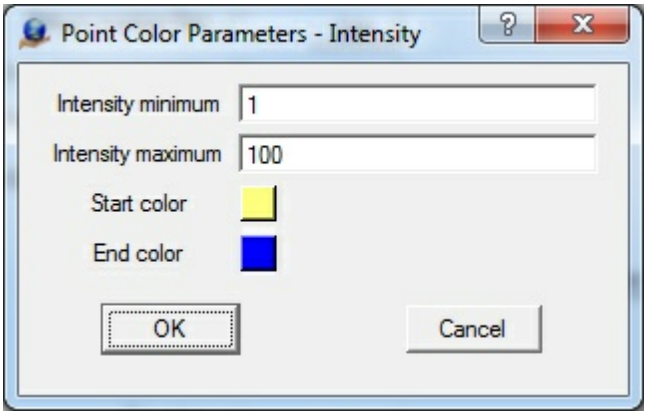


The Intensity histogram dialog

The above intensity histogram shows an intensity range from 0 to 255 however the majority of the point intensities are in the range of 0 to approximately 50. Moving the cursor over the histogram area of the dialog displays the intensity value and the number of points that have that value.

Point Color Parameters - Intensity Edit



The Intensity parameter dialog

The Intensity histogram may be used to determine the usable intensity value range of the currently opened VrOne files (see Intensity Histogram).

Intensity Minimum
Defines the minimum intensity value for which the start color will be assigned.

Intensity Maximum
Defines the maximum intensity value for which the end color will be assigned.

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Start Color
Defines the start color value. Press the color square to change the color assignment. Point colors will be blended from the start color to the end color for point intensities between the minimum and maximum intensities.

End Color
Defines the end color value. Press the color square to change the color assignment. Point colors will be blended from the start color to the end color for point intensities between the minimum and maximum intensities.

Point Color Parameters - Classification

User-defined colors may be assigned to each of the 32 ASPRS standard LiDAR point classes.

Point Color Parameters - Classification Edit

Color values may be assigned by pressing the color squares. The "Color blend" button will blend color assignments between classification 0 and classification 31. Classification 0 is the start color and classification 31 is the end color. The "Color random" button sets color assignments randomly for the 32 classifications.

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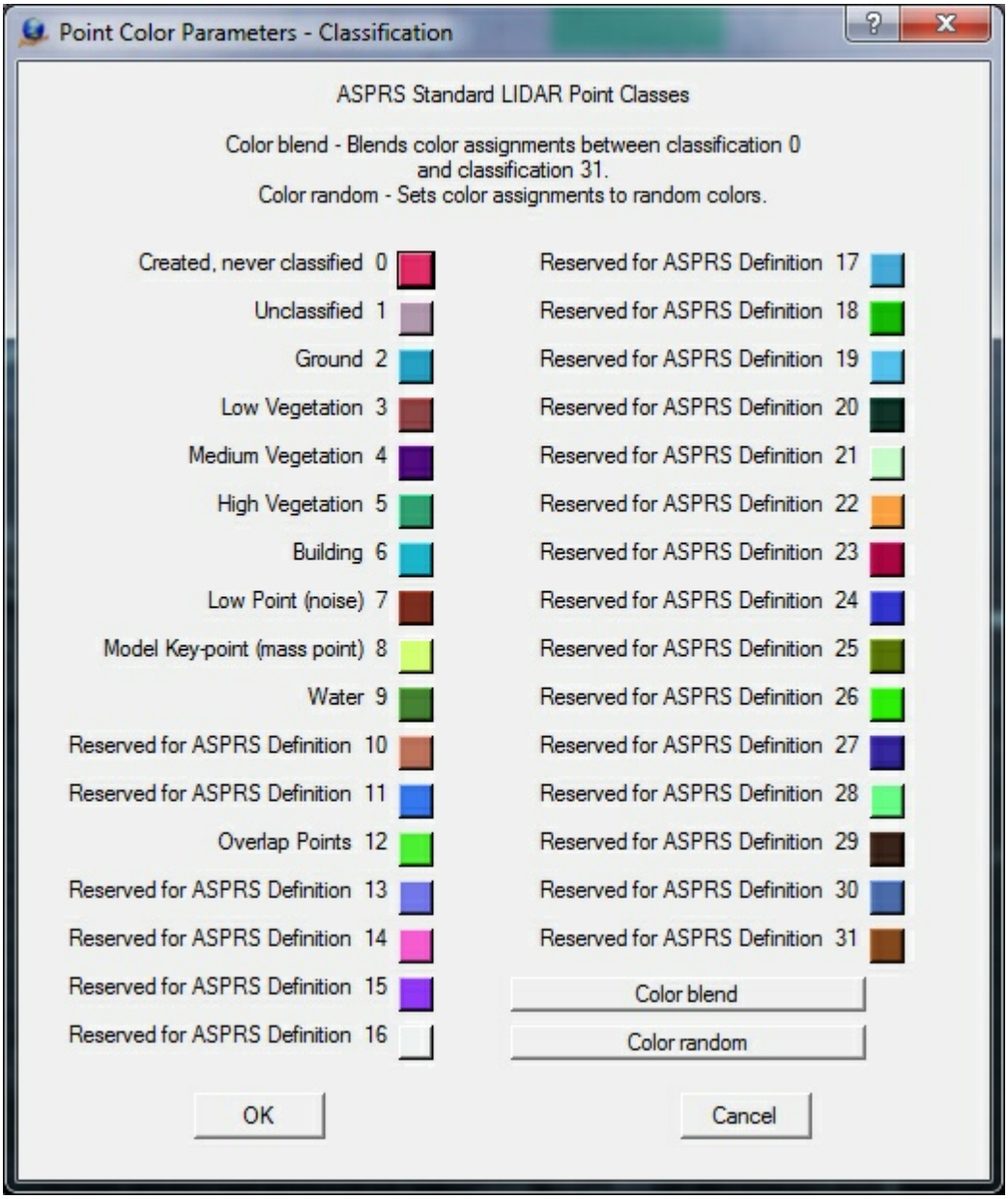

The Intensity color assignment dialog

Point Color Parameters - RGB

The point data base contains three color channels for each LiDAR point if these values exist. These fields are used to color each point and are normally obtained using secondary data, typically a camera. Checking this options will use these values. White will be used if RGB is not available.

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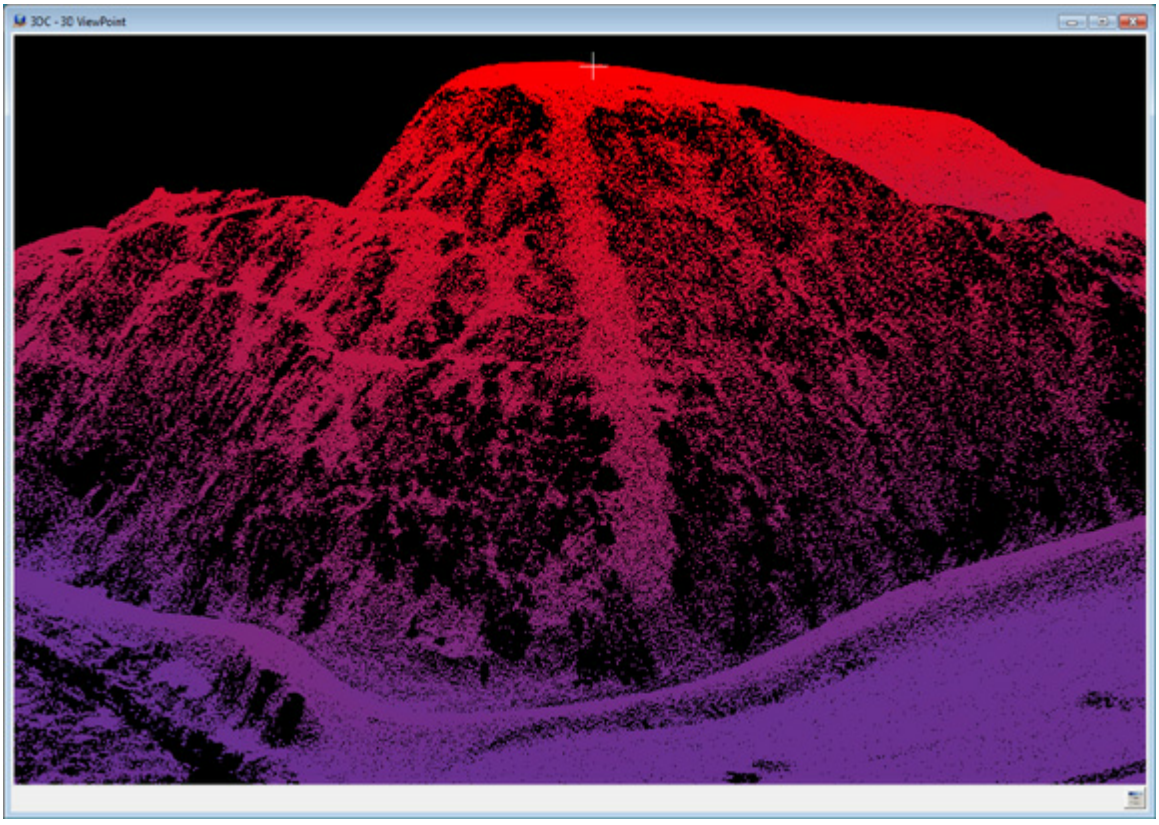
LiDAR points with RGB assignments

Point Color Parameters - Elevation

Colors points by elevation. Not all LiDAR data contains point intensities, classifications, or RGB values, but the data always contains elevations for each point. The option to color points using elevations is always available.



Point colors based on elevation

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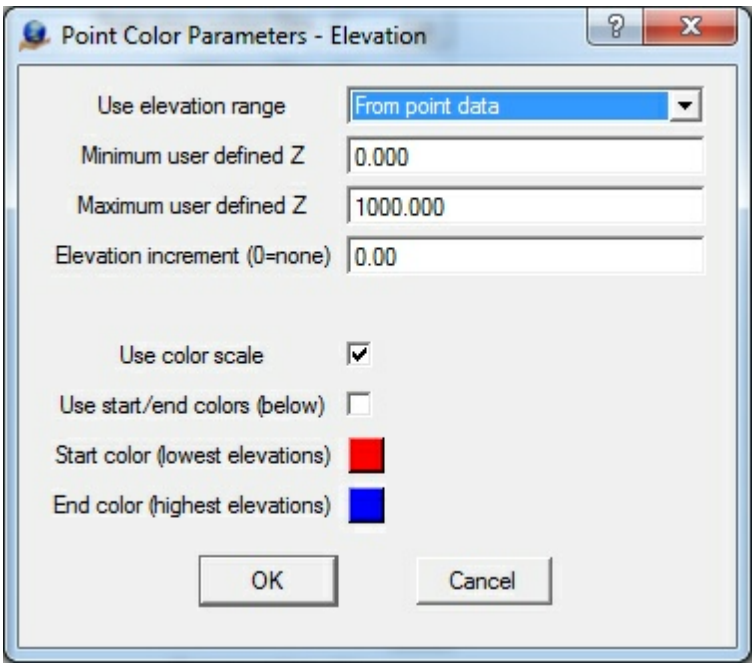
Points that fall below the minimum defined elevation will use the start color and points that fall above the maximum defined elevation will use the end color.



Point Color Parameters - Elevation dialog

Use elevation range
When displaying point colors based on elevation, the elevation range may be defined "From Point data" or "From a user defined Z range". If "From user defined Z range" is selected then the minimum and maximum user defined Z will be used.

Minimum user defined Z
If the "Use elevation range" option is set to "From user defined Z range", this value will be used for the minimum elevation when setting point colors.

Maximum user defined Z
If the "Use elevation range" option is set to "From user defined Z range", this value will be used for the maximum elevation when setting point colors.

Elevation increment (0=none)
If this parameter is set to a non zero positive number, the Point colors will be held to a constant value for this elevation increment (see example below). When this parameter is set to zero, the point colors are evenly blended from the minimum defined elevation to the maximum defined elevation.

Use color scale
Using the color scale defines the color for the lowest elevations to the highest in a predefined, broad color range. This setting overrides the "Start color" and "End color" parameters.

Use start/end colors (below)
When checked, the "Start color" and "End color" parameters will be used to define the colors for

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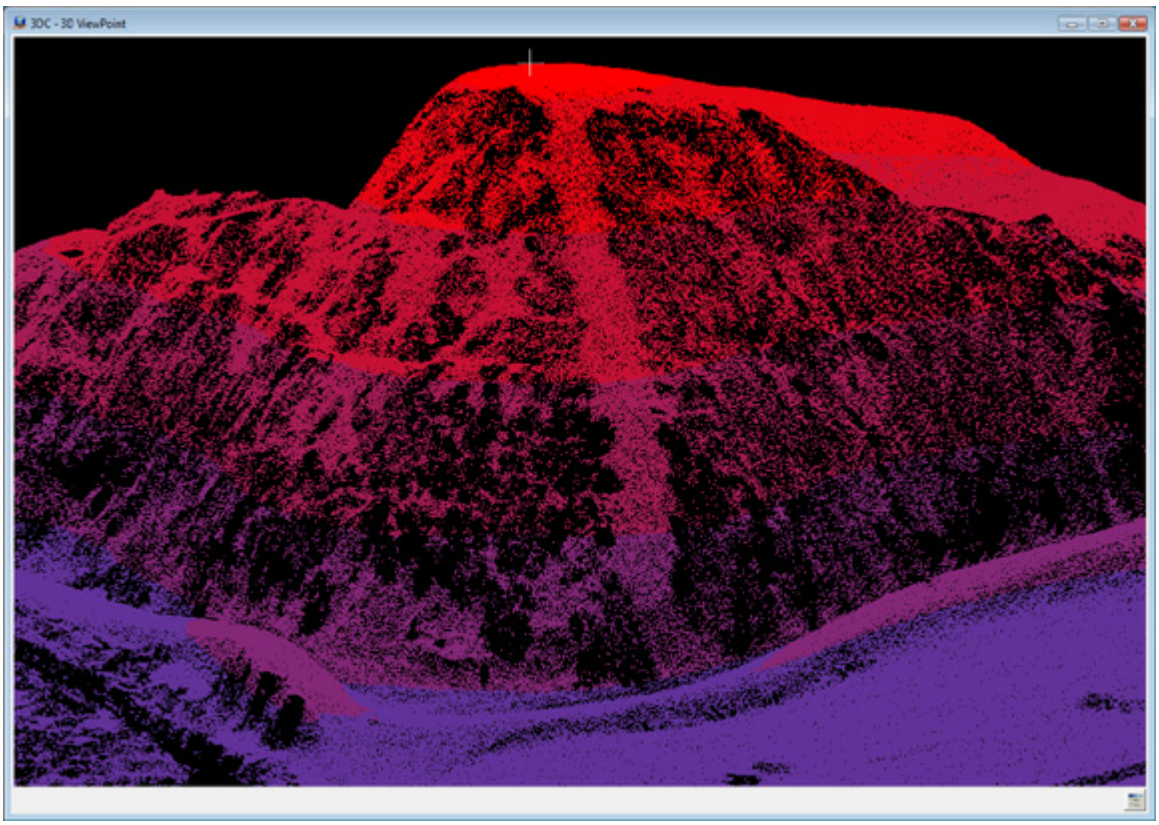
the lowest to highest elevations.

Start color (Lowest Elevations)
Defines the start color value for the lower elevation. Press the color square to change the color assignment. Point colors will be blended from the start color to the end color for elevations between the minimum and maximum elevation range.

End color (Highest Elevations)
Defines the end color value for the highest elevation. Press the color square to change the color assignment. Point colors will be blended from the start color to the end color for elevations between the minimum and maximum elevation range.



Point colors based on elevation using the Elevation Increment option

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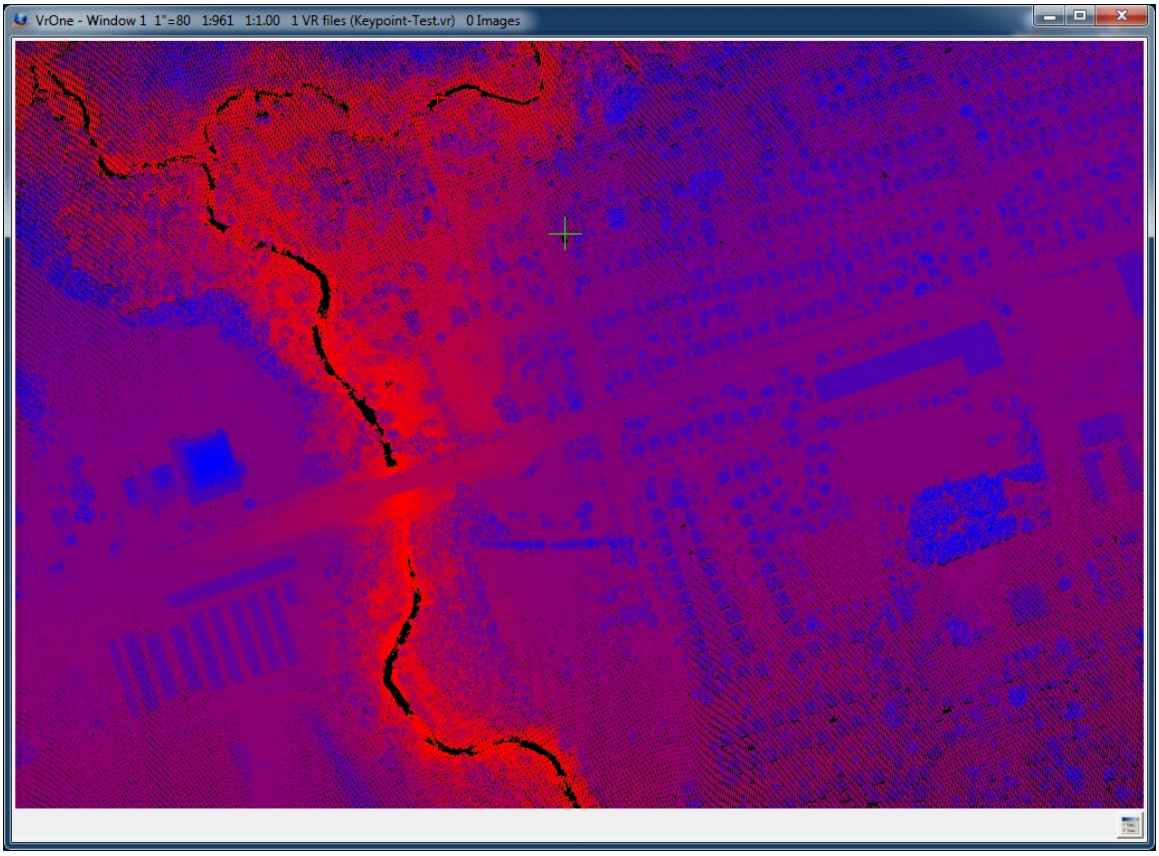

Point colors based on elevation using start and end colors of red and blue

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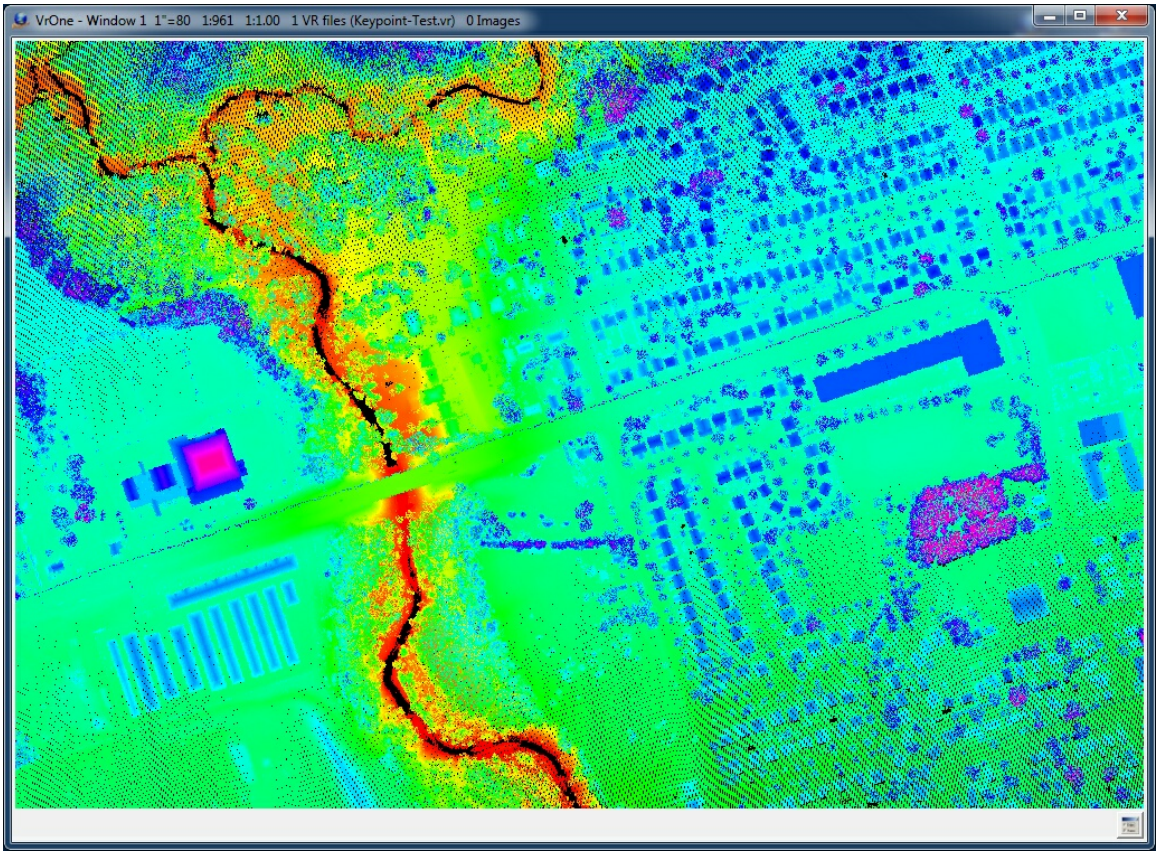

Point colors based on elevation using color scale

Point Color Parameters - Elevation Histogram

The Elevation histogram button displays the elevation range values of the VrPoints in the currently opened VrOne files.

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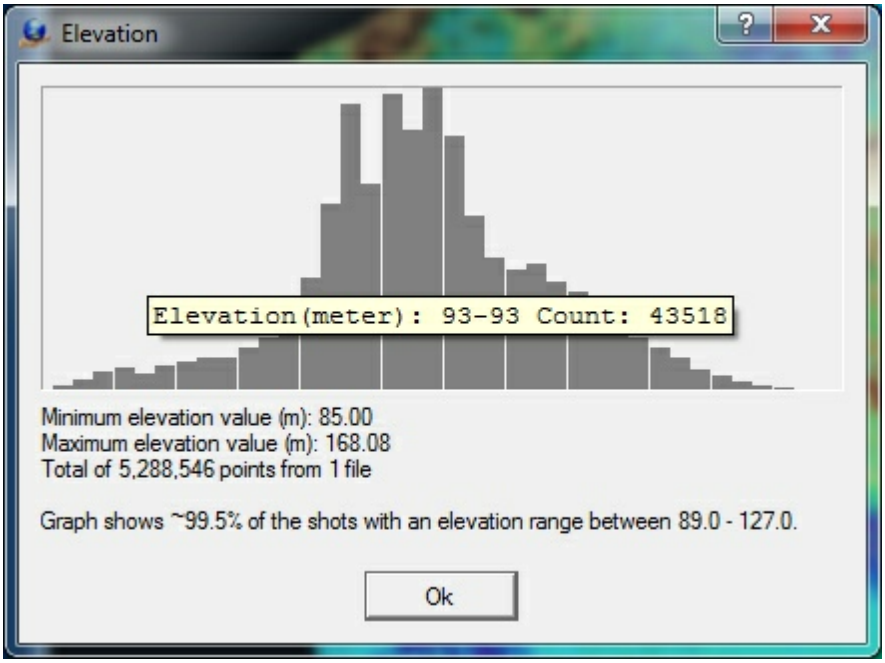

Elevation histogram

Point Color Parameters - Slice

This option allows the setting of individual colors for user defined elevation ranges. This option is useful when elevation ranges need to be identified.

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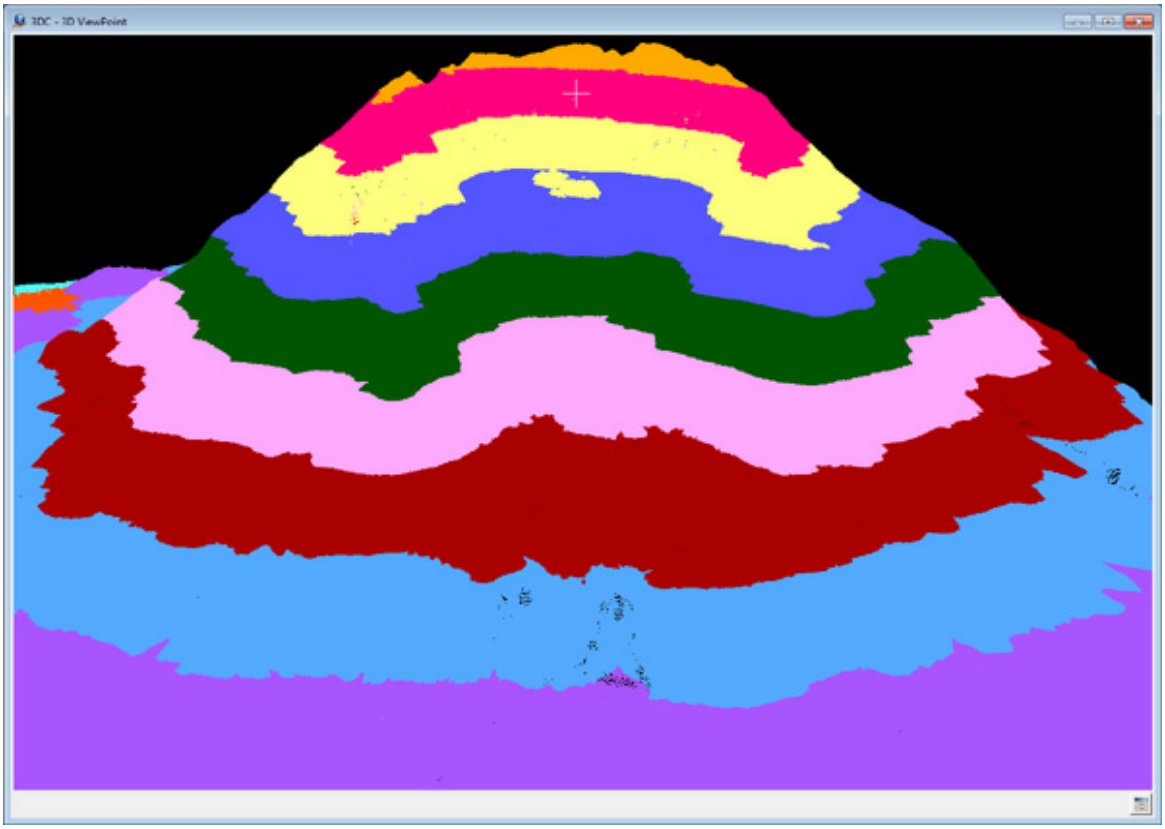

Scene from 3D VrThree of Mount St. Helens showing color slices

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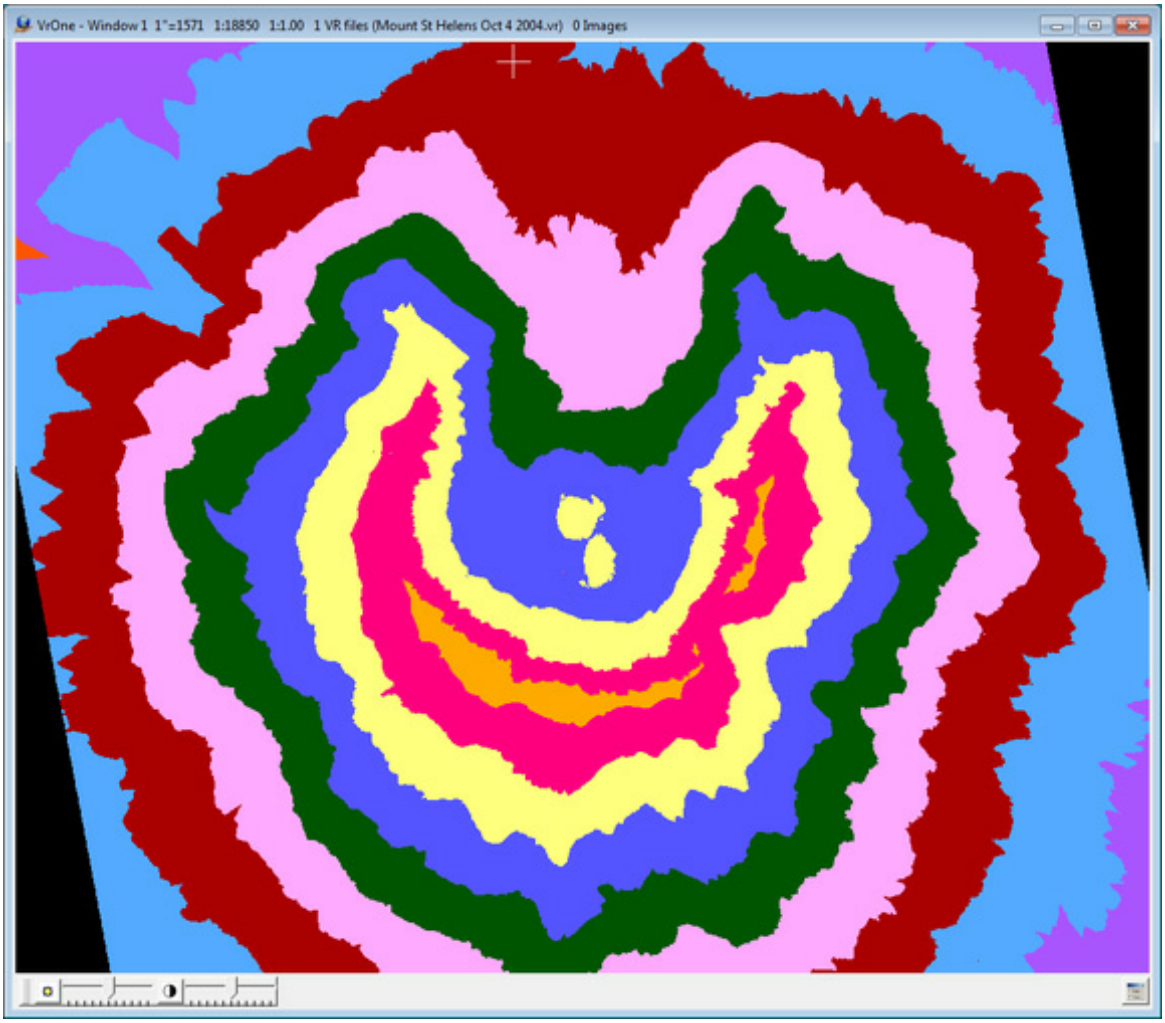

Scene from VrOne of Mount St. Helens showing color slices

Up to 20 elevation slices may be defined. If both the minimum and maximum elevations are set to zero the slice will not be used.

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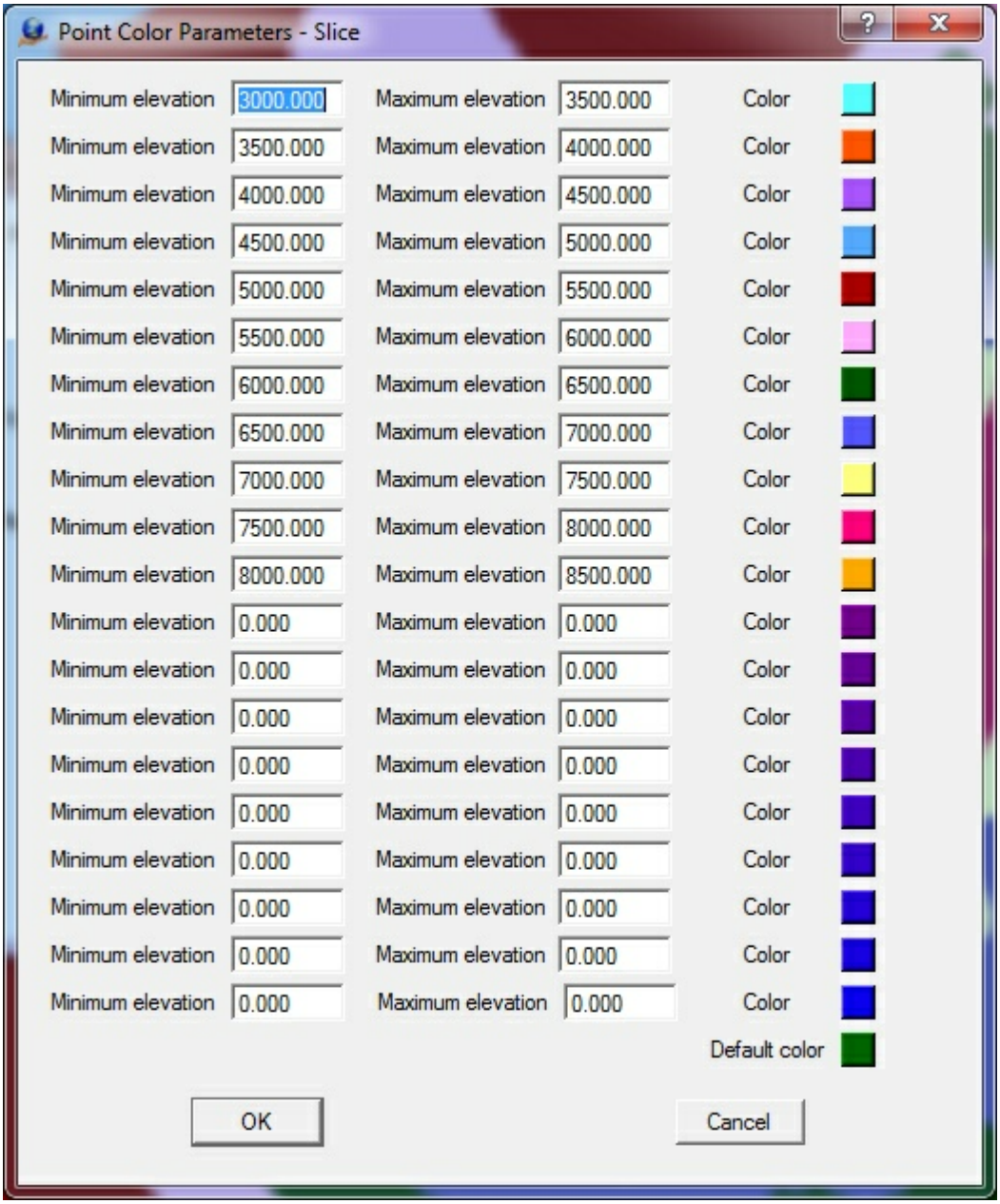

Point Color Parameters -Slice Dialog

Minimum User Defined Z

Defines the minimum elevation for the Z slice in ground units.

Maximum User Defined Z

Defines the maximum elevation for the Z slice in ground units.

Color

Shows the current color for the Z slice. Press the color square to change the color.

Point Color Parameters - Sensor Number

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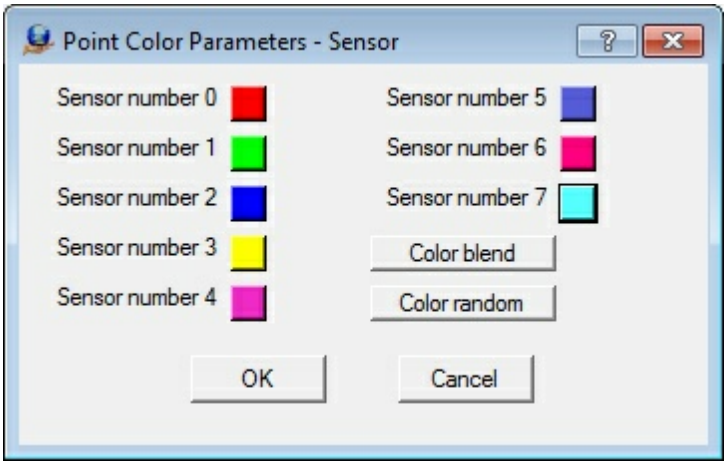
LiDAR collection platforms such as mobile LiDAR may use more than one sensor that work simultaneously. The Sensor Number parameter allows filtering by up to eight sensor numbers. On input, the sensor number may be embedded in the input file name. Starting at LAS version 1.4, the sensor number is a point attribute in this format. Selecting "Sensor number" colors points based on up to eight sensor numbers.

Color values may be assigned by pressing the color squares. The "Color blend" button will blend color assignments between sensor number 0 and sensor number 7. Sensor color 0 is the start color and sensor color 7 is the end color. The "Color random" button sets color assignments randomly for the 8 sensors.



Point Color Parameters - Sensor color dialog

Point Color Parameters - Flight/strip Number

Each point in the VrPoint (LiDAR) database has an attribute for the storage of the flight or strip number. In aerial applications, this number may indicate a flight line number; in the case of mobile LiDAR collection, it may indicate a pass number. On input, the flight/strip numbers may be embedded in the input file name. This attribute is not part of the LAS format. Selecting "Flight/strip number" will color points based on their flight/strip number.

Color values may be assigned by pressing the color squares. The "Color blend" button will blend color assignments between flight/strip number 0 and flight/strip number 255. Sensor color 0 is the start color and sensor color 255 is the end color. The "Color random" button sets color assignments randomly for the 256 flight/strip numbers.

There are 256 possible flight numbers from 0 to 255. 64 of these flight/strip numbers are displayed in the dialog at one time. Pressing the Previous or Next buttons will move between the four possible pages.

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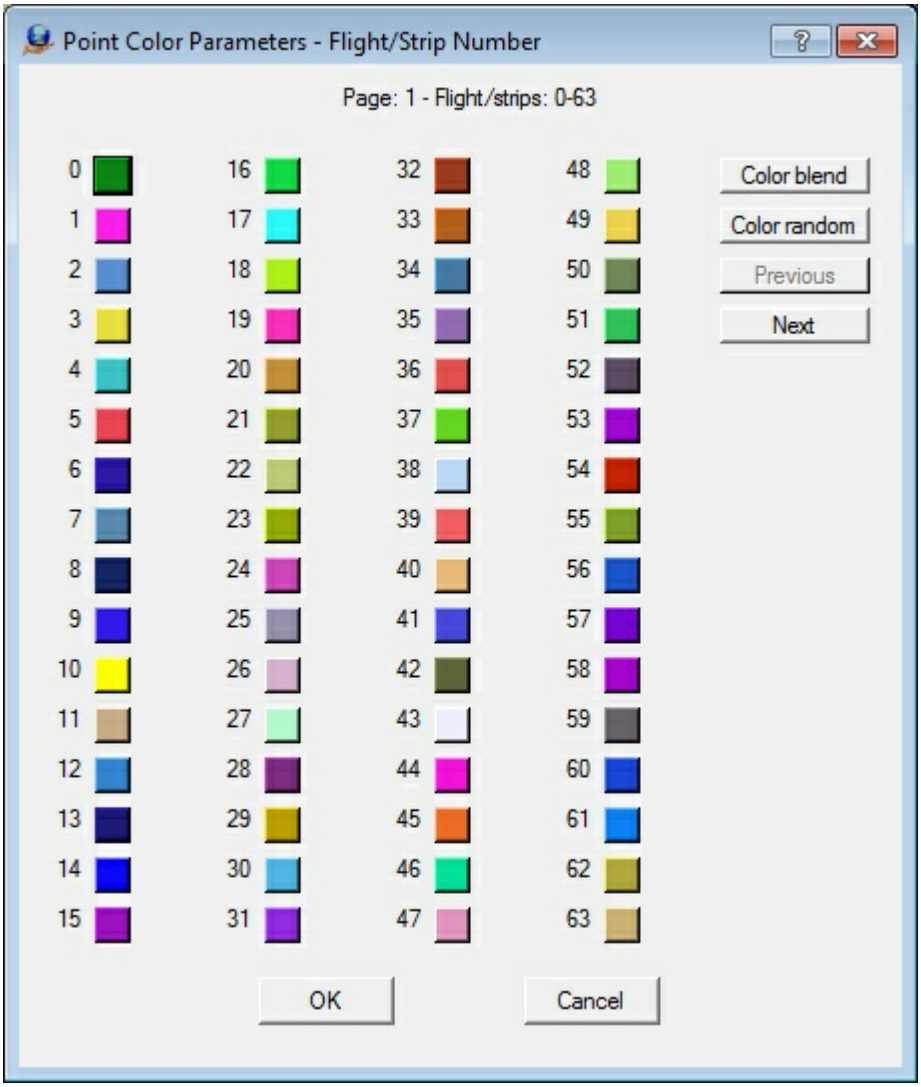

Point Color Parameters - Flight/Strip Number dialog

Point Color Parameters - Intensity Drape

When coloring VrPoint (LiDAR) data using any of the coloring options (except Intensity) it is possible to add intensity coloring in addition to the current coloring option. Selecting "Intensity Drape" will turn this coloring addition on.

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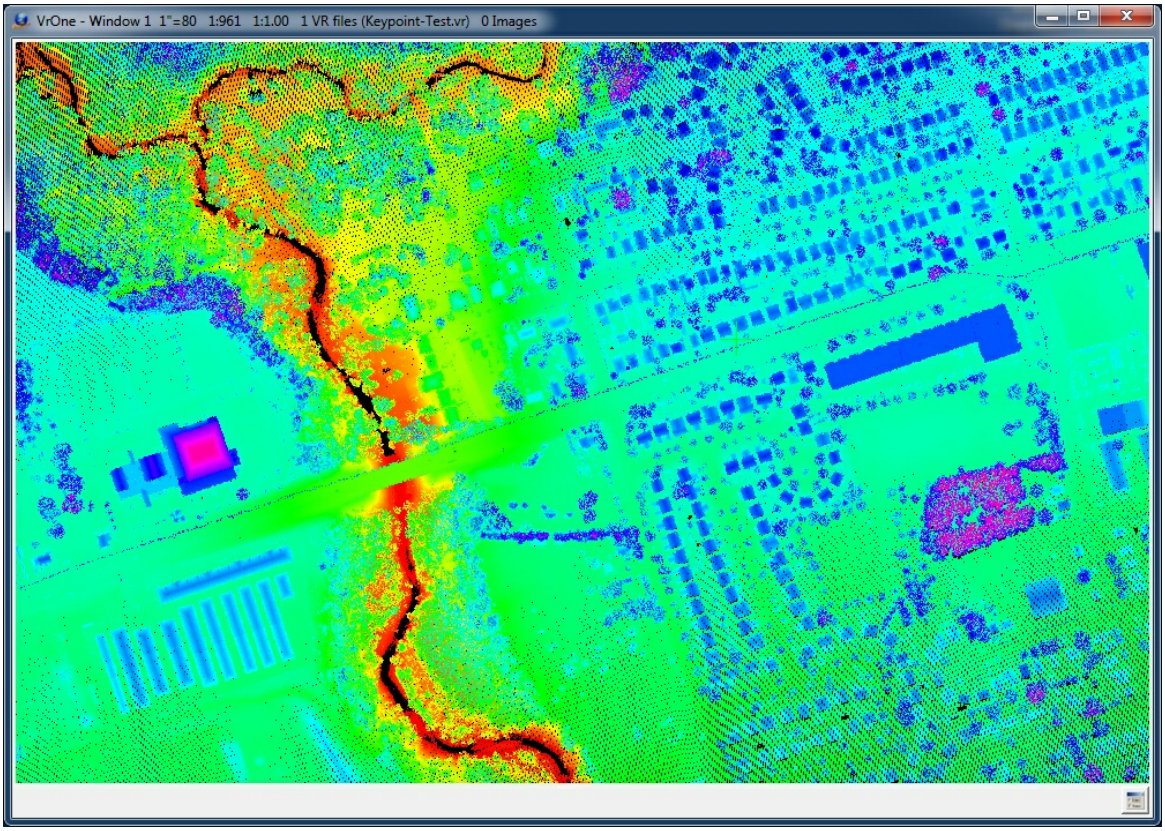

Point colors based on elevation using color scale without Intensity Drape

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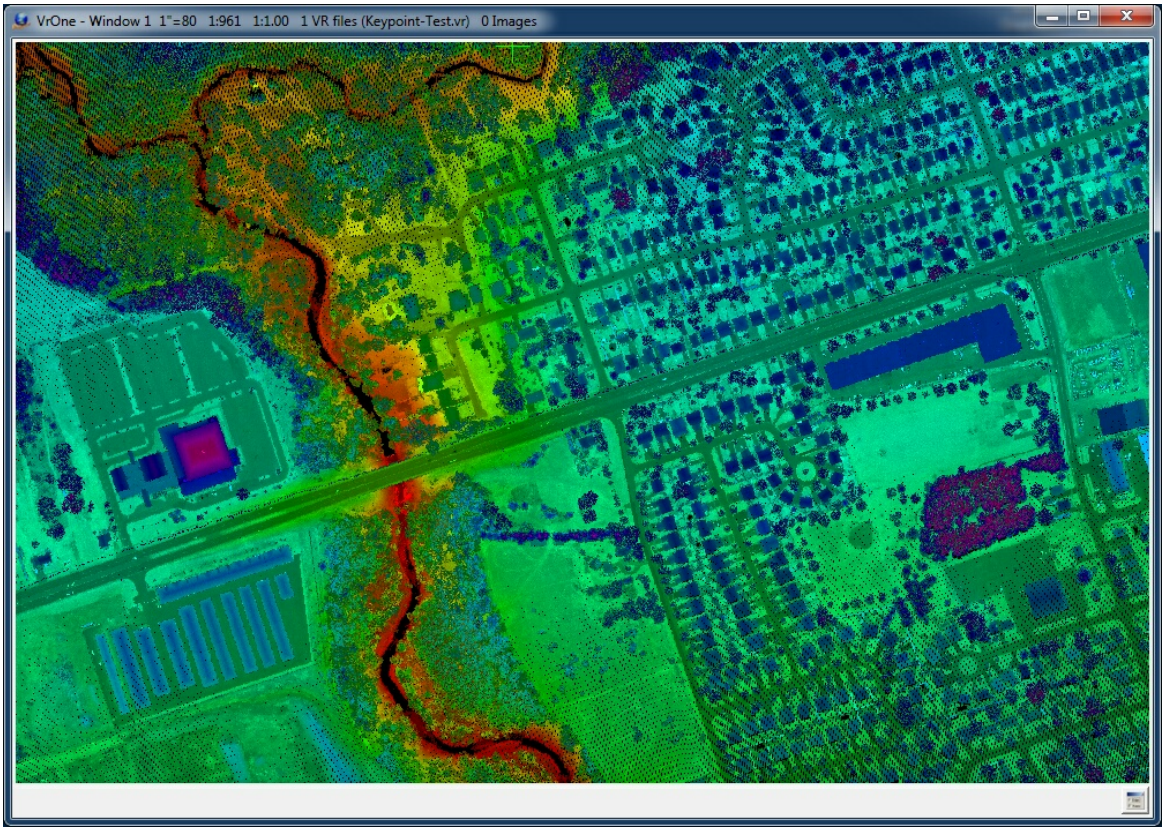

Point colors based on elevation using color scale with Intensity Drape

Point Display Key-ins

Following are equivalent Vr key-ins for conditioning the Point Display parameters.

Description	Key-in	Keyword	Parameters	Example
Point Display Filter - Z Slice - On/Off	PoiFilZsl	On|Off|Tog		`PoiFilZsl On`
Point Display Filter - Z Slice - Set Base Z	PoiFilZsl	BasZ	BaseZ	`PoiFilZsl BasZ 117.0`
Point Display Filter - Z Slice - Set Z Range	PoiFilZsl	RanZ	RangeZ	`PoiFilZsl RanZ 4.0`
Point Display Filter - Minimum Delta Z	PoiFilZsl	MinDel	Minimum Delta Z	`PoiFilZsl MinDel -2.0`
Point Display Filter - Minimum Delta Z	PoiFilZsl	MaxDel	Maximum Delta Z	`PoiFilZsl MaxDel 5.0`

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Point Display Filter - Classification - On/Off	PoiFilCla	On|Off|Tog		PoiFilCla On
Point Display Filter - Classification - Set	PoiFilCla	Set	NumberLine (0-31) On|Off	PoiFilCla Set 0-5;7;14 On
Point Display Filter - Return Number - On/Off	PoiFilRet	On|Off|Tog		PoiFilRet On
Point Display Filter - Return Number - Return number to display (0=Last)	PoiFilRet	RetNum	0-5	PoiFilRet RetNum 0
Point Display Filter - Sensor Number - On/Off	PoiFilSen	On|Off|Tog		PoiFilSen On
Point Display Filter - Sensor Number - Sensor numbers to display	PoiFilSen	Set	NumberLine (0-7) On|Off	PoiFilSen Set 0;3-5 On
Point Display Filter - Flight/Strip Number - On/Off	PoiFilFli	On|Off|Tog		PoiFilFli On
Point Display Filter - Flight/Strip Number - Strip numbers to display	PoiFilFli	Set	NumberLine (0-255) On|Off	PoiFilFli Set 0-5;7;14 On
Point Display Filter - GPS Time - On/Off	PoiFilGps	On|Off|Tog		PoiFilGps On
Point Display Filter - GPS Time - Min time to display	PoiFilGps	Min	GPS Time	PoiFilGps Min 1000
Point Display Filter - GPS Time - Min time to display	PoiFilGps	Max	GPS Time	PoiFilGps Max 5000
Point Display Filter - Scan Angle - On/Off	PoiFilSca	On|Off|Tog		PoiFilSca On
Point Display Filter - Scan Angle - Min Scan Angle to display	PoiFilSca	Min	Angle (degrees)	PoiFilSca Min -20
Point Display Filter - Scan Angle - Max Scan Angle to display	PoiFilSca	Max	Angle (degrees)	PoiFilSca Max 20
Point Display Filter - KeyPoint - On/Off	PoiFilKey	On|Off|Tog		PoiFilKey Tog
Point Display FIlter - Turn all filters off	PoiFilOff			PoiFilOff

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Point Color Parameters - Entity (Color by layer) - On	PoiColEnt	On		PoiColEnt Off
Point Color Parameters - Intensity - On	PoiColInt	On		PoiColInt On
Point Color Parameters - Intensity - Intensity minimum	PoiColInt	Min	Intensity	PoiColInt Min 100
Point Color Parameters - Intensity - Intensity maximum	PoiColInt	Max	Intensity	PoiColInt Max 4096
Point Color Parameters - Intensity - Start color	PoiColInt	StaCol	R-G-B	PoiColInt StaCol 20-40-255
Point Color Parameters - Intensity - End color	PoiColInt	EndCol	R-G-B	PoiColInt EndCol 125-50-255
Point Color Parameters - Classification - On	PoiColCla	On		PoiColCla On
Point Color Parameters - Classification - Set color	PoiColCla	Col	Classification# R-G-B	PoiColCla Col 5 75-0-255
Point Color Parameters - RGB - On	PoiColRgb	On		PoiColRgb On
Point Color Parameters - Elevation - On	PoiColEle	On		PoiColEle On
Point Color Parameters - Elevation - Elevation range source	PoiColEle	Sou	Poi | Usr	PoiColEle Sou Poi
Point Color Parameters - Elevation - Minimum user defined Z	PoiColEle	MinZ	Elevation	PoiColEle MinZ 630.0
Point Color Parameters - Elevation - Maximum user defined Z	PoiColEle	MaxZ	Elevation	PoiColEle MaxZ 860.0
Point Color Parameters - Elevation - Elevation increment (0=none)	PoiColEle	EleInc	ElevationIncrement	PoiColEle EleInc 5.0
Point Color Parameters - Elevation - Start color for lowest elevation	PoiColEle	StaCol	R-G-B	PoiColEle StaCol 25-45-75
Point Color Parameters - Elevation - End color for highest elevation	PoiColEle	EndCol	R-G-B	PoiColEle EndCol 125-50-255
Point Color Parameters - Elevation - Color scale type to use	PoiColEle	ScaTyp	Sca|Usr|Tog (Scale or User)	PoiColEle ScaTyp Sca

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Point Color Parameters - Slice - On	PoiColSli	On		PoiColSli On
Point Color Parameters - Slice - Slice elevations	PoiColSli	SliZ	Index MinZ MaxZ	PoiColSli SliZ 10 3000.0 350
Point Color Parameters - Slice - Color for elevation slice	PoiColSli	SliCol	Index R-G-B	PoiColSli SliCol 10 120-80-1
Point Color Parameters - Slice - Default color	PoiColSli	DefCol	R-G-B	PoiColSli DefCol 255-0-255
Point Color Parameters - Slice - Reset elevation parameters	PoiColSli	ResZ		PoiColSli ResZ
Point Color Parameters - Sensor - On	PoiColSen	On		PoiColRgb On
Point Color Parameters - Flight/ strip Number On	PoiColFli	On		PoiColFli On
Point Color Parameters - Intensity Drape - On/Off	PoiColIDr	On|Off|Tog		PoiColIDr On

Point Display Key-In Parameter Notes

- **Number Line** - Blanks and commas are used to separate commands on a Vr key-in. When using a number line, semicolons, colons, or stars should be used to separate the fields. For example: to specify classifications 0, 1, 2, 3, 4, 5, 7, 14, the number line "0-5;7;14" could be used.
- **Tog** - When Tog is listed as a keyword or parameter option, it may be used to toggle the current value. For example, if the classification filter were turned on, "PoiFilCla Tog" would turn it off.
- **Red Green Blue (RGB) values** - The red, green and blue values that define a color are separated with a dash. For example, 127-255-212 would define the color aquamarine.
- **Point Filters** - Multiple point filters (PoiFil) can be active.
- **Point Color** - Only one point color (PoCol) mode can be active. When a mode is selected the previous color mode is de-selected.
- **Point Color Parameters - Slice** - The Index is the elevation slice number. There may be up to 20 elevation slices. The range of Index is from 1 to 20.

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2.1.1.7.2 Point Set Z

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DOCUMENTATION
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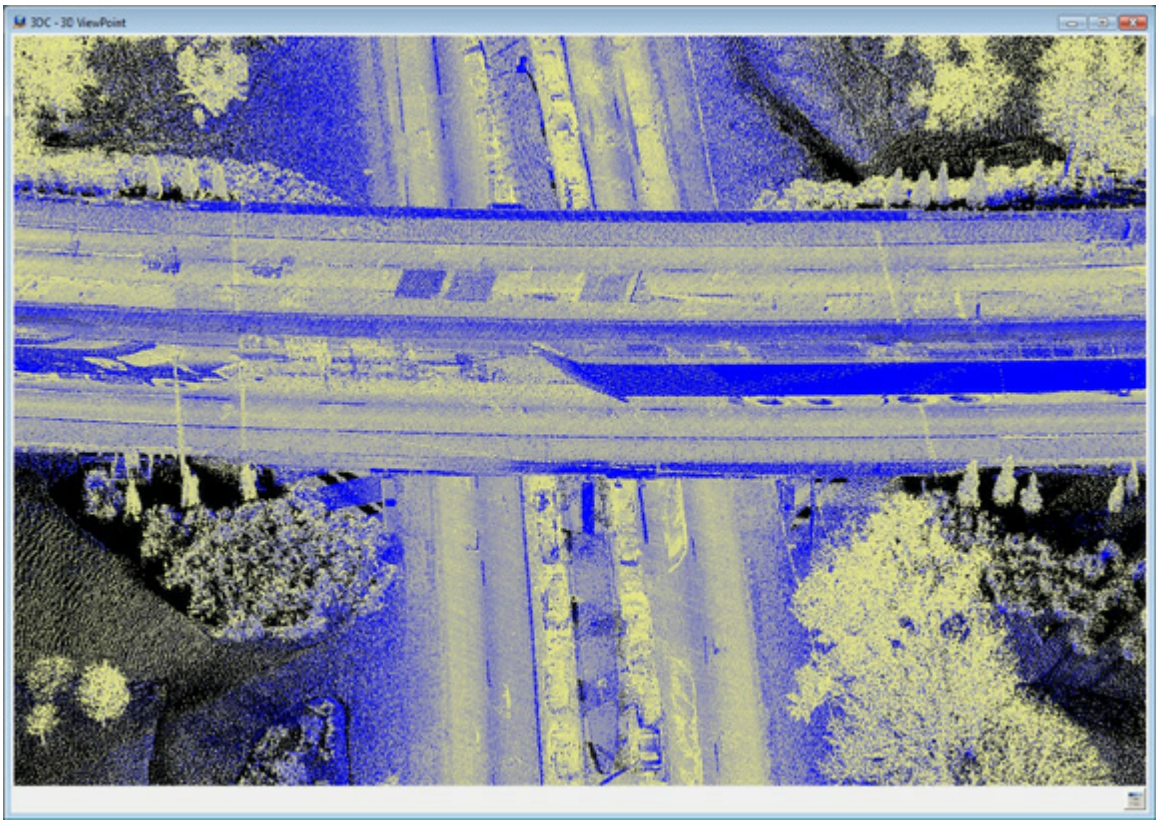
Vr Mapping

Point Set Z (PoiSetZ)

Type: Interactive - Display Management

When the Point Z Slice filter is active only points that fall within the elevation range are displayed. This filter is useful when some of the point data -- like decks, tunnels, and areas of tree cover -- obscure other data. The Z Slice filter may be turned on/off with the check box. The following is an example of a Z Slice applied to an overpass area in which LiDAR data was collected on a highway overpass and on the roadway under it. By using the Z Slice filter, either the overpass or the roadway may be isolated for viewing and data collection.



Overpass area with all data displayed

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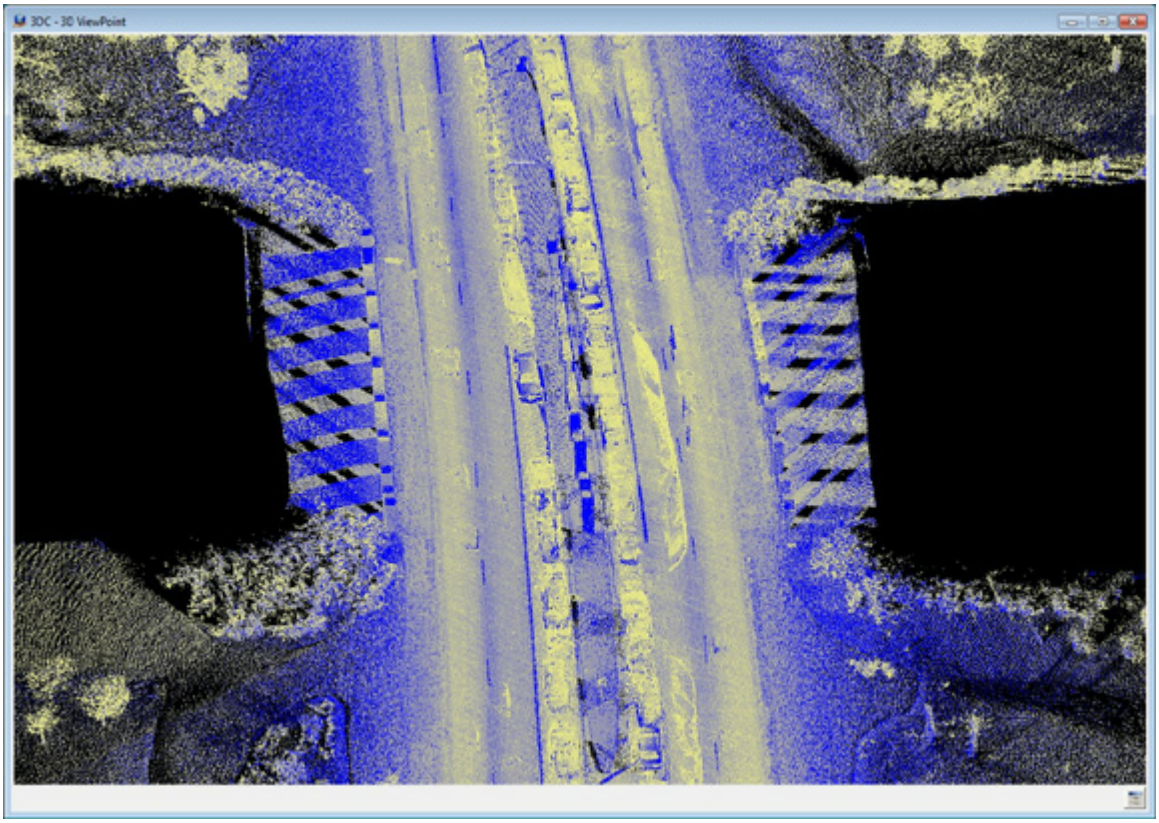

Overpass area with Z Slice showing roadway without bridge deck

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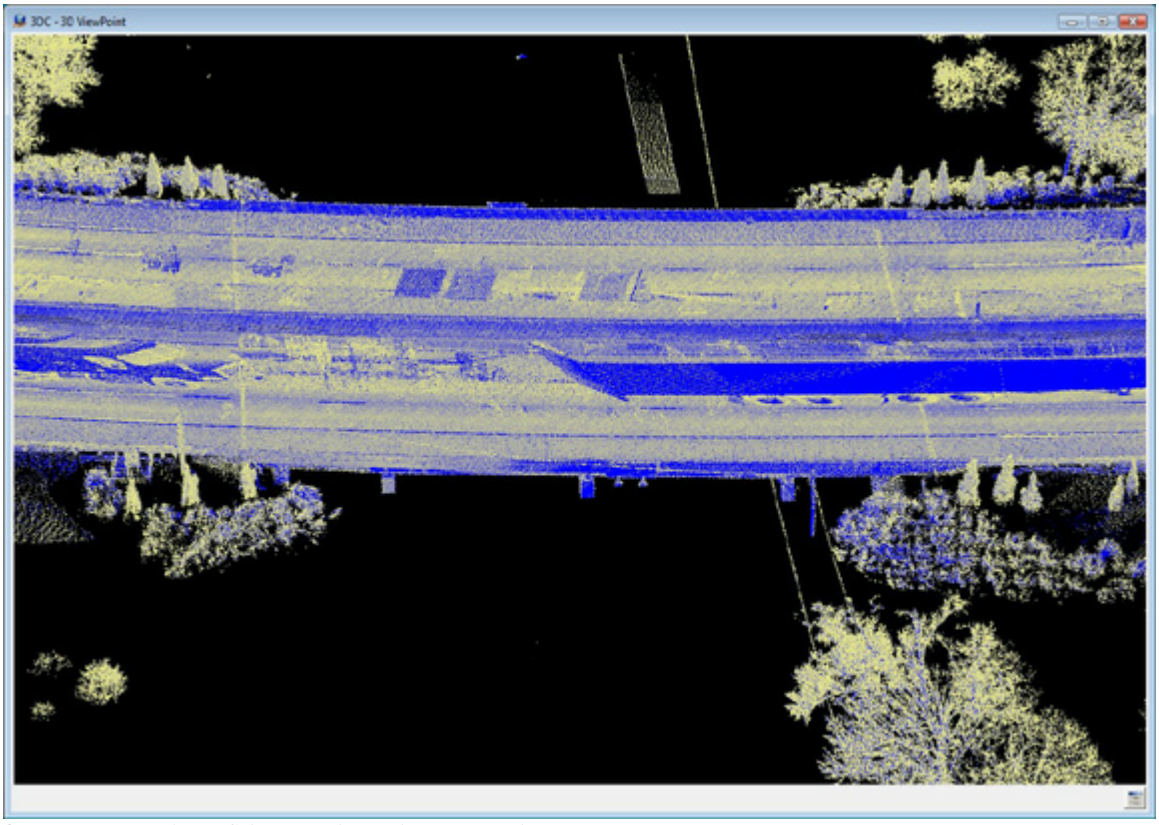

Overpass area with Z Slice showing bridge deck without road

The Z Slice is defined as a base elevation (Base Z) and an elevation range (Range Z). The Z Slice is computed by subtracting the Range Z from the Base Z for the lower elevation and by adding the Range Z to the Base Z for the upper elevation.

Points with an elevation in the Z Slice range will be displayed if the point passes other active point filters also.

The Z Slice parameters may also be set in Point Display (PoiDis).

Local Commands

Key-in	Description	Range
BasZ=	Sets the Base Z	Ground coordinate
RanZ=	Sets the Range Z	Ground coordinate

Button Assignments

Point Set Z

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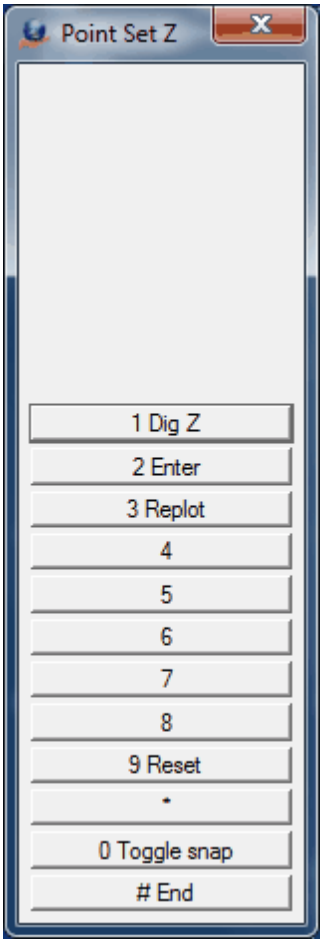

Button	Description
1 Dig Z	Digitizes an elevation at the current cursor location for the Base Z
2 Enter	Allows entry/edit of the Base Z and the Range Z
3 Replot	Replots graphics
4	
5	
6	
7	
8	
9 Reset	Resets parameters
*	
0 Toggle snap	Toggles snapping on / off
# End	Ends Point Set Z

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Vr Mapping

Window Clip View (WinCli)

Type: Interactive - Display Management

Rotates the view in 3D VrThree along a user digitized base line (about the z axis) to the x display axis. This is similar to a cross section view. Along with the view direction, a near/far clip distance may also be defined by digitizing the distance or by entering it as a parameter. The viewing angle along the x axis may also be defined. An x viewing angle of 0 would be a top view while an angle of 90 would be a side view.

Window Clip View is useful when isolating point cloud and LiDAR points for interactive applications such as reclassification. Once a view is set, all the available viewing operations in 3D VrThree are available.

Please see Point Display - Adjust Clip Limits on Recenter for more information about near/far display clipping.

NOTE: Window Clip View is only available in the 3D VrThree 3D stereo (3DSC or Vr3 or VrThree) and 2.5 dimension (3DC) environments.

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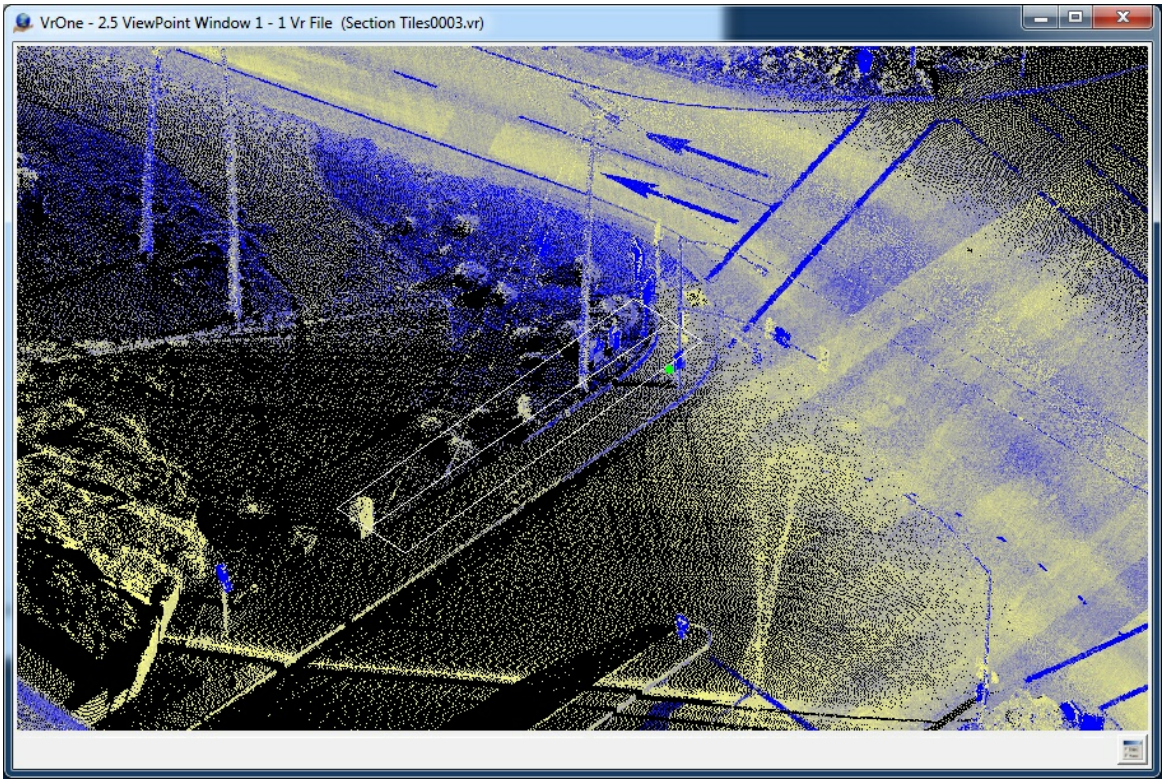
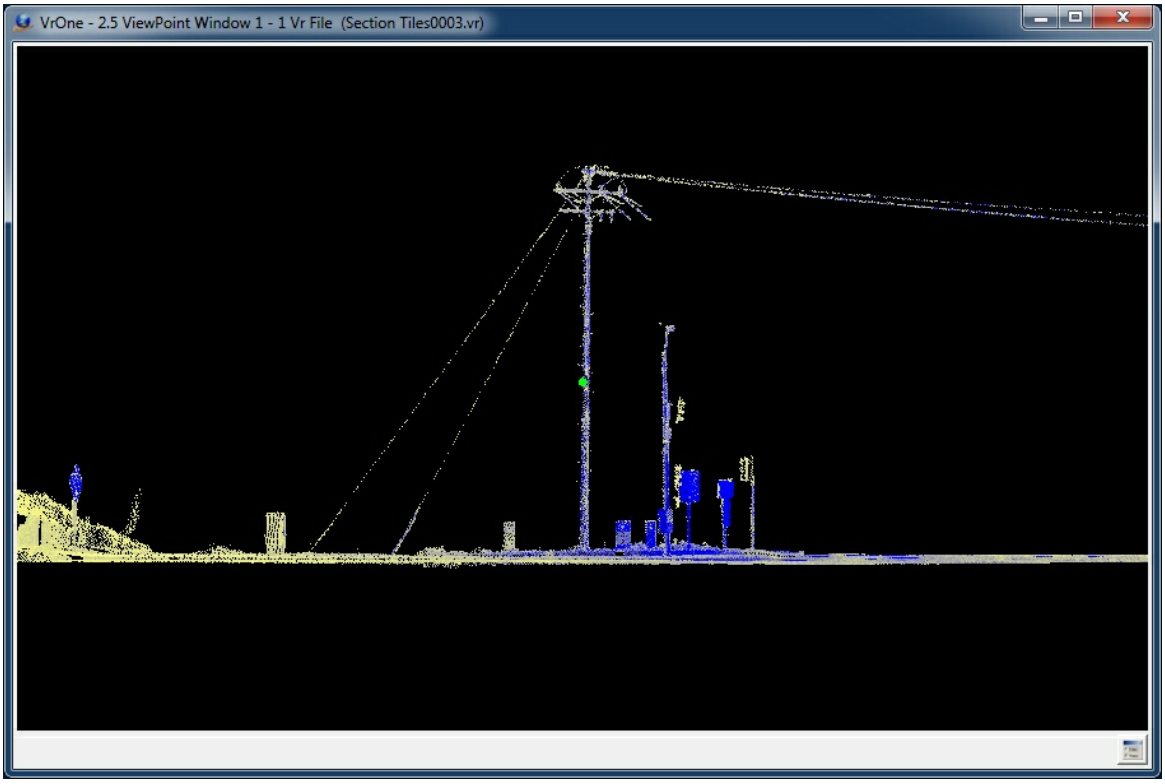


View showing the base line and clip limits



Resulting view rotated 90 degrees (side view) with the base line along the x display axis

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Button Assignments



Window Clip View Menu Keys dialog

Button	Description
1 Dig point n	Digitizes points 1 and 2 of the base line and optionally, the clip width
2	
3	
4	
5	
6	
7 Enter params	Allows entry/edit of parameters (see Parameters below)
8	
9	
*	
0	
# End	Ends Window Clip View

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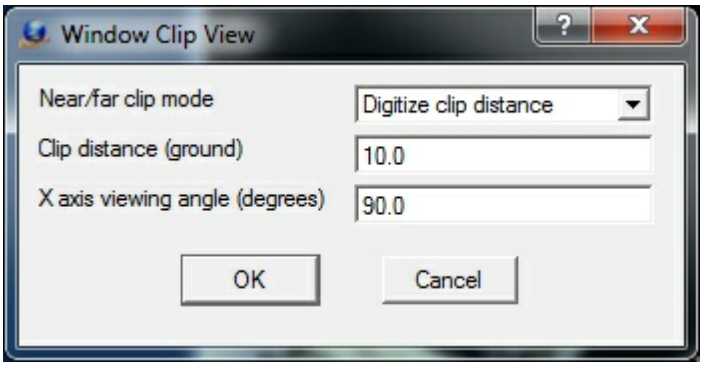
Parameters



Enter Parameters dialog box

Near/far clip mode

Defines the near/far clipping mode and the method of determining the clipping distance. Options include:

- **Clip off** - Near/far clipping is turned off.
- **Digitize clip distance** - After the base line is digitized using two points, the third digitized point defines the clipping distance.
- **Use 'Clip distance'** - The near/far clipping distance is defined by the user in the 'Clip distance' field.

Clip distance (ground)

If the 'Near/far clip mode' is set to 'Use Clip distance', this parameter defines the near/far clipping distance. This distance from the base line to the near and far clip limits so the total clipping distance is twice this parameter. The Clip distance is entered as ground units.

X axis viewing angle (degrees)

Defines the viewing angle about the x axis after the view has been rotated to the base line. The parameter has a range of 0 degrees to 360 degrees. A rotation angle of 0 would be a top view and a rotation of 90 degrees would be a side view. Following are several examples of the X axis viewing angle.

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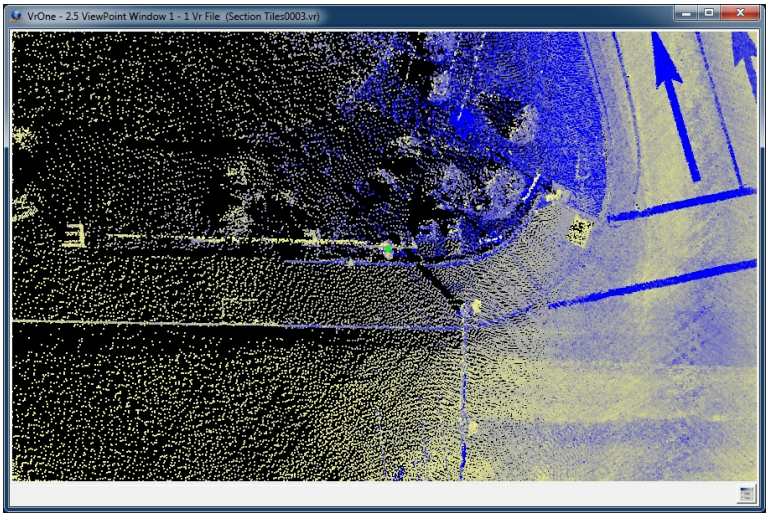
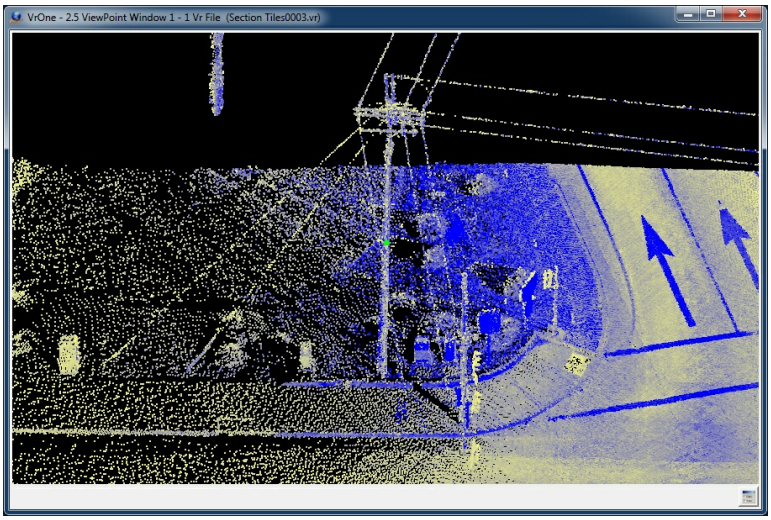
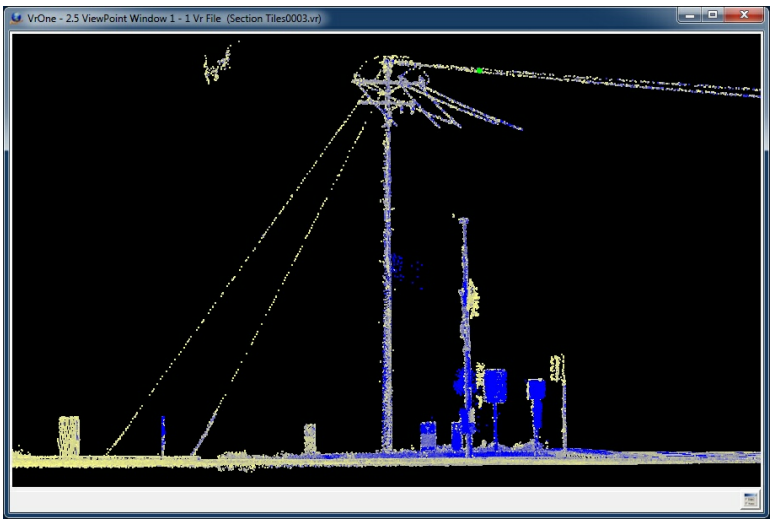


X viewing angle of 0 degrees with a clip distance of 50 feet.



X viewing angle of 45 degrees with a clip distance of 50 feet.



X viewing angle of 90 degrees with a clip distance of 50 feet.

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Local Commands

Key-in	Description	Range
CliMod=	Clip mode	Clipping mode: 0=Clipping off 1=Digitize clip distance 2=Use user clip distance
CliDis=	Clip Distance	User clip distance (ground)
XVie=	X viewing angle	X viewing angle (0-360 degrees) 0=Top view 90=Side view

2.1.1.8 Drive File Management

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Drive File Management

Name	Key-in	Arguments	Description
Open Drive File	OpeDri		Opens drive file using dialog box.
Open Drive File	OpeDri	File name	Opens drive file using the file name passed. File name many be: LinCor – Line Cross drive file BatJoi – Batch Join drive file BatNod – Batch Node drive file
Drive	Dri		Drives to next point in drive file.
Drive and Set Complete	DriAndSet		Sets current point as complete and drives to next point in drive file.
Drive Set Complete	DriSet		Sets current point as complete.

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Drive Clear Complete	DriCle		Sets current point as incomplete.
Drive Reset Complete All	DriResCom		Resets all complete markers to incomplete.
Drive Toggle Skip Completed	DriTog		Toggles skipping completed points when driving to next or previous point.
Re-drive	ReDri		Re-drives to current point in drive file.
Drive Previous	DriPri		Drives to previous point.
Show Drive Points	ShoDri		Shows all drive points in the graphics window.
Show Drive Points Fit	ShoDri	Fit	Shows all drive points in the graphics window and zooms the graphics window to the extents of the drive points.
Reset Drive File	ResDri		Resets drive file to first point.
Close Drive File	CloDri		Closes drive file.
Export Drive File	ExpDri		Translates a drive file to an XYZ formatted ASCII file.
Import Drive File	ImpDri		Imports an XYZ formatted ASCII file to a drive file.
Drive to Control Point	ConDriCd	H	Displays Control Drive help.
Drive to Control Point	ConDriCd		Drives to the next point (no argument).
Drive to Control Point	ConDriCd	-	Drives to previous point.
Drive to Control Point	ConDriCd	P	Prompts for point.
Drive to Control Point	ConDriCd	L	Drives to model load point.
Drive to Control Point	ConDriCd	R	Re-drives to current point.
Drive to Control Point	ConDriCd	PointNumber	Drives to point by sequence number.
Drive to Control	ConDri	“PointNa	Drives to point by name.

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Point	Cd	me”	
Drive KML	DriKml DriGoo		Drives to a point in a KML program such as Google Earth after being digitized in VrOne, VrTwo or VrThree (VrLiDAR).

2.1.1.8.1 Export Drive File

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Vr Mapping

Export Drive File (ExpDri)

Type: Translator

Exports an existing VrOne drive file to an ASCII file.

Detailed Description

VrOne drive files (.drv) are stored in a binary format. Export Drive File translates a binary drive file to an XYZ formatted ASCII file. The following is an example of an ASCII drive file.

```
634251.010689   1761639.884518        27.000000
634907.271607   1760401.788854        28.000000
634916.029990   1760389.327126        28.000000
634947.153448   1760403.256970        28.000000
635017.584574   1760455.106385        28.000000
635028.486218   1760446.562766        28.000000
634413.773877   1761956.830080        28.000000
635070.112476   1762245.693583        28.000000
```

Parameters

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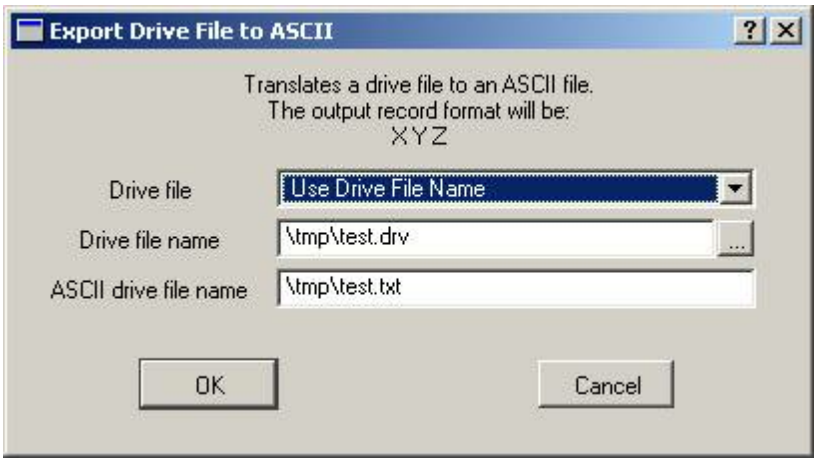

Drive file

Defines the drive file to export. Certain batch applications create batch files in order to drive to problem areas. Options include a batch application drive file such as "Line Cross (LinCro)" and "Batch Join (BatJoi)". There is also an option to export a user-defined drive file. When the "Use Drive File Name" option is selected, the drive file to export is defined in the Drive File Name prompt.

Drive file name

If the Drive file is set to "Use Drive File Name" this field defines the user-defined drive file to export.

ASCII drive file name

Defines the output file name.

2.1.1.8.2 Import Drive File

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Import Drive File (ImpDri)

Type: Translator

Imports an ASCII XYZ file to a VrOne drive file.

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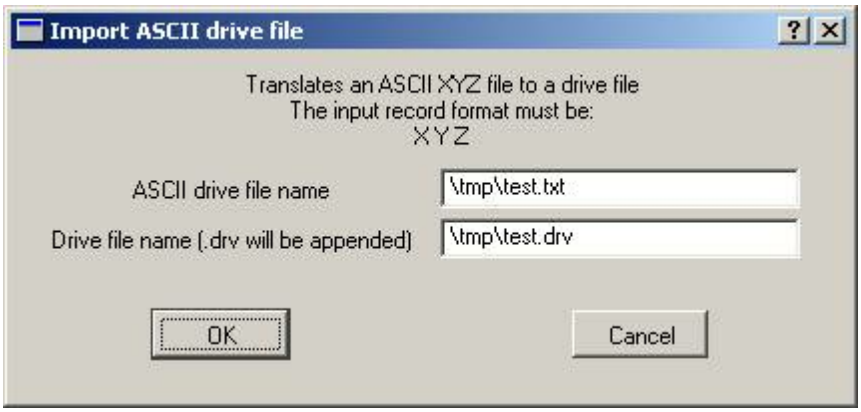
Detailed Description

VrOne drive files (.drv) are stored in a binary format. Import Drive File translates an XYZ formatted ASCII file to a VrOne drive file. After translation, this file may be accessed by the VrOne drive routines as a user-defined drive file. The following is an example of an ASCII drive file.

```
634251.010689   1761639.884518        27.000000
634907.271607   1760401.788854        28.000000
634916.029990   1760389.327126        28.000000
634947.153448   1760403.256970        28.000000
635017.584574   1760455.106385        28.000000
635028.486218   1760446.562766        28.000000
634413.773877   1761956.830080        28.000000
635070.112476   1762245.693583        28.000000
```

Parameters



ASCII drive file name
Defines the XYZ formatted ASCII drive file to import.

Drive file name
Defines the VrOne drive file to create. NOTE: If this file already exists, it will be overwritten.

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DOCUMENTATION
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Vr

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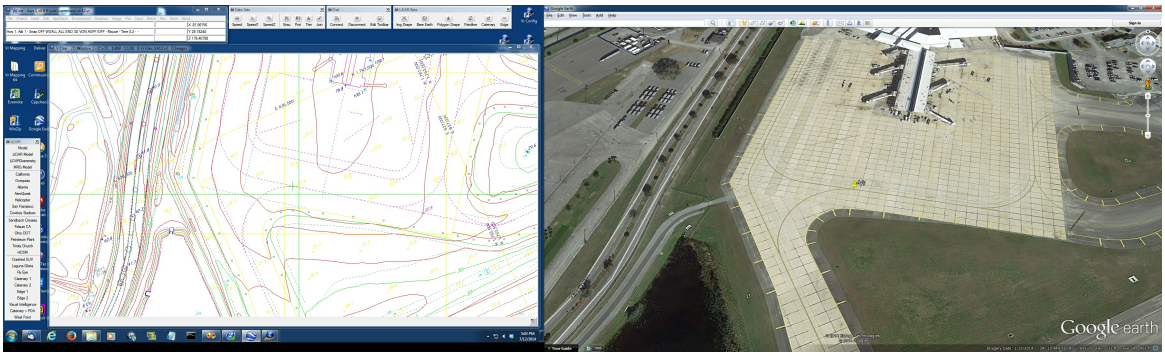
Mapping

Drive KML (DriKml or DriGoo)

Type: Viewing application

Drives to a point in a Keyhole Markup Language (KML) virtual globe compatible program such as Google Earth, The "drive to" point is selected in VrOne, VrTwo or VrThree (VrLiDAR).



Detailed Description

The Keyhole Markup Language (KML) is an XML notation for expressing geographic annotation and visualization within earth browsers. Support for KML is provided by programs such as Google Earth. This allows locations in the earth program to be driven to from other sources such as Vr Mapping.

KML viewing parameters which is how the point is viewed when driven to may be defined. Also, the local "drive to" coordinates may have a shift and (or) scale factor applied before converting to KML coordinates.

Prerequisites

An KML compatible program must be installed on the same computer running Vr Mapping and the name and location of the program must be defined in the parameters.

The coordinate projection of the VrOne file must be defined. If multiple VrOne files (workspaces) are open then each file should have it's coordinate projection defined. The coordinate projection of a VrOne file may be defined under the File pull-down -> Edit Vr Header -> Coordinate projection. If the VrOne file coordinate projection is not defined or defined incorrectly then the KML program will drive to the wrong location.

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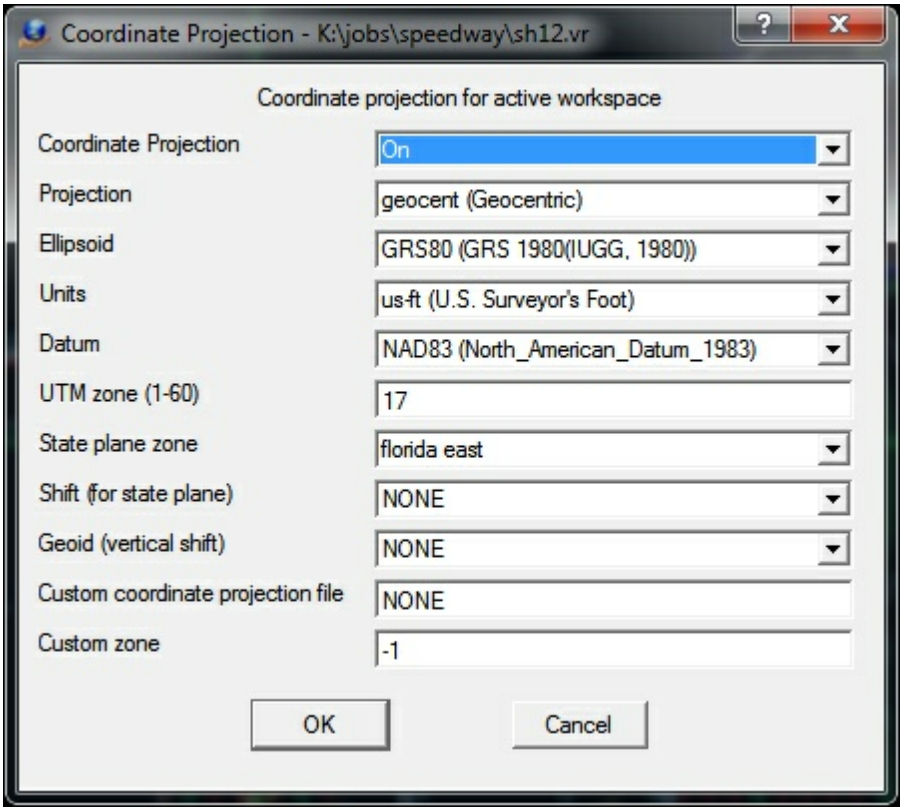

Example VrOne fie coordinate projection definition

Drive KML Menu Keys

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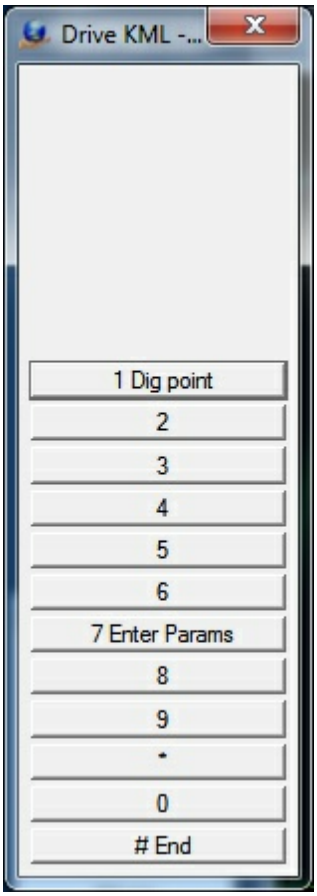

Menu Keys

1 - Dig Point - Digitizes "drive to" point and starts the KML program which to drive to the point specified.
7 - Enter Parameters - Allows entry/edit of parameters
 # - End - Ends application

Parameters

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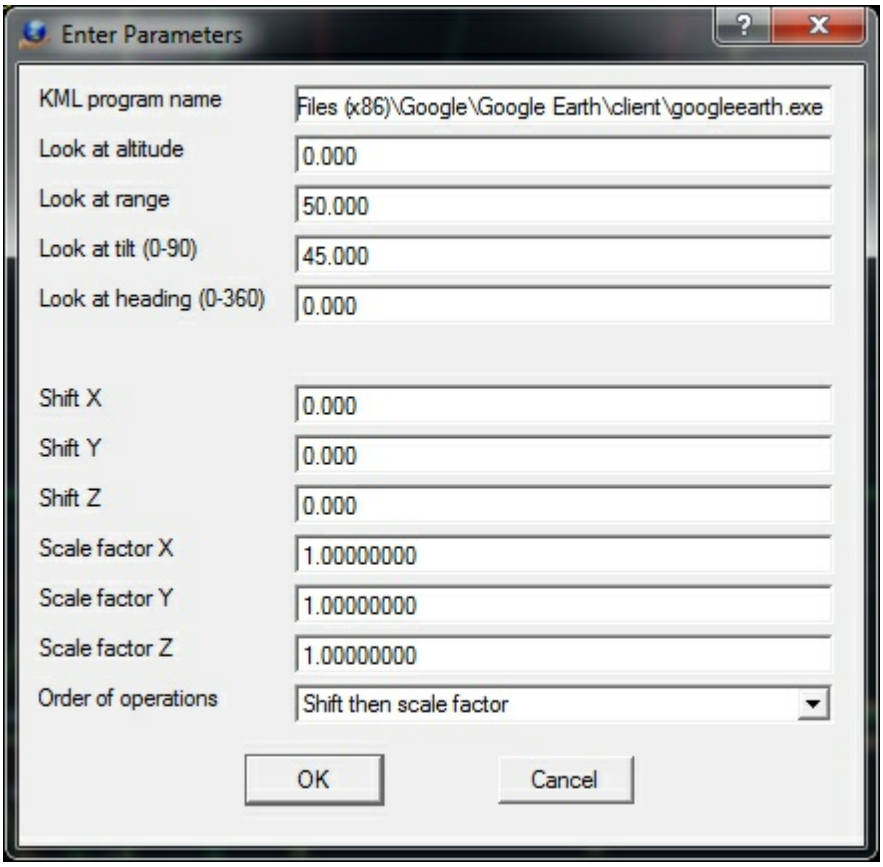

Drive KML parameters

KML program name
When a "drive to" point is digitized in Drive KML, program specified in this field is started and the defined coordinate position is driven to. The program name and path must be specified. Default: C:\Program Files (x86)\Google\Google Earth\client\googleearth.exe

Look at altitude
The distance above the surface in meters. Default: 0

Look at range
The distance from the eye point to the "drive to" point in meters. Default: 400

Look at tilt (0-90)
The angle between the direction of the position and the normal to the surface in degrees. An angle of zero will view the "drive to" point from an ortho position or a position directly above. The range is 0 to 90. Default: 45

Look at heading (0-360)
The viewing azimuth about the Z axis in clockwise degrees. Default: 0

Shift X, Shift Y, Shift Z
Shift value for the Y, Y and Z axis before converting the coordinates to KLM. This value is in the VrOne coordinate system. A value of 0.0 is no shift. Default: 0.0

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Scale factor X, Scale factor Y, Scale factor Z
Scale factor for the Z axis before converting the coordinate to KLM. A value of 1.0 is no scale factor. Default: 1.0

Order of operations
Defines the order to apply the shift and scale factor values to the local coordinates before converting to KLM. Options are "Shift then scale factor" or "Scale factor then shift". Default: "Shift then scale factor"

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2.1.1.9 Edit Applications

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Edit Applications

Name	Key-in	Description
Break Line	BreLin	Breaks line.
Change Elevations	ChaEle	Changes elevations to Z Source elevations.
Change Graphic Pointer	ChaGra	Changes graphic pointer.
Classify 3D	Cla3D	Classifies, changes layer, or deletes VrPoints (LiDAR) based on shapes in a 3D stereo environment.
Copy Window	CopWin	Copies window.
Copy Polygon	CopPol	Copies from user-defined polygon.
Cut Polygon	CutPol	Cuts from a user-defined polygon.
Cut Sheet	CutShe	Cuts vector/image data against sheet lines.
Cut Window	CutWin	Cuts from a user-defined window.

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Delete Window	DelWin	Deletes window.
Drape Polygon	DraPol	Drapes VrPoints (LiDAR) against DTM created from user defined polygon.
Drape To Points	DraPoi	Drapes line points and (or) symbols to existing VrPoints (LiDAR).
Edit Elevations	EdiEle	Edits elevations.
Edit Line	EdiLin	Edits line.
Edit Vertex	EdiVer	Interactively edits line point positions.
Edit Point	EdiPoi	Interactively edits a single VrPoint (LiDAR) in a VrOne workspace.
Edit Symbol	EdiSym	Edits symbol.
Edit Text	EdiTex	Edits text.
Explode Line	ExpLin	Explodes fonted line(s) into individual lines.
Explode Symbol	ExpSym	Explodes symbol(s) into lines.
Explode Text	ExpTex	Explodes text into lines.
Fast Delete	FasDel	Fast deletes.
Grid Line	GriLin	Grids line(s).
Hack Line	HacLin	Hacks line.
Hatch Line	HatLin	Hatches line or layer(s)
Inherit	Inh	Copies entity properties.
Join Lines	JoiLin	Joins lines.
Line Lines Intersect	LinLin	Line to lines intersection.
Move Polygon	MovPol	Moves from user-defined polygon.
Move Window	MovWin	Moves window.
Polygon Elevation	PolEle	Changes elevation of symbols inside polygons.
Reverse Line	RevLin	Reverses line(s).
Slope Line	SloLin	Slopes lines based on two existing points.
Square Existing Lines	SquExi	Squares existing line(s).
Tick Line	TicLin	Ticks line(s).
Trim Lines	TriLin	Trims lines.

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Vr Mapping

Break Line (BreLin)

Type: Interactive Application

Breaks line.

Detailed Description

Breaks an existing line into two entities at two user-identified points. It is possible to re-save the middle, broken portion of the line into another layer. Specifying the Break Layer (BreLay=) as 0 will break the line into two lines. Specifying the Break Layer as a layer between 1 and 32001 will result in the original line being broken into two lines with the middle portion re-saved in the layer specified.

Local Commands

Key-in	Description	Range
BreLay=	Break Layer	0-32001

Parameters

None

Button Assignments

Break Line – Lock on

	Button	Description
1	Id line	Identifies the line to break.
2		
3		
4		

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5		
6		
7	Parameters	Allows entry of user definable parameters.
8		
9		
*		
0		
#	End	Ends application.

Break Line – Bp1 / Bp1

	Button	Description
1	Dig break 1,2	Digitizes break points one and two.
2	Abandon	Abandons break and returns to Lock on.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Break Line – Confirm

After the two break points have been read, the line will be broken and the break will be verified.

	Button	Description
1	Accept break	Accepts break and returns to Lock on.
2	Rejects break	Rejects break and returns to Lock on.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

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2.1.1.9.2 Change Elevations

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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Change Elevations (ChaEle)

Type: Interactive Application

Changes entity elevations.

Detailed Description

Interactively changes entity elevations based on the current Z source elevation. Entities to be edited are identified by pointing at them. Elevations may be displayed in the graphics windows and many edit functions such as increment and decrement may be performed.

What is the difference between Edit Elevations and Change Elevations?
Edit Elevations drives the 3D device to the points that are occupied. Change Elevations moves the point elevation to the current input elevation when a point is occupied. Change Elevations may be more useful when editing line elevations from a 3D input device such as a stereo plotter or softcopy. Change Elevations may also be more useful when editing elevations that are a great distance from the current elevation as with lines with a zero elevation.

NOTE: The current point elevation is modified when the entity is locked onto. If the Accept key is pressed to look for another entity the change will be re-saved. If the changed is not wanted the Abandon key must be pressed. Undo may be used if an entity is accepted by mistake.

Related applications: Edit Elevations

Local Commands

Key-in	Description	Range
SEALIN=	Search for lines	0=No 1=Yes

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SEASYM=	Search for symbols	0=No 1=Yes
SEATEX=	Search for text	0=No 1=Yes
ROTMOD=	Line text rotation mode	0-1 0 = Rotate text to mean line 1 = Rotate text to defined angle
INC=	Elevation increment	Ground units
HGT=	Height of display text	Inches | Mm
ROT=	Rotation of display text	0-360 degrees
DEC=	Number of places to left of decimal for display text.	0-10
SHOELE=	Show elevations when editing	0=No 1=Yes
EREELE=	Erase elevations when finished with edit	0=No 1=Yes

PARAMETERS

Search for Lines? (SEALIN=)

Sets the Search for Lines flag.

Search for Lines? (SEASYM=)

Sets the Search for Symbols flag.

Search for Lines? (SEATEX=)

Sets the Search for Text flag.

Text rotation mode (ROTMOD=)

Defines the mode of the rotation of the text labels. 0=Rotate the text labels to the mean line azimuth. 1=Rotate the text labels to defined angle.

Elevation increment (INC=)

Defines the elevation increment to use when incrementing and decrementing elevations.

Height of display text (HGT=)

Defines the height for elevation text labels. This parameter is entered as inches or millimeters.

Rotation of display text (ROT=)

Defines the rotation of the display text. This parameter is used if the line text rotation mode is 1 (Rotate text to defined angle).

Number of decimal places (DEC=)

Defines the number of characters to the right of the decimal point for text elevation labels.

Show elevations (SHOELE=)

Specifies whether text elevations are shown during editing. 0=No 1=Yes.

Erase elevations (EREELE=)

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Specifies whether text elevations are erased after editing. 0=No 1=Yes.

Button Assignments

Edit Elev – Id

	Button	Description
1	Id entity	Identifies an entity.
2	Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3		
4	Toggle lines	Toggles searching lines.
5	Toggle symbols	Toggles searching symbols.
6	Toggle text	Toggles searching text.
7	Enter Params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Edit Elev – Main

This menu is displayed if a line is locked on to.

	Button	Description
1	Accept	Accepts changes and returns to Lock on.
2	Next point	Moves the cursor to the next line point.
3	Prev point	Moves the cursor to the previous line point.
4	Increment	Increments the current elevation by the increment parameters.
5	Decrement	Decrements the current elevation by the increment parameters.
6	Interpolate	Interpolates the current elevation based on the previous and next line points.
7	Enter point Z	Enters the current point elevation.
8	Enter line Z	Sets all the points on the current line to the elevation entered.
9	Prev point Z	Sets the current elevation to the previous point elevation.
*		
0		
#	Abandons	Abandons changes and returns to Lock on.

Edit Elev – Main

This menu will be displayed if a symbol or text label is locked on to.

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	Button	Description
1	Accept	Accepts changes and returns to Lock on.
2		
3		
4	Increment	Increments the current elevation by the increment parameters.
5	Decrement	Decrements the current elevation by the increment parameters.
6		
7	Enter point Z	Enters the current point elevation.
8		
9		
*		
0		
#	Abandon	Abandons changes and returns to Lock on.

2.1.1.9.3 Change Graphic Pointer

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Change Graphic Pointer (ChaGra)

Type: Interactive Application

Changes entity graphic pointers.

Detailed Description

Changes the graphic pointer of an entity by pointing at it. For example, this can be used to change a brush line to a tree line. This application supports the changing of line and symbol graphic pointers.

Local Commands

Key-in	Description	Range
LINGRA=	Defines Line Graphic Pointer	1 – MAX_LFONTS
SYMGRA=	Defines Symbol Graphic Pointer	1 – MAX_SYMBOLS

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SEALIN=	Search for Lines	0=No 1=Yes
SEASYM=	Search for Symbols	0=No 1=Yes
SEATEX=	Search for Text	0=No 1=Yes

Button Assignments

Change Gpoint – Id

	Button	Description
1	Id entity	Identifies entity to change.
2	Cycle ent type	Cycles entity type between Lines and Symbols.
3		
4	Toggle lines	Toggles searching for lines.
5	Toggle symbols	Toggles searching for symbols.
6		
7	Enter params	Enter parameters.
8		
9		
*		
0		
#	End	Ends application.

Change Gpoint - Verify

	Button	Description
1	Accept	Accepts change.
2	Rejects	Rejects change.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

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Vr Mapping

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Classify 3D (Cla3D)

Type: Interactive Application

Classifies, changes layer, or deletes VrPoints (LiDAR) based on shapes in a 3D stereo environment.

Detailed Description

Classify 3D has the ability to identify VrPoints (LiDAR) based on 3-dimensional shapes such as a cube or an extruded polygon. These identified points may have their classification or layer changed or may be deleted. This interactive application is useful in VrTwo stereo and especially in the VrThree (VrLiDAR) application 3D VrThree.

Once a shape has been defined it may be dragged with the cursor and placed anywhere in the 3D space for point identification.

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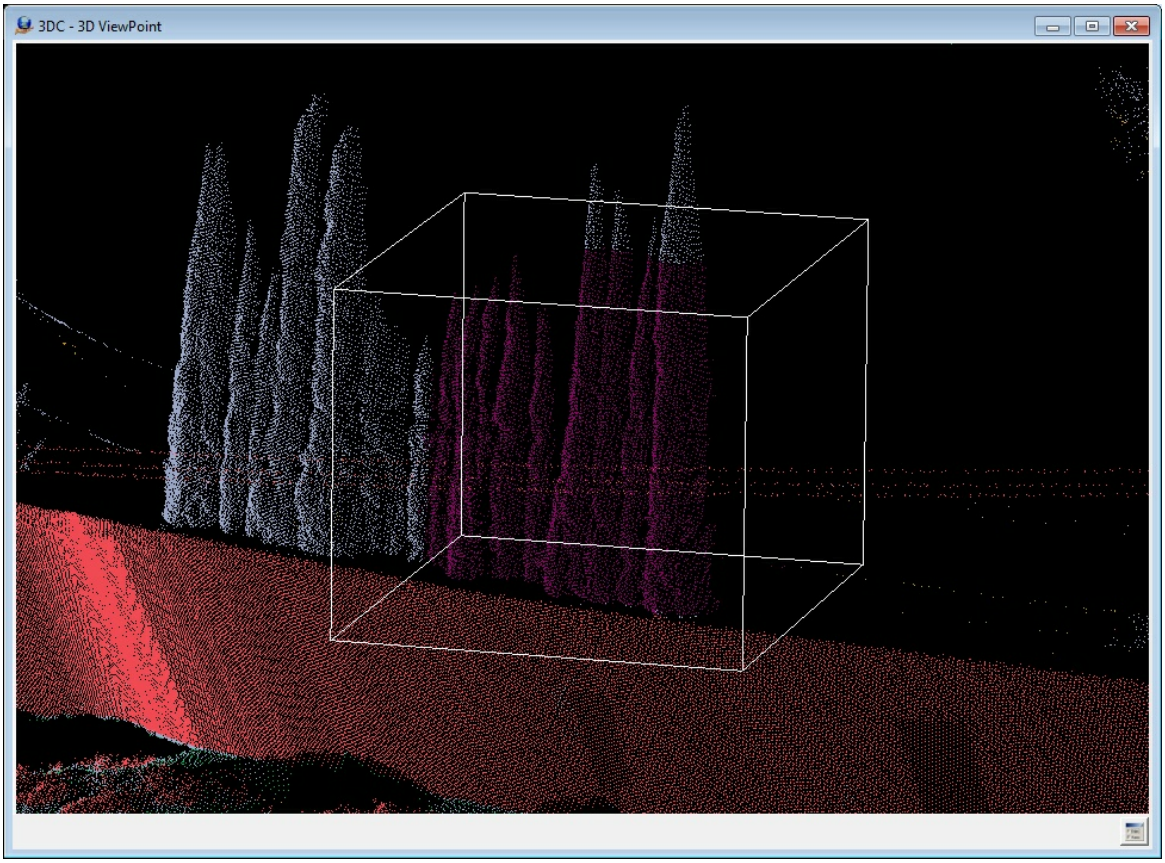

Classify 3D re-classifying points in 3D VrThree using a cube for point identification.

Local Commands

None

Button Assignments

Cube Mode

A 3-dimensional cube is one of the shapes available to identify points. The cube's size is defined by the user by digitizing two corners and by scaling the X, Y or Z axis.

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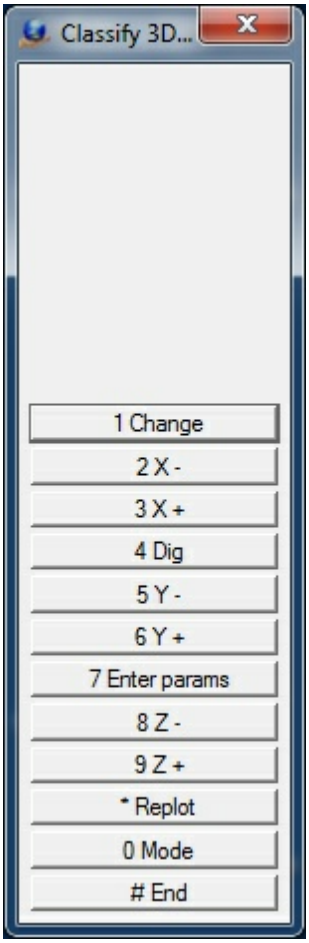

Classify 3D - Cube Menu Keys

1- Change
Changes the points that fall within the current cube location. If Confirm Changes is active, the points will show the change and verification will be required before the points are committed to the database.

2 - X-
Decrements the X axis size of the cube by the Resize Increment.

3 - X+
Increments the X axis size of the cube by the Resize Increment.

4 - Dig
Allows the size of the cube to be digitized with two points.

5 - Y-
Decrements the Y axis size of the cube by the Resize Increment.

6 - Y+
Increments the Y axis size of the cube by the Resize Increment.

7 - Enter Params
Allows the entry/editing of parameters. See Enter Parameters below.

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8 - Z-
Decrements the Z-axis size of the cube by the Resize Increment.

9 - Z+
Increments the Z-axis size of the cube by the Resize Increment.

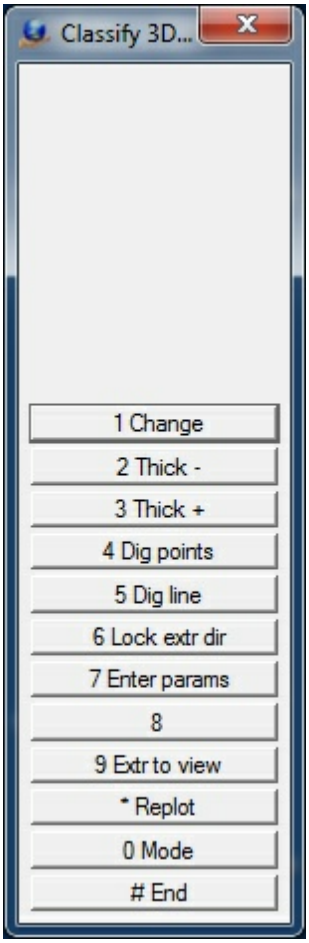
*** - Replot**
Re-displays graphics.

0 - Mode
Toggle the shape mode between cube and polygon.

 # - End
Ends Classify 3D.

Polygon Mode

A 3-dimensional polygon is one of the shapes available to identify points. This polygon is defined by digitizing points in the current 3D environment then specifying an extrusion value for its depth. The depth can be based on the current view projection (3D VrThree) or on the coordinate system Z direction.



Classify 3D - Polygon Menu Keys

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1- Change
Changes the points that fall within the current polygon location. If Confirm Changes is active then the points will show the change and verification will be required before the points are committed to the database.

2 - Thick -
Decrements the thickness (extrusion factor) of the polygon by the Resize Increment.

3 - Thick+
Decrements the thickness (extrusion factor) of the polygon by the Resize Increment.

4 - Dig points
Allows the definition of the polygon by digitizing points in the 3D environment.

5 - Dig line
Allows the definition of the polygon by selecting an existing line in an opened workspace.

6 - Lock ext dir / Unlock ext dir
Locks the extrusion direction so it is not affected by rotating view, or unlocks the extrusion direction so it follows the view again. This only applies when the extrusion direction is set to View. This is useful if you want to see the polygon from another view point without changing the polygon extrusion.

7 - Enter params
Allows the entry/editing of parameters. See Enter Parameters below.

9 - Ext to view / Extr to ground
Toggles between "extrude to view" and "extrude to ground" modes.

*** - Replot**
Re-displays graphics.

0 - Mode
Toggle the shape mode between cube and polygon.

 # - End
Ends Classify 3D.

Enter Parameters

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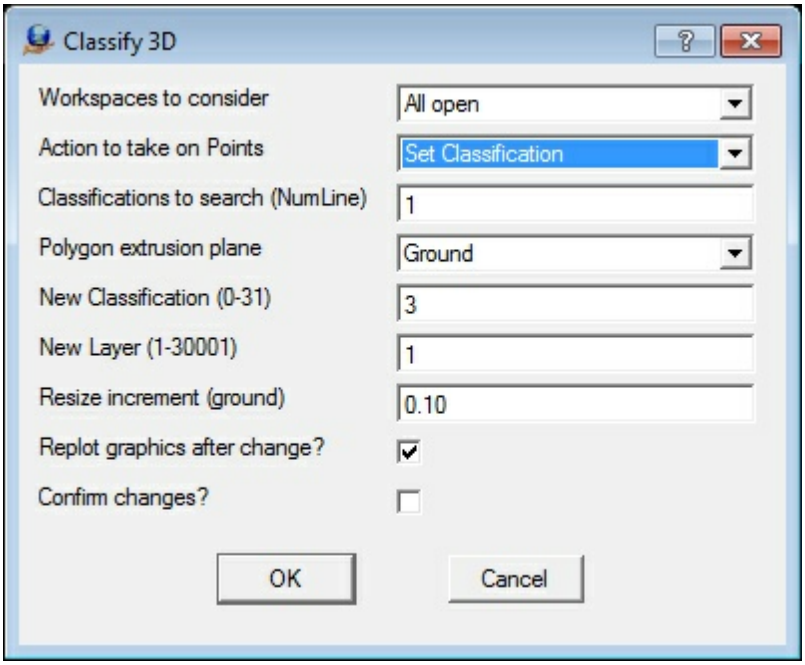

The Classify 3D parameters dialog

Workspaces to consider

Defines the workspaces to consider when identifying points for change. This may be set to "Current only", or "All open".

Action to take on Points

Defines the action to take on the points identified with a cube or polygon.

- **Set Classification** - Changes the points classification number;
- **Change Layer** - Changes the points layer number;
- **Delete** - Deletes the points.

Classifications to search (NumLine)

Defines the classifications to search for when processing VrPoints. Normally points that are displayed are considered but using this parameter allows all points to be displayed while only the classifications defined will be considered for modification. Leaving the field blank will indicate that all VrPoints that are displayed will be considered. A Number Line may be used to define this parameter.

Polygon extrusion plane

Defines the extrusion or thickness plane when using the polygon mode to identify points. A polygon is first digitized then extruded along this plane to create a 3D polygon.

- **Ground** - The extrusion or direction is based on the current coordinate system Z direction;
- **View** - The extrusion direction is based on the view direction. In 3D VrThree, this view direction is determined by the current 3-dimensional direction from the eye point and may be any angle.

New Classification (0-31)

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If the "Action to take on Points" is defined as "Set Classification", this value is used as the new Classification for the points identified.

New Layer (1-30001)
If the "Action to take on Points" is defined as "Change Layer", this value is used as the new Layer number for the points identified.

Resize increment (ground)
When the current shape is being resized interactively by pressing and holding Vr buttons, this value is used as the positive or negative size increment. The Resize increment is entered as ground units.

Replot graphics after change?
If checked, graphics are updated in real-time after the Change button is pressed.

Confirm changes?
If checked, the change operation must be confirmed by the user before the changes are committed to the database. It is recommended that this option is checked.

2.1.1.9.5 Copy Polygon

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Move, Copy Polygon (MovPol, CopPol)

Type: Interactive Application

Moves or copies entities defined by a polygon.

Detailed Description

Allows a polygon to be selected, then interactively moves or copies the entities inside the

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polygon.

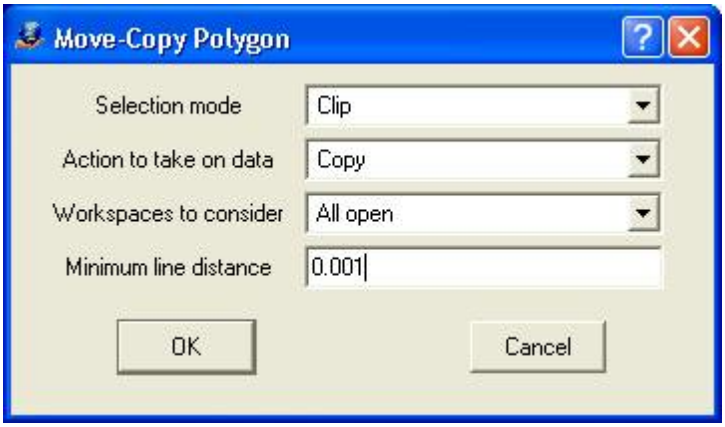
It can be started with two different commands. The MovPol command will always start in Move mode and the CopPol command will always start in Copy mode.

Entities may be selected by clipping, crossing, or inside. Entities from multiple workspaces may be moved or copied, with the new data going into the current workspace.

Local Commands

Key-in	Description	Range
WSTC=	Workspaces to consider	0=Current 1=All
ACT=	Action	0=Move1=Copy
SELMOD=	Selection Mode	0=Clip1=Crossing 2=Inside
DELX=	Delta Shift X	Floating point
DELY=	Delta Shift Y	Floating point
DELZ=	Delta Shift Z	Floating point
MINLINDIS=	Minimum line distance	Floating point

Parameters Dialog



Selection mode

Defines the selection mode for entities inside the polygon.

Clip	Selects all entities that cross or are inside the polygon and clips lines to the polygon boundary
Crossing	Selects all entities that cross or are inside the polygon. Does not clip lines to the polygon boundary
Inside	Selects all entities that fall completely inside the polygon

Action to take on data

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Defines the action to take on the selected entities.

Copy	Copies the data, leaving the original entities unchanged
Move	Moves the data, deleting or clipping the original entities

Workspaces to consider

It is possible to copy or move data from up to 2000 workspaces if this parameter is set to All open. All new entities are placed in the active workspace.

Minimum line distance

Any resulting clipped line that is shorter than this ground distance will be deleted.

Offset Dialog



Shift X (ground), Shift Y (ground), Shift Z (ground)

These parameters define an offset to apply to all selected entities. When Ok is pressed, the entities will be offset using these values.

Examples

Original data with selected polygon shown in bold blue.

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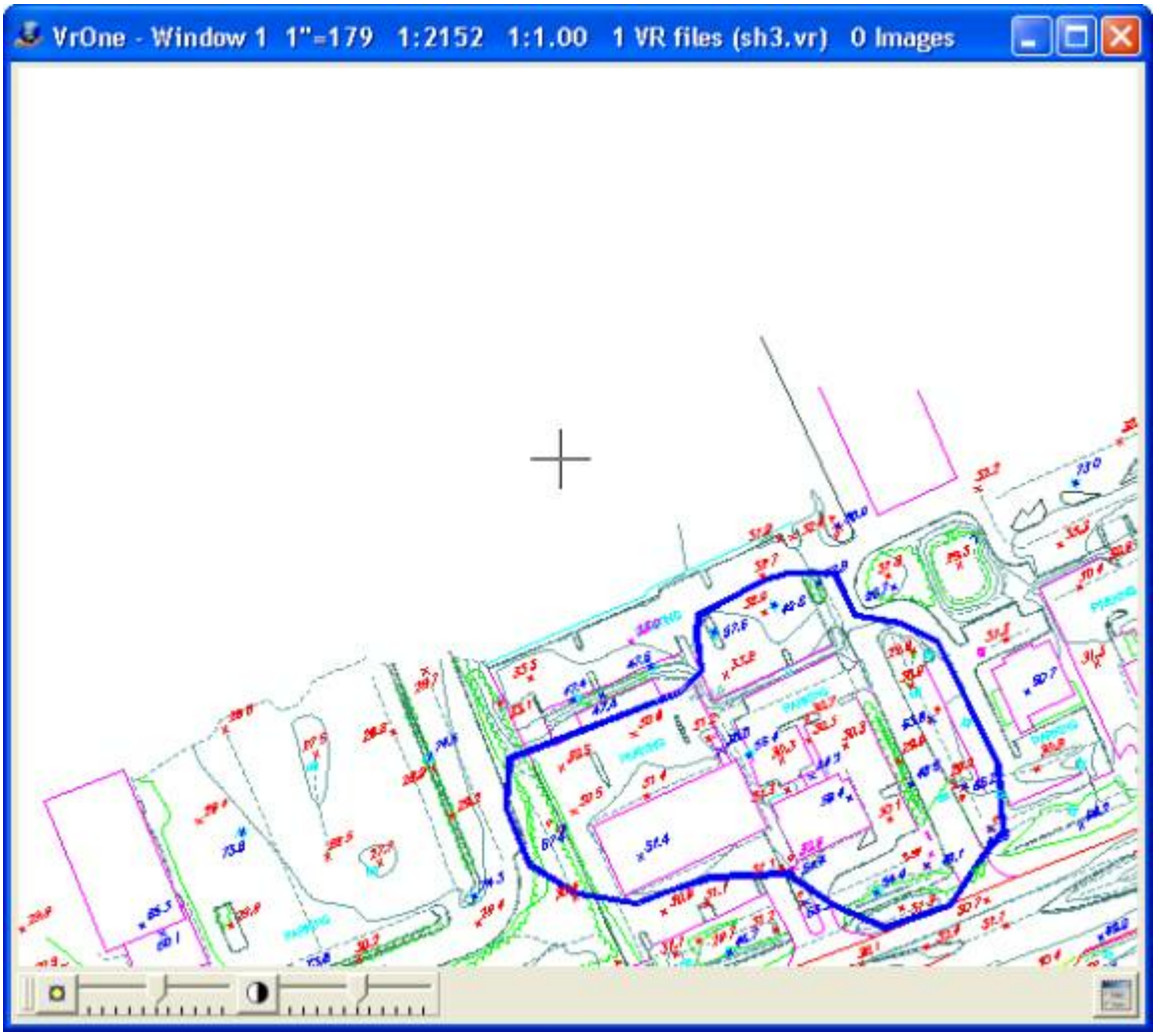

Selection Mode: Copy
Action to take on data: Clip

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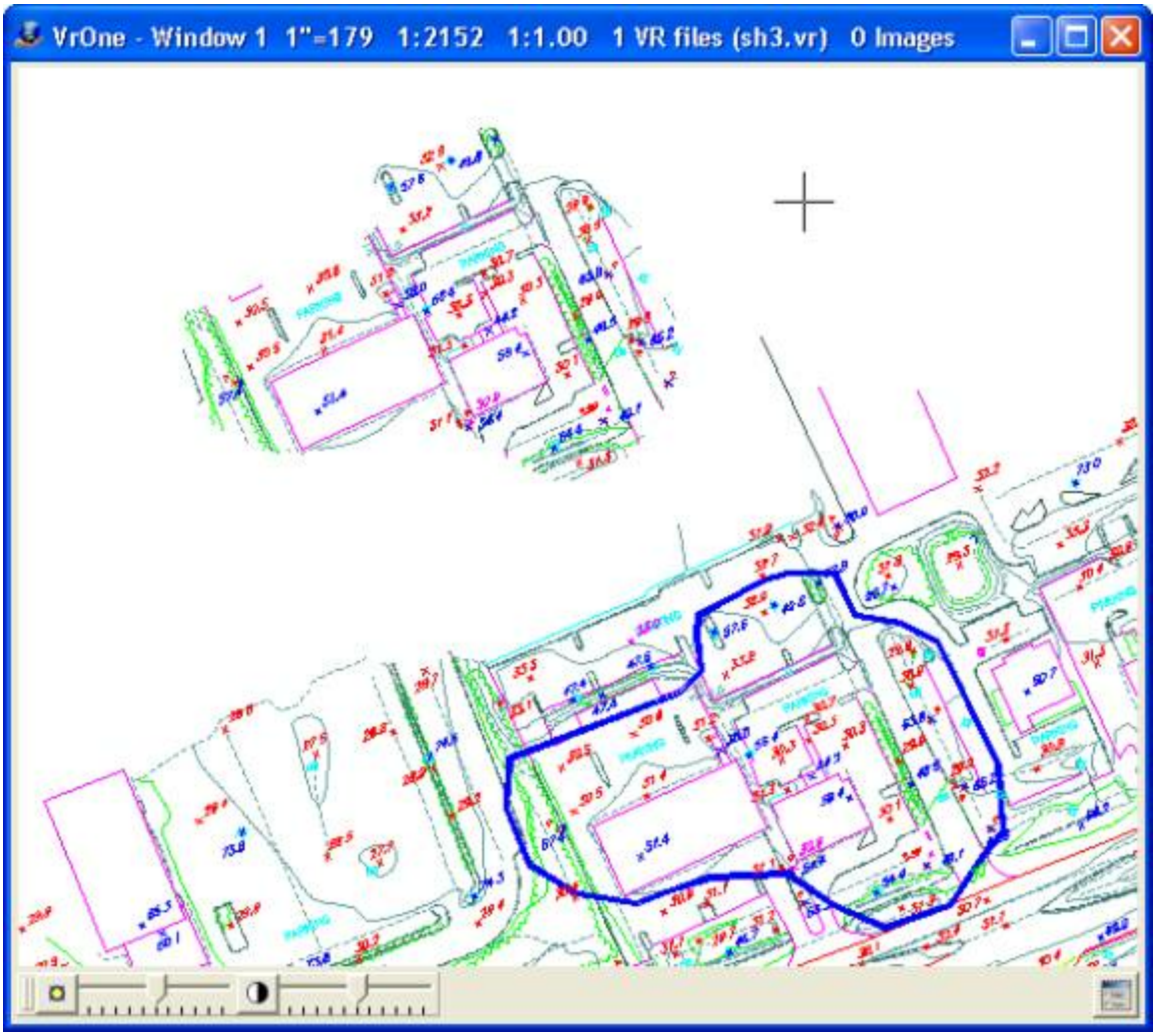

Selection Mode: Move
Action to take on data: Clip

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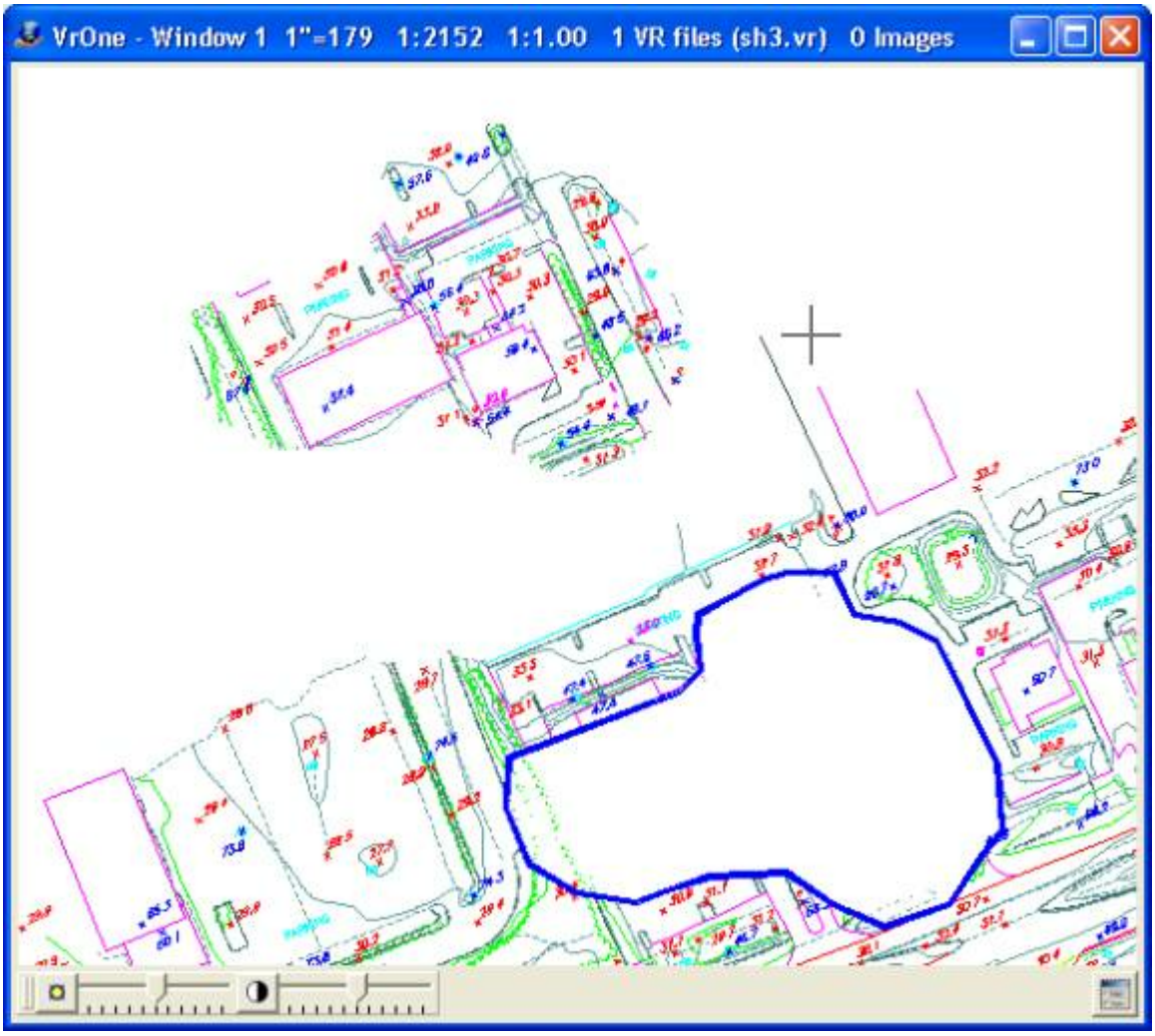

Selection Mode: Copy
Action to take on data: Crossing

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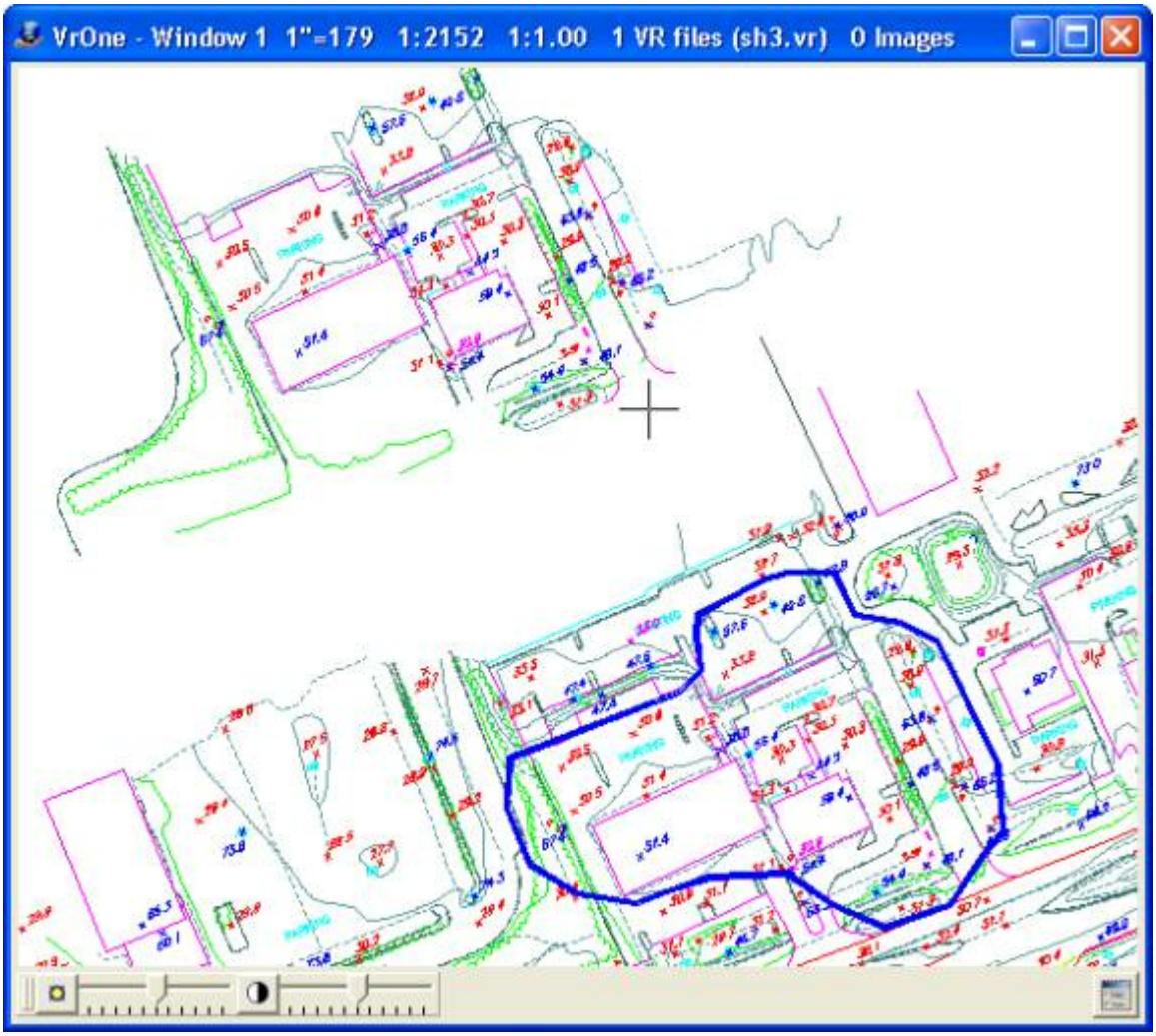

Selection Mode: Move
Action to take on data: Inside

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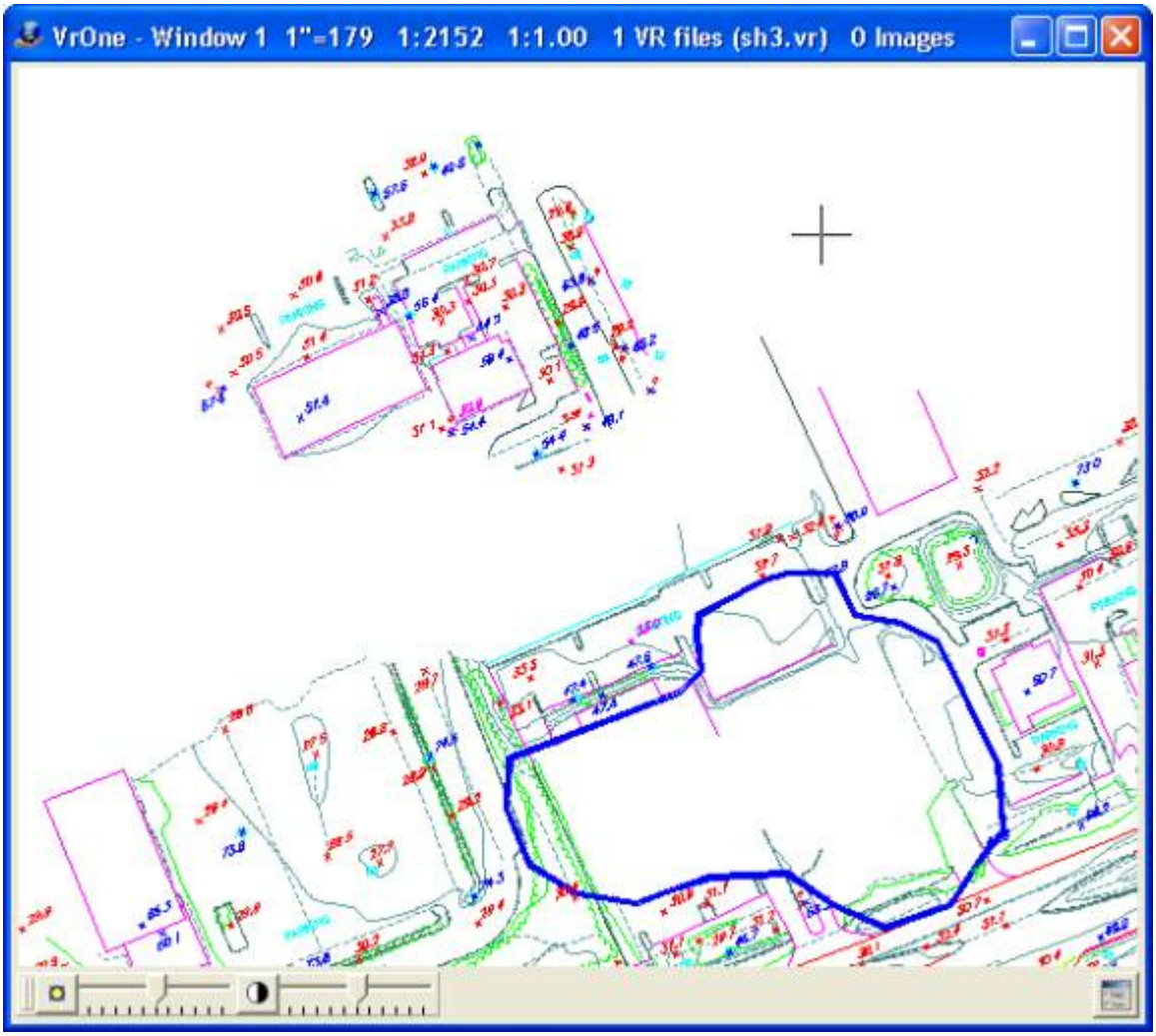

Button Assignments

Move-Copy Polygon – Lock on

	Button	Description	Displays Next
1	Id line	Identifies polygon. The line does not have to be closed.	Confirm
2			
3			
4			
5			
6			
7	Enter params	Enter parameters from dialog box.	Params Dialog
8			
9			

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*			
0			
#	End	Ends application.	

Move-Copy Polygon – Confirm

	Button	Description	Displays Next
1	Accept line	Accepts polygon chosen.	Origin
2	Reject line	Rejects polygon chosen.	Lock On
3			
4			
5			
6			
7			
8			
9			
*			
0			
#			

Move-Copy Polygon – Origin

	Button	Description	Displays Next
1	Dig origin	Selects origin point for move or copy.	New
2	New polygon	Allows new polygon to be chosen.	Lock On
3	Enter offset	Allows entry of exact X,Y,Z offset instead of digitizing origin and new points.	Offset dialog
4			
5			
6			
7			
8			
9			
*			
0	Toggle Snap	Turns snap on/off.	
#			

Move-Copy Polygon – New location

	Button	Description	Displays Next
1	Dig new loc	Selects new location point for move or copy. If using copy mode, continually prompts for new location until	New location in Copy Mode,

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		New Polygon or End is selected.	Lock On in Move Mode
2	New polygon	Allows new polygon to be chosen.	Lock On
3	Enter offset	Allows entry of exact X,Y,Z offset instead of digitizing origin and new points.	Offset dialog
4			
5			
6			
7			
8			
9			
*			
0	Toggle Snap	Turns snap on/off.	
#			

2.1.1.9.6 Copy Window

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Copy Window (CopWin)

Type: Interactive Application

Copies the contents of a user defined window.

Detailed Description

Copies the contents of a user-defined window. Entities that fall completely within the window will be copied. Entities that are turned off will not be considered.

Local Commands

Key-in	Description	Range
WSTC=	Workspaces to consider	0-1

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Parameters

Workspaces to Consider (WSTC=)

Defines workspaces to consider when searching for entities to copy. If set to 0, only the current workspace will be considered. If set to 1, all open workspaces will be considered.

Button Assignments

Copy Window – Main

	Button	Description
1	Dig corner	Digitizes lower left and upper right corners of search window.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Copy Window – Origin

	Button	Description
1	Dig origin	Digitizes new origin for window contents.
2	New window	Abandons current copy and returns to Main.
3	Enter offset	Enter XY offset for movement of window contents.
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

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Copy Window – New loc

	Button	Description
1	Dig new loc	Digitizes new location of window.
2	New window	Abandons current copy and returns to Main.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#		

Copy Window - Verify

	Button	Description
1	Accept	Accepts current window location and returns to Main.
2	Rejects	Rejects current window location and returns to New loc.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.7 Cut Polygon

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

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Mapping

Cut Polygon (CutPol)

Type: Interactive Application

Cuts data against a user defined polygon.

Detailed Description

Cuts entity data against a user-defined polygon. Multiple workspaces may be cut from. If the cut data is to be copied or moved to another VrOne file, the contents will be merged into one file if cut from multiple workspaces. Options include the ability to process lines, symbols, text and/or Vr Points (LiDAR). Other options include the ability to change layers or graphic pointers.

Local Commands

None

Parameters

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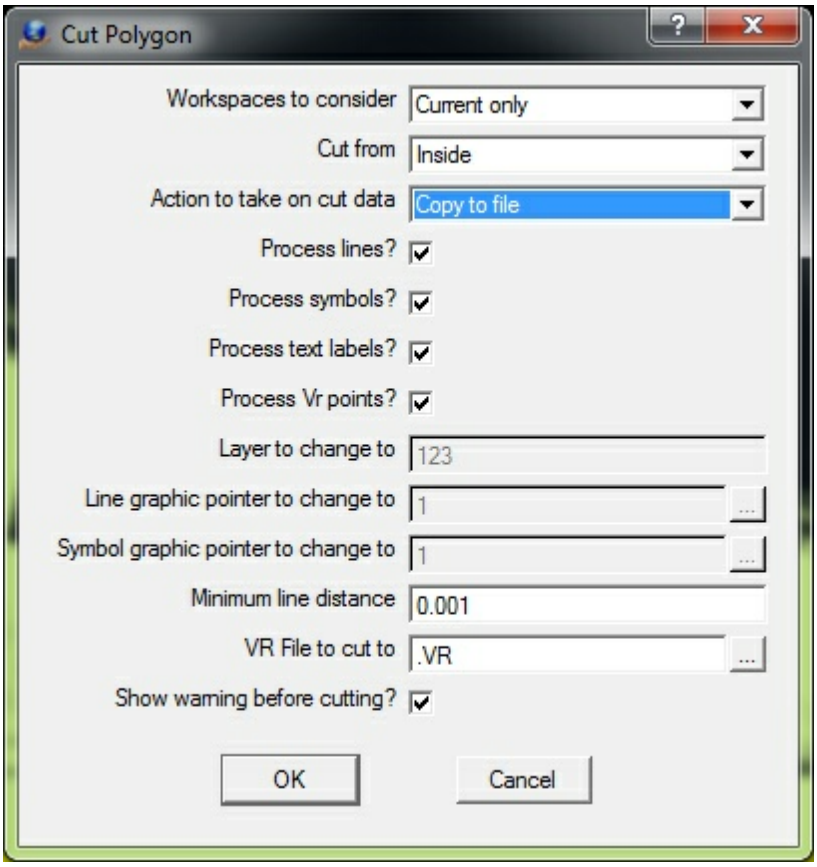

The Cut Polygon Enter Parameters dialog

Workspaces to consider

It is possible to cut data from up to the maximum number of open workspaces if this parameter is set to "All open".

Cut from

Defines the side of the polygon from which to cut data. Options are Inside and Outside.

Action to take on cut data

Data cut from polygon can be:

Thrown away	Deletes cut data.
Copy to File	Copies cut data to user-specified file.
Move to File	Moves cut data to user-specified file.
Change Layer	Changes the layer of cut data and places it back in the workspace.
Change Graphic Pointer	Changes the graphic pointer of cut data and places it back in the workspace.

Process Lines?

If checked, lines are processed when cutting data.

Process Symbols?

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If checked, symbols are processed when cutting data.

Process Text?
If checked, text labels are processed when cutting data.

Process Vr Points?
If checked, Vr Points (LiDAR) are processed when cutting data.

Layer to change to
If the action to take on the cut data is "Change layer", this parameter defines the new layer to which to change entities.

Line graphic pointer to change to
If the action to take on the cut data is to "Change graphic pointer", this parameter defines the line graphic pointer to which to change entities.

Symbol graphic pointer to change to
If the action to take on the cut data is to "Change graphic pointer", this parameter defines the symbol graphic pointer to which to change entities.

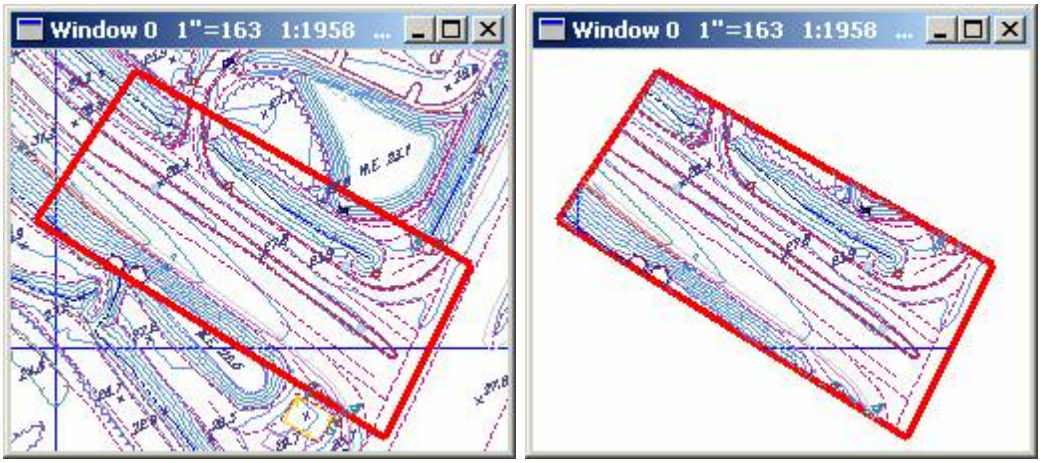
Minimum line distance
Specifies the ground distance shorter than which any resulting cut line is deleted.

Vr File to cut to
Defines the VrOne file name to which to cut if the action to take on the cut data is Copy to file or Move to file. If this file does not exist, it will be created. If this file exists the cut data will be appended.

Show warning before cutting?
If this parameter is checked, a dialog will be displayed warning that deleted data cannot be recovered.

Examples

Cut from: Outside
Action to take on cut data: Throw away or Move to file



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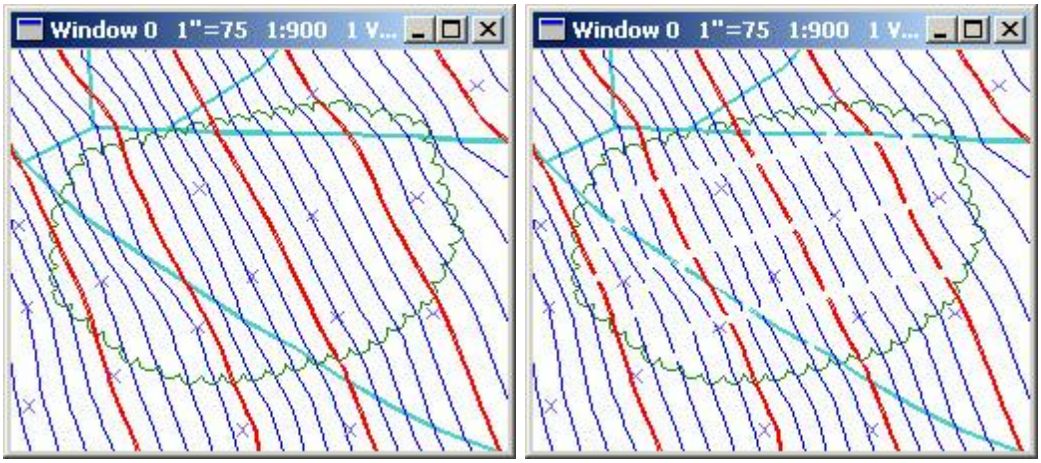
Cut from: Inside
Action to take on cut data: Change graphic pointer



Button Assignments

Cut Polygon – Lock on

	Button	Description
1	Id line	Identifies line to cut against. The line does not have to be closed.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.8 Cut Sheet

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Mapping

Cut Sheet (CutShe)

Type: Batch Application

Cuts vector and image data against sheet lines with options to output sheets to new VrOne files.

Detailed Description

Cuts vector and image data against user-defined sheet lines. Multiple sheets may be defined using standard VrOne lines, and each sheet may be any shape. Multiple workspaces may be cut from. If the cut data is to be copied or moved to another VrOne file, the contents will be placed in a separate VrOne file for each sheet line. If image data is being cut, it will be placed in a separate TIFF file for each sheet. The VrOne and image file names will either be taken from existing text labels or created automatically based on user settings.

Local Commands

None

Parameters

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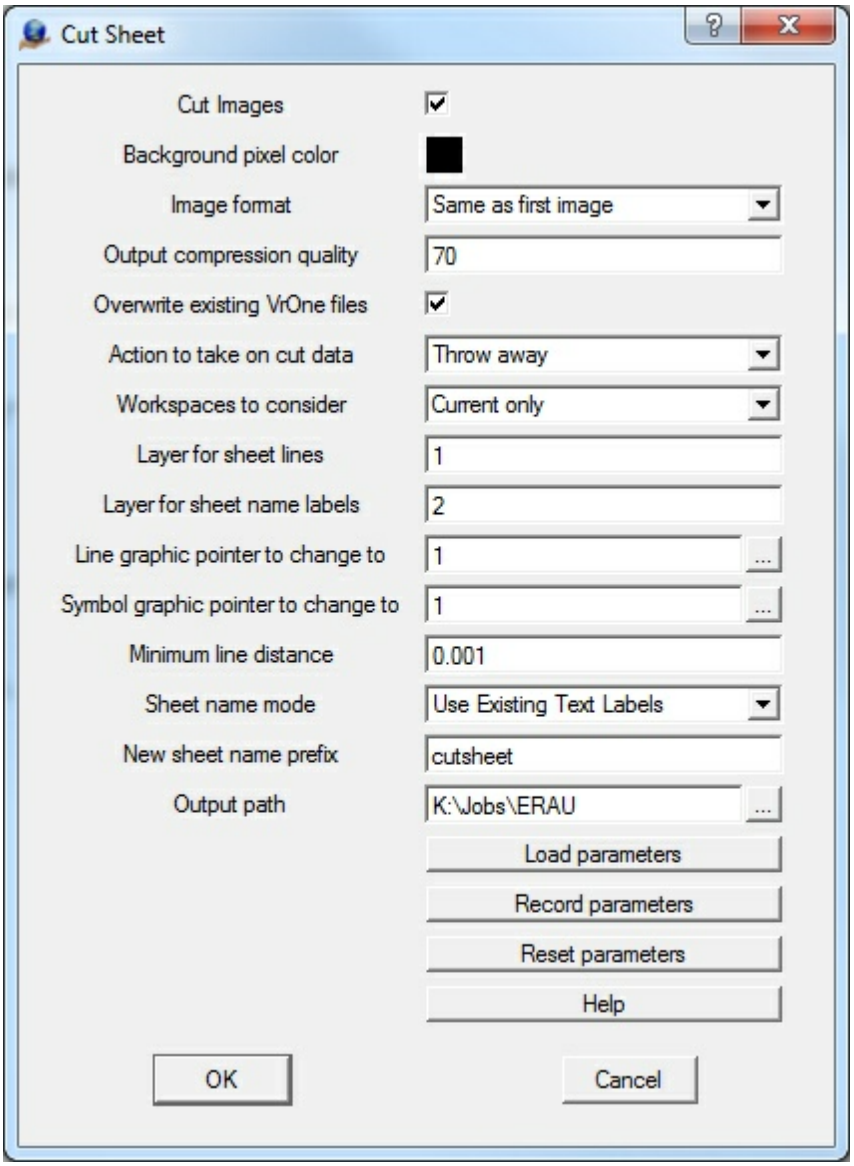

Cut Images

Determines if image data will be cut out to new image files. This is only valid if action taken is set to Move to file or Copy to file. For images, Move to file and Copy to file have the same meaning. Image data is never cut from the original image.

Background pixel color

Sets the color to use for pixels that do not fall within an existing image area.

Image format

Specifies the output image format. The available output formats are:

- **Same as the first image** - Use the same format as the first opened image;
- **TIFF** - TIFF image format;
- **JPEG** - JPEG image format.

Output compression quality

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Determines how much the output image will be compressed via a value from 0 to 100. Lower numbers result in greater compression but with more loss of image quality. Higher numbers achieve greater image quality with larger file sizes. A good default value is 70, providing a compression ratio around 8 to 1 for color images with minimal loss of quality.

Overwrite existing VrOne files

If this parameter is selected, VrOne files will be overwritten. If it is not selected, the cut data will be appended to the VrOne files.

Action to take on cut data

Data cut from polygon can be:

- **Thrown away** - Deletes cut data. Does not apply to image data;
- **Change Graphic Pointer**- Changes the graphic pointer of cut data and places it back in the workspace;
- **Copy to File** – Copies cut data to output files;
- **Move to File** – Moves cut data to output files.

Workspaces to consider

It is possible to cut data from all open workspaces if this parameter is set to All open.

Layer for sheet lines

This layer is searched for sheet lines. Only the current workspace is searched.

Layer for sheet name labels

This layer is searched for sheet name labels. Only one sheet name label should be placed within each sheet line. Only the current workspace is searched.

Line graphic pointer to change to

If the action to take on the cut data is to change its graphic pointer, this parameter defines the line graphic pointer to which to change line entities.

Symbol graphic pointer to change to

If the action to take on the cut data is to change its graphic pointer, this parameter defines the symbol graphic pointer to which to change symbol entities.

Minimum line distance

Defines the ground distance shorter than which any resulting cut line is deleted.

Sheet name mode

Defines the method that is used to determine output sheet names. The same name is used for the VrOne vector files and the TIFF image files.

- **Use Existing Text Labels** - Searches for text labels in the layer specified in the "Layers for sheet lines" options. A single text label should be placed inside each sheet line. For example, if the sheet is to be written as sheet1.vr and sheet1.tif, a text label of "sheet1" should be placed inside the sheet line.
- **Generate Sequential Sheet Names** - Generates the sheet names automatically by using the specified "New Sheet Name Prefix" starting with the number 1. For example, if the "New Sheet Name Prefix: is set to "sheet", the first sheet files written will be sheet1.vr and sheet1.tif.

New Sheet Name Prefix

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Defines the prefix to be used if sheet name mode is set to "Generate sequential sheet names".

Output Path
Defines the output path directory in which to place all output files. If left blank, the files will be placed in the current working directory.

Examples

Cut vector and image data from multiple sheets



Output files:
CUTSHEET1.VR, CUTSHEET1.TIF

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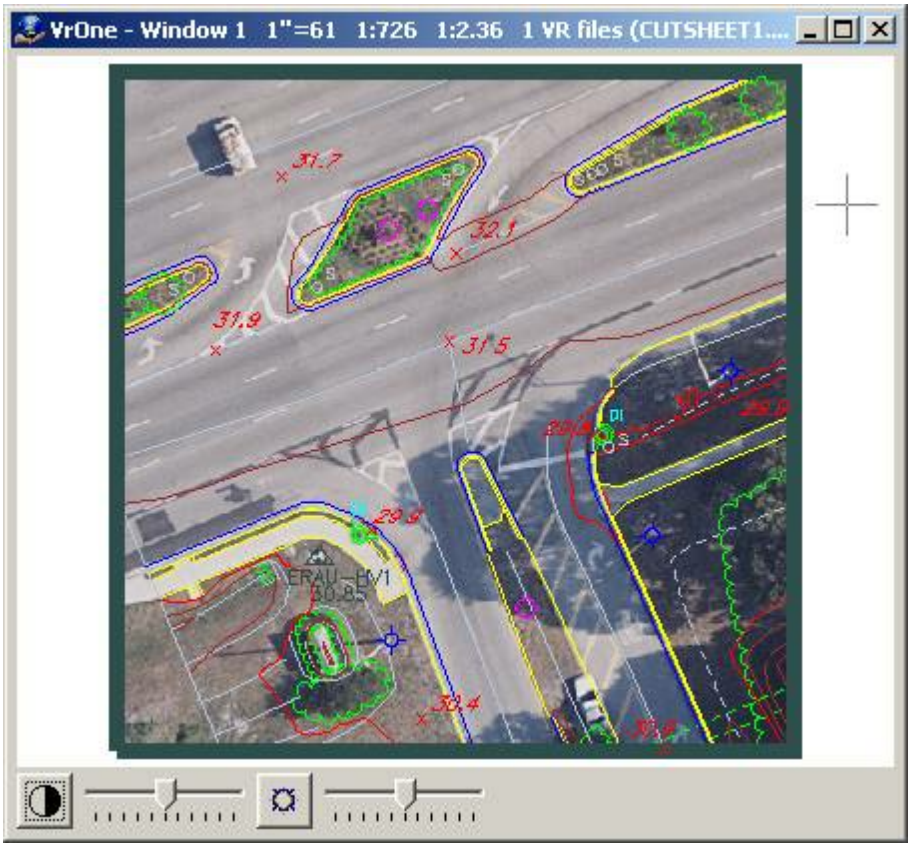

CUTSHEET2.VR CUTSHEET2.TIF

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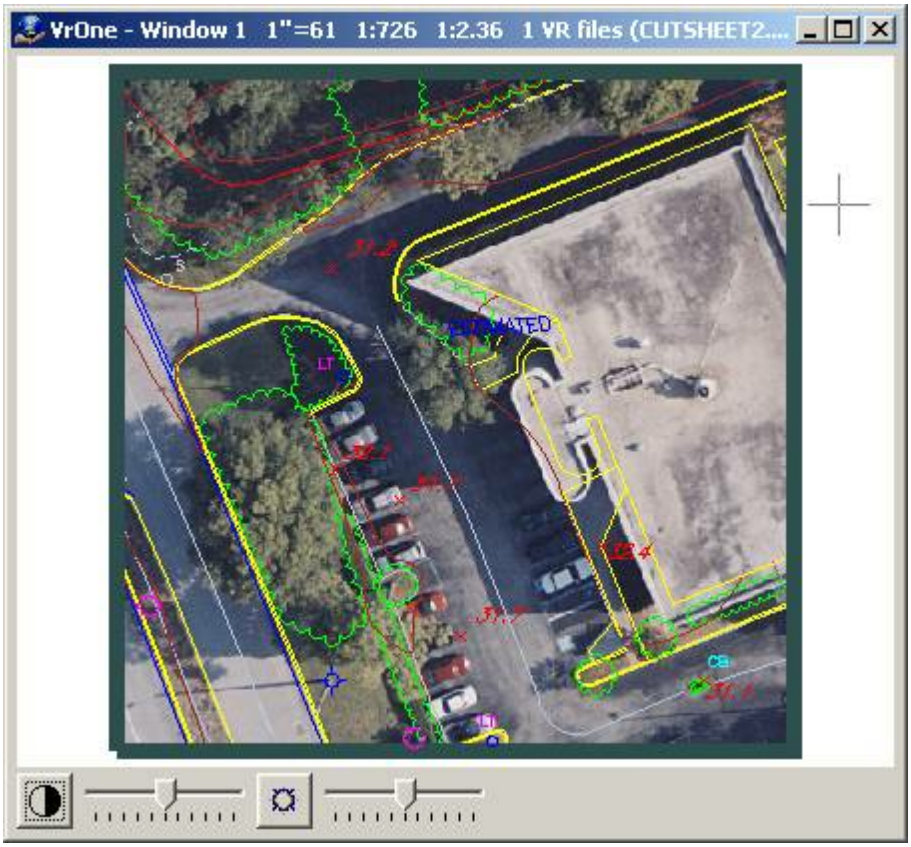

2.1.1.9.9 Cut Window

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Cut Window (Win)

Type: Interactive Application

Cuts the contents of a window.

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Detailed Description

Clips and cuts data from a user-defined window. Data cut from the window may be thrown away, copied to another VrOne file, or moved to another VrOne file.

Local Commands

Key-in	Description	Range
WSTC=	Workspaces to consider	0-1
CUTACT=	Cut action	0 = Throw cut data away 1 = Copy cut data to another VrOne file 2 = Move cut data to another VrOne file
CUTFIL=	File to cut to	VrOne file to cut data to if CUTACT is 1 or 2

Parameters

Workspaces to Consider (WSTC=)

Defines workspaces to consider when searching for entities to cut. If set to 0, only the current workspace will be considered. If set to 1, all open workspaces will be considered.

Cut Action (CUTACT=)

Defines the action to take when cutting data against the cut window.

Cut File (CUTFIL=)

Defines the VrOne file to cut data to if the Cut Action is set to 1 or 2.

Button Assignments

Del Window – Main

	Button	Description
1	Dig corner	Digitizes lower left and upper right corners of search window.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		

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0		
#	End	Ends application.

Del Window - Verify

	Button	Description
1	Accept	Accepts the current cut window and starts cutting process.
2	Rejects	Rejects current cut window and returns to Main.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.10 Delete Window

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Delete Window (DelWin)

Type: Interactive Application

Deletes the contents of a window.

Detailed Description

Deletes the contents of a user-defined window. Entities that fall completely within the window will be copied. Entities that are turned off will not be considered.

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Local Commands

Key-in	Description	Range
WSTC=	Workspaces to consider	0-1

Parameters

Workspaces to Consider (WSTC=)

Defines workspaces to consider when searching for entities to delete. If set to 0, only the current workspace will be considered. If set to 1, all open workspaces will be considered.

Button Assignments

Del Window – Main

	Button	Description
1	Dig corner	Digitizes lower left and upper right corners of search window.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Del Window - Verify

	Button	Description
1	Accept	Deletes entities in window and returns to Main.
2	Rejects	Rejects delete and returns to Main.
3		
4		
5		
6		
7		
8		

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9		
*		
0		
#	End	Ends application.

2.1.1.9.11 Drape Polygon

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Drape Polygon (DraPol)

Type: Interactive/Batch Application

Detailed Description

Creates a Digital Terrain Model (DTM surface) based on a user identified or user digitized polygon and optional three-dimensional symbols. VrPoints (LiDAR) or Symbols may be draped to this surface, or the surface, along with an elevation tolerance, may be used to re-classify VrPoints above, below, inside, or outside a region in reference to the surface (see "Change Data in Region Examples"). An additional option includes the deletion of VrPoints or Symbols that fall within the a region in reference to the DTM surface. The polygon is referred to as the boundary polygon.

The use of Drape Polygon for re-classification of VrPoints should be considered an editing or refinement tool to fix classification errors from previous batch applications. It should not be considered a primary tool for the initial classification of VrPoints (LiDAR). Drape Polygon considers VrPoints (LiDAR) and Symbols only.

NOTE: Drape Polygon considers the Vr Point Display (PoiDis) parameters when processing VrPoints. If a VrPoint is not displayed, it will not be considered, even if it is specified.

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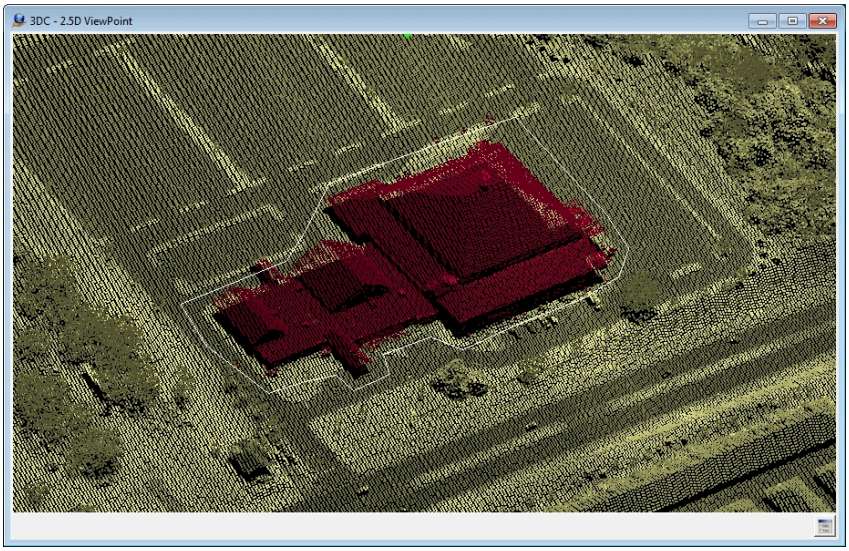
Original VrPoint (LiDAR) point data before re-classification



VrPoint (LiDAR) point data after re-classification

The examples above show VrPoint (LiDAR) point data with classifications on a building that are incorrect. The next example shows the result of Drape Polygon using the Drape Action of Classify to re-classify VrPoints that are within a user defined region in reference to the DTM surface Please see "Change Data in Region Examples.

Button Assignments

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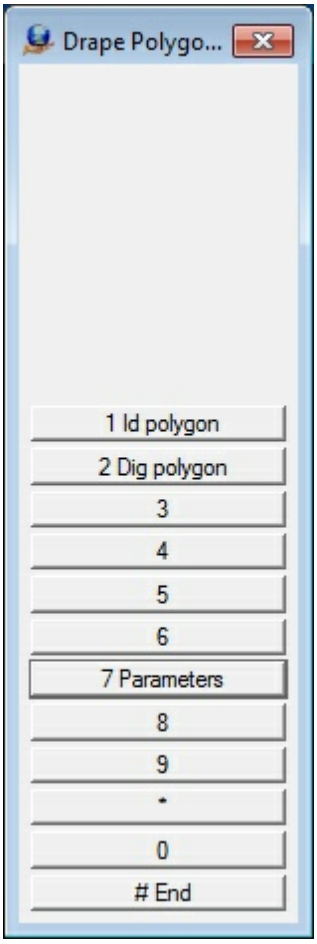

The Drape Polygon Menu Keys

Drape Polygon – Main

	Button	Description
1	**Id polygon**	Identifies an existing polygon as the boundary.
2	**Dig polygon**	Allows the boundary polygon to be digitized. The Insert Line application is used to digitize the line. The resulting line is not saved after processing.
3		
4		
5		
6		
7	**Parameters**	Allows the definition of Drape Polygon parameters (see below).
8		
9		
*		
0		
#	**End**	Ends application.

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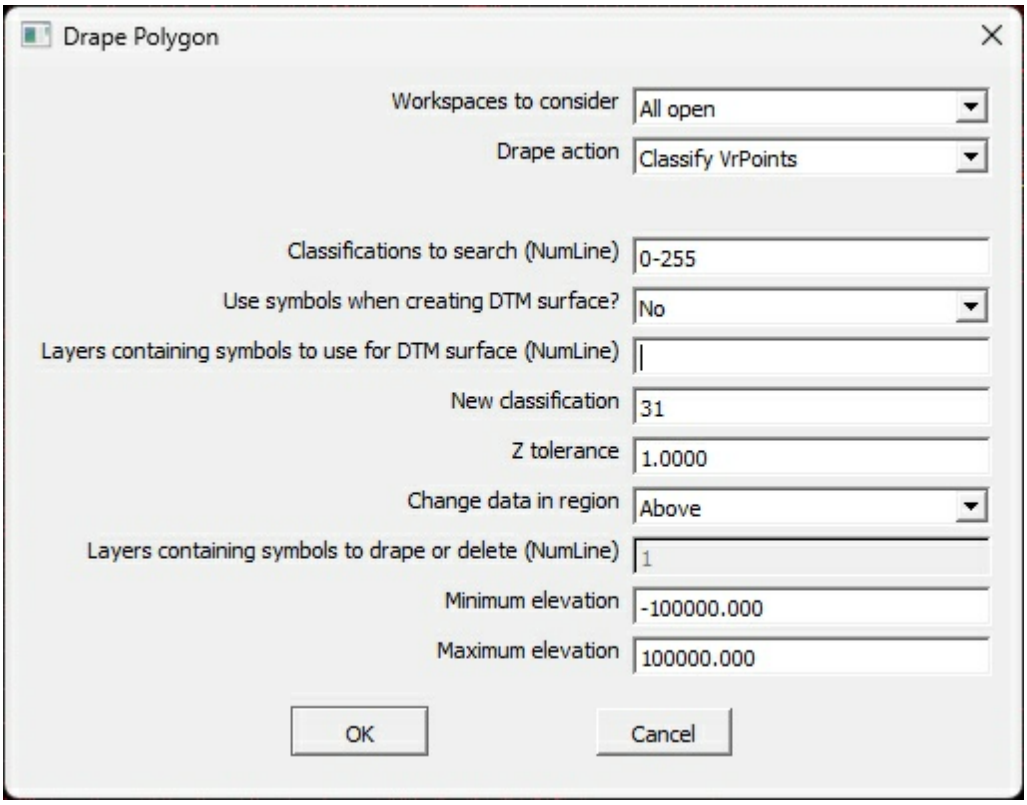
Parameters



The Drape Polygon parameter dialog

Workspaces to consider - Defines the workspaces to consider when identifying points for change. This may be set to "Current only", or "All Open".

Drape action - Three options are available when considering VrPoints against the DTM surface created by the polygon and optional symbols:

- **Drape VrPoints** - VrPoints that fall within the boundary polygon are draped to the DTM surface;
- **Classify VrPoints** - VrPoints that fall within the boundary polygon and whose elevations are within a user defined region (see "Change Data in Region Examples") will have their classification set to the "New classification";
- **Delete VrPoints** - VrPoints that fall within the boundary polygon and whose elevations are above or below the DTM surface plus the "Z tolerance" will be deleted.
- **Delete VrPoints All Elevations** - VrPoints that fall within the boundary polygon will be deleted without consideration of their elevations.
- **Drape Symbols** - Symbols that fall within the boundary polygon are draped to the DTM surface.

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- **Delete Symbols** - Symbols that fall within the boundary polygon and whose elevations are within a user defined region (see "Change Data in Region Examples") will be deleted.

Classifications to search (NumLine) - Defines the classifications to search for when processing VrPoints. Normally points that are displayed are considered but using this parameter allows all points to be displayed while only the classifications defined will be considered for modification. Leaving the field blank will indicate that all VrPoints that are displayed will be considered. A Number Line may be used to define this parameter.

Use symbols when creating the DTM surface? - When active, symbols that are in the "Layers containing symbols" and are within the boundary polygon will be used along with the points on the polygon to define the DTM surface.

Layers containing symbols to use for DTM surface (NumLine) - If the "Use symbols when creating DTM surface" is set to Yes then this parameter will be used to define the layers containing symbols to be used to supplement the DTM surface. A Number Line may be used to define more than one layer.

New classification - If the "Drape action" is set to "Classify VrPoints" then the VrPoints that meet the search criteria are changed to the Classification number defined by this parameter.

Z tolerance - If the "Drape action" is set to "Classify VrPoints" or "Delete VrPoints" or "Delete Symbols" then this parameter defines the minimum vertical distance above or below the DTM surface. This distance will be combined with a user defined region to determine what data will be re-classified or deleted (see "Change Data in Region Examples").

Change data in region - If the "Drape action" is set to "Classify VrPoints" or "Delete VrPoints" or "Delete Symbols" then this parameter defines the region of the DTM surface to modify data. Options are Above, Below, Inside, or Outside
In the following parameter definition, DTM is the DTM surface and ZToler is the Z Tolerance parameter (see "Change Data in Region Examples").

- **Above** - The region above DTM+ZToler
- **Below** - The region below DTM-ZToler
- **Inside** - The region between DTM-ZToler and DTM+ZToler
- **Outside** - The regions above DTM+ZToler and below DTM-ZToler

Layers containing symbols to drape or delete - If the "Drape actions" is set to "Drape Symbols" or "Delete Symbols", this parameter is used to define the layers containing symbols that are draped or deleted if they fall within the boundary. A Number Line may be used to define more than one layer.

Minimum elevation - Defines the minimum elevation for VrPoints or Symbols to be considered.

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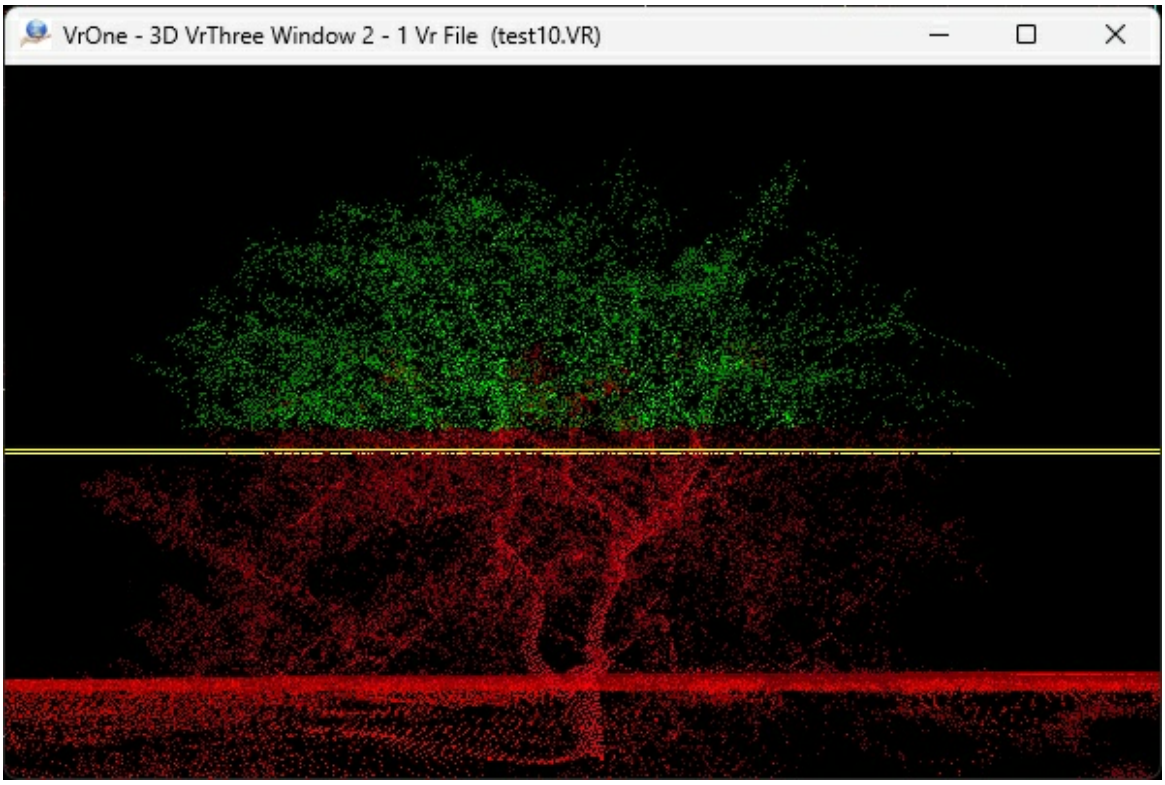
Maximum elevation - Defines the maximum elevation for VrPoints or Symbols to be considered.

Change Data in Region Examples

The following examples show the result of each of the "Change data in region" parameters. This example is not intended to be a real-world example but an illustration of the effect of each of the possible parameters. Shown is a cross section view of a tree with the DTM surface shown as the yellow horizontal line which is a flat surface in this example. The points in red are points with their original classification and the points in green are the draping result.

Above



Above
The region above the DTM surface plus the Z Tolerance. The Z Tolerance is 1.0 in this example.

Below

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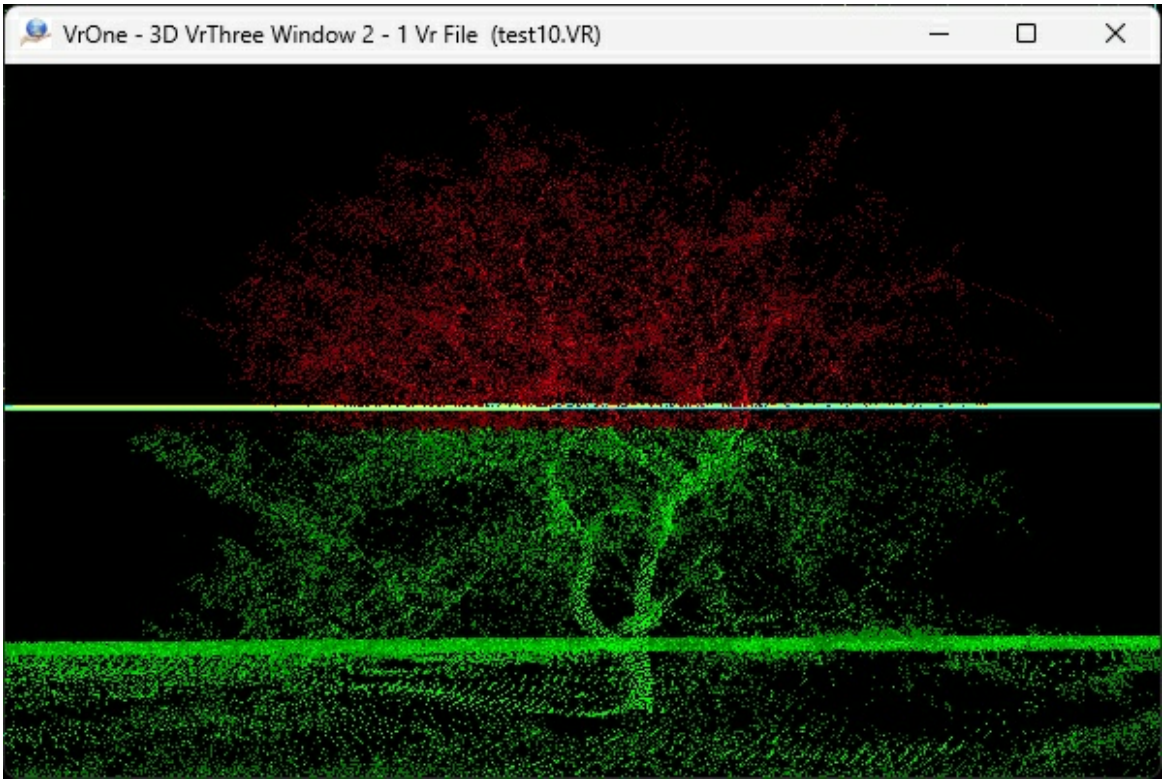
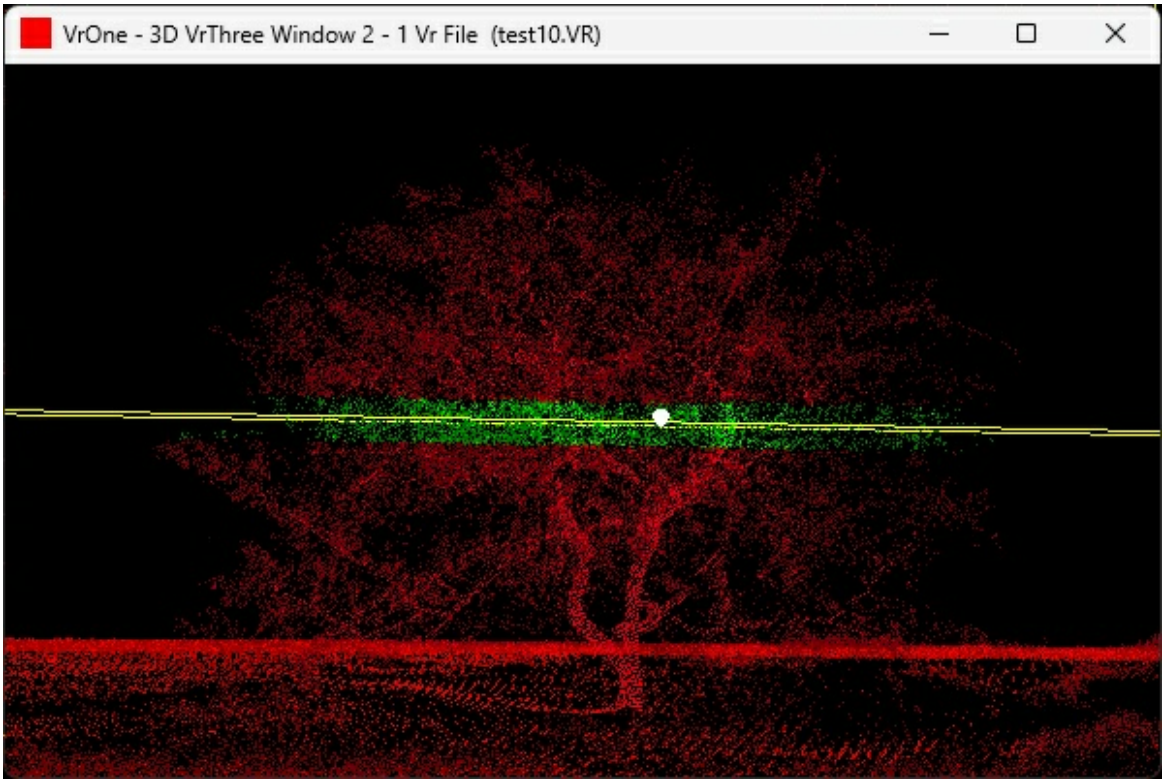


Below

The region below the DTM surface minus the Z Tolerance. The Z Tolerance is 1.0 in this example.

Inside



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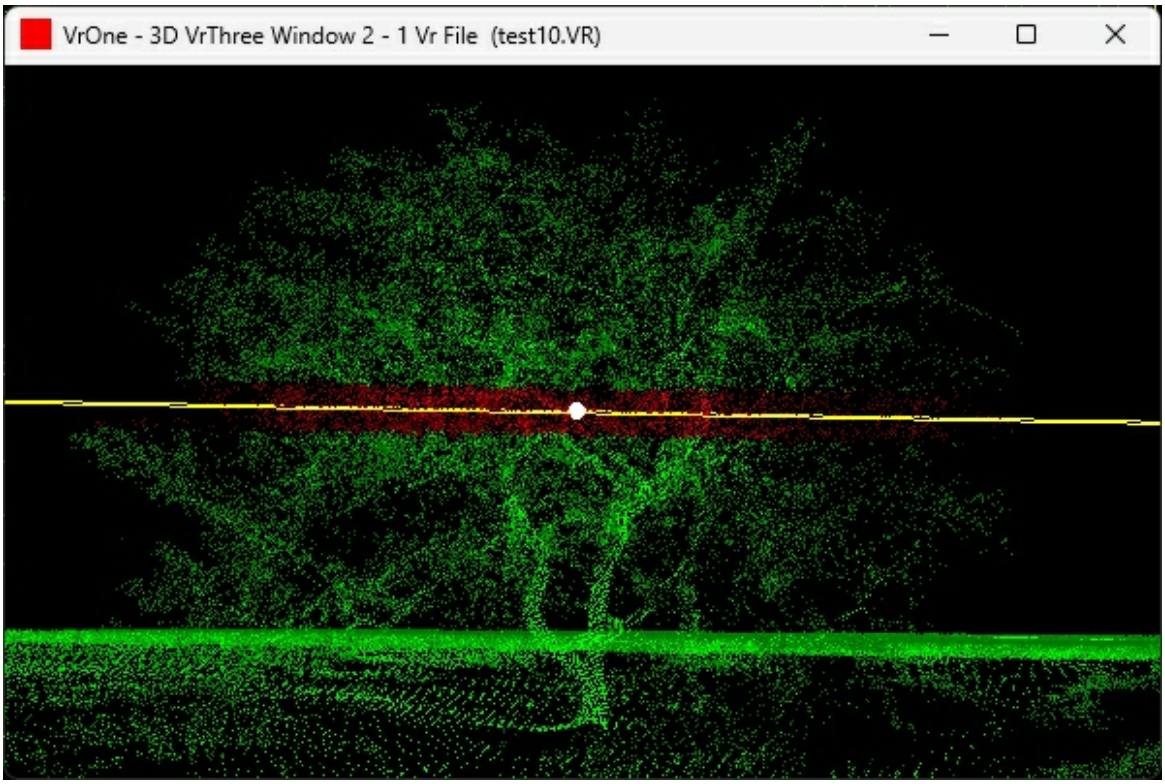
Inside
The region between the DTM surface minus the Z Tolerance and the DTM surface plus the Z Tolerance. The Z Tolerance is 1.0 in this example.

Outside



Outside
The region above the DTM surface plus the Z Tolerance and below the DTM surface minus the Z Tolerance. The Z Tolerance is 1.0 in this example.

Local Commands

Key-in	Description	Range
WsTc=	Workspaces to consider	0=Current 1=All open
DraAct=	Drape Action	0=Drape VrPoints 1=Classify VrPoints 2=Delete VrPoints 3=Delete VrPoints All Elevations 4=Drape Symbols 5=Delete Symbols
SeaCla=	Classifications to search	Number Line
UseSym=	Use symbols for DTM surface	0=No 1=Yes
DtmSymLay=	Symbol layer(s) to use for DTM surface	Number Line
NewCla=	New Classification number	0-31
ZTol=	Z tolerance	Ground units
ChgReg=	Change data in Region	0=Above

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		1=Below 2=Inside 3=Outside
DraSymLay=	Symbol layer(s) to drape or delete	Number Line
MinZ=	Minimum elevation for VrPoints or Symbols to be considered	Ground units
MaxZ=	Maximum elevation for VrPoints or Symbols to be considered	Ground units

Modified "Change data above or below DTM Surface" to "Change data in region" version 07.01.23 - July 2024

2.1.1.9.12 Drape To Points

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Drape To Points (DraPoi)

Type: Interactive/Batch Application

Detailed Description

Drapes line points and/or symbols to existing VrPoints (LiDAR). The line points and symbols are identified by a user-defined boundary polygon. An existing polygon may be identified or a temporary polygon may be digitized as the boundary polygon. Options include generating a grid of symbols in the boundary polygon before draping.

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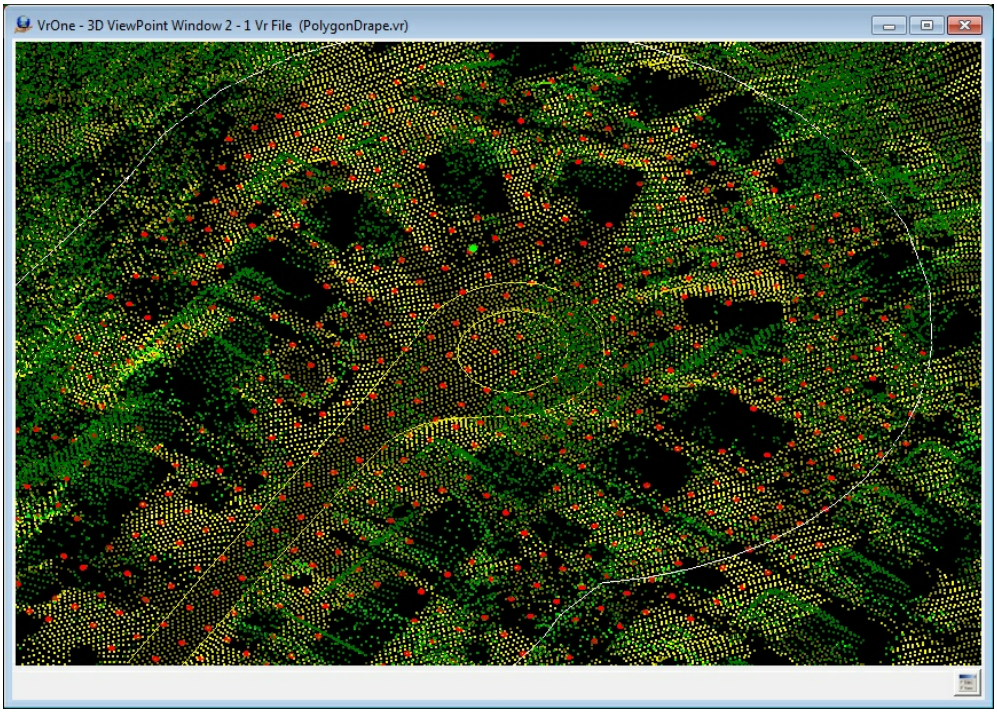
Drape example - before



Drape example - after

The example above shows an area delineated by a user defined polygon (white line). The "before" screen shot shows the user-defined polygon along with a road edge. The elevation of the road is above the surface defined by the points (LiDAR). The "after" screen shot shows the road edge draped onto the surface and the addition of a grid of symbols that is also draped onto

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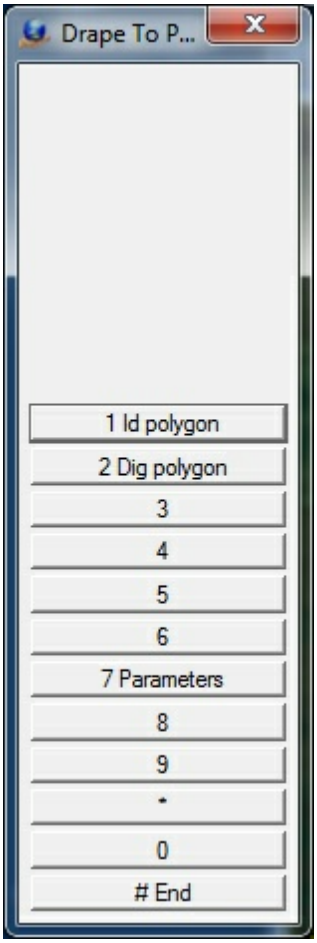
the surface.

Button Assignments



The Drape To Points Menu Keys

Drape Polygon – Main

	Button	Description
1	**Id polygon**	Identifies an existing polygon as the boundary.
2	**Dig polygon**	Allows the boundary polygon to be digitized. The Insert Line application is used to digitize the line. The resulting line is not saved after processing
3		
4		
5		
6		
7	**Parameters**	Allows the definition of Drape to Points parameters (see below).
8		
9		

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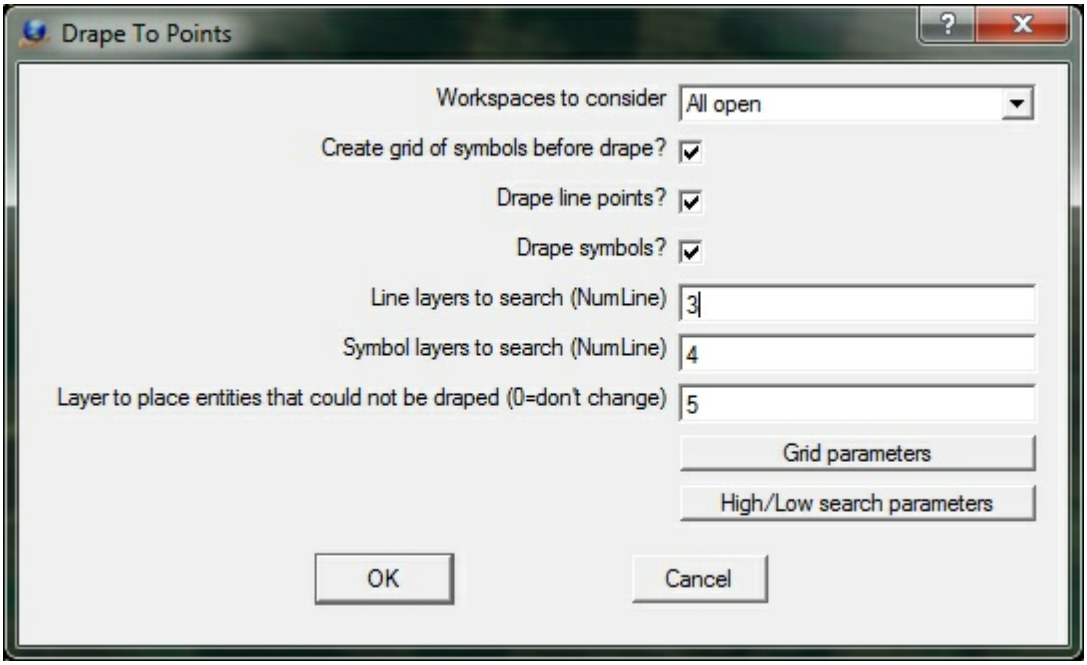
*		
0		
#	End	Ends application.

Parameters



Drape To Points parameter dialog

Workspaces to consider - Defines the workspaces to consider when identifying points for change. This may be set to "Current only", or "All Open".

Create grid of symbols before drape? - Allows the creation of a grid of symbols that are placed at the user defined increment. The initial elevation of the symbols is defined by the first point of the boundary polygon. See "Grid parameters" below for the definition of the grid parameters. NOTE: If the symbols created are to be draped, the layer specified for the symbols must be included in the "Symbol layers to search" below.

Drape line points? - If checked, the line points that fall within the user defined boundary polygon are draped. It is not required that all the points that make up a line be inside the polygon.

Drape symbols? - If checked, the symbols that fall within the user defined boundary polygon are draped.

Line layers to search (NumLine) - If "Drape line points?" is checked, this parameter defines the layers to search for lines to be draped. A Number Line (NumLine) may be used to specify more than one layer number. NOTE: Layers that are turned off will not be considered

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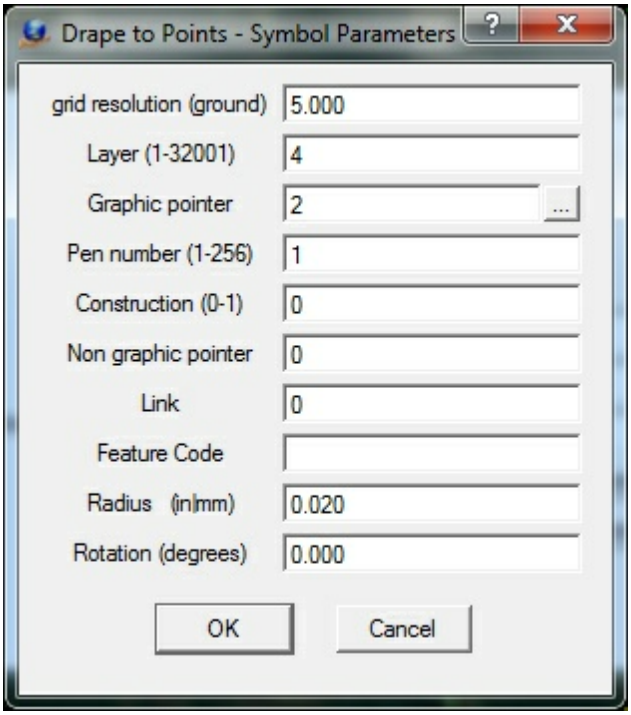
even if they are specified.

Symbol layers to search (NumLine) - If "Drape symbols?" is checked, this parameter defines the layers to search for symbols to be draped. A Number Line (NumLine) may be used to specify more than one layer number. NOTE: Layers that are turned off will not be considered even if they are specified.

Layer to place entities that could not be draped (0=don't change) - Specifies layer into which lines that contain points or symbols that could not be draped during the draping process are placed. Draping might not occur if there are no VrPoints (LiDAR) within the High/Low search radius in reference to the point being draped. Setting this parameter to zero will indicate that the layer number should not be changed if draping cannot occur.

Grid parameters - Allows the definition of the symbol grid parameters.



Drape To Points Symbol parameters dialog

High/Low search parameters - Allows the definition of the High/Low point search parameters. See High/Low Point Search Parameters for more information on these variables and the search process.

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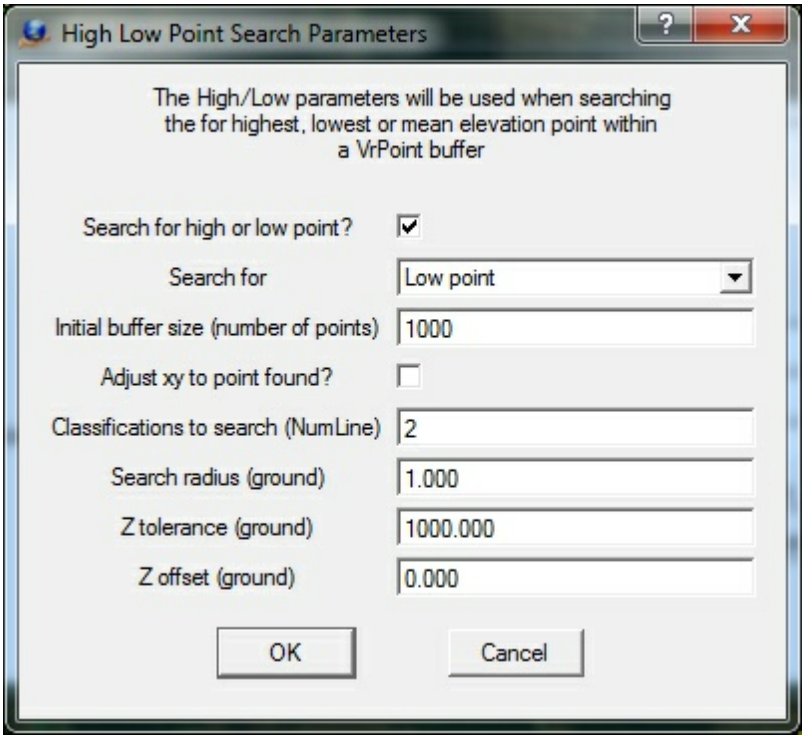

Drape To Points High/Low Search parameters dialog

Local Commands

Local Commands may be keyed-in any time or may be placed in Vr Macros or the Local Args field of a Function Key.

Drape To Points Parameters

Key-in	Description	Range
WsTc=	Workspaces to consider	0=Current 1=All open
CreGri=	Create grid of symbols before draping	0=No 1=Yes
DraLin=	Drape line points	0=No 1=Yes
DraSym=	Drape symbols	0=No 1=Yes
LinLay=	Layers to search for lines	Number Line
SymLay=	Layers to search for symbols	Number Line
FaiLay=	Layer for entities that cannot be draped	0-32001 (0=don't change layers)

Grid Parameters

Lay=	Layer number	1-10001
Grp=	Graphic pointer	1-60
Pen=	Pen number	1-256
Con=	Construction flag	0-1
Ngr=	Non graphic pointer	32 bit
Lnk=	Link number	32 bit

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Fc=	Feature code	48 characters
Rad=	Symbol radius	Inches | Mm
Rot=	Symbol rotation	0-360 degrees

High/Low Point Search Parameters

HiLo_OnOff=	Turns on/off High/Low point searching	0=Off 1=On
HiLo_Mod=	Search mode	0=Search for lowest elevation 1=Search for mean elevation 2=Search for highest elevation
HiLo_BufSiz=	Initial buffer size	Number of points (default=1000)
HiLo_XyAdj=	Adjust point to xy position of high or low elevation	0=Off 1=On
HiLo_SeaCla=	Classifications to use when searching	Number Line (blank=all)
HiLo_SeaRad=	Radius to search for points from line point or symbol	Radius (ground)
HiLo_ZTol=	Z tolerance for search for points	Distance (ground)
HiLo_Zoff=	Z offset to add to found elevation	Distance (ground)

See High/Low Point Search Parameters for more information on the High/Low search parameters.

2.1.1.9.13 Edit Elevations

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Edit Elevations (EdiEle)

Type: Interactive Application

Edits entity elevations.

Detailed Description

Interactively edits entity elevations. Entities to be edited are identified by pointing at them. Elevations may be displayed in the graphics windows. Many edit functions such as increment and

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decrement may be performed. Point elevations may be changed in real-time from a 3D input device such as a stereo plotter or softcopy. When the current input is 2D, rolling the mouse wheel forward will decrement the current elevation and rolling the mouse wheel backward will increment it. The increment/decrement value may be set in Enter Params (button 7).

What is the difference between Edit Elevations and Change Elevations?
Edit Elevations drives the 3D device to the points that are occupied. Change Elevations moves the point elevation to the current input elevation when a point is occupied. Change Elevations may be more useful when editing line elevations from a 3D input device such as a stereo plotter or softcopy. Change Elevations may also be more useful when editing elevations that are a great distance from the current elevation, as with lines with a zero elevation.

Related applications: Change Elevations

Local Commands

Key-in	Description	Range
SEALIN=	Search for lines	0=No 1=Yes
SEASYM=	Search for symbols	0=No 1=Yes
SEATEX=	Search for text	0=No 1=Yes
ROTMOD=	Line text rotation mode	0-1 0 = Rotate text to mean line 1 = Rotate text to defined angle
INC=	Elevation increment	Ground units
HGT=	Height of display text	Inches | Mm
ROT=	Rotation of display text	0-360 degrees
DEC=	Number of places to left of decimal for display text	0-10
SHOELE=	Show elevations when editing	0=No 1=Yes
EREELE=	Erase elevations when finished with edit	0=No 1=Yes

Parameters

Search for Lines? (SEALIN=)

Sets the Search for Lines flag.

Search for Lines? (SEASYM=)

Sets the Search for Symbols flag.

Search for Lines? (SEATEX=)

Sets the Search for Text flag.

Text rotation mode (ROTMOD=)

Defines the mode of the rotation of the text labels. 0=Rotate the text labels to the mean line

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azimuth. 1=Rotate the text labels to defined angle.

Elevation increment (INC=)

Defines the elevation increment to use when incrementing and decrementing elevations.

Height of display text (HGT=)

Defines the height for elevation text labels. This parameter is entered as Inches or Millimeters.

Rotation of display text (ROT=)

Defines the rotation of the display text. This parameter is used if the line text rotation mode is 1 (Rotate text to defined angle).

Number of decimal places (DEC=)

Defines the number of characters to the right of the decimal point for text elevation labels.

Show elevations (SHOELE=)

Specifies whether text elevations are shown during editing. 0=No 1=Yes

Erase elevations (EREELE=)

Specifies whether text elevations are erased after editing. 0=No 1=Yes

Button Assignments

Edit Elev – Lock on

	Button	Description
1	Id entity	Identifies entity.
2	Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3		
4	Toggle lines	Toggles the searching for lines.
5	Toggle symbols	Toggles the searching for symbols.
6	Toggle text	Toggles the searching for text labels.
7	Enter Params	Enters parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Edit Elev – Main

This menu will be displayed if a line is locked on to.

	Button	Description
1	Accept	Accepts changes and returns to Lock on.
2	Next point	Moves the cursor to the next line point.

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3	Prev point	Moves the cursor to the previous line point.
4	Increment	Increments the current elevation by the increment parameters.
5	Decrement	Decrements the current elevation by the increment parameters.
6	Interpolate	Interpolates the current elevation based on the previous and next line points.
7	Enter point Z	Enters the current point elevation.
8	Enter line Z	Sets all the points on the current line to the elevation entered.
9	Prev point Z	Sets the current elevation to the previous point elevation.
*		
0		
#		

Edit Elev – Main

This menu will be displayed if a symbol or text label is locked on to.

	Button	Description
1	Accept	Accepts changes and returns to Lock on.
2		
3		
4	Increment	Increments the current elevation by the increment parameters.
5	Decrement	Decrements the current elevation by the increment parameters.
6		
7	Enter point Z	Enters the current point elevation.
8		
9		
*		
0		
#		

2.1.1.9.14 Edit Line

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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Edit Line (EdiLin)

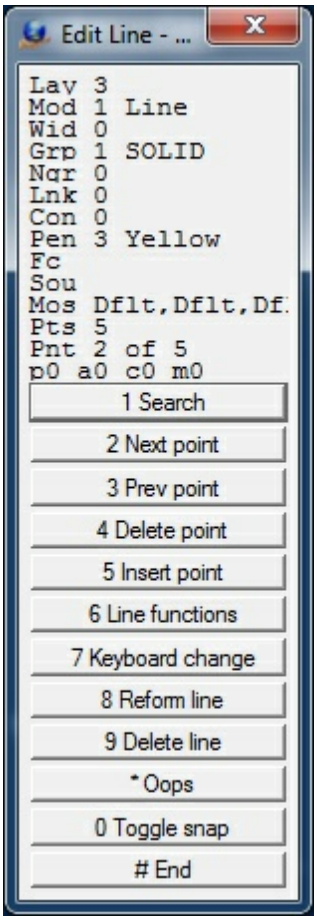
Type: Interactive Application

Interactively edits a line in a VrOne workspace.

Entity Elevations When Editing in 2D

When editing using a two dimensional device such as the system mouse, there are two parameters that control the assignment of the elevation during a move line, copy line, move line points, copy line point, and snap operation. Z Mode Move may be set to "hold" the original elevation or set the elevation to the "Active Z". Z Mode Snap may be set to "hold" the original elevation, set the elevation to the "Active Z", or "Snap" when snapping the current symbol entity to an existing entity.

When moving or inserting a line point, only that point elevation is changed. When moving or copying a line, all the line points are shifted in relation to the current line point.



Edit Line Menu Keys dialog

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Local Commands

Key-in	Description	Range
LAY=	Layer number	1-30001
MOD=	Mode	1-2 (1=line 2=spline line)
GRP=	Graphic pointer	1-60
WID=	Line width	0-255
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	15 char
Z=	Point elevation	Floating point value
F=	Point flag (Used by VrOne internal routines)	0-255
C=	Point code (Not used)	0-255
M=	Point mosaic width (Used by VrMosaic)	0-255
P=	Point pen code	0-4 0 = Continue, 1 = Up, 2 = Continue 4 = End
DIG=x y z	Digitizes point	
ZMOMOV=	Z Mode when moving or copying a line or line point	0 = Hold original elevation 1 = Use Active Z
ZMOSNA=	Z Mode when snapping a line or line point	0 = Hold original elevation 1 = Use Active Z 2 = Use elevation of snapped entity
FKEY=name	Changes to function key parameters	
SEACYC=	Sets search cycle mode	0 = Don't cycle through entities when searching 1 = Cycle through entities when searching
ZMODE=	Z mode in Keyboard Change	0 = Change point 1 = Change line
ZOPER=	Z operator in Keyboard Change	0 = Equals 1 = Add 2 = Subtract 3 = Multiply 4 = Divide

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Parameters

Z Mode Move (ZMOMOV=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the line or line point when moving or copying a line or line point. Option 0 is "hold", which maintains the original elevation; option 1 is "Active Z", which sets the elevation or the line or line point to the currently set Active Z.

Z Mode Snap (ZMOSNA=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the line or line point when moving or copying the line or line point then snapping it to an existing entity. Option 0 is "hold", which maintains the original elevation. Option 1 is "Active Z", which sets the line or line point elevation to the currently set Active Z . Option 2 sets the elevation of the line or line point to that of the entity to which the line or line point was snapped.

Inherit Function Key Parameters (FKEY=)

Changes symbol parameters to the parameters in a function key.

Z Mode (ZMODE=)

This parameter is used in the Keyboard Change (button 7) option after a line has been identified. Determines which points on the current line will have their elevation modified.

0 - Change Point (ZMODE=0) - The Elevation is applied to the current point only.

1 - Change line (ZMODE=1) - The Elevation is applied to all the points on the current line.

Z Operator (ZOPER=)

This parameter is used in the Keyboard Change (button 7) option after a line has been identified. Determines how the Elevation will be applied to the line point(s).

0 - Equals (ZOPER=0) - The elevation(s) will be set to the Elevation specified

1 - Add (ZOPER=1) - The elevation will be added to the current line point elevation(s)

2 - Subtract (ZOPER=2) - The elevation will be subtracted from the current line point elevation(s)

3 - Multiply (ZOPER=3) - The current line elevation point(s) will be multiplied by the Elevation specified

4 - Divide (ZOPER=4) - The current line elevation point(s) will be divided by the Elevation specified. If this option is active then the Elevation specified cannot be zero.

Button Assignments

Edit Line - Lock On

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Allows searching for a line to edit.

	Button	Description
1	Identify line	Identifies a line to edit.
2	Reset search	Resets search cycling if turned on.
3		
4		
5		
6		
7	Enter params	Enter parameters.
8		
9		
*		
0		
#	End	Ends Edit Line.

Edit Line - Main

These buttons are active after a line has been locked on to.

	Button	Description
1	Search	Saves the current line and returns to Lock on.
2	Next point	Moves to the next point on the line.
3	Prev point	Moves to the previous point.
4	Delete point	Deletes the current line point.
5	Insert point	Inserts a point after the current point.
6	Line functions	Starts menu with more line edit functions (Line Funcs).
7	Keyboard change	Allows changing line parameters using a dialog box.
8	Reform	Reforms line.
9	Delete line	Deletes the current line after verification.
*	Oops	Discards changes and returns to Lock on.
0	Toggle snap	Toggles snap on/off.
#	End	Ends Edit Line.

Edit Line - Ins Point

Places a point on line between the current point and the next point on line.

	Button	Description
1	Dig new point	Digitizes a new XYZ point.
2	Point on line	Places a new point.
3		
4		
5		
6		

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7		
8		
9		
*	*	
0	Toggle snap	Toggles snap on/off.
#	End	Ends Insert Point and returns to Main.

Edit Line – POL (Point on Line)

Places a point on line between the current point and the next point on line. A VrOne Point on Line (Pol) application is available for placing a point on an existing line.

	Button	Description
1	Dig new point	Places a point on line at offset from current location.
2		
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends Point on Line and returns to Main.

Edit Line - Line Funcs

More line editing functions

	Button	Description
1	Move point	Moves the current line point.
2	Move line	Moves the line.
3	Rotate line	Rotates the line about the current point.
4	Copy line	Copies the line.
5	Mirror	Mirrors the line.
6	Delete arc flags	Deletes all arc flags on the line.
7	B spline	Fits a B-spline curve through the existing line points. Line is re-saved and Edit Line returns to Lock On.
8	Length Area Z	Displays the horizontal and slope distances, area, and mean elevation of the line.
9	Close line	Closes the line by placing a line segment from the first point to the last point. Execution returns to Main.
*	Slope line	The elevations of the line are interpolated based on the first and last points on the line

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0	Toggle snap	Toggles snap on/off.
#	End	Ends Line Functions and returns to Main.

Copy Line Notes:
When copying a line, the elevation of the current line point will be moved to the Active Z if the input Active Digitizer is XYZ (Stereo plotter). If the Active Digitizer is XY (Digitizing tablet) or mouse, the elevations are not changed.

Edit Line - Copy line

Mirrors the line about the current point.

	Button	Description
1	Dig	Digitizes the location for the copied line.
2	New base point	Digitizes a new base point for ortho mode.
3	Duplicate	Duplicates the identified line.
4	Rev duplicate	Reverses the point order and duplicates the identified line.
5	Copy to Ws	Copies the identified line to another open Workspace.
6		
7		
8		
9		
*		
0		
#		Ends Copy Line and returns to Line Functions.

Copy Line Notes:
When a line is duplicated or copied, the position of the points on the line are taken from the originally identified line and not the edited points, if any. The copied line is positioned on top of the identified line.Attributes such as Layer and Graphic Pointer will be copied with the line.

Edit Line - Rotate

Rotates the line about the current point.

	Button	Description
1	Accept	Accepts the current line rotation and returns to Main.
2	Rotate plus	Rotates clockwise by current rotation increment.
3	Rotate minus	Rotates counterclockwise by current rotation increment.
4	Rotate 45 deg	Rotates clockwise by 45 degrees.
5	Rotate 90 deg	Rotates clockwise by 90 degrees.
6		
7	Enter rot incr	Allows entry of rotation increment.
8	Enter rotation	Allows entry and rotation of line by user-defined value.
9		
*		

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0		
#		

Edit Line - Mirror

Mirrors the line about the current point.

	Button	Description
1	Mirror X	Mirrors the line about the X axis.
2	Mirror Y	Mirrors the line about the Y axis.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#		Ends Mirror and returns to Line Functions

Edit Line - Reform

Moves a group of points by dragging the current point. Points to be moved are defined by a negative and positive side pivot point. The basic shape of the lines between the pivot points and the current point are maintained while the current point is being moved.

	Button	Description
1	Reform Line	Reforms the line based on the current point and the pivot points.
2	Add points	Moves both pivot points away from the current point.
3	Remove points	Moves both pivot points towards the current point.
4	Toggle 2D/3D	2D – Reform is done in the XY plane only. 3D – Elevations are interpolated based on the distance moved.
5	Add point -	Moves negative side pivot point away from current point.
6	Remove point -	Moves negative side pivot point towards current point.
7	Edit defaults	Allows setting parameters such as reform radius.
8	Add point +	Moves positive side pivot point away from current point.
9	Remove point +	Moves positive side pivot point towards current point.
*		
0		
#	Abandon	Abandons Reform Line and returns to Main.

Updated: May 2019

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ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Edit Vertex (EdiVer)

Type: Interactive Application

Interactively edits line point positions.

Detailed Description

Edit Vertex is point oriented, interactive editor which has the ability to edit single or multiple line points at a time. Features (Action) include the ability to move, insert, delete and merge line points along with options for setting the point elevations. A hack/extend function is also available to clip or extend single or multiple lines. This function is similar to the Hack Line (HacLin) application which operates on a single line. For more information on the parameters for Edit Vertex please see Edit Vertex - Parameters.

For the interactive editing of single lines please see Edit Line.

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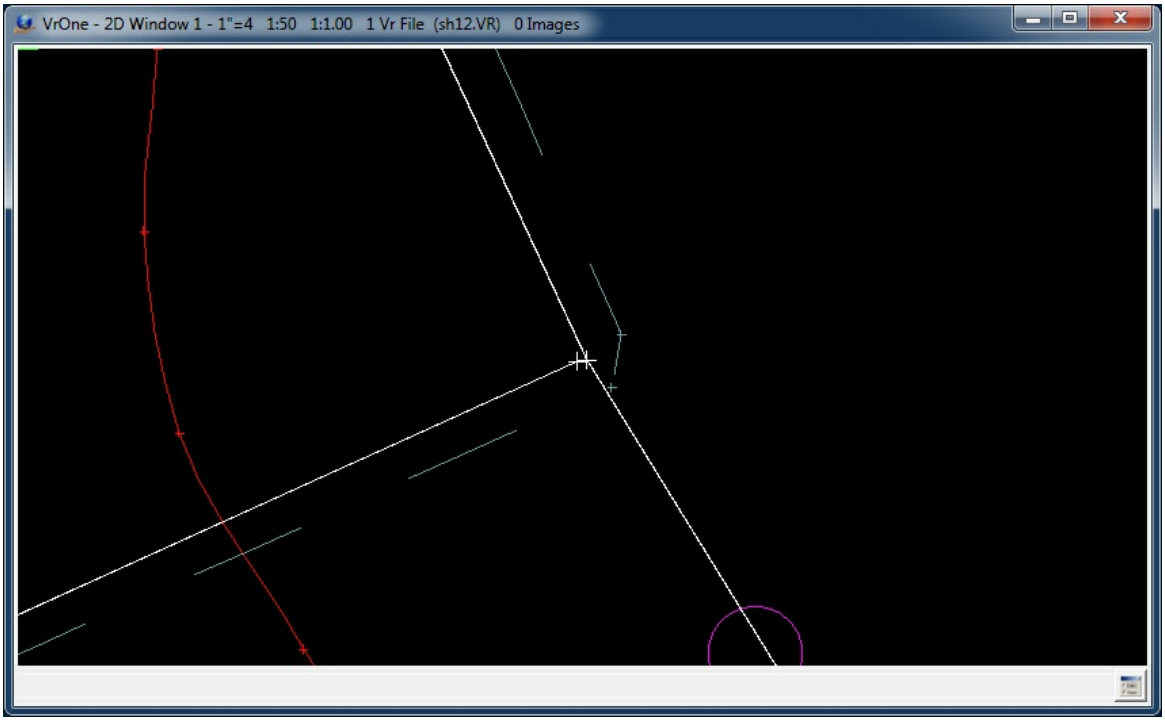

Two line points on two lines identified

Button Assignments

Edit Vertex - Lock On

The Lock On menu allows the identification of line points and the editing of Edit Vertex parameters.

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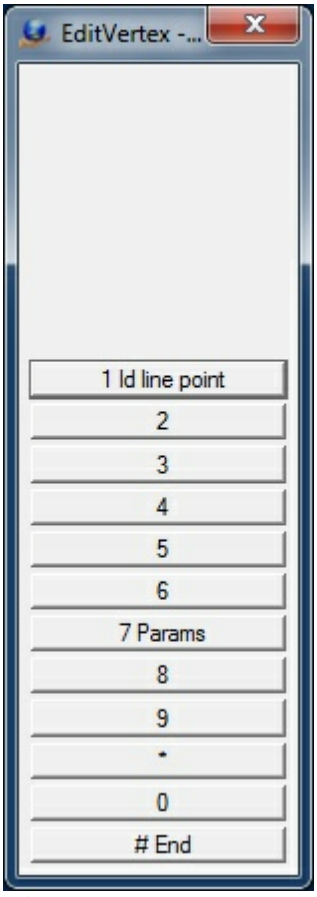

Edit Vertex - Lock-on

1 Id line point

Allows the identification of a line point or line points to be edited. The identification of these line points is determined by a user defined search radius. Identified points my be on multiple lines in multiple workspaces. When the points are identified, each point is marked with a white cross and the lines are shown as tentative lines. If multiple points have been identified, the attributes of the closest point (close point) to the search location are displayed in the information area of the Menu Keys dialog box in the subsequent menu. Depending on the current setting of Action, the Move menu or Insert menu or Hack/Extend menu or Delete confirmation menu or Merge conformation menu will be displayed.

7 Params

The Edit Vertex parameters may be edited with this option. See Edit Vertex - Parameters below for more information.

 # End

Ends Edit Vertex. Any points that are in the process of being edited will be saved.

Edit Vertex - Move

Allows the moving of the identified line points.

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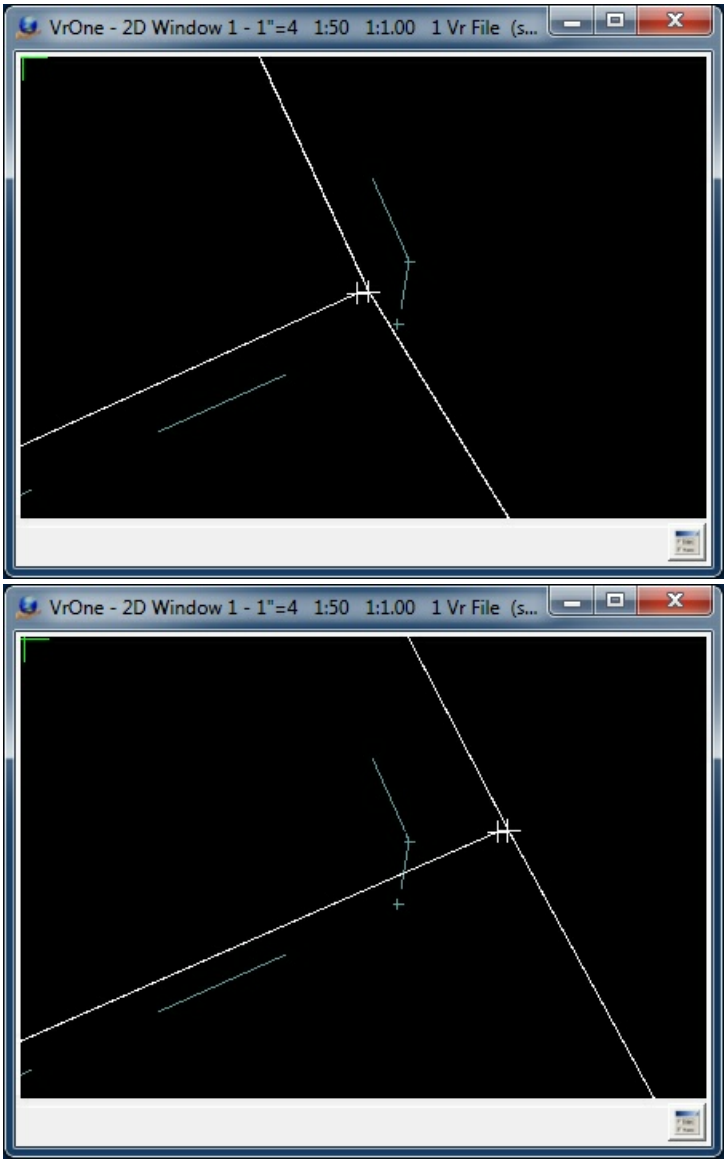

Edit Vertex showing the identified line points before (left) and after (right) Move.

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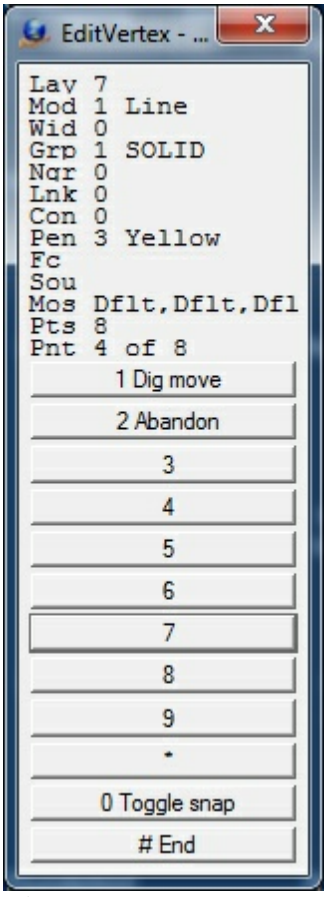

Edit Vertex - Move

1 Dig move

Digitized a new location for the identified line points. The closest line point to the search point ("close point") will be at this new position and the remainder of the line points will be placed at the proper delta distance from this point. New Z values are determined by the Z Mode in Edit Parameters. The revised lines will be displayed as tentative and the Accept/Reject menu is displayed.

2 Abandon

Abandons the current menu and returns to the Lock On menu.

0 Toggle snap

Toggles snap on/off

 # End

Ends Edit Vertex.

Edit Vertex - Insert

Allows the insertion of a new point. The new point will be inserted on all identified lines and will be placed as a "point on line" function on each line.

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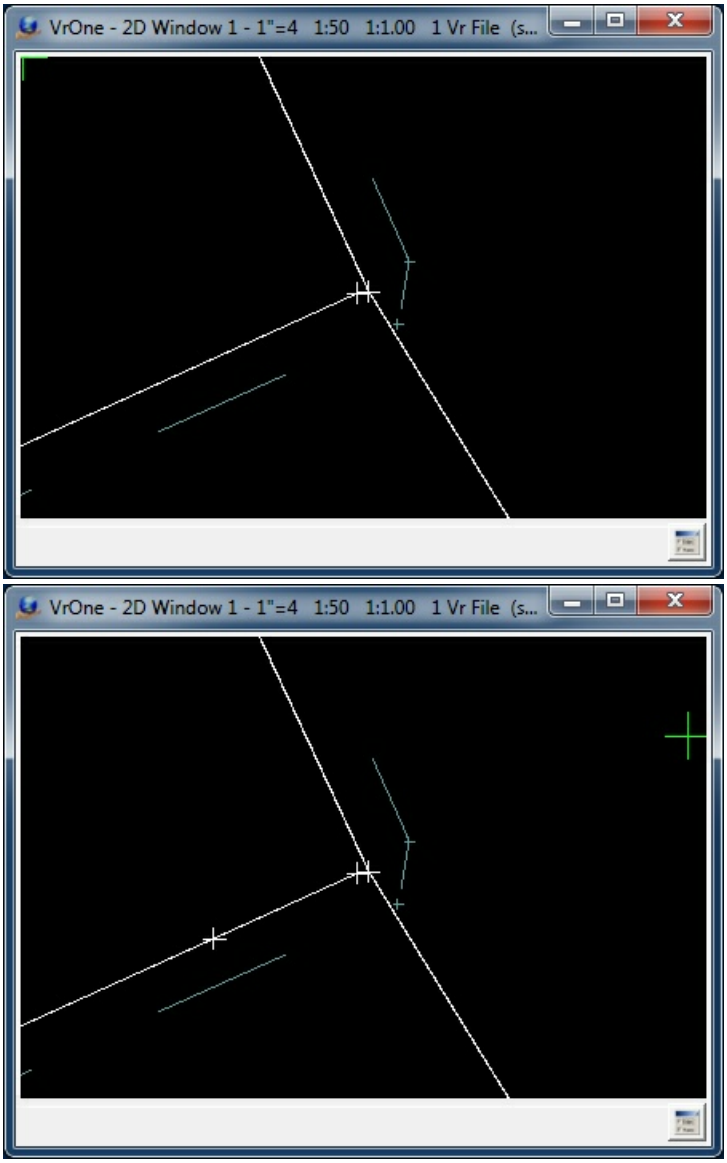

Edit Vertex showing the identified line points before (left) and after (right) Insert.

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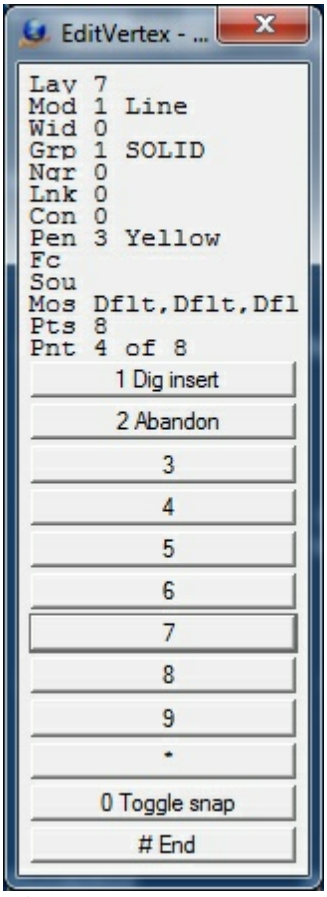

Edit Vertex - Insert Menu

1 Dig insert

Digitizes the insert point to be placed on The new point will be inserted on all identified lines and will be placed as a "point on line" function on each line. New Z values are determined by the Z Mode in Edit Parameters. The revised lines will be displayed as tentative and the Accept/Reject menu is displayed.

2 Abandon

Abandons the current menu and returns to the Lock On menu.

0 Toggle snap

Toggles snap on/off

 # End

Ends Edit Vertex.

Edit Vertex - Hack/Extend

The Hack/Extend function operates on the lines that are common with the line points identified. This operation supports the hacking or extending of these lines. It operates similar to the Hack Line (HacLin) application with works with a single line.

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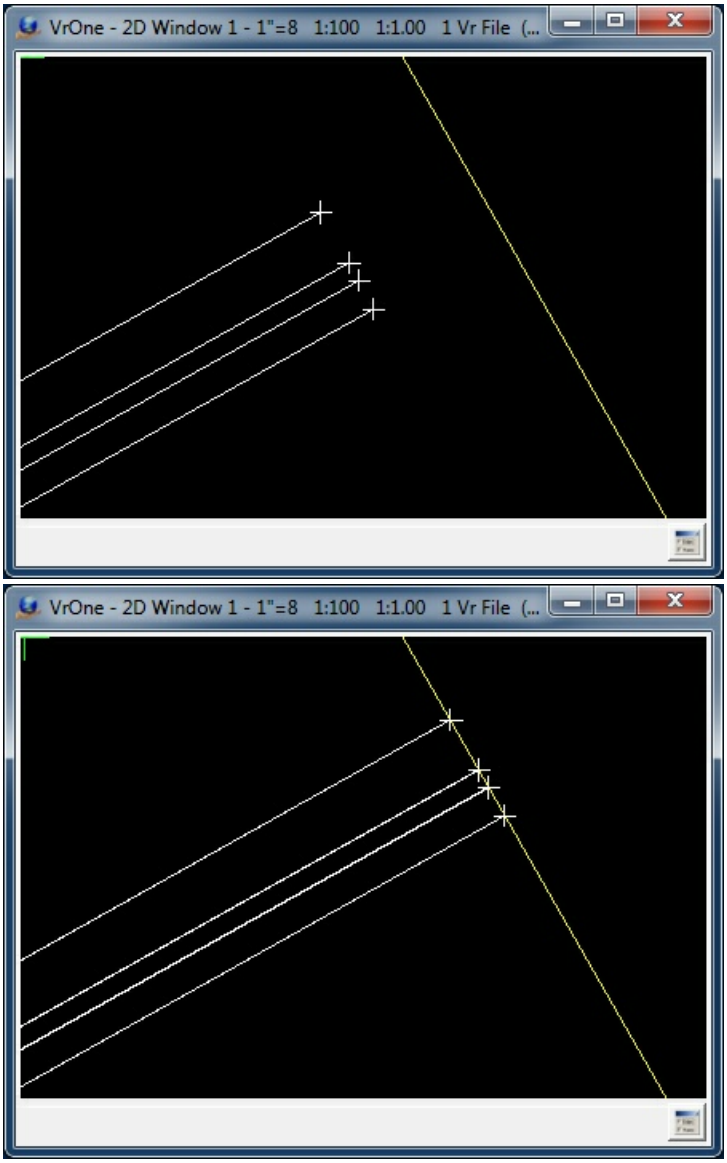

Edit Vertex showing the identified line points before (left) and after (right) Hack/Extend.

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Edit Vertex - Hack/Extend Menu

1 Dig hack/extend

Digitizes the hack/extend location. The location of this point determines if the lines will be hacked or extended. New Z values are determined by the Z Mode in Edit Parameters. The revised lines will be displayed as tentative and the Accept/Reject menu is displayed.

2 Abandon

Abandons the current menu and returns to the Lock On menu.

0 Toggle snap

Toggles snap on/off

 # End

Ends Edit Vertex.

Edit Vertex - Delete Conformation

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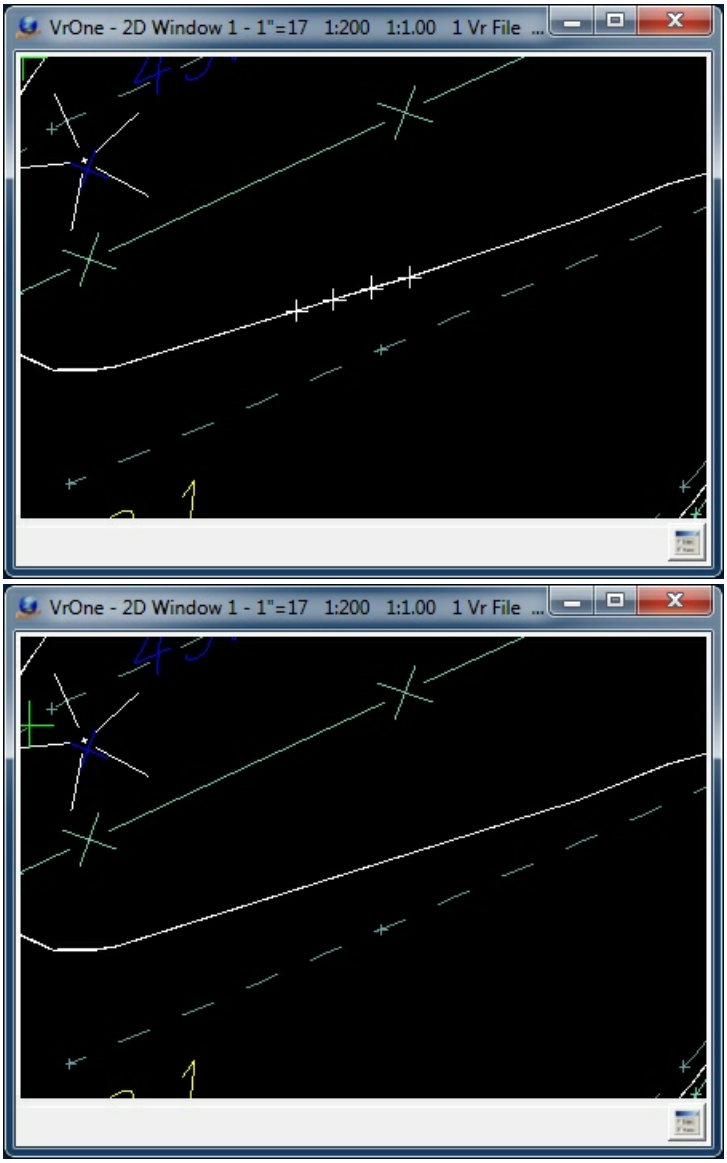

Edit Vertex showing the identified line points before (left) and after (right) Delete.

If the Action parameter is set to Delete then the current line points that have been identified will be deleted. Before the line points are deleted, the following menu is displayed allowing the user to review the points that were identified before modifying them. If the identified line points are Accepted then the revised lines will be displayed as tentative and the Accept/Reject menu is displayed.

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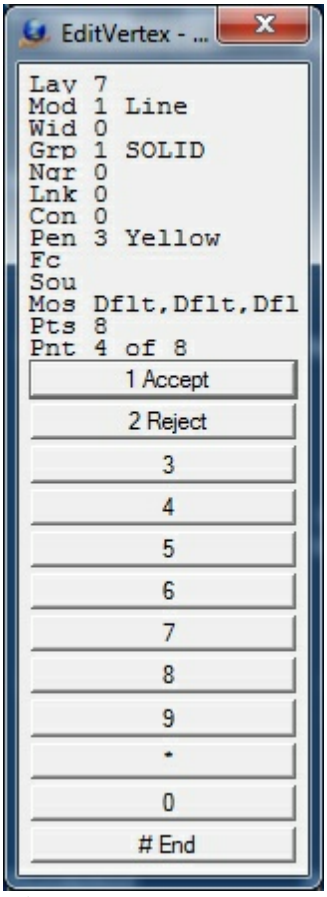

Edit Vertex - Delete Menu

1 Accept
Accepts the points identified to be deleted.

2 Reject
Rejects the points identified to be deleted.

 # End
Ends Edit Vertex.

Edit Vertex - Merge Conformation

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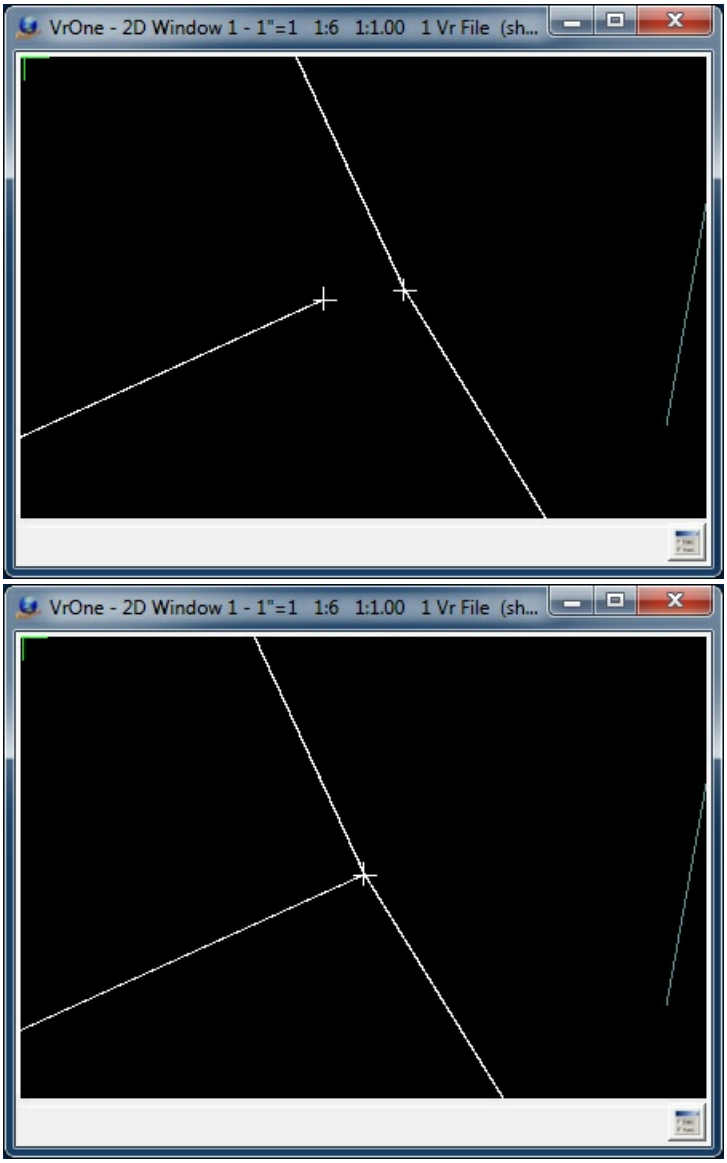

Edit Vertex showing the identified line points before (left) and after (right) Merge.

If the Action parameter is set to Merge then the current line points that have been identified will be merged. Before the line points are merged, the following menu is displayed allowing the user to review the points that were identified before modifying them. If the identified line points are Accepted then the revised lines will be displayed as tentative and the Accept/Reject menu is displayed.

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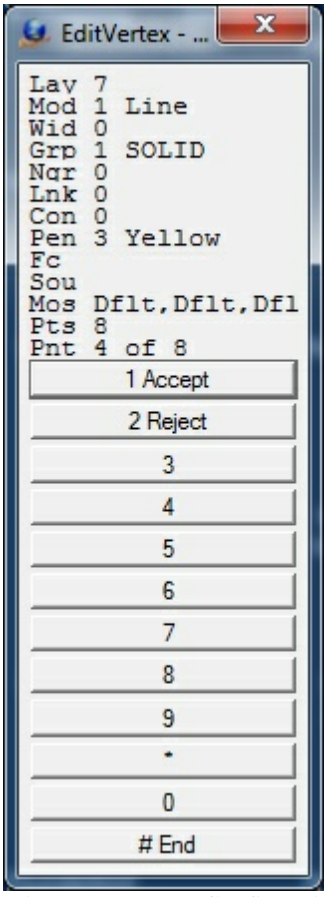

Edit Vertex -Merge Confirmation Menu

1 Accept
Accepts the points identified to be merged.

2 Reject
Rejects the points identified to be merged.

 # End
Ends Edit Vertex.

Edit Vertex - Accept/Reject

Each function that modifies line points confirms the changes before storing the new positions. Move, Insert, Hack/Extend, Delete and Merge will display the Accept/Reject menu after modifying line points and before storing the points in the Vr database if Accept is selected.

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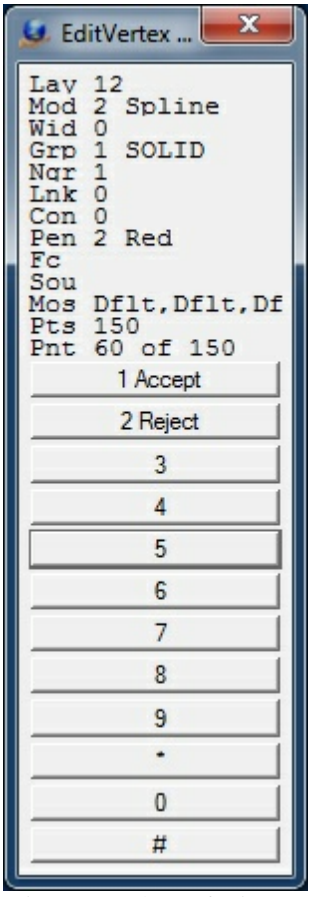

Edit Vertex - Accept/Reject Menu

1 Accept

Accepts the changes to the current line points and changes the lines in the Vr database.

2 Reject

Rejects the changes to the current line points and does not change the lines in the Vr database.

Edit Vertex - Parameters

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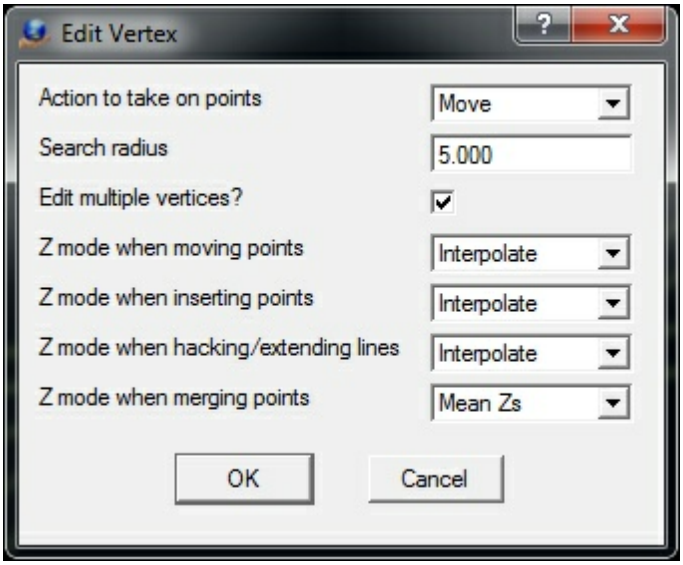

Edit Vertex - Edit Parameters

Action to take on points

This parameter determines the "Action" to perform on the line points that are identified. These actions include Move, Insert, Hack/Extend, Delete and Merge.

Search Radius

The search radius specifies the distance from the search point in which to search for line points. This parameter is specified in ground units.

Edit multiple vertices?

When this item is checked then multiple line points will be searched for based on the search radius. If it is unchecked then the closest line point to the search point will be used if it is within the search distance.

Z mode when moving points

Determines the action to take on the line point elevations when moving line points. The options include "Interpolate", "Use current Z" and "Don't change".

- **Interpolate** - The "close point" elevation will become the current Z and the remainder of the line points will have a delta elevation applied.
- **Use current Z** - All line point elevations will be assigned the current Z.
- **Don't change** - The line point elevations will not be modified.

Z mode when inserting points

Determines the action to take on the line point elevations when inserting line points. The options include "Interpolate" and "Use current Z".

- **Interpolate** - The new inserted point elevations will be interpolated based on a vertical slope from the elevation of the points before and after the insertion point.
- **Use current Z** - All line point elevations will be assigned the current Z.

Z mode when hacking or extending lines

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Determines the action to take on the line point elevations when hacking or extending line points. The options include "Interpolate" and "Use current Z".

- **Interpolate** - The new inserted point elevations will be interpolated based on a vertical slope from the elevation of the points before and after the insertion point when hacking or a vertical slope based on the last two points on the line when extending points.
- **Use current Z** - All line point elevations will be assigned the current Z.

Z mode when merging points

Determines the Z mode, which determines the action to take on the line point elevations when merging line points. The options include "Mean Zs", "Use current Z" and "Don't change".

- **Mean Zs** - The elevations of the points will be averaged to a common elevation. Using this mode will make cause all the merged points to have the same X,Y,Z coordinates which will result in a single line point when the line is saved.
- **Use current Z** - All line point elevations will be assigned the current Z. Using this mode will make cause all the merged points to have the same X,Y,Z coordinates which will result in a single line point when the line is saved.
- **Don't change** - The line point elevations will not be modified. If the elevations of the existing points are different then this mode may result in points placed at the same X,Y location with different elevations. This may not be desirable.

Local Commands

Key-in	Description	Range
SEARAD=	Search Radius (ground)	0.01 - 1,000,000
HELP	Displays this help page	

Search Radius (SeaRad=)

Sets the current line point search radius in ground units.

Help Page (Help)

Displays this help page.

Edit Vertex was available in VrOne/VrTwo beginning in Vr Mapping version 05.07.21

ON-LINE REFERENCE DOCUMENTATION
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Mapping

Edit Point (EdiPoi)

Type: Interactive Application

Interactively edits a single VrPoint (LiDAR) in a VrOne workspace.

Detailed Description

Allows interactive, graphical editing of an existing point in a VrOne workspace. Points may be changed, moved, copied or deleted.

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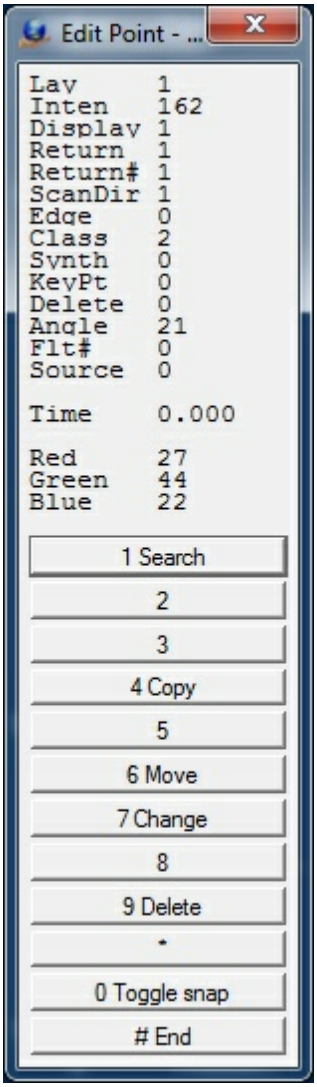

Edit Point Menu Keys dialog

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-30001
INT=	Intensity	0-65535
RET=	Return number	1-5
RE#=	Number of returns	1-5
SCA=	Scan direction flag	0-1
EDG=	Edge flag	0-1
CLA=	Classification	0-31
SYN=	Synthetic flag	0-1
KEY=	Key point flag	0-1
ANG=	Scan angle	-90 to 90

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FLT=	Flight number	0-255
SOU=	Point source Id	0-65535
TIM=	Gps Time	+/– 1.8e308
RED=	Red image channel	0-255
GRE=	Green image channel	0-255
BLU=	Blue image channel	0-255

Parameters

Layer number (LAY=)

Vr Layer number. Range: 1-30001

Intensity (INT=)

The intensity value is the integer representation of the pulse return magnitude. This value is optional and system specific. Range: 0-65535

Return number (RET=)

The Return Number is the pulse return number for a given output pulse. A given output laser pulse can have many returns which must be marked in sequence of return. The first return will have a Return Number of one, the second a Return Number of two, and so on up to five returns. Range: 1-5

Number of returns (RE#=)

The Number of Returns is the total number of returns for a given pulse. For example, a laser data point may be return two (Return Number) within a total number of five returns. Range: 1-5

Scan direction flag (SCA=)

The Scan Direction Flag denotes the direction in which the scanner mirror was traveling at the time of the output pulse. A bit value of 1 is a positive scan direction and a bit value of 0 is a negative scan direction (where positive scan direction is a scan moving from the left side of the in-track direction to the right side and negative the opposite). Range: 0-1

Edge flag (EDG=)

The Edge of Flight Line data bit has a value of 1 only when the point is at the end of a scan. It is the last point on a given scan line before it changes direction. 1=Point is edge of flight line.

Classification (CLA=)

Point classification. If a point has never been classified, this value must be set to zero. Range: 0-31

NOTE: The Vr database supports a Classification range of 0-255 although the current software complies with the LAS specification of 0-31.

0	Created, never classified
1	Unclassified
2	Ground

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3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point (mass point)
9	Water
10	Reserved for ASPRS Definition
11	Reserved for ASPRS Definition
12	Overlap Points
13-31	Reserved for ASPRS Definition

Synthetic flag (SYN=)

If set to 1, this point was created by a technique other than LiDAR collection, such as digitized from a photogrammetric stereo model. Range: 0-1

Key point flag (KEY=)

If set to 1, this point is considered to be a model key-point and thus generally should not be withheld in a thinning algorithm. Range: 0-1

Scan angle (ANG=)

The Scan Angle has a valid range from -90 to +90 and is the angle (rounded to the nearest integer in the absolute value sense) at which the laser point was output from the laser system including the roll of the aircraft. The scan angle is within 1 degree of accuracy from +90 to –90 degrees. The scan angle is an angle based on 0 degrees being nadir, and –90 degrees to the left side of the aircraft in the direction of flight. LAS range: +90 to -90. Vr range: -32767 to 32768

Flight number (FLT=)

User-defined flight number. This attribute is not defined in the LAS specification. Range: 0-255

Point source Id (SOU=)

This value indicates the file from which this point originated. Valid values for this field are 1 to 65,535 inclusive with zero being used for a special case discussed below. The numerical value corresponds to the File Source ID from which this point originated. Zero is reserved as a convenience to system implementers. A Point Source ID of zero implies that this point originated in this file. This implies that processing software should set the Point Source ID equal to the File Source ID of the file containing this point at some time during processing. Range: 0-65535

GPS time (TIM=)

GPS time at which the point was acquired in seconds. This attribute is available in VrPoint formats 1 and 3. Range: -1.8e307 to 1.8e307

Red (RED=)

The red image channel value associated with this point. This attribute is available in VrPoint formats 2 and 3. Range: 0-255

Green (GRE=)

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The green image channel value associated with this point. This attribute is available in VrPoint formats 2 and 3. Range: 0-255

Blue (BLU=)

The blue image channel value associated with this point. This attribute is available in VrPoint formats 2 and 3. Range: 0-255

Button Assignments

Edit Point - Lock On

	Button	Description
1	Id point	Identifies point to edit
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application

Edit Point - Main

	Button	Description
1	Search	Saves the current point and returns to Lock on
2		
3		
4	Copy	Copies point
5		
6	Move	Moves point
7	Change	Allows changing of point attributes using a dialog box
8		
9	Delete	Deletes the current point after verification
*		
0	Toggle snap	Toggles snap on/off
#	End	Ends application

Pressing button 7 (Change) displays the following dialog which allows the modification of the current point's attributes.

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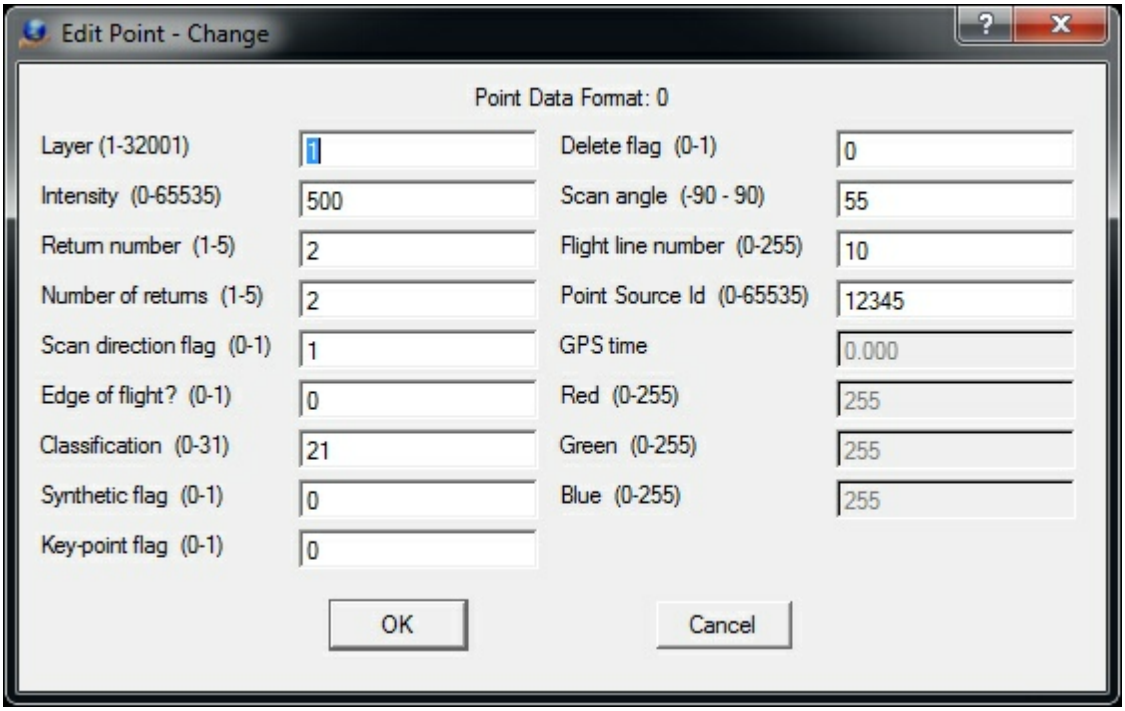

Edit Point Change dialog

Each VrOne file uses one of the four Point Data Formats. These formats are based on the LAS specified data formats. The current Point Data Format number is displayed at the top of this dialog and attributes that are not supported by the current format are dimmed. See Parameters above for information on each attribute presented in this dialog.

2.1.1.9.17 Edit Symbol

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Vr Mapping

Edit Symbol (EdiSym)

Type: Interactive Application

Interactively edits a symbol in a VrOne workspace.

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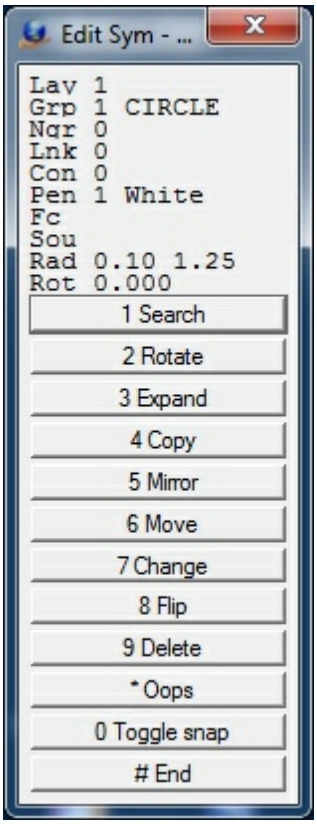
Detailed Description

Allows interactive, graphical editing of an existing symbol in a VrOne workspace. Symbols may be changed, moved, copied, re-sized and rotated.

Entity Elevations When Editing in 2D
When editing using a two dimensional device such as the system mouse, there are two parameters that control the assignment of the elevation during a move, copy, and snap operation. Z Mode Move may be set to either "hold" the original elevation or to set the elevation to the "Active Z". Z Mode Snap may be set to "hold" the original elevation, set the elevation to the "Active Z", or "Snap" when snapping the current symbol entity to an existing entity.



Edit Symbol Menu Keys dialog

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-30001
MOD=	Mode	1-2
GRP=	Graphic pointer	1-60
WID=	Line width	0-255
PEN=	Pen number	1-256

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CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	15 char
DIG=x y z	Digitizes point	
ZMOMOV=	Z Mode when moving or copying a symbol	0 = Hold original elevation 1 = Use Active Z
ZMOSNA=	Z Mode when snapping a symbol	0 = Hold original elevation 1 = Use Active Z 2 = Use elevation of snapped entity
FKEY=name	Changes to function key parameters	
SEACYC=	Sets search cycle mode	0 = Don't cycle through entities when searching 1 = Cycle through entities when searching

Parameters

Z Mode Move (ZMOMOV=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the symbol entity when moving or copying the entity. Option 0 is “hold”, which maintains the original elevation. Option 1 is “Active Z”, which sets the entity elevation to the current Active Z.

Z Mode Snap (ZMOSNA=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the symbol entity when moving or copying the symbol then snapping it to an existing entity. Option 0 is “hold”, which maintains the original elevation. Option 1 is “Active Z”, which sets the entity elevation to the current Active Z. Option 2 sets the elevation to that of the entity to which the symbol was snapped.

Inherit Function Key Parameters (FKEY=)

Changes symbol parameters to the parameters in a function key.

Button Assignments

Edit Symbol - Lock On

	Button	Description
1	Id symbol	Identifies symbol to edit.
2	Reset search	Resets search cycling if turned on .
3		

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4		
5		
6		
7	Enter params	Enter parameters.
8		
9		
*		
0		
#	End	Ends application.

Edit Symbol - Main

	Button	Description
1	Search	Saves the current symbol and returns to Lock on.
2	Rotates	Rotates symbol.
3	Expand	Expands/shrinks symbol.
4	Copy	Copies symbol.
5		
6	Move	Moves symbol.
7	Change	Allows changing symbol parameters using a dialog box.
8	Flip	Flips symbol.
9	Delete	Deletes current symbol after verification.
*	Oops	Discards changes and returns to Lock on.
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Edit Symbol – Rotate

	Button	Description
1	Accept rot	Accepts current rotation and returns to Main.
2	Rotate -	Rotates symbol one degree counterclockwise.
3	Rotate +	Rotates symbol one degree clockwise.
4		
5	Rotate – fine	Rotates symbol .25 degrees counterclockwise.
6	Rotate + fine	Rotates symbol .25 degrees clockwise.
7	Zero rotation	Sets symbol rotation to zero.
8	Rotate 45 deg	Rotates symbol 45 degrees clockwise.
9	Rotate 90 deg	Rotates symbol 90 degrees clockwise.
*		
0		
#		

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Edit Symbol - Expand

	Button	Description
1	Accept	Accepts current size and returns to Main.
2	Shrink	Shrinks symbol radius by 1%.
3	Expand	Expands symbol radius by 1%.
4		
5		
6		
7		
8		
9		
*		
0		
#		

2.1.1.9.18 Edit Text

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Vr Mapping

Edit Text (EdiTex)

Type: Interactive Application

Interactively edits a text label in a VrOne workspace.

Detailed Description

Allows interactive, graphical editing of an existing test label in a VrOne workspace. Text labels may be changed, moved, copied, re-sized and rotated.

Entity Elevations When Editing in 2D
When editing using a two dimensional device such as the system mouse, there are two parameters that control the assignment of the elevation during a move, copy, and snap operation.

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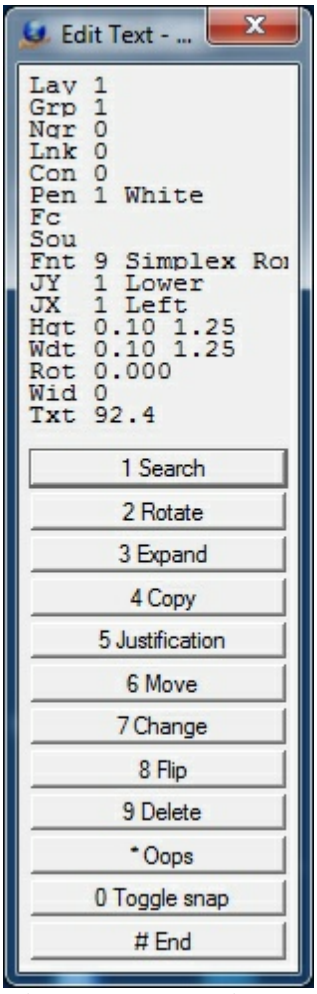
Z Mode Move may be set to either “hold” the original elevation or to set the elevation to the “Active Z”. Z Mode Snap may be set to “hold” the original elevation, set the elevation to the “Active Z”, or “Snap” when snapping the current text entity to an existing entity.



Edit Text Menu Keys dialog

Available Key-ins

Key-in	Description	Range
LAY=	Layer number	1-30001
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC	Feature code	48 characters
FNT=	Font number	1 – 12
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal

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JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
SIZ=	Text height and width	Inches | Mm
ROT=	Text rotation	0-360 degrees
SLT=	Text slant	-180 – 180 degrees
TXT=	Text label	511 characters
=	Text label	511 characters
DIG=	Places text at location supplied	X Y Z
ZMOMOV=	Z Mode when moving or copying text	0 = Hold original elevation 1 = Use Active Z
ZMOSNA=	Z Mode when snapping text	0 = Hold original elevation 1 = Use Active Z 2 = Use elevation of snapped entity
FKEY=	Changes text parameters to function key parameters.	Function key name
SEACYC=	Sets search cycle mode	0 = Don't cycle through entities when searching 1 = Cycle through entities when searching

Parameters

Z Mode Move (ZMOMOV=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the text entity when moving or copying the entity. Option 0 is “hold”, which maintains the original elevation. Option 1 is “Active Z”, which sets the entity elevation to the current Active Z.

Z Mode Snap (ZMOSNA=)

When using a two dimensional input device such as the system mouse, this parameter controls the elevation of the text entity when moving or copying the text then snapping it to an existing entity. Option 0 is “hold”, which maintains the original elevation. Option 1 is “Active Z”, which sets the entity elevation to the current Active Z. Option 2 sets the elevation to that of the entity to which the text was snapped.

Inherit Function Key Parameters (FKEY=)

Changes text parameters to the parameters in a function key except text label.

Button Assignments

Edit Text - Lock On

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	Button	Description
1	Id Text	Identifies text label to edit
2	Reset search	Resets search cycling if turned on
3		
4		
5		
6		
7	Enter params	Enter parameters
8		
9		
*		
0		
#	End	Ends application

Edit Symbol - Main

	Button	Description
1	Search	Saves the current text label and returns to Lock on
2	Rotates	Rotates text label
3	Expand	Expands/shrinks text label
4	Copy	Copies label
5	Justification	Changes text label justification
6	Move	Moves text label
7	Change	Allows changing of text parameters using a dialog box
8	Flip	Flips text label
9	Delete	Deletes the current text label after verification
*	Oops	Discards changes and returns to Lock on
0	Toggle snap	Toggles snap on/off
#	End	Ends application

Edit Text – Rotate

	Button	Description
1	Accept rot	Accepts current rotation and returns to Main
2	Dig 1 point	Digitizes the text rotation based on the text origin and the current Xy position
3	Dig 2 points	Digitizes the text rotation based on two digitized locations
4		
5	Rotate –	Rotates text label 1 degree counterclockwise
6	Rotate +	Rotates text label 1 degree clockwise
7	Zero rotation	Sets text label rotation to zero
8	Rotate 45 deg	Rotates text label 45 degrees clockwise

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9	Rotate 90 deg	Rotates text label 90 degrees clockwise
*		
0		
#		

Edit Text - Expand

	Button	Description
1	Accept	Accepts current size and returns to Main
2	Shrink	Shrinks the text label size by 1%
3	Expand	Expands the text label by 1%
4		
5		
6		
7		
8		
9		
*		
0		
#		

2.1.1.9.19 Explode Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Explode Line (ExpLin)

Type: Interactive/Batch Application

Explodes a line (usually, a fonted line) into individual line segments.

Detailed Description

Explodes a line or lines into individual line segments. Explode Line may be run interactively, in

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which each line is identified before it is exploded, or it may be run in batch mode, in which all the lines in a layer or group of layers is exploded. The application also supports the necessary key-ins to allow it to be placed in a macro. When a line is exploded it is placed into the same layer as the original line. This application is undoable. **NOTE:** Although Explode Line is undoable, after the undo stack has been cleared by a pack or a file re-open, the original lines cannot be recovered.

Local Commands

Key-in	Description	Range
WS=	Workspaces to consider	0-1
LAY=	Layers containing lines to explode	1-10,001 (Number line)
RUN	Runs Explode Line with current parameters	

Parameters

The WS=, LAY= and RUN parameters are provided so that Explode Line may be run unattended from a macro. Following is an example macro that runs Explode Line:

```
ExpLin
WS=1
LAY=10 23-35
RUN
```

When the RUN command completes, Explode Line exits.

Button Assignments

Exp Line – Lock on

	Button	Description
1	Id line	Identifies line to explode.
2	Explode layer	Explodes lines in defined layers in batch mode.
3		
4		
5		
6		
7		
8		
9		
*		
0		

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#	End	Ends application.

2.1.1.9.20 Explode Symbol

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Explode Symbol (ExpSym)

Type: Interactive/Batch Application

Explodes symbols into lines.

Detailed Description

Explodes symbols into lines. Explode Symbol may be run interactively, in which each symbol is identified before it is exploded, or it may be run in batch mode, in which all the symbols in a layer or group of layers is exploded. The application also supports the necessary key-ins to allow it to be placed in a macro. When a symbol is exploded, it is placed into the same layer as the original symbol. This application is undoable.

Local Commands

Key-in	Description	Range
WS=	Workspaces to consider	0-1
LAY=	Layers containing symbols to explode	1-10,001 (Number line)
RUN	Runs Explode Symbol with current parameters	

Parameters

The WS=, LAY= and RUN parameters are provided so that Explode Symbol may be run unattended from a macro. Following is an example macro that runs Explode Symbol:

```
ExpSym
WS=1
```

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```
LAY=10 23-35
RUN
```

When the RUN command completes, Explode Symbol exits.

Button Assignments

Exp Sym – Lock on

	Button	Description
1	Id symbol	Identifies symbol to explode.
2	Explode layer	Explodes symbols in defined layers in batch mode.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.21 Explode Text

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Explode Text (ExpTex)

Type: Interactive/Batch Application

Explodes text label into lines.

Detailed Description

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Explodes text label into lines. Explode Text may be run interactively, in which each text label is identified before it is exploded, or it may be run in batch mode, in which all the text labels in a layer or group of layers is exploded. The application also supports the necessary key-ins to allow it to be placed in a macro. When a text label is exploded, it is placed into the same layer as the original text. This application is undoable.

Local Commands

Key-in	Description	Range
WS=	Workspaces to consider	0-1
LAY=	Layers containing text labels to explode	1-10,001 (Number line)
RUN	Runs Explode Text with current parameters	

Parameters

The WS=, LAY= and RUN parameters are provided so that Explode Text may be run unattended from a macro. Following is an example macro that runs Explode Text:

```
ExpText
WS=1
LAY=10 23-35
RUN
```

When the RUN command completes, Explode Text exits.

Button Assignments

Exp Text – Lock on

	Button	Description
1	Id Text	Identifies text label to explode.
2	Explode layer	Explodes text labels in defined layers in batch mode.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

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2.1.1.9.22 Fast Delete

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Fast Delete (FasDel)

Type: Interactive Application

Deletes entities by pointing at them.

Detailed Description

There are several procedures in VrOne that will delete entities, including Edit Line, Edit Symbol, Edit Text, Global Change, and Delete Window. There are time,s however, when entities must be chosen individually for deletion. Fast delete is a quick way to touch a single entity and delete it.

Local Commands

Key-in	Description	Range
SEALIN=	Search for Lines	0=No 1=Yes
SEASYM=	Search for Symbols	0=No 1=Yes
SEATEX=	Search for Text	0=No 1=Yes

Button Assignments

Fast Delete – Id

	Button	Description
1	Id entity	Identifies entity to delete.
2	Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3		
4	Toggle lines	Toggles searching for lines.

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5	Toggle symbols	Toggles searching for symbols.
6	Toggle text	Toggles searching for text labels.
7		
8		
9		
*		
0	Snap off	Turns snap off.
#	End	Ends application.

2.1.1.9.23 Grid Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Grid Line (GriLin)

Type: Interactive/Batch Application

Grids existing line(s).

Detailed Description

Grids existing line(s) by placing points on line or placing symbols along the line grid points. Points may be placed by linear distance from the start of the line or in distance in X or Y in the coordinate system. Original points on the lines may be deleted (except for the first and last points) or may be left unchanged when gridding the line(s).

Options for the assignment of elevations for the line points or symbols include:

- The interpolation of the elevation based on the points before and after each new point (when inserting line points)
- The use of the current Z Source
- The draping of the line points or symbols onto a point cloud (LiDAR) with the use of the High/Low Point Search feature.

An optional Duplicate Point Distance may be set to keep new points from being placed too

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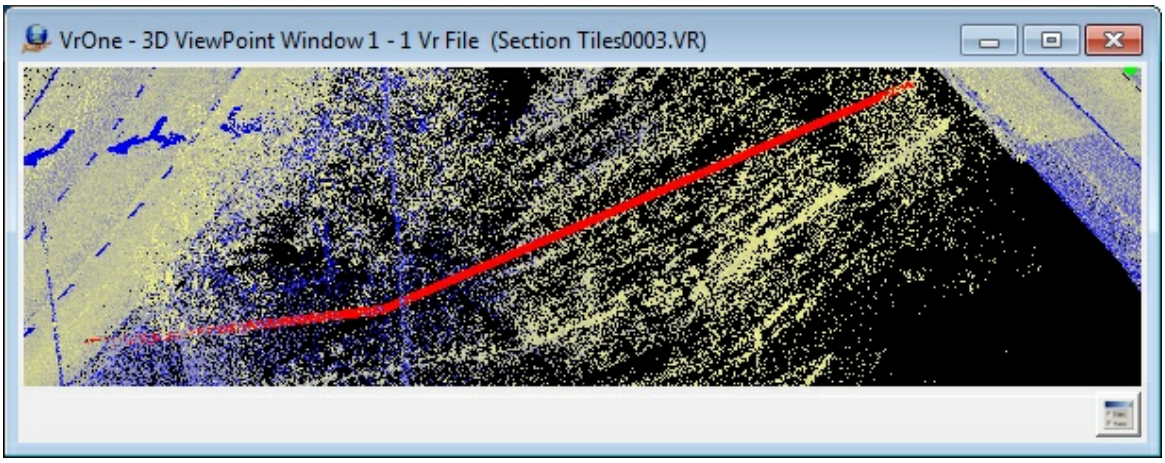
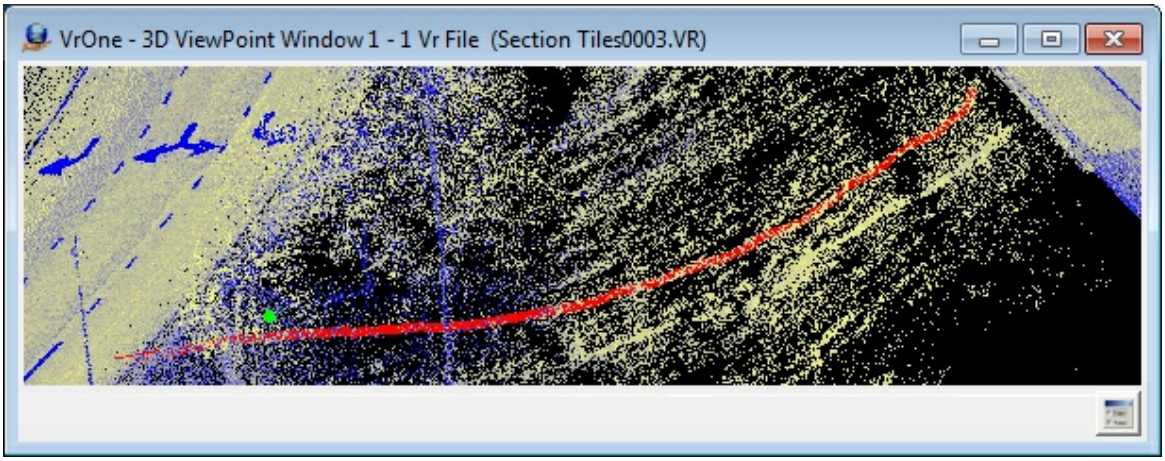
close to existing line points. Lines may also be gridded based on a user defined baseline. See Grid From Baseline for more information.

Grid line may be run interactively on single lines identified by the user or may be run in layer mode in which the lines in a user defined layer or layer(s) are gridded.



Line before gridding



Line after gridding with High/Low Z interpolation option

Button Assignments

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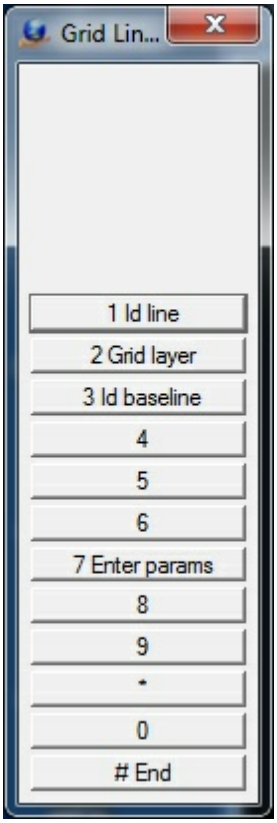

Grid Line Menu Keys

	Button	Description
1	Id Line	Interactive mode - Identifies a single line to be gridded.
2	Grid layer	Interactive batch mode - Allows Grid Line to be run on a layer or group of layers. (see Parameters)
3	Id baseline	Identifies a baseline to be used if the Grid Mode is set to "Grid from baseline" (see Grid From Baseline for more information)
4		
5		
6		
7	Enter params	Enter/edit Grid Line parameters (see Parameters)
8		
9		
*		
0		
#	End	Ends application

Parameters

The following parameters are used when gridding line in interactive and batch modes (layer mode). Pressing button 7 allows the entry of these parameters.

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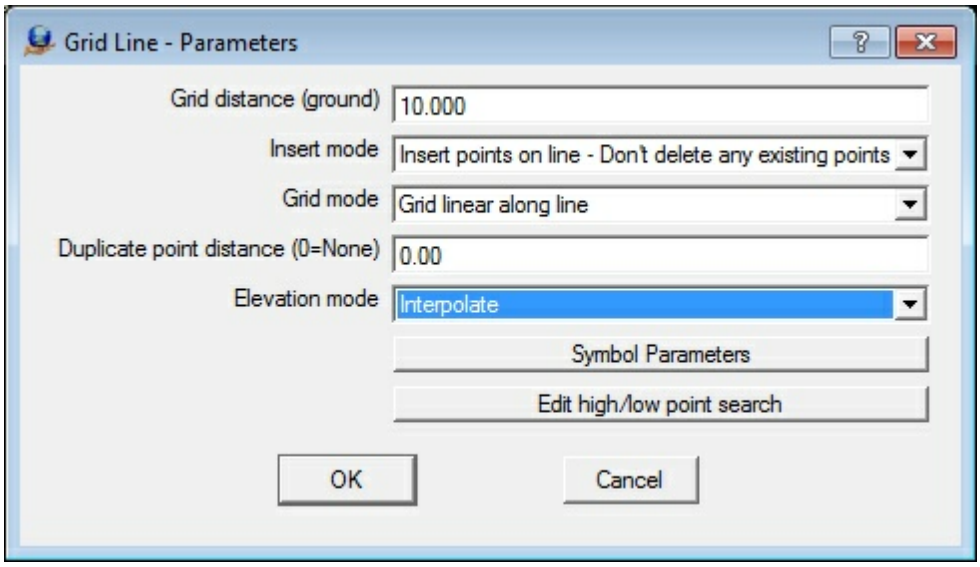

Grid distance

Defines the gridding distance. This parameter is entered in ground units.

Insert mode

Defines the action to be taken on the existing line points.

Insert points on line - Don't delete any existing points	The original points on the line are left unmodified
Insert points on line - Delete original points except end points	Original points on the line are deleted except the first and last point
Insert points on line - Delete all original points	All original points are deleted. The only points left on the line are the points inserted by this application.
Insert symbols on line	Inserts symbols on the line grid points
Insert symbols on line and line endpoints	Inserts symbols on the line grid points and on the line endpoints

Grid mode

Defines the point insertion mode.

Grid linear along line	Points are inserted linearly along the line starting from the first point on the line
Grid on coordinate system X	Points are inserted on the coordinate system X
Grid on coordinate system Y	Points are inserted on the coordinate system Y
Grid linear along each	Points are inserted linearly along each line segment starting at the

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line segment	beginning of each line segment
Grid from baseline	Uses a user defined baseline to compute grid points

Duplicate point distance (0=none)

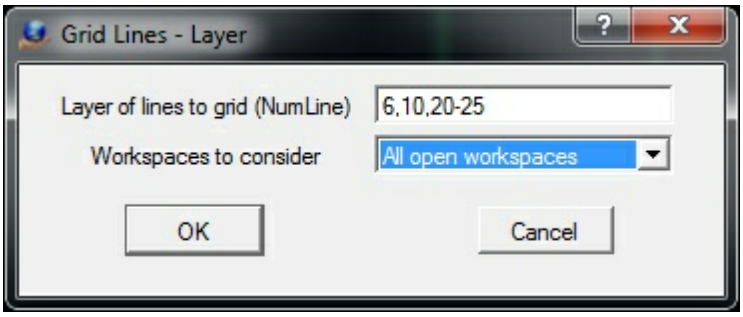
Duplicate Distance. New points that are within this distance of an existing line point will be considered duplicate and will not be placed on the line. This parameter is entered in ground units. A value of zero disables the use of this parameter when inserting points on the line.

Elevation mode

The Elevation Mode determines the method of interpolating the elevation of new line points or symbols that are created.

Interpolate	Interpolate elevation from the point before and after the new point
Use Z source	Interpolate elevation from existing points if Z Source is not set to Active Surface. Interpolate from active surface if Z Source is set to Active Surface. See Z Source for more information.
Use High/Low search	Use the current High/Low settings to set the elevation and (or) the xy coordinates. See High/Low Point Search for more information.

The following parameters are used when gridding lines in a layer or layers. This menu is displayed when the "Grid layer" (button 2) is pressed. Gridding the lines in a layer or a group of layers is running Grid Lines in the interactive/batch or layer mode.



Grid Layer dialog

Layer of lines to grid

Defines the layers to search when gridding lines. A number line may be entered here.

Workspaces to consider

The current workspace or all open workspaces may be searched when gridding lines.

NOTE: Lines in layers that are turned off will not be considered even if they are specified.

Local Commands

The Grid Line parameters may be set using key-ins. This allows macros to set parameters and run Grid Line in layer mode.

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Key-in	Description	Range
GRIDIS=	Defines the gridding distance	Real number - Ground units
INSMOD=	Defines the action to be taken on the existing line points	0 = Insert points on line - Don't delete any existing points 1 = Insert points on line - Delete original points except end points 2 = Insert points on line - Delete all original points 3 = Insert symbols on line points 4 = Insert symbols on line points and on line endpoints
GRIMOD=		0 = Grid linear along line 1 = Grid on coordinate system X 2 = Grid on coordinate system Y 3 = Points are inserted linearly along each line segment 4 = Grid from user defined base line
DUPDIS=	Duplicate point distance. New points that are within this distance of an existing line point will be considered duplicate and will not be placed on the line.	Real number - Ground units
ELEMOD=	Elevation mode.	0=Interpolate 1=Use Z Source 2=Use High/Low search
LAY=	Layers to search for lines to grid when running in layer mode.	Number line
WSTC=	Workspaces to consider when running in layer mode.	0=Current 1=All
RUN	Run Grid Lines in layer mode	

Symbol Parameters

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
RAD=	Symbol radius	Inches | Mm
ROT=	Symbol rotation	0-360 degrees

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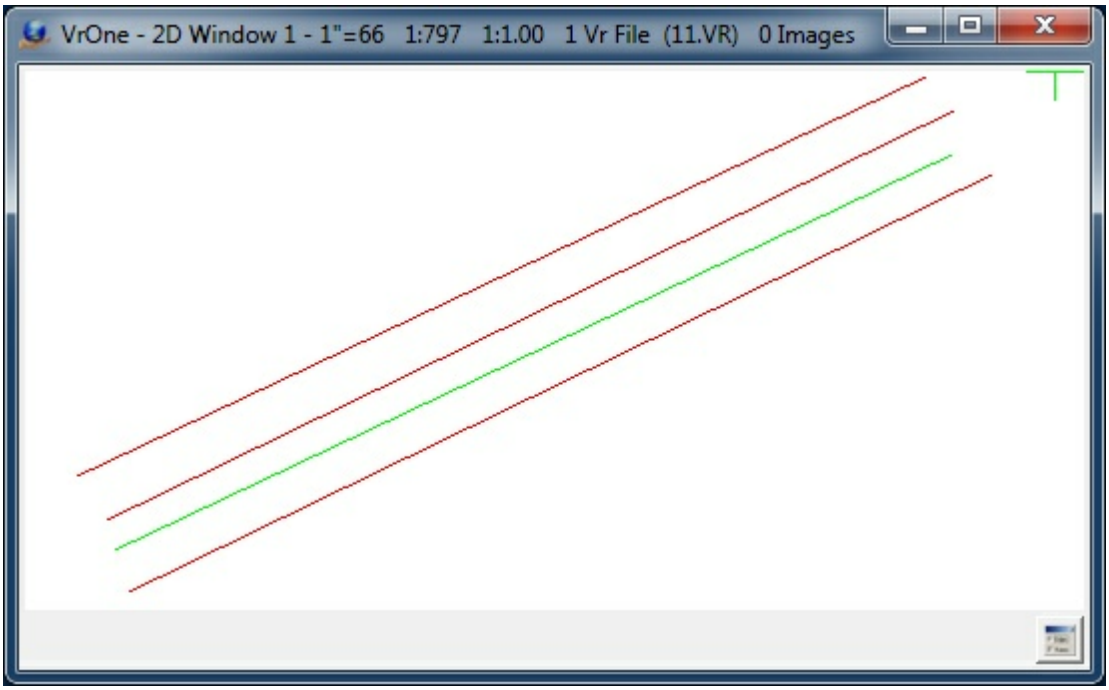
High/Low Search Parameters

Please see High/Low Point Search for the setting of the High/Low search parameters using key-ins.

Grid from Baseline

Intersection lines are projected perpendicular to the base lines at user defined intervals to intersect the lines to be gridded. After a base line has been identified, each line to be gridded is then identified. The three examples show the gridding from a baseline process.

The "Grid mode" must be set to "Grid from baseline" to grid from a baseline. The baseline is identified using "Id baseline" (button 3). A new baseline may be identified at any time. The example graphics window below shows the baseline as the green line and the lines to be gridded as the red lines.



Baseline (green) and lines to be gridded from the baseline (red)

After a baseline has been identified, each line to be gridded is identified using "Id line" (button 1). In the graphics window example below, the projected lines from the base line are shown in cyan. The spacing of the projected lines along the baseline is determined by the "Grid distance" parameter. The projection lines are show here as an example but are not shown when running Grid Line.

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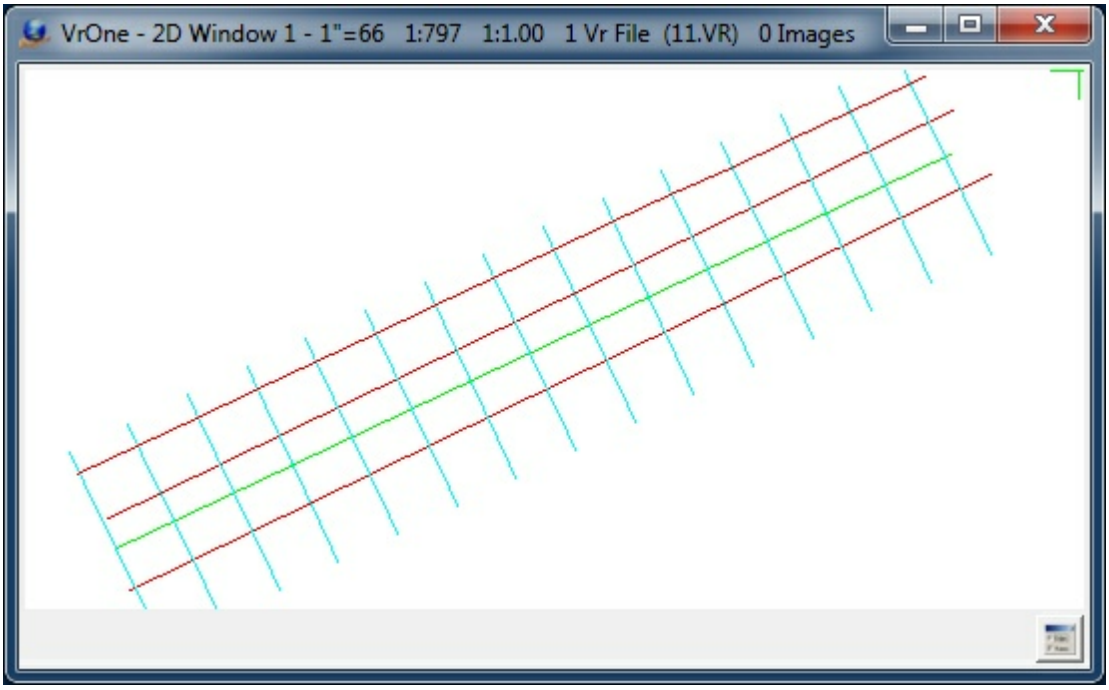
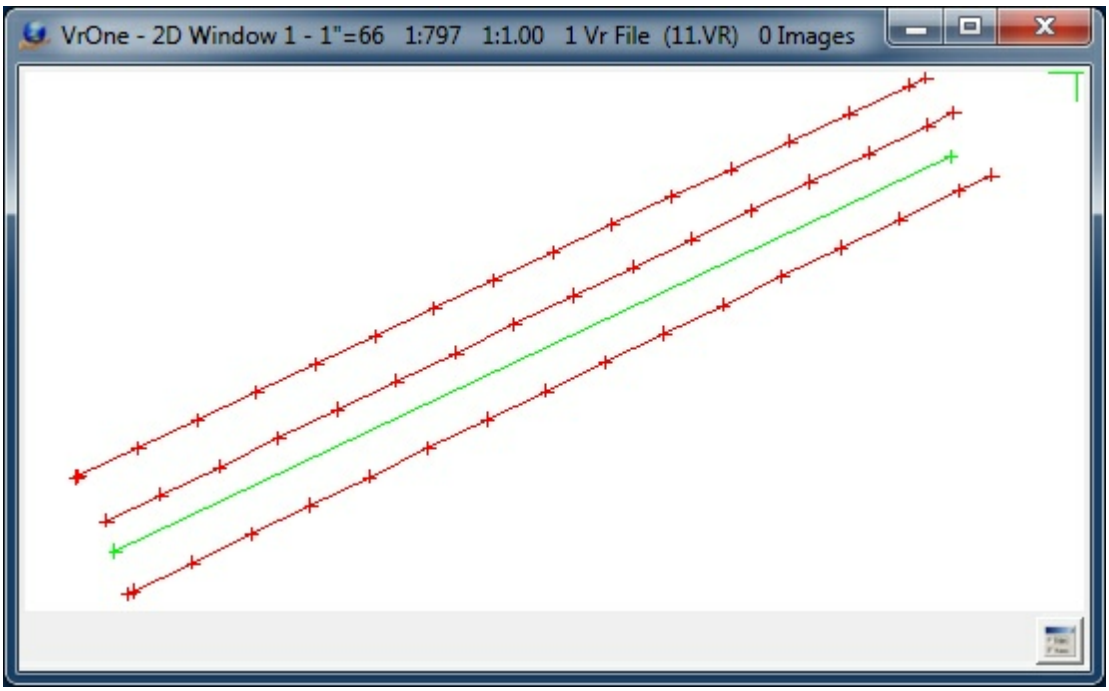


Projection lines (cyan) are show computed from the baseline

The resulting grid points are shown in the graphics window example below as crosses. The "Grid distance", "Insert mode", "Duplicate point distance", and "Elevation mode" settings are used when placing the intersecting points on the lines that are gridded. The line points may be shown in VrOne by checking "Display line points?" under Environment -> Set Display Parameters or with the Set Display (SetDis) command.



Resulting grid points (red crosses)

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Grid from baseline was added in version 05.07.29t - April 2016

2.1.1.9.24 Hack Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Hack Line (HacLin)

Type: Interactive Application

Hacks a line.

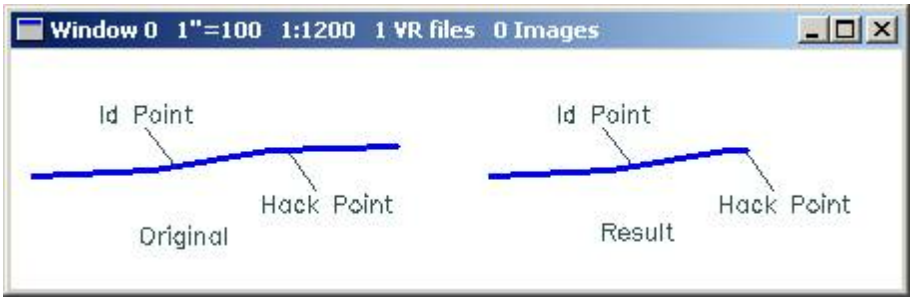
Detailed Description

Hacks (shortens) or extends the end of a line. Two points are read to hack or extend a line as follows:

Id Point	Point used to identify line to hack
Hack Point	Point used to identify location to hack line

Which end of the line to hack?

The side of the line on which the Hack Point is placed in reference to the Id Point will be hacked.



How to extend a line

Place the Hack Point past the end of one of the end line segments. The Id Point may be placed

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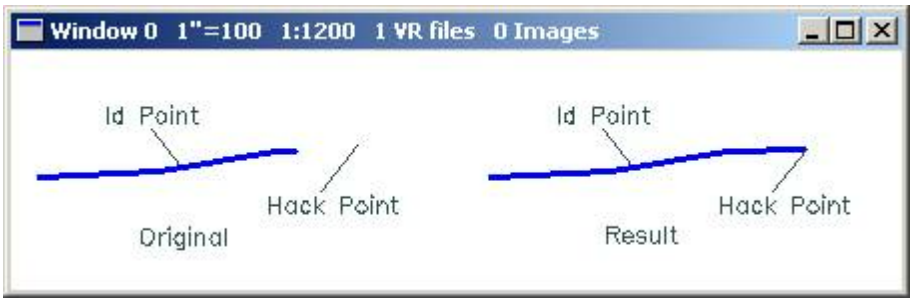
anywhere necessary to Id the line. Extending a line can be difficult if the end points are very close or on top of each other. Edit Line may need to be used in this case to move one of the end points.



Local Commands

None

Parameters

None

Button Assignments

Hack Line – Lock on

	Button	Description
1	Id line	Identifies the line to break and the Id Point.
2		
3		
4		
5		
6		
7	Params	Allows entry/edit of parameters
8		
9		
*		
0		
#	End	Ends application.

Hack Line – Dig hack

	Button	Description
1	Dig hack	Digitizes the Hack Point.

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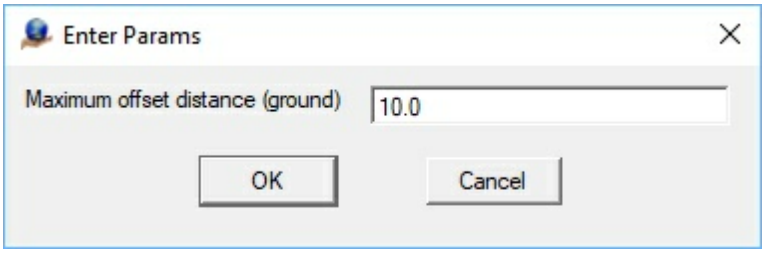
2	Abandon	Abandons hack and returns to Lock on.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Break Line – Confirm

After the Id Point and Hack Point have been read, the line will be hacked and the results will be verified.

	Button	Description
1	Accept break	Accepts hack and returns to Lock on.
2	Rejects break	Rejects hack and returns to Lock on.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Parameters



Maximum offset distance (ground) - The Maximum Offset is used when searching for line segments that fall perpendicular to the digitized hack point. A segment must be within this parameter from the hack point to be considered. This avoids using a line segment for extend

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information when the hack point is digitized at a location meant to extend the line. Enter ground units (default=10)

Updated November 2017 - Version 05.09.06

2.1.1.9.25 Hatch Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

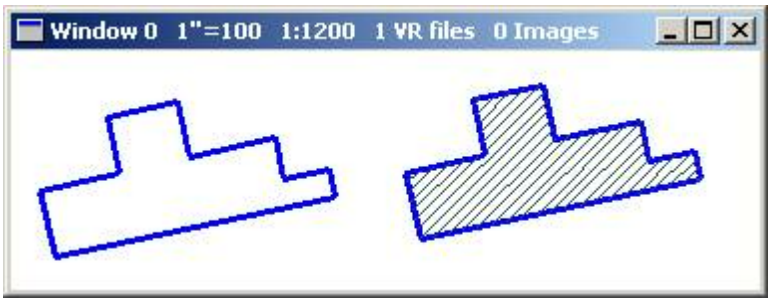
Hatch Line (HatLin)

Type: Interactive/Batch Application

Hatches line.

Detailed Description

Fills a user-defined polygon or polygons with hatch lines. Single lines to be hatched may be identifying each one. Alternatively, a batch hatch may be run on a group of layers which results with all the polygons within the specified layers being hatched.



Button Assignments

Hatch Line – Lock on

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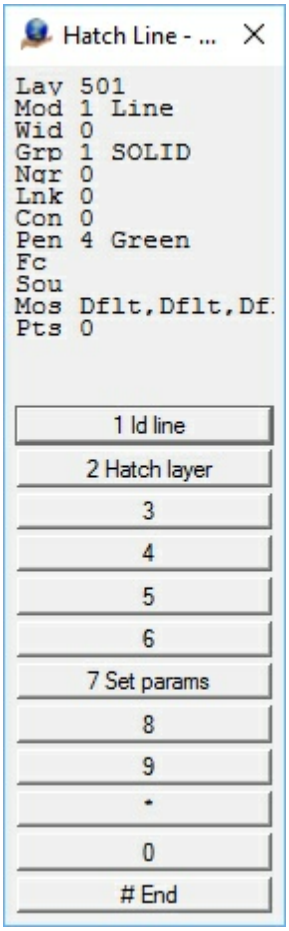

Hatch Line - Lock on

1 Id line
Allows the identification of a line (polygon) to be hatched

2 Hatch layer
Hatches the lines in the layers defined in Set Parameters

7 Set params
The Hatch Line parameters may be edited with this option. See Hatch Line - Parameters below for more information.

Hatch Line – Parameters

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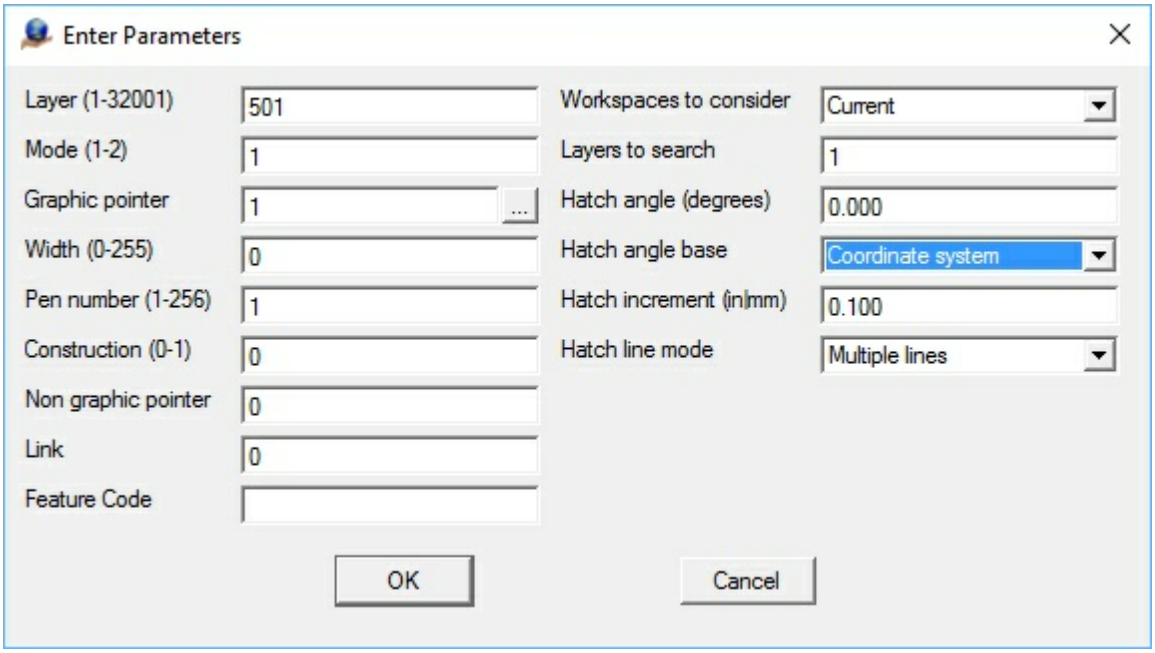

The Set Params dialog

Layer, Mode, Graphic pointer, Width, Pen number, Construction, Non graphic pointer, Link, Feature Code
The hatch lines created will inherit these entity parameters.

Workspaces to consider
Defines the workspaces to consider when running Hatch Line in batch mode (button 2 - Hatch layer).

Layers to Search
Defines the layers to search when running Hatch Line in batch mode (button 2 - Hatch layer).

Hatch angle (degrees)
Defines angle for hatch lines. The hatch angle can be modified for each polygon with the "Hatch angle base" (see below).

Hatch angle base
Defines the hatch base angle which defines the hatch angle for each polygon. Options include:

- **Coordinate system** - The current coordinate is used to define the hatch angle. For example, if the "Hatch angle" is set to zero then the hatch lines will be along the coordinate system north axis.
- **First side** - The hatch angle will be based on the first side of the line (polygon) to be hatched.
- **Longest side** - The hatch angle will be based on the longest side of the line (polygon) to be hatched.
- **Shortest side** - The hatch angle will be based on the shortest side of the line (polygon) to be hatched.

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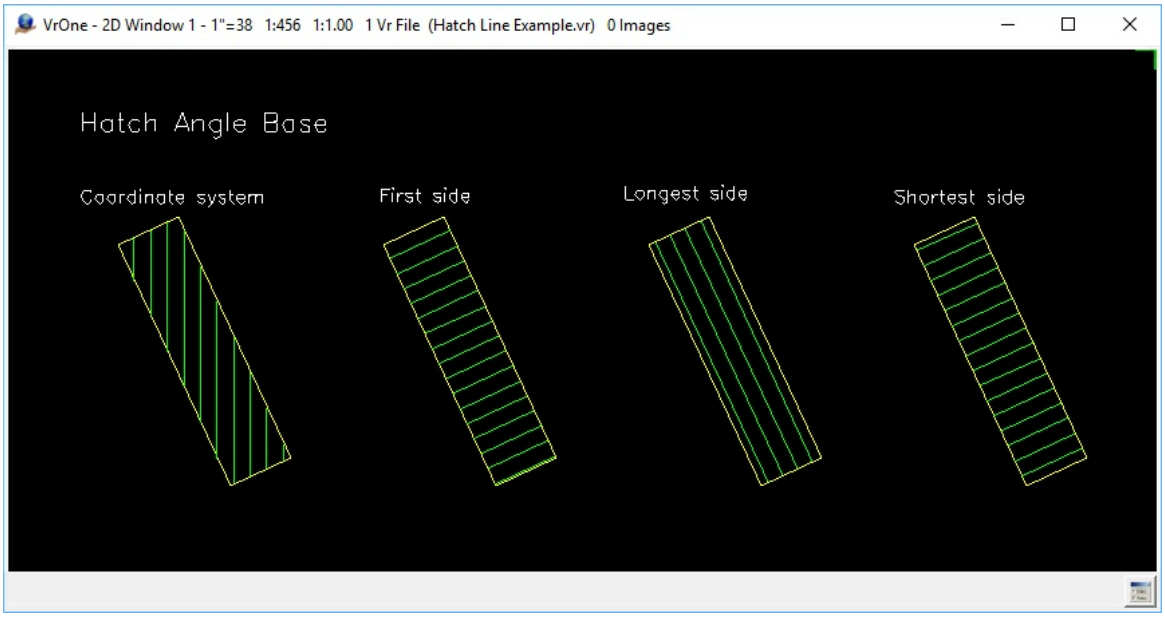
Below is show and example of the "Hatch angle base" with the "Hatch angle" set to zero. The upper left corner to the upper right corner of each line (polygon) is the first side. The "First side" and "Shortest side" yield the same results in the example.



Hatch Angle Base Example

Hatch increment (in|mm)

Defines the distance between hatch lines. This parameter is entered in inches or millimeters at Target Scale

Hatch line mode

Specifies whether hatch lines should be considered multiple lines or a single line with a pen-up command. Setting Hatch Mode to "Single line" reduces the entity count and makes hatch lines easier to delete if needed. Care should be taken, however, because other systems that receive these lines may not be able to create pen-up commands like VrOne.

Local Commands

See Parameters above for definitions for the Local Commands listed.

Key-in	Description	Range
LAY=	Layer number for hatch lines	1-10001
MOD=	Mode	1=Line 2=Spline
GRP=	Graphic pointer	1-60
WID=	Width	0-255
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters

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FKEY=	Change to function key properties	Function key name
SEALAY=	Layers to search for in batch mode	Number line
HATANG=	Hatch angle	0-360 degrees
HATANGBAS=	Hatch angle base	0-3 (see definition in Parameters)
HATINC=	Hatch increment	Inches | Mm
HATMOD=	Hatch mode	0=Multiple lines 1=Single line
RUN	Run Hatch Line on layers	None

2.1.1.9.26 Inherit

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Inherit (Inh)

Type: Interactive Application

Inherit allows entity properties to be copied from one existing entity to another. An existing "source" entity is first identified. The source's properties are copied to any subsequently identified "target" entities. Lines, symbols, and text are supported. Parameter settings allow for selection of the properties to be transferred. When a target entity is identified, properties are copied without verification. If a mistake is made, undo can be used to reestablish the entity to its previous state.

Local Commands

Key-in	Description	Range
SEALIN=	Sets line searching	0=No 1=Yes
SEASYM=	Sets symbol searching	0=No 1=Yes
SEATEX=	Sets text searching	0=No 1=Yes

Button Assignments

Inherit – Id Source

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Button	Description
1 Id source	Identifies a source entity. The current search mode will determine the entity types that will be searched for.
2 Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3	
4 Toggle lines	Toggles searching for lines.
5 Toggle symbols	Toggles searching for symbols.
6 Toggle text	Toggles searching for text.
7 Params	Edits the entity properties to be transferred.
8	
9	
*	
0	
# End	Ends application.

Inherit – Id Target

Button	Description
1 Id target	Identifies a target entity.
2 New source	Returns to ID Source menu.
3 Undo	Applies undo to the last operation.
4	
5	
6	
7	
8	
9	
*	
0	
# End	Ends application.

Parameters

Parameters may be entered by pressing button 7 when the Id Source menu is active.

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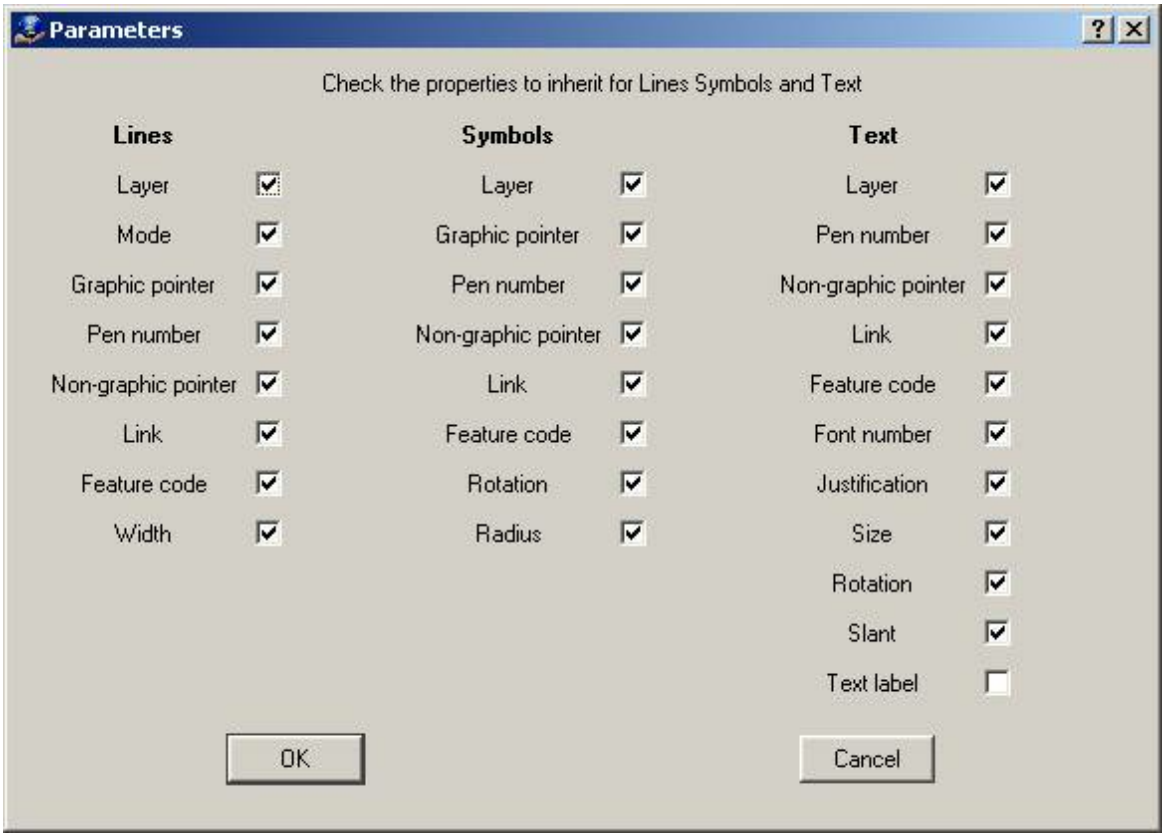

Parameters determine the properties for each entity type that will be copied when a target entity is identified. These settings are remembered each time Inherit is started.

2.1.1.9.27 Join Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Join Lines (JoiLin)

Type: Interactive Application

Joins lines together.

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Detailed Description

Joins or matches two lines together. The lines to be joined are identified by the user and may reside in the same workspace or in any open workspace. Lines that are short of each other or that overlap each other may be joined. If lines are joined, the second line is added to the first. The line parameters of the first line are used when joining. Lines that are matched are graphically joined but remain two entities and maintain their graphic parameters. Lines identified in multiple workspaces will be matched regardless of the Join Mode.

During joining or matching it is possible to mean the join or hold to the first or second line identified.

Local Commands

Key-in	Description	Range
JOIMOD=	Join mode	0=Join lines 1=Match lines
HOLMOD=	Hold mode	Defines the line to hold when joining 0=Mean both lines 1=Hold to line 1 2=Hold to line 2

Parameters

Join Mode (JOIMOD=)

If join mode is set to 0, lines will be joined into one entity with the first line determining the line parameters. If join mode is set to 1, the lines are graphically joined but remain separate entities.

Hold Mode (HOLMOD=)

Defines the line to hold when joining. The first line identified is line 1 and the second line identified is line 2. This parameter is useful when joining lines to an existing job that has been delivered and cannot be modified.

Button Assignments

Join Lines – Id 1

	Button	Description
1	Id line 1	Identifies the first line to join.
2		
3		
4		
5		

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6		
7	Enter params	Enter parameters from dialog box
8		
9		
*		
0		
#	End	Ends application

Join Lines – Id 2

	Button	Description
1	Id line 2	Identifies the second line to join.
2	Re-id line 1	Returns to Id 1 menu.
3	Close line 1	Closes the first line identified.
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Join Lines – Confirm

After the second line is identified the lines are joined and displayed.

	Button	Description
1	Accept line	Accepts the join, re-saves the line(s), and returns to the Id 1 menu
2	Reject line	Rejects the join and returns to Id 1 menu.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#		

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DOCUMENTATION
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www.cardinalsystems.net

Vr Mapping

Line to Lines Intersection (LinLin)

Type: Interactive Application

Intersects a user-identified line against other lines in the current or all open workspaces. A point is placed on the user-identified line at the intersection and a Z Rule is applied to the intersecting elevation. Options include the definition of the layers to intersect and the consideration of the current or all workspaces.
Line To Lines Intersection is undoable.
NOTE: Lines that are turned off will not be considered even if their layer is specified.

Local Commands

Key-in	Description	Range
WSTC=	Workspaces to consider	0=Current 1=All open
INTLAY=	Layers to intersect against	Number line
ZRUL=	Z Rule of intersection points	0 = Original 1 = Mean 2 = From line 1 (user-identified line) 3 = From line 2

Button Assignments

Line Lines – Lock on

Button	Description
1 Id line	Identifies the line to intersect.
2	
3	

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4	
5	
6	
7 Enter	Allows entry of line parameters.
8	
9	
*	
0	
# End	Ends application.

2.1.1.9.29 Move Polygon

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Move, Copy Polygon (MovPol, CopPol)

Type: Interactive Application

Moves or Copies entities defined by a polygon.

Detailed Description

Allows a polygon to be selected and then interactively moves or copies the entities inside.

This application can be started with two different commands. The MovPol and CopPol commands begin the application in Move mode and Copy mode, respectively.

Selection modes are clip, crossing, and inside. Entities from multiple workspaces may be moved or copied. The new data goes to the current workspace.

Local Commands

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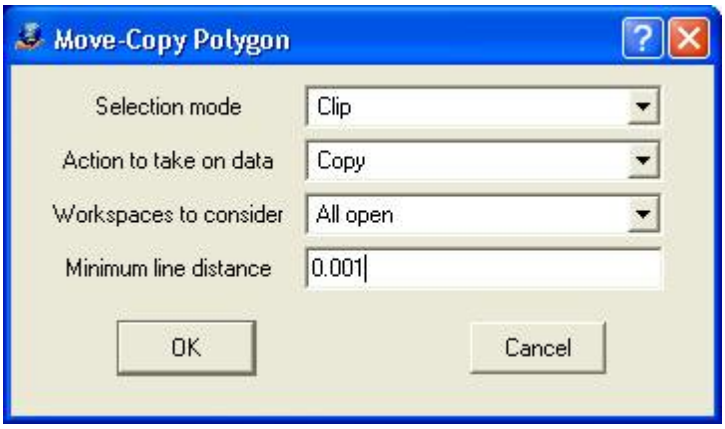
Key-in	Description	Range
WSTC=	Workspaces to consider	0=Current 1=All
ACT=	Action	0=Move1=Copy
SELMOD=	Selection Mode	0=Clip1=Crossing 2=Inside
DELX=	Delta Shift X	Floating point
DELY=	Delta Shift Y	Floating point
DELZ=	Delta Shift Z	Floating point
MINLINDIS=	Minimum line distance	Floating point

Parameters Dialog



Selection mode

Defines the selection mode for entities inside the polygon.

Clip	Selects all entities that cross or are inside the polygon, and clips lines to the polygon boundary
Crossing	Selects all entities that cross or are inside the polygon. Does not clip lines to the polygon boundary
Inside	Selects all entities that fall completely inside the polygon

Action to take on data

Defines the action to take on the selected entities.

Copy	Copies the data, leaving the original entities unchanged
Move	Moves the data, deleting or clipping the original entities

Workspaces to consider

It is possible to copy or move data from up to 2000 workspaces if this parameter is set to All open. All new entities are placed in the active workspace.

Minimum line distance

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Specifies the ground distance shorter than which any resulting clipped line is deleted.

Offset Dialog



Shift X (ground), Shift Y (ground), Shift Z (ground)

Defines an offset to apply to all selected entities.

Examples

Original data with selected polygon shown in bold blue.

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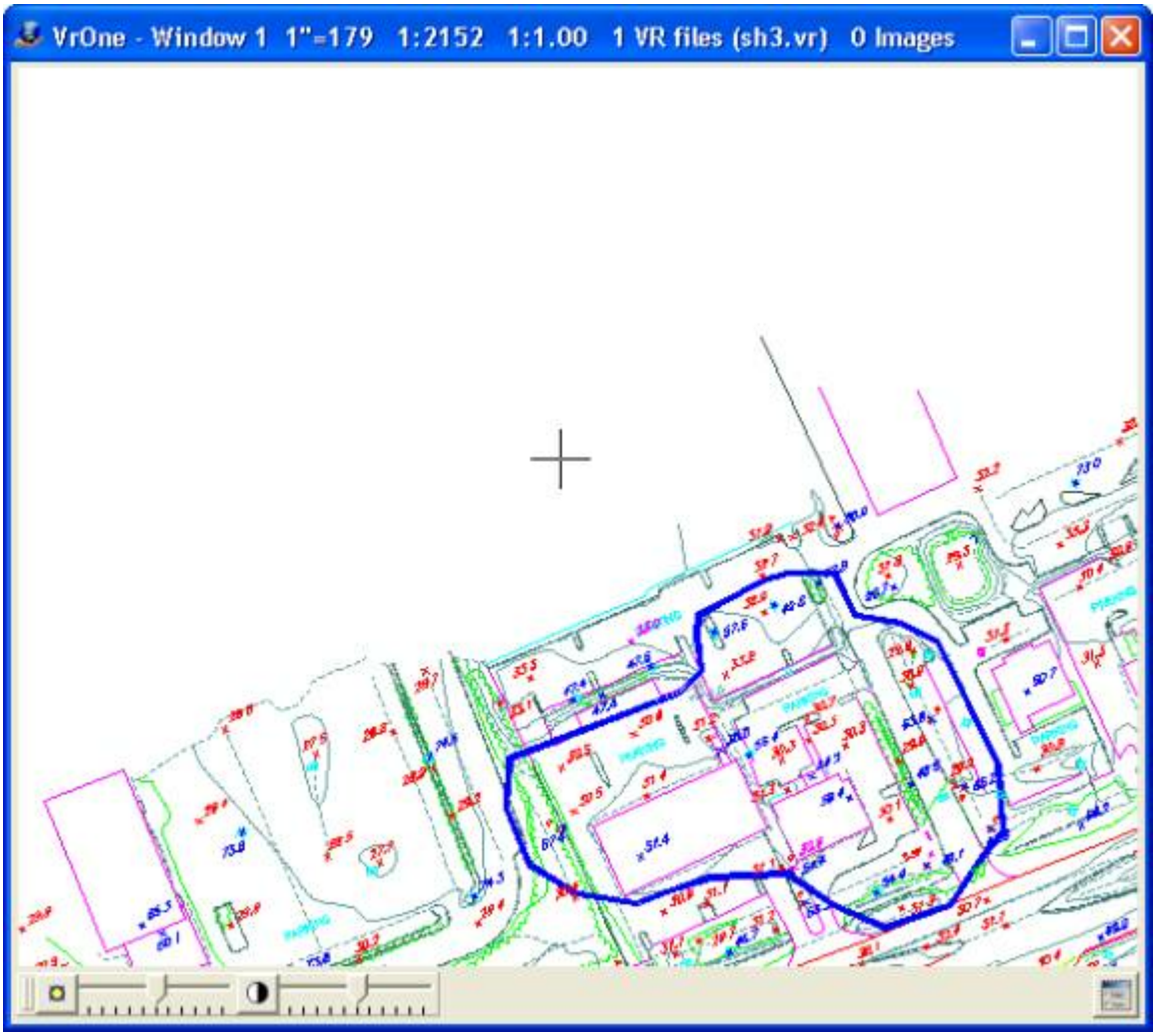

Selection Mode: Copy
Action to take on data: Clip

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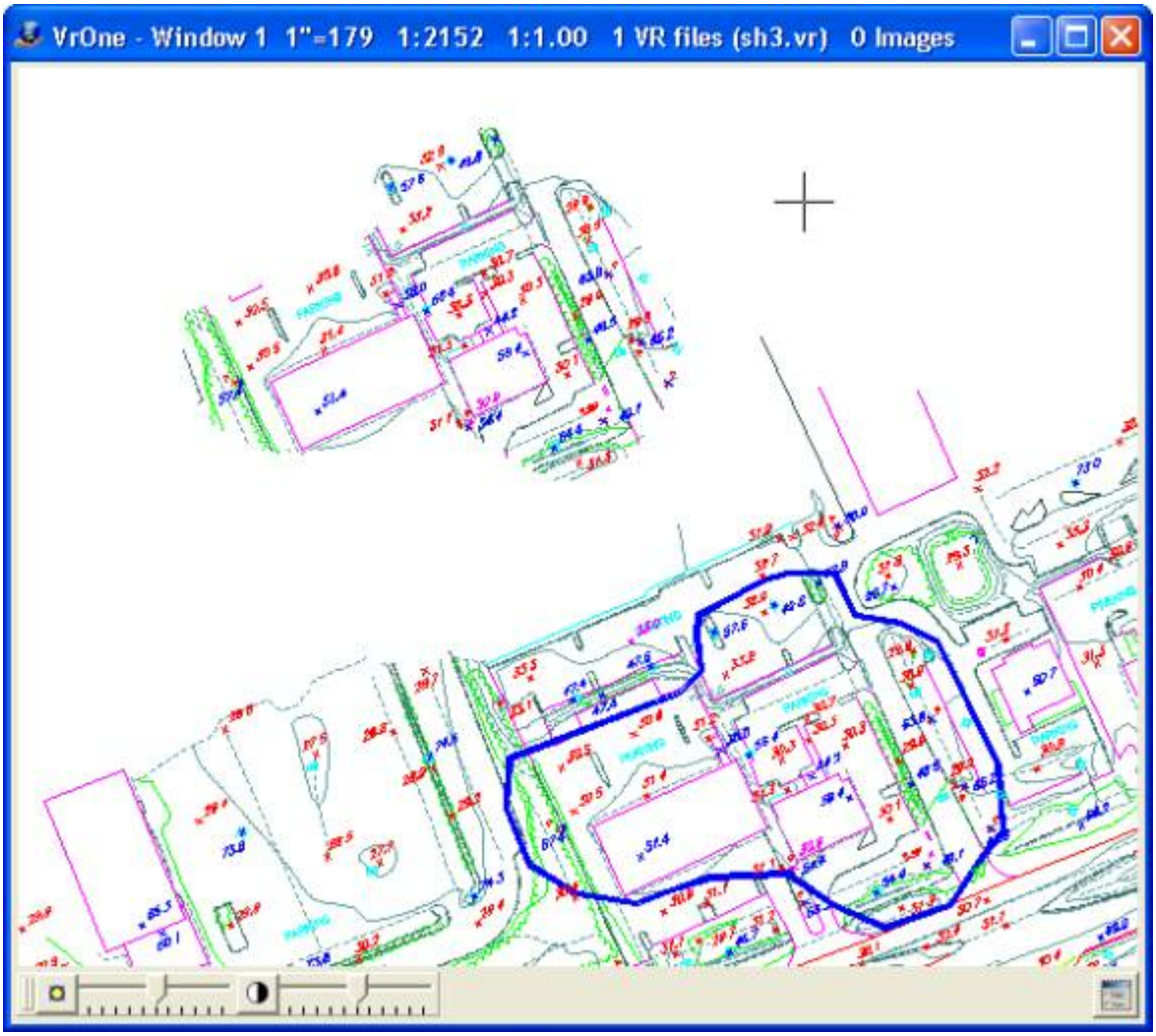

Selection Mode: Move
Action to take on data: Clip

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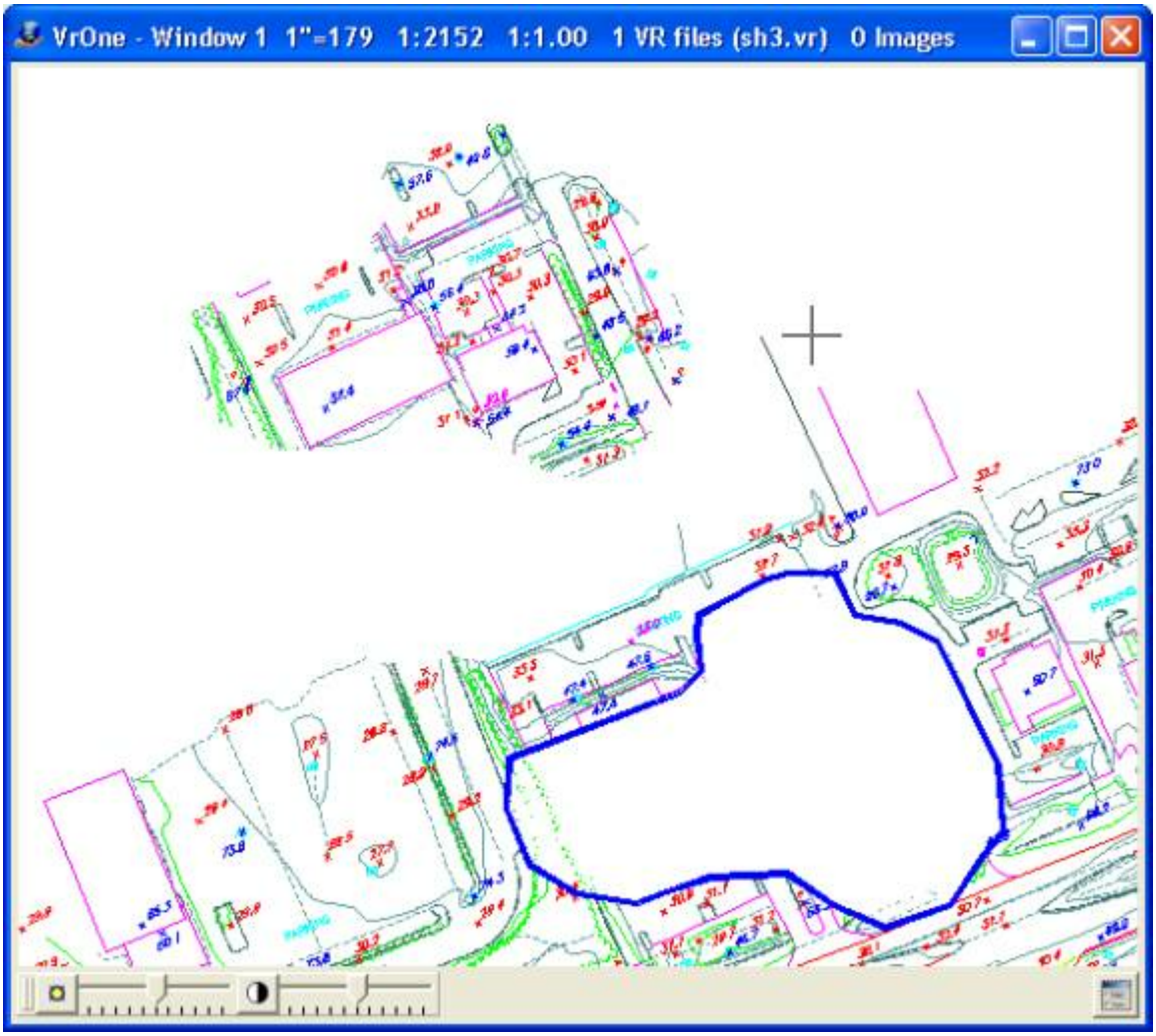

Selection Mode: Copy
Action to take on data: Crossing

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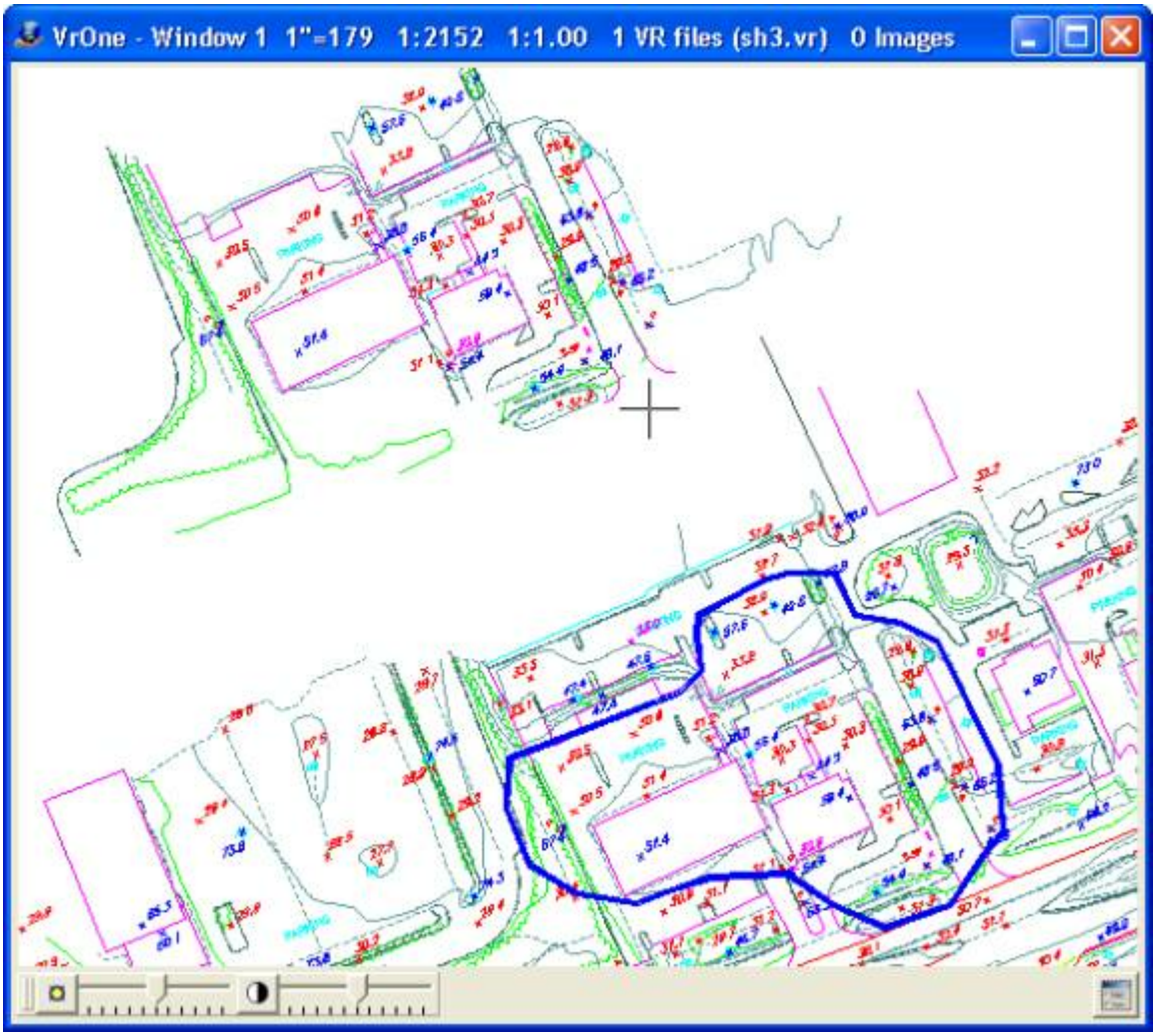

Selection Mode: Move
Action to take on data: Inside

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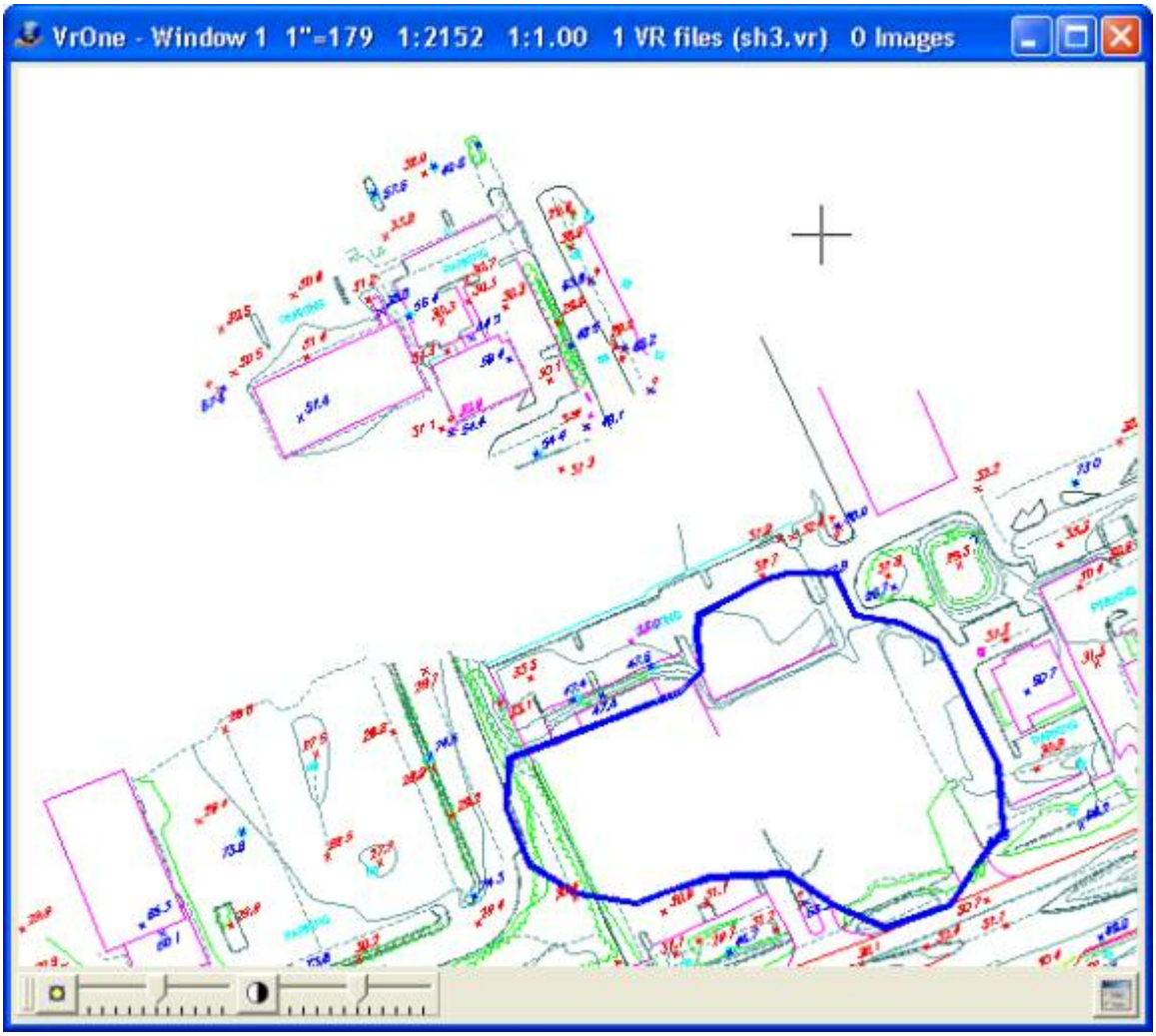

Button Assignments

Move-Copy Polygon – Lock on

	Button	Description	Displays Next
1	Id line	Identifies polygon. The line does not have to be closed.	Confirm
2			
3			
4			
5			
6			
7	Enter params	Enter parameters from dialog box.	Params Dialog
8			
9			

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*			
0			
#	End	Ends application.	

Move-Copy Polygon – Confirm

	Button	Description	Displays Next
1	Accept line	Accepts polygon chosen.	Origin
2	Reject line	Rejects polygon chosen.	Lock On
3			
4			
5			
6			
7			
8			
9			
*			
0			
#			

Move-Copy Polygon – Origin

	Button	Description	Displays Next
1	Dig origin	Selects origin point for move or copy.	New
2	New polygon	Allows new polygon to be chosen.	Lock On
3	Enter offset	Allows entry of exact X,Y,Z offset instead of digitizing origin and new points.	Offset dialog
4			
5			
6			
7			
8			
9			
*			
0	Toggle Snap	Turns snap on/off	
#			

Move-Copy Polygon – New location

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	Button	Description	Displays Next
1	Dig new loc	Selects new location point for move or copy. If using copy mode, continually prompts for new location until New Polygon or End is selected.	New location in Copy Mode, Lock On in Move Mode
2	New polygon	Allows new polygon to be chosen.	Lock On
3	Enter offset	Allows entry of exact X,Y,Z offset instead of digitizing origin and new points.	Offset dialog
4			
5			
6			
7			
8			
9			
*			
0	Toggle Snap	Turns snap on/off.	
#			

2.1.1.9.30 Move Window

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Move Window (MovWin)

Type: Interactive Application

Moves the contents of a window.

Detailed Description

Moves the contents of a user-defined window. Entities that fall completely within the window are moved. Entities that are turned off are not moved.

Local Commands

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Key-in	Description	Range
WSTC=	Workspaces to consider	0-1

Parameters

Workspaces to Consider (WSTC=)

Defines workspaces to consider when searching for entities to move. If set to 0, only the current workspace is considered. If set to 1, all open workspaces are considered.

Button Assignments

Move Window – Main

	Button	Description
1	Dig corner	Digitizes lower left and upper right corners of the search window.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Move Window – Origin

	Button	Description
1	Dig origin	Digitizes new origin for window contents.
2	New window	Abandons current move and returns to Main.
3	Enter offset	Enters XY offset for movement of window contents.
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.

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#	End	Ends application.

Move Window – New loc

	Button	Description
1	Dig new loc	Digitizes new location of window.
2	New window	Abandons current move and returns to Main.
3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off
#		

Move Window - Verify

	Button	Description
1	Accept	Accepts current window location and returns to Main.
2	Rejects	Rejects current window location and returns to New loc.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.31 Move Vertex

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Mapping

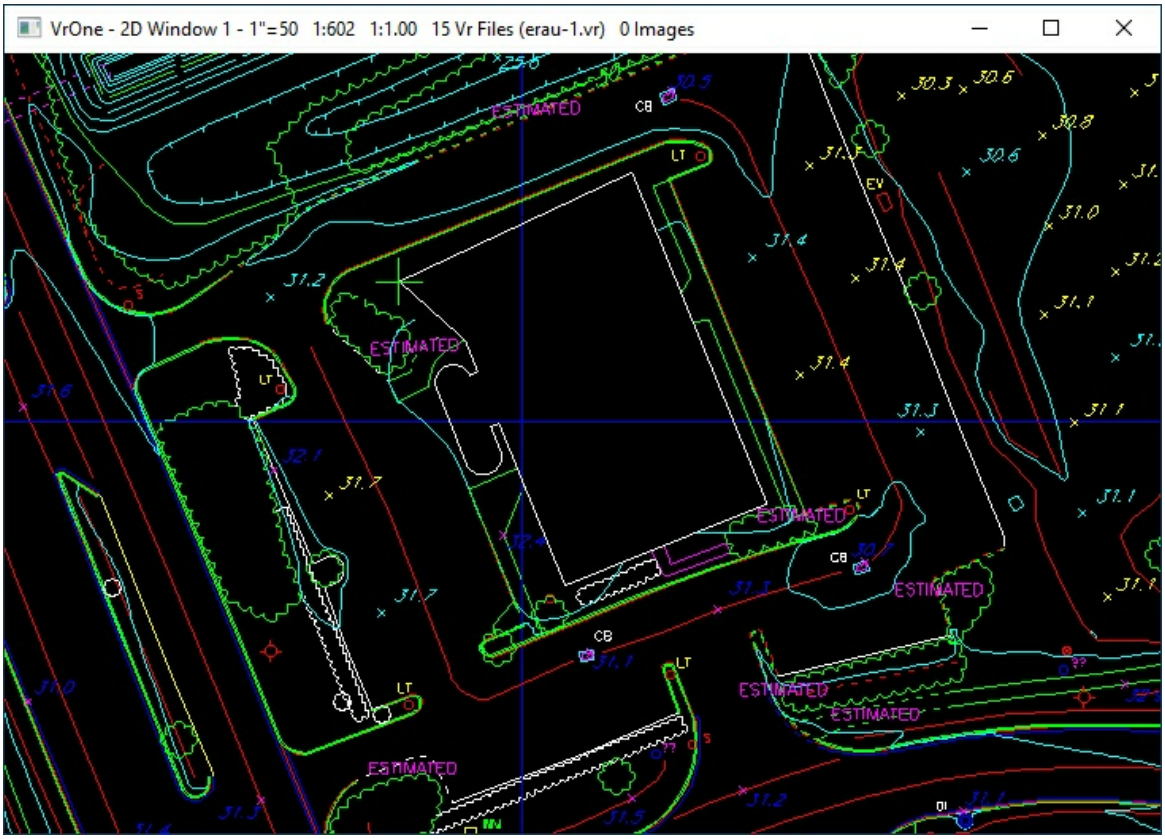
Move Vertex (MovVer)

Type: Interactive Application

Interactively moves points on a line.

Detailed Description

Move Vertex is point oriented, interactive editor which has the ability quickly identify and move points on a line. This application is specialized for the quick relocation of line points one at a time with a minimum of key presses needed. The movement of the current line point is active when the point is identified or moved to. No other edit capabilities are possible using Move Vertex. For more line editing features please see Edit Line.



Moving a Line point

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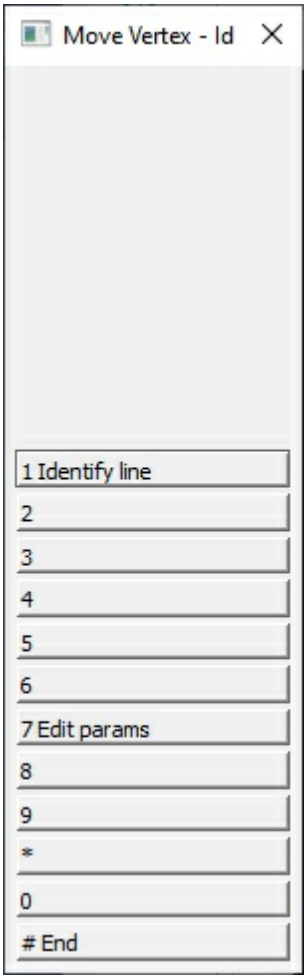
Button Assignments

Move Vertex - Id

The Id (Identify) menu allows the identification of a line for editing. The editing of Move Vertex parameters is also available from this menu.



Edit Vertex - Id (Identify)

1 Identify line

Allows the identification of a line to be edited. When a line is identified the closest line point is locked onto. The interactive movement of the current line point is active once the line is identified.

7 Edit params

The Move Vertex parameters may be edited with this option. See Move Vertex - Parameters below for more information.

End

Ends Move Vertex. Any points that have been move or are in the process of moving will be

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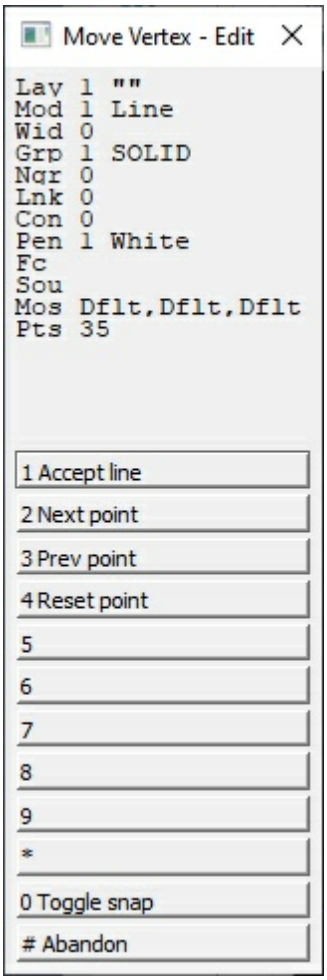
saved.

Move Vertex - Edit

Allows the moving of the current line point



Move Vertex - Edit

1 Accept line

Saves the current line and the modifications made to the line point locations.

2 Next point

Moves to the next point on the current line. Point movement is active when the point is moved to.

3 Prev point

Moves to the previous point on the current line. Point movement is active when the point is moved to

4 Reset point

Resets the current point to its original location. After the reset, point movement is still active.

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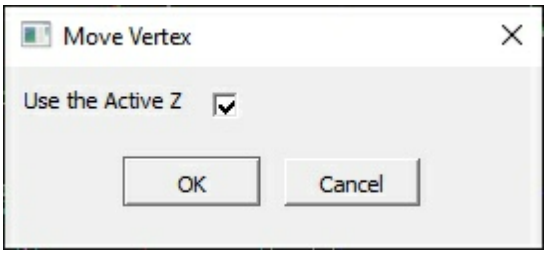
0 Toggle snap
Toggles snap on/off. If the snap is accepted then the line is accepted and the application returns to the Id Menu.

 # End
Ends Move Vertex.

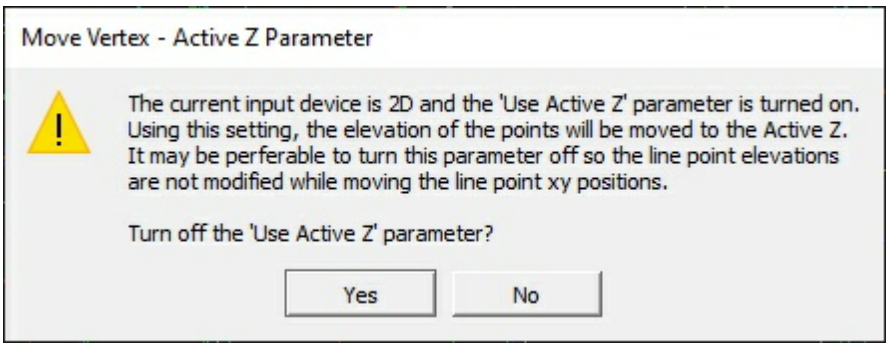
Move Vertex - Parameters



Move Vertex - Edit Parameters

Use the Active Z
If this parameter is turned on (checked) then the Active Z will be used when moving points. If this parameter is turned off (unchecked) then the Active Z will be ignored and each point's elevation will not change during the move process.
If the active input device is a 3D device such as a 3D mouse in VrTwo, the active Z is the current elevation and is changed each time a 3D input device is read.
If the active input device is a 2D device such as the system mouse, the Active Z can be changed by the Z key-in and when an entity is locked onto.

It is recommended that the Use the Active Z parameter should be turned off when a 2D input device is active and turned on when a 3D input device is active.
During application start, one of the following warning dialogs will be displayed if the Use Active Z parameter setting might conflict with the current input device. The dialog may be used to chance the setting.



Warning dialog if the input device is 2D and the Use Active Z parameter is turned on

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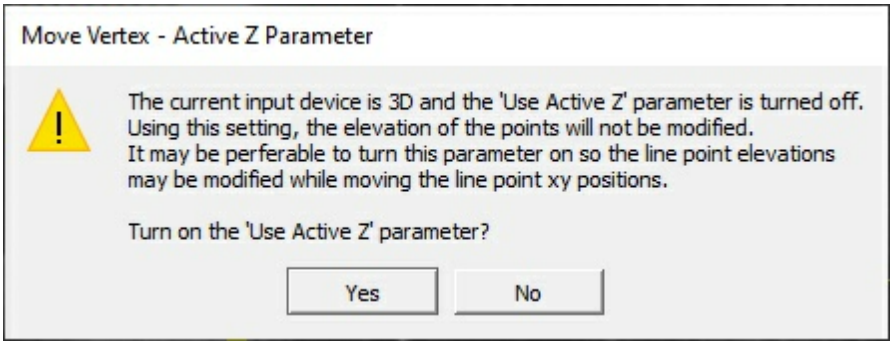

Warning dialog if the input device is 3D and the Use Active Z parameter is turned off

Local Commands

Key-in	Description	Range
ACTZ=	Sets the "Use Active Z" parameter	0=No 1=Yes
HELP	Displays this help page	

Set the Use Active Z parameter (ActZ=)
Sets the Use Active Z parameter. For example, ActZ=0 turns this parameter off and Act=1 turns this parameter on.

Help Page (Help)
Displays this help page.

Move Vertex was available in VrOne/VrTwo/VrThree beginning in Vr Mapping version 07.01.12 - January 2022

2.1.1.9.32 Node Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Node Lines (NodLin)

Type: Interactive Application

Nodes lines together.

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Detailed Description

Interactively nodes two lines at their intersect points. The two lines to be noded are identified by the user. The user can simply place node points on each line or node the lines and break the lines at the intersect points. The elevations of the node points are interpolated based on the slope of the point in front and behind the node points. Z Rules may be applied to the node points.

A batch version of this application is available. See Batch Node (BatNod).

Local Commands

Key-in	Description	Range
BREMOD=	Break mode	0=Node Only 1=Node and Break
ZRUL=	Z Rule	Defines Z Rule to apply to node points 0=Use original elevations 1=Mean elevations 2=Use elevations from first line 3=Use elevations from second line

Parameters

Break Mode (BREMOD=)

Specifies the break mode when two lines are nodded. Options are "Node only", in which a node point is placed on each line at the intersection, and "Break and node", in which the lines are broken at the intersection.

Z Rule (ZRUL=)

Specifies the rule to be used during computation of the elevation at the intersection of the two lines. During noding, an elevation for each line is computed at the break point. These elevations are based on the slope of the line segment as determined by the point before and after the break point. The Z Rule determines the action to be taken on these two elevations as follows:
Original elevations – The elevations of the break points is not modified.
Mean node elevations – The elevations are averaged and stored for both node points.
Elevation from line 1 – The elevation from the node point on line 1 is used on both lines.
Elevation from line 2 – The elevation from the node point on line 2 is used on both lines.

Button *Assignments*

Node Lines – Id 1

	Button	Description

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1	Id line 1	Identifies the first line to node.
2		
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Node Lines – Id 2

	Button	Description
1	Id line 2	Identifies the second line to node.
2	Re-id line 1	Returns to Id 1 menu.
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Node Lines – Confirm

After the second line is identified, the lines are displayed. No noding is performed until the two lines are accepted.

	Button	Description
1	Accept node	Accepts the node, re-saves the line(s), and returns to the Id 1 menu.
2	Reject node	Rejects the join and returns to Id 1 menu.
3		
4		
5		
6		
7		
8		

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9		
*		
0		
#		

2.1.1.9.33 Polygon Elevation

Vr Mapping

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www.cardinalsystems.net

Polygon Elevation (PolEle)

Type: Batch application

Changes elevation of symbols and (or) VrPoints (LiDAR) inside a polygon or group of polygons. This operation may be performed on the points or symbols in a single polygon by identifying the baseline polygon or a group baseline polygons in an interactive batch mode.

Detailed Description

This interactive batch application can be used to change the elevations of all symbols and (or) VrPoints (LiDAR) that fall within a baseline polygon to a single elevation. A baseline polygon is selected, and all points that fall within the polygon and meet the search criteria are changed to the new elevation.

This application can be applied to multiple workspaces, multiple layers, and multiple symbol graphics pointers.

Layers that are turned off will not be considered.

Available Key-ins

Key-in	Description	Range
WsTc=	Workspaces to consider	0 - Current 1 - All
ProSym=	Process symbols	0 - No

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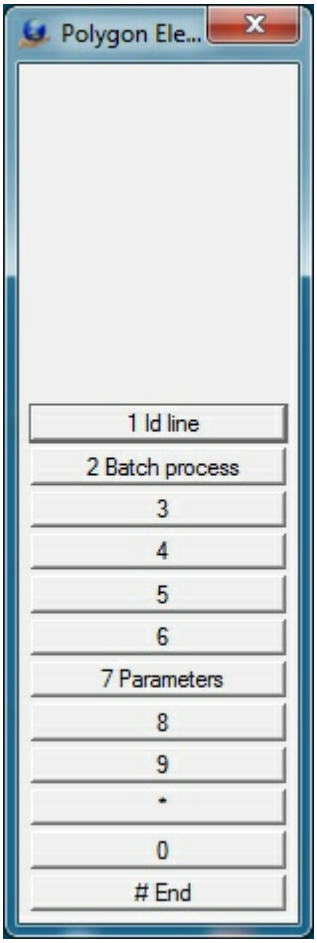
		1 - Yes
ProPoi=	Process points	0 - No 1 - Yes
EleMod	Elevation mode	0 - Use New Elevation 1 - Use mean elevation from base line 2 - Use lowest elevation from base line 3 - Use highest elevation from base line
NewEle	New elevation to use if Elevation Mode is set to 0.	Real number
SeaGp	Graphic pointer to search when searching for symbols.	Number line
SeaBas=	Layers of base lines when processing in batch mode	Number line

Button Assignments

The following menu keys dialog is displayed at startup.



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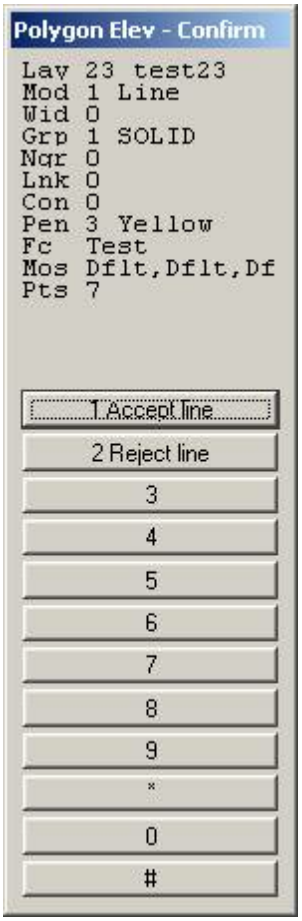
Polygon Elevation – Main

	Button	Description
1	Id Line	Allows selection of polygon. Displays confirm menu keys dialog.
2	Batch Process	Runs Polygon Elevation in batch mode.
3		
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

The following menu keys dialog is displayed after a polygon is selected.



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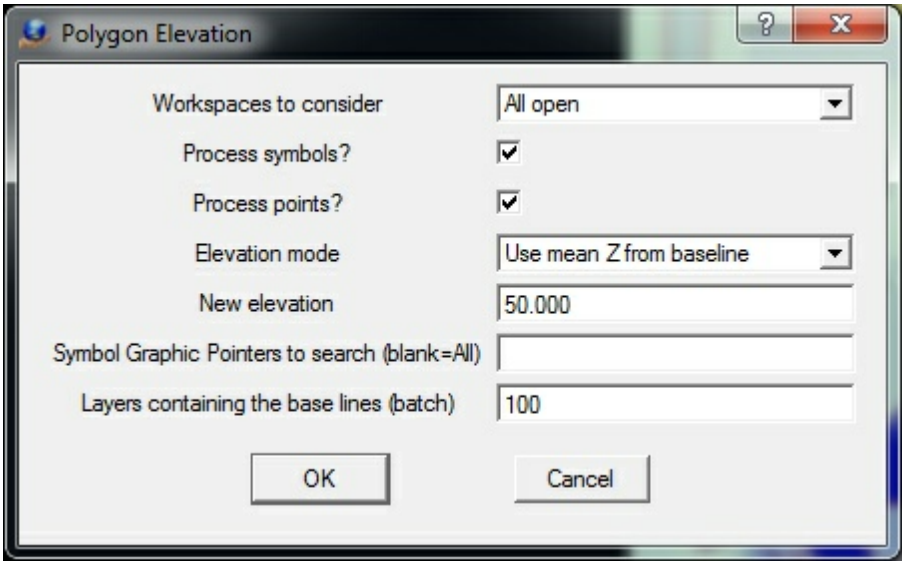
Polygon Elev – Confirm

	Button	Description
1	Accept	Accepts line and starts the elevation change process.
2	Reject	Rejects the line and displays the main menu keys dialog.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#		

Parameters for Polygon Elevation



Workspaces to consider

Defines the workspaces to consider. Options are Current only or All open workspaces.

Process symbols?

Specifies whether symbols should be processed.

Process points

Specifies whether points should be processed.

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Elevation mode

Specifies the mode to determine the elevation to which to set the symbols and/or points which fall within the baseline polygon or polygons. Options are:

- **Use New Elevation** - Uses the elevation defined in the New Elevation field.
- **Use mean Z from baseline** - Uses the mean of the elevations from the points which define the baseline polygon.
- **Use low Z from baseline** - Uses the lowest elevation from the points which define the baseline polygon.
- **Use high Z from baseline** - Uses the highest elevation from the points which define the baseline polygon.

Symbol Graphic Pointers to search

Specifies the graphic pointers to consider when searching for symbols. This parameter may be entered as a number line.

Layers containing the base lines (batch)

Defines the layers in which to search form baseline polygons. This parameter is used only when running Polygon Elevation in batch mode. This parameter is entered as a number line.

2.1.1.9.34 Reverse Line

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Reverse Line (RevLin)

Type: Interactive/Batch Application

Reverses the direction of lines.

Detailed Description

At times the order of line points must be a certain direction. This is true when drawing fonted lines such as tree lines or depression contours. Reverse Line can reverse single lines after

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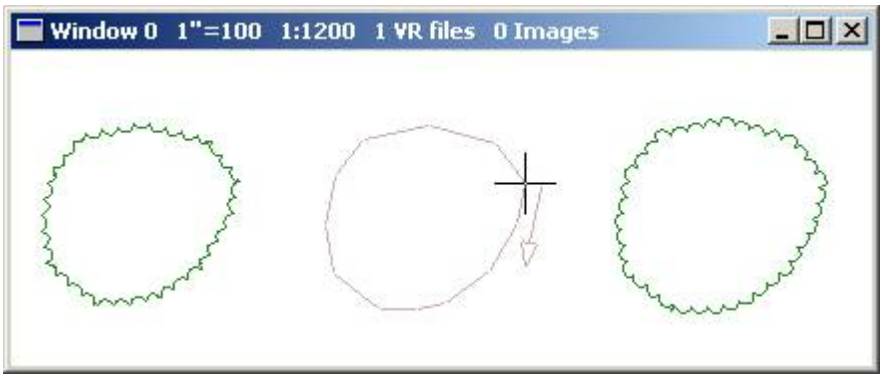
identification or batch reverse lines in user-defined layers and modes.



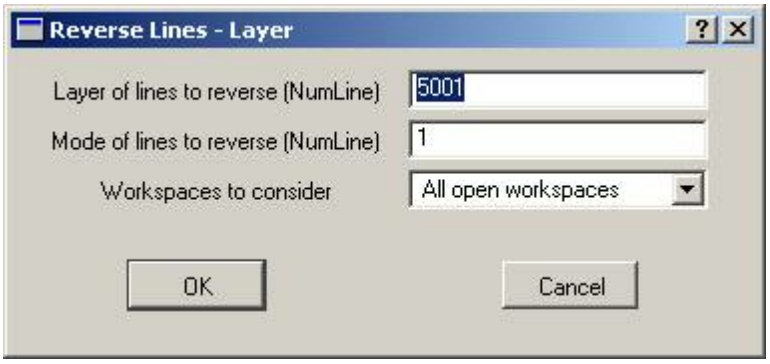
Local Commands

None

Parameters

When a line is identified, the line font will disappear and a direction arrow will be shown during verify.

The following parameters are used when batch reversing a layer:



Layer of lines to reverse

Defines the layers to search when reversing lines. A number line may be entered here.

Mode of lines to reverse

Defines the line modes to search when reversing lines. A number line may be entered here.

Workspaces to consider

Specifies the workspaces to search for lines to reverse. The current workspace or all open workspaces may be searched.

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NOTE: Lines in layers that are turned off will not be considered even if they are specified.

Button Assignments

Rev Line – Lock on

	Button	Description
1	Id line	Identifies line to reverse.
2	Reverse layer	Runs in batch mode.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.35 Slope Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Slope Line (SloLin)

Type: Interactive Application / Interactive Batch Application

Interpolates (slopes) point elevations on a line based on two existing line points. There are three modes that are available:

1. The line to slope is identified and the two existing line elevations are identified.
2. The line to slope is identified and that line's end points are used as the existing points
3. All lines in layer(s) specified are sloped and the line end points are used as the existing

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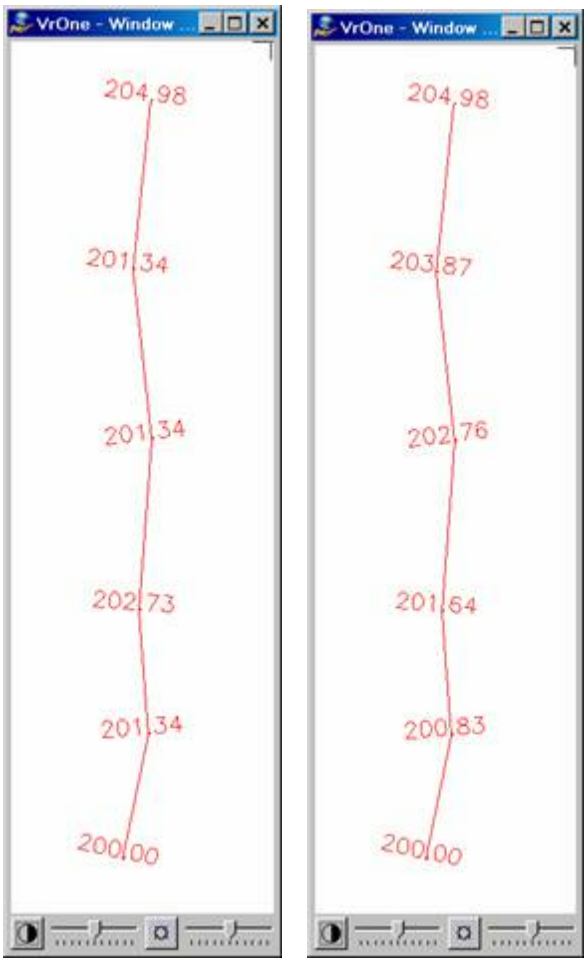
points.

The following examples show the results of Slope Line. The example on the left shows a line before sloping and the example on the right shows the same line after sloping from the first to the last point on the line.



Local Commands

Key-in	Description	Range
MOD=	Existing points mode	0 = Identify 1 = Use line end points
SEALAY=	Layers to search for lines to slope	Number line
WSTC=	Workspaces to consider	0=Current 1=All

Button Assignments

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Slope Line – Lock on

Button	Description
1 Id line	Identifies a line to slope.
2 Slope layer	Starts batch mode to slope lines in layer(s) specified (see below).
3	
4	
5	
6	
7 Params	Allows entry/edit of parameters.
8	
9	
*	
0	
# End	Ends Slope Line.

Slope Line – Pt1/2

If the Slope Mode is set such that the user identifies the start and end point, the following menu will be displayed.

Button	Description
1 Dig point 1/2	Digitizes the start or end points
2 Abandon	Abandons and returns to the previous menu
3	
4	
5	
6	
7	
8	
9	
*	
0 Toggle Snap	Turns snap on/off
# End	Ends Slope Lines

Slope Line – Confirm

Button	Description
1 Accept	Accepts the current slope results and re-saves the line.
2 Reject	Rejects the current line.

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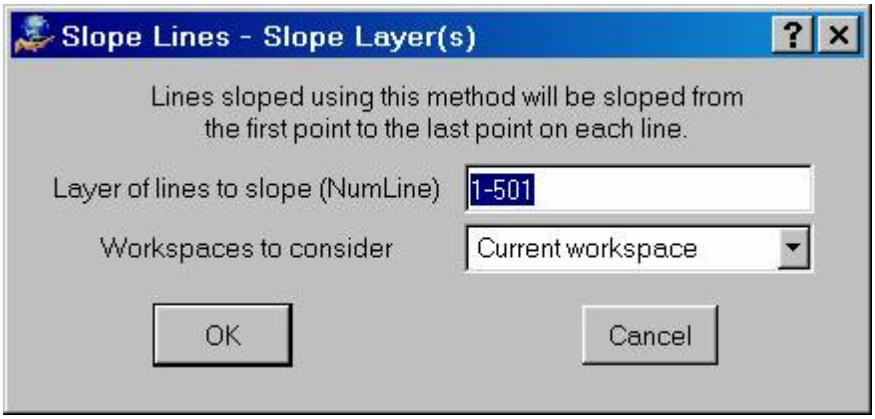
3	
4	
5	
6	
7	
8	
9	
*	
0	
# End	Ends Slope Lines.

Slope Line – Slope Layer(s)



Slope Line may be run in a batch mode, in which it will slope the lines in the layers that are specified. The first and last points on the lines will be used as the base points. Multiple layers may be specified using a number line and the current or all open workspaces may be searched.

2.1.1.9.36 Square Existing Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Square Existing Lines (SquExi)

Type: Interactive/Batch Application

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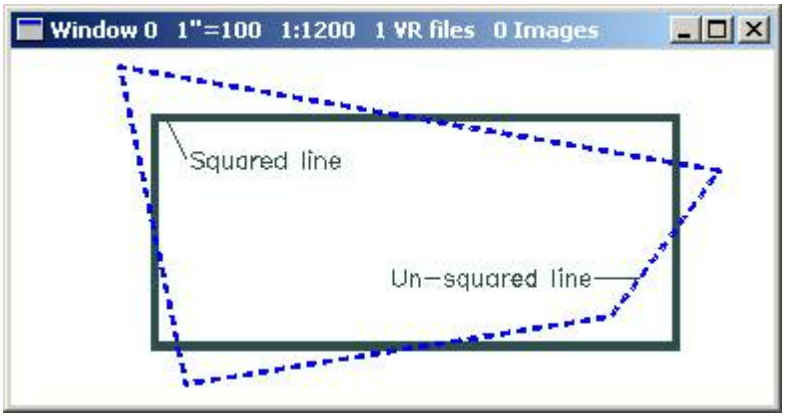
Squares existing line(s).

Detailed Description

This application squares existing line(s) in the current workspace or all open workspaces. Lines to square may be identified by pointing at them or by specifying layers in a batch mode. Line segments are rotated about their midpoints to the Square to Azimuth at 0, 90, 180 or 270 degrees and re-intersected with the previous and next segments to square a polygon. Line segments that are greater than the Square to Tolerance are not squared (rotated). Please note the example below is exaggerated.



Sequential parallel line segments are removed before squaring.
The squaring tolerance is used to determine parallel lines.

Local Commands

Key-in	Description	Range
STF=	Square to flag	0 - Longest side 1 - Square to azimuth 2 - First side 3 - Mean of all sides
AZI=	Azimuth to square to (degrees)	0-360 degrees
TOL=	Squaring tolerance (degrees)	0=80 degrees
CLODIS=	Close distance	Ground units
WSTC=	Workspaces to consider when squaring layers	0=Current 1=All open
SEALAY=	Layers to search when squaring layers	Number line
RUN	Runs square layer(s)	

PARAMETERS

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Square To Flag (STF=)

Specifies the azimuth to square the polygon to. The available square to flags are as follows:
0=Longest side
1=Use "Square to azimuth"
2=First side
3=Mean of all sides
NOTE: Flag 3 should NOT be used if there are unsquared sides on the polygon.

Square To Azimuth (AZI=)

Defines the base azimuth to which all line segments are squared. Each line segment is rotated from its midpoint to 0, 90, 180 or 270 degrees to the Square to Azimuth.

Squaring Tolerance (TOL=)

Defines the degree measure of a line segment's azimuth greater than which that line segment is left unsquared.

Close Distance (CLODIS=)

Defines the ground distance within which lines' end points are closed before squaring.

Workspaces to consider (WSTC=)

Defines the workspaces to consider when squaring layers in batch mode.

Search Layer (SEALAY=)

Specifies layers to search when squaring in batch mode.

Run

Runs Square Existing Lines in batch mode on the layers specified.

Button Assignments

Square Exist – Lock on

	Button	Description
1	Id line	Identifies line to square.
2	Square layer	Squares lines in layers specified in batch mode.
3		
4		
5		
6	Dig azimuth	Digitizes azimuth for use when squaring to Azimuth.
7	Enter params	Enter parameters from dialog box.
8		
9		
*		

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0		
#	End	Ends application.

Square Exist – Confirm

	Button	Description
1	Accept	Accepts squaring of identified line and returns to Lock on.
2	Reject	Rejects squaring of identified line and returns to Lock on.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application

2.1.1.9.37 Tick Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Tick Line (TicLin)

Type: Interactive/Batch Application

Places tick lines on existing line(s).

Detailed Description

Ticks existing lines by placing tick lines at user-defined intervals. User parameters include tick

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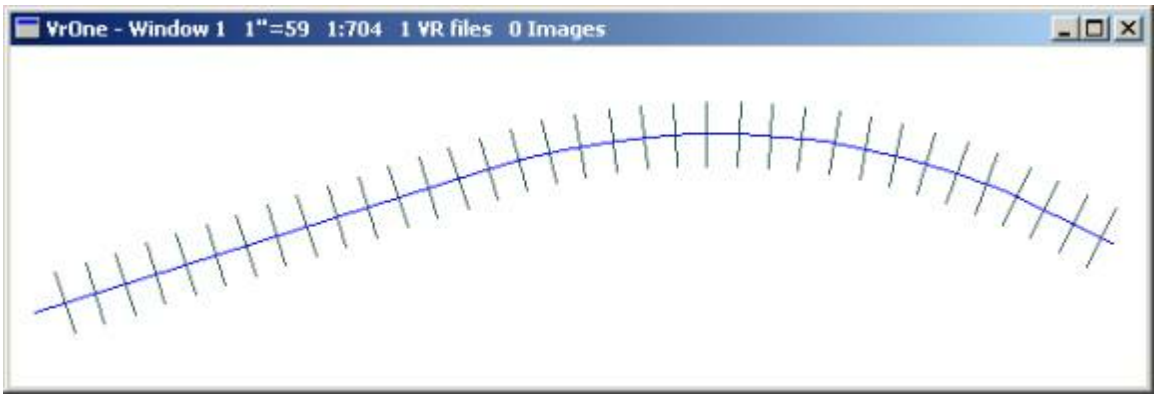
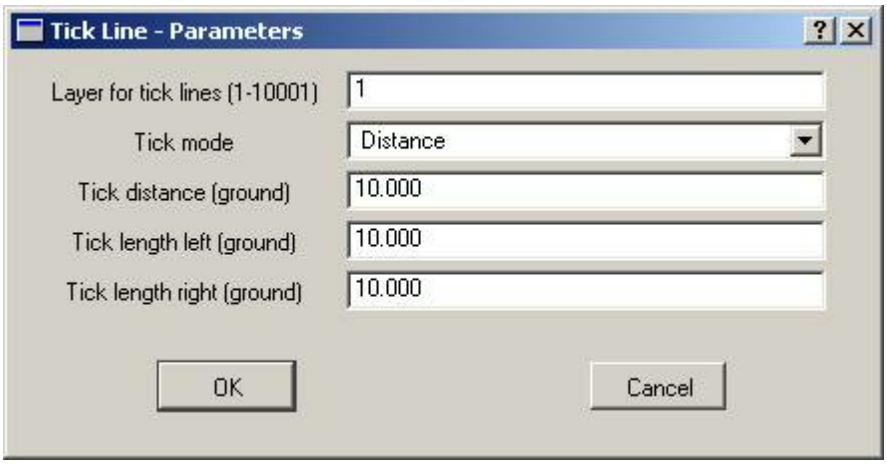
distance left and right of the base line. The elevations of the tick lines are interpolated based on the points before and after the tick line.



Parameters and Local Commands

The following parameters are used when ticking a line in interactive and batch modes. Pressing button 7 allows the entry of these parameters.



Layer for tick lines (TICLAY=)

Defines the layer in which the new tick lines will be placed.

Tick mode (TICMOD=)

Defines the method to use for line ticking. Options are "Distance" (TICMOD=0) and "Tick line ends only" (TICMOD=1). The Distance setting ticks a line each Tick distance from the start of the line. The "Tick line ends only" ticks only the beginning and end of the line.

Tick distance (TICDIS=)

Defines the distance between tick lines. This parameter is entered in ground units.

Tick length left (TICLEF=)

Defines the tick line length to the left of the base line looking upstream. This parameter is

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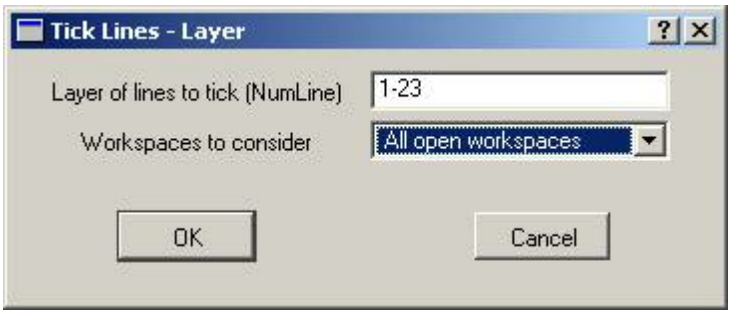
entered in ground units.

Tick length right (TICRIG=)

Defines the tick line length to the right of the base line looking upstream. This parameter is entered in ground units.

Batch Mode



Layer of lines to tick (SEALAY=)

Defines the layers to search when ticking lines in batch mode. A number line may be entered here.

Workspaces to consider (WS= or WSTC=)

The current workspace (WS=0) or all open workspaces (WS=1) may be searched when ticking lines.

Run (RUN)

Runs tick line in batch mode. This is normally used when running Tick Line from a macro. The following is a sample macro that starts Tick Line, sets parameters, and runs the application:

```
TicLin
SEALAY=1-10 23 25
WS=0
TICLAY=55
TICMOD=0
TICDIS=100
TICLEF=25
TICRIG=75
RUN
```

NOTE: Lines in layers that are turned off will not be considered even if they are specified.

Button Assignments

Tick Line – Lock on

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	Button	Description
1	Id line	Identifies line to tick.
2	Tick layer	Runs tick line in batch mode.
3		
4		
5		
6		
7	Enter params	Allows entry of tick line parameters.
8		
9		
*		
0		
#	End	Ends application.

2.1.1.9.38 Trim Lines

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Trim Lines (TriLin)

Type: Interactive Application

Trims two lines against each other.

Detailed Description

Trims two lines together. The lines to be trimmed are identified by the user and consist of line 1, which is the base line, and line 2, which is the line to trim. Line 2 may be short of line 1 (under-shoot) or extend over line 2 (over-shoot). line 2 may also cross line 1 at one or more locations. The type of trim to be performed is determined by the location of the digitized point (Id point) when identifying line 2. The Id point identifies both the line to be trimmed and the action to take when trimming the lines. Other options include support for a Z Rules and the noding of the baseline.

NOTE: Trim Line is one of two interactive trim lines applications. Please also see Trim Lines1.

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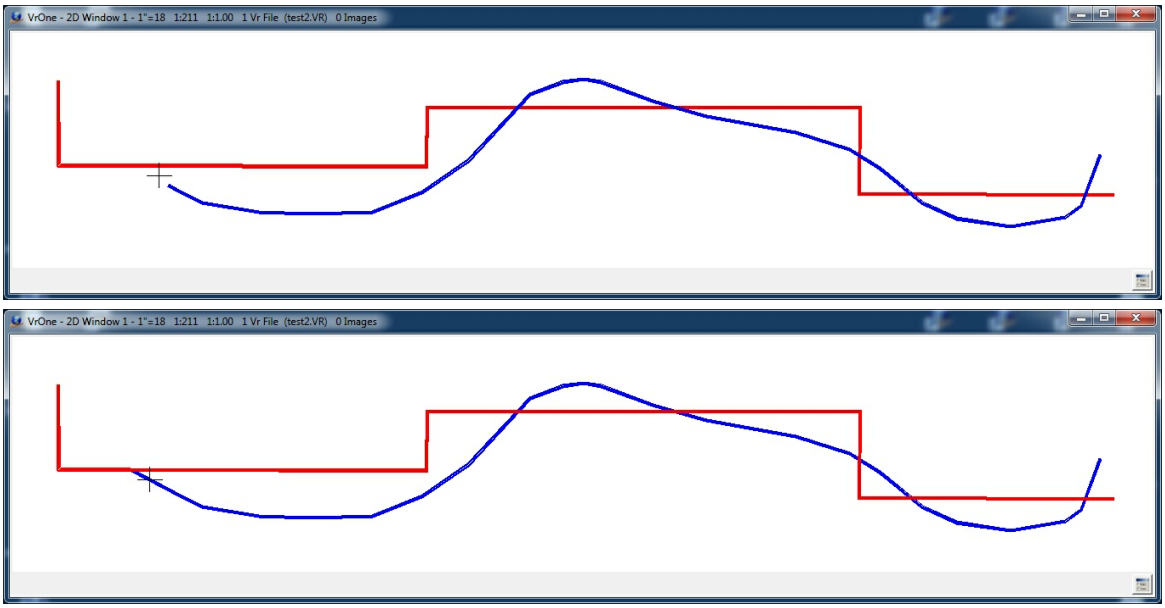
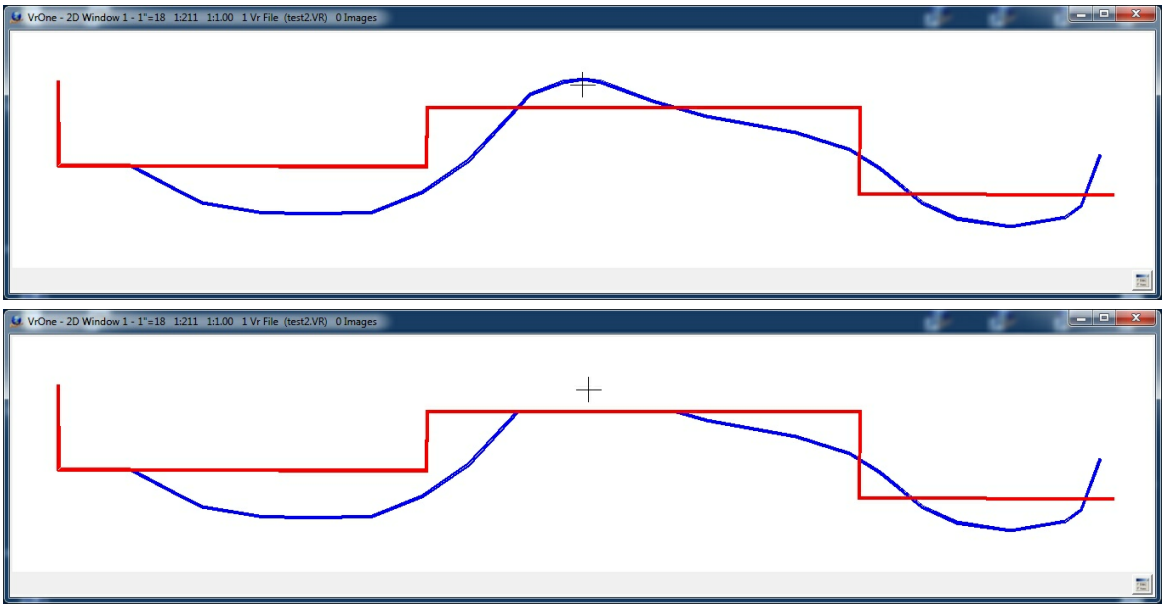
Following are several examples of the use of Trim Lines. Line 1, which is the line being trimmed to, is shown in red. Line 2, which is the line to be trimmed, is shown in blue. The current cursor location is shown as a small black cross.

Example 1



The undershoot of the left side of line 2 is extended to line 1. The Id point is digitized past the end of the line indicating a line extension.

Example 2



The line segment above line 1 is removed. The Id point is placed near the segment to be removed.

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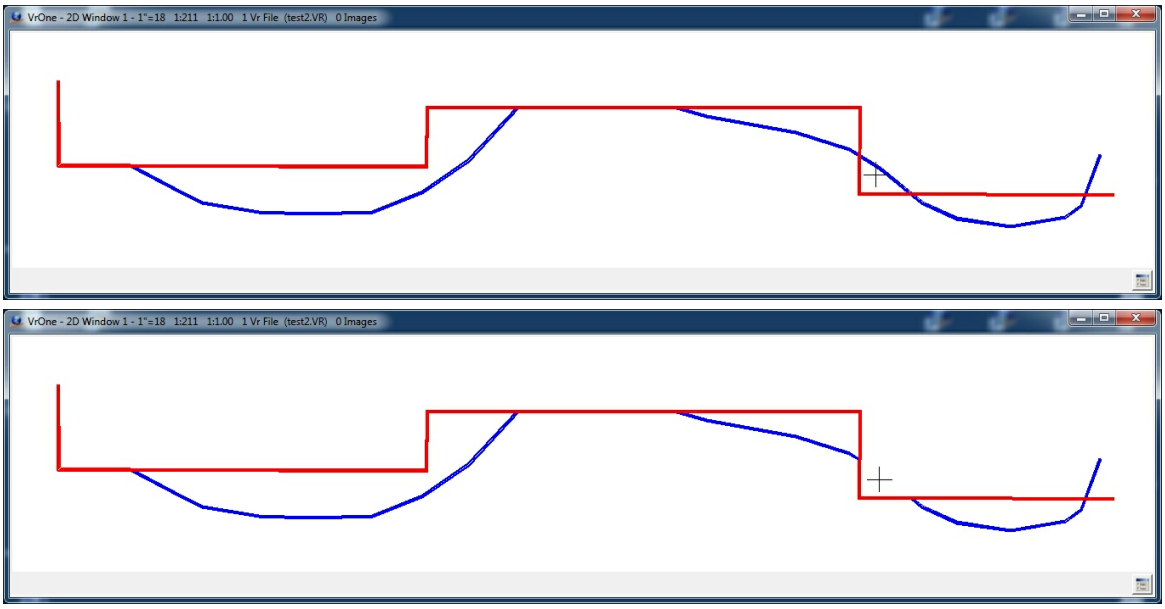
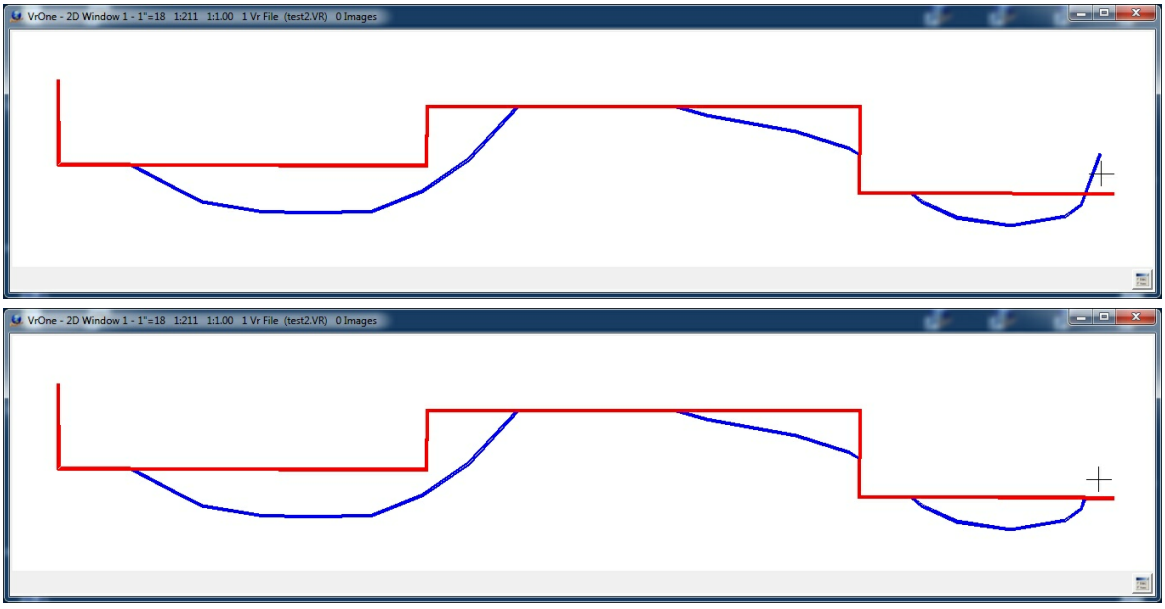
Example 3



The line segment crossing the two segments on line 1 is removed. The Id point is placed near the segment to be removed.

Example 4



The overshoot on the right side of line 2 is removed. The Id point is placed near the segment to be removed.

Menu Key Button Assignments

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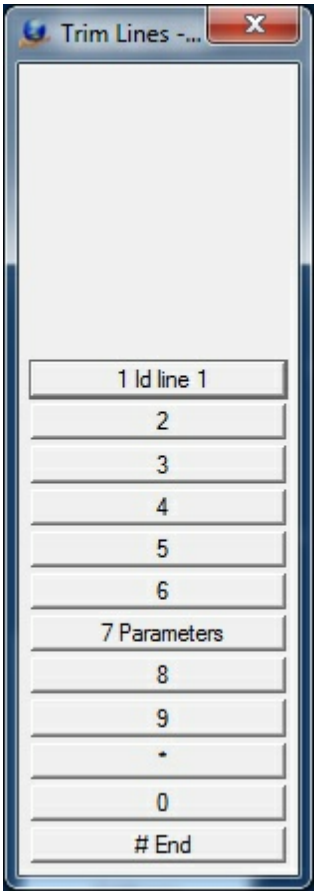
Trim Lines – Id 1



Id line 1 menu

1 Id Line 1
Identifies line 1 which is the line to be trimmed to

7 Parameters
Allows the entry of parameters (see below)

 # End
Ends Trim Lines

Trim Lines – Id 2

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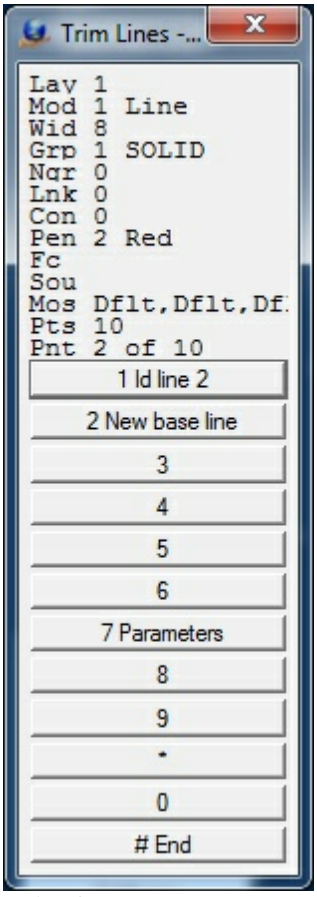

Id line 2 menu

1 Id line 2

Identifies line 2 which is the line to be trimmed and the Id point. The location of the cursor when this button is pressed is the Id point which defines the action to be taken when trimming the lines. (see examples above)

2 New base line

Indicates that a new base line is to be identified. Program execution returns to the previous menu.

7 Parameters

Allows the entry of parameters (see below)

 # End

Ends Trim Lines

Trim Lines - Confirm

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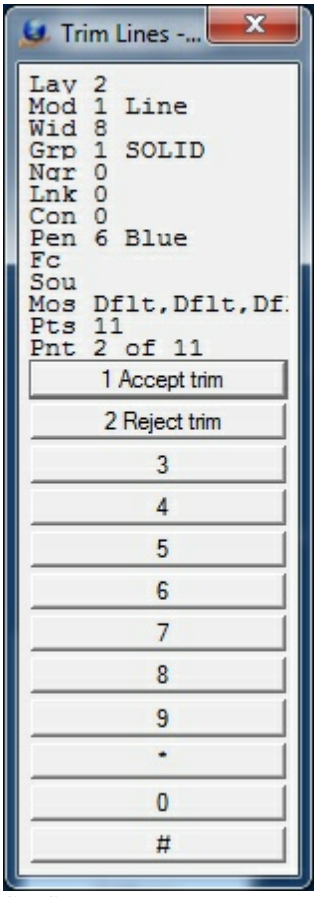
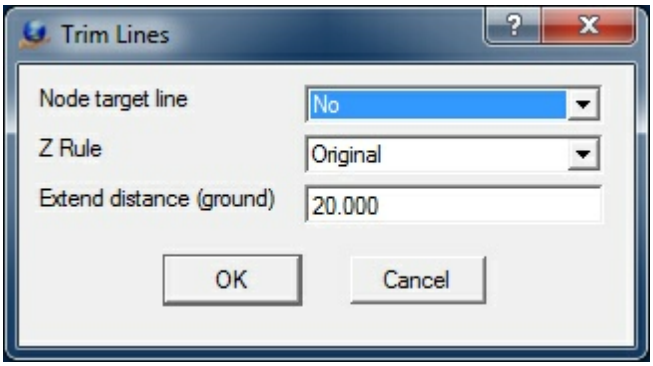


Confirm menu

1 Accept trim
Accepts the current trim operation.

2 Reject trim
Rejects the current trim operation.

Parameters



Trim Lines parameters dialog

Node target line? (NODTAR=)
Specifies whether the target (line 1) should be noded when trimming against line 2. The Z Rule

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will be applied to this trim.

Z Rule (ZRULE=)
Z Rule for intersecting point elevation which is applied if "Node target line" is set to Yes. (See Z Rules)

Distance to extend end points (EXTDIS=)
Defines the amount by which the line end can be extended. Such an extension forces a line 2 end that falls short (undershoot) of line 1 to cross for trimming. This parameter also helps mis-trimming to the wrong line segment on line 1. If the line to be trimmed does not cross the target line even after extension, trimming will not be done.

Local Commands (key-ins)

Key-in	Description	Range
NODTAR=	Node target line?	0=No 1=Yes
ZRULE=	Z rule for intersecting point elevation	0 - Original - Interpolate Z based on each line 1 - Mean - Mean Z at intersection 2 - From line 1 - Use Z from line 1 3 - From line 2 - Use Z from line 2
EXTDIS=	Distance to extend end points	Ground units

Note: Trim Lines was redesigned in Version 05.07.29

2.1.1.9.39 Trim Lines 1

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Trim Lines1 (TriLi1)

Type: Interactive Application

Trims lines together.

Detailed Description

Interactively trims two lines together. The lines to be trimmed are identified by the user and

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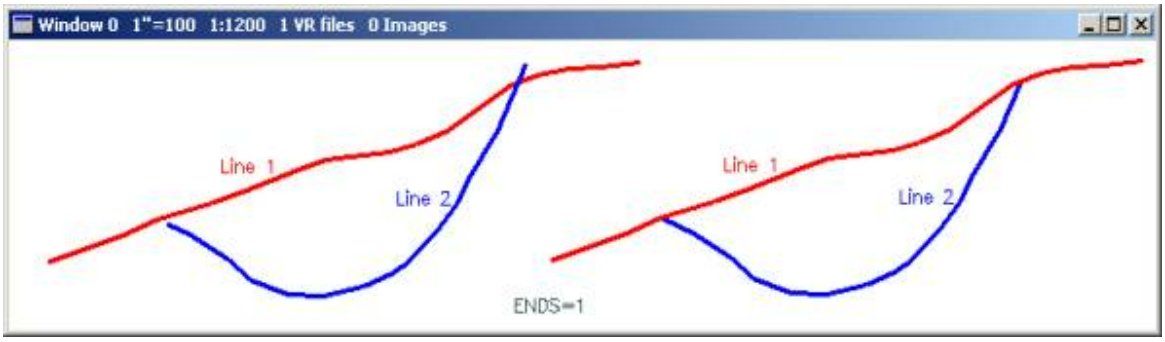
consist of line 1, which is the base line, and line 2, which is the line to trim. Line 2 may be short of line 1 (undershoot) or extend over line2 (overshoot). Options include support for a Z Rules and the noding of the baseline.

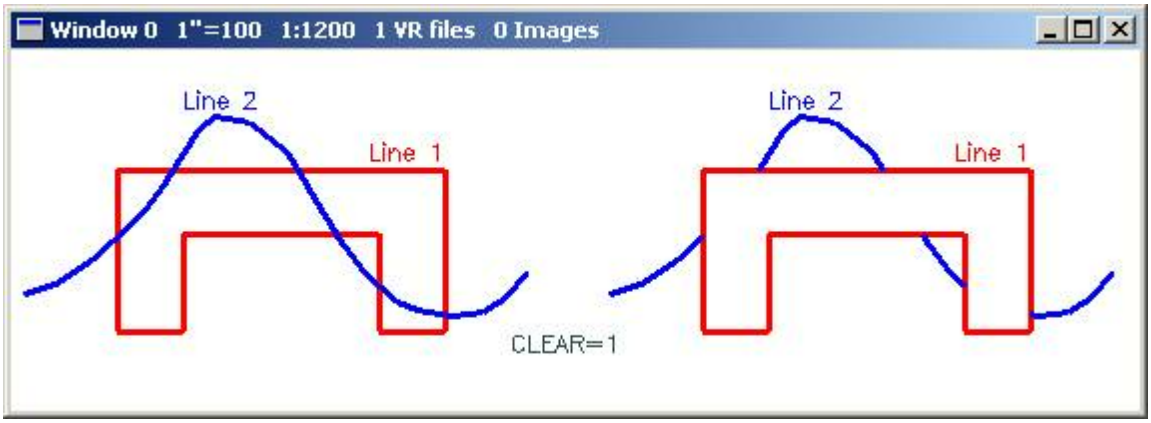
NOTE: Trim Line1 is one of two interactive trim lines applications. Please also see Trim Lines.

Lines may be extended (undershoot) or clipped (overshoot).



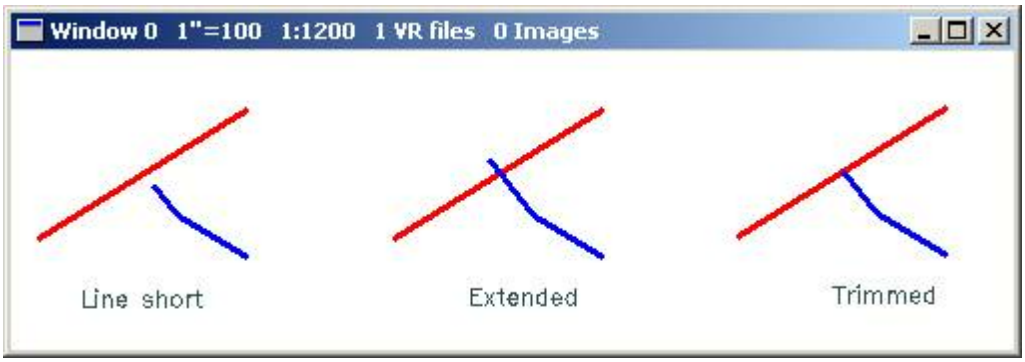
Trim Lines1 example

An optional clear polygon operation is available.



Trim Lines1 clear polygon example

Following is an example of how a line undershoot is handled. "Line short" shows the original configuration of line 1 and line 2. "Extended" shows line two extended. "Trimmed" shows the existing trim. During the process of extending and trimming line 2, the elevation of the extended/ trimmed point is interpolated based on the elevations of the original end line segment.



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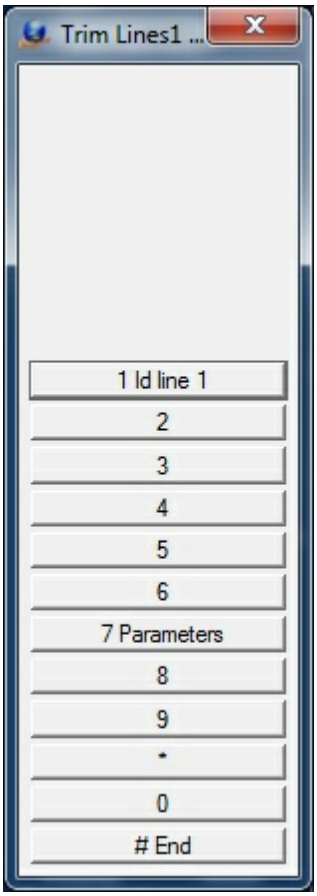
Trim Lines1 undershoot handling

Menu Key Button Assignments

Trim Lines – Id 1



Id line 1 menu

1 Id Line 1
Identifies line 1 which is the line to be trimmed to

7 Parameters
Allows the entry of parameters (see below)

 # End
Ends Trim Lines

Trim Lines – Id 2

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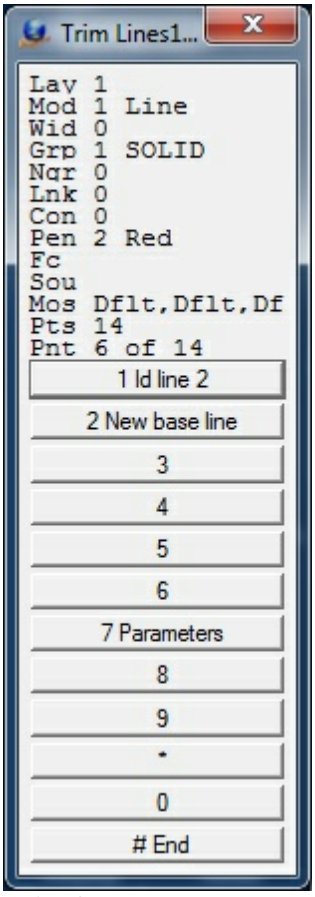

Id line 2 menu

1 Id line 2
Identifies line 2 which is the line to be trimmed to line 1.

2 New base line
Indicates that a new base line is to be identified. Program execution returns to the previous menu.

7 Parameters
Allows the entry of parameters (see below)

 # End
Ends Trim Lines

Trim Lines - Confirm

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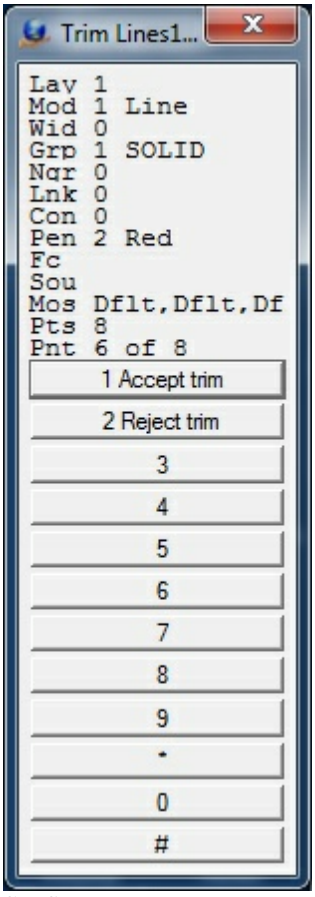
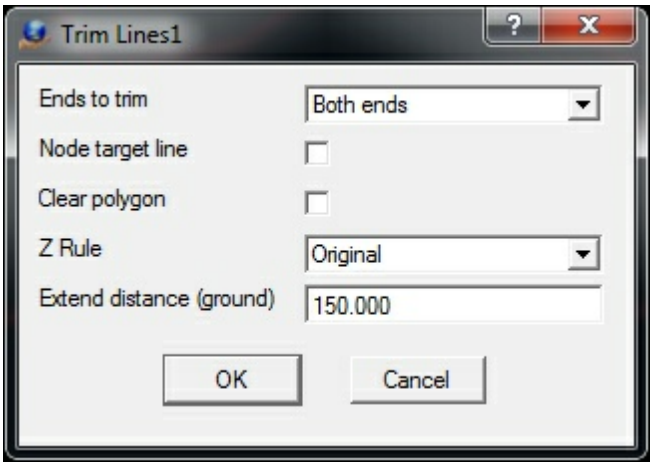


Confirm menu

1 Accept trim
Accepts the current trim operation.

2 Reject trim
Rejects the current trim operation.

Parameters



Trim Lines1 parameters dialog

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Ends to trim
Defines the ends of line 2 to trim to line 1. Options include:
Closest end to id - The closest end to the point digitized that was used to identify line 2
Both ends - Both ends of line 2 will be trimmed to line 1 if possible.

Node target line
If checked, the trimmed line 2 end points will be added to line 1 as node points.

Clear polygon
If checked then line 1 will be considered a closed polygon and the contents of line 2 that pass through this polygon will be cleared. If line1 is not a closed polygon then a closing phantom line segment will be added for computations.

Z Rule
If "Node target line" is checked then a ZRule will be applied to the common points.
0 - Original - Interpolate Z based on each line
1 - Mean - Mean Z at intersection
2 - From line 1 - Use Z from line 1
3 - From line 2 - Use Z from line 2

Extend distance (ground)
This ground distance will be used to extend the line 2 end points which will accommodate line undershoots.

Drive option during verify
Drives to the intersection of the two lines being trimmed during the verification step. Options include "Don't drive" and "Drive to intersection".

Local Commands

Key-in	Description	Range
ENDS=	Ends of line to trim	0=Closest line end 1=Both ends
NODTAR=	Node target line?	0=No 1=Yes
CLEAR=	Clear target polygon?	0=No 1=Yes
ZRULE=	Z rule for intersecting point elevation	0 - Original - Interpolate Z based on each line 1 - Mean - Mean Z at intersection 2 - From line 1 - Use Z from line 1 3 - From line 2 - Use Z from line 2
EXTDIS=	Distance to extend end points	Ground units
DRIOPT=	Drive option	0=Don't drive 1=Drive to intersection during verification

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2.1.1.10 Elevation Management

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Elevation Management

Key-in	Arguments	Description
Z	Value	Sets current elevation to Value.
Z	=Value	Sets current elevation to Value.
Z	+	Increments current elevation by contour interval.
Z	-	Decrements current elevation by contour interval.
Z	+Value	Increments current elevation by Value.
Z	-Value	Decrements current elevation by Value.
Z	R	Rounds to the closest contour interval.
Z	Dtm	Sets current elevation to DTM surface if active.
XYZ	X Y Z	Drives to value specified. Supports the same operators as Z A key-in of XYZ with no arguments will bring up a dialog box in which coordinates may be entered.
High/Low Point Search		Selects the highest, lowest or mean elevation point from a group of VrPoints within a user defined radius.
Z Source	ZSou	Sets the method to determine the cursor elevation

2.1.1.10.1 High/Low Point Search

Vr

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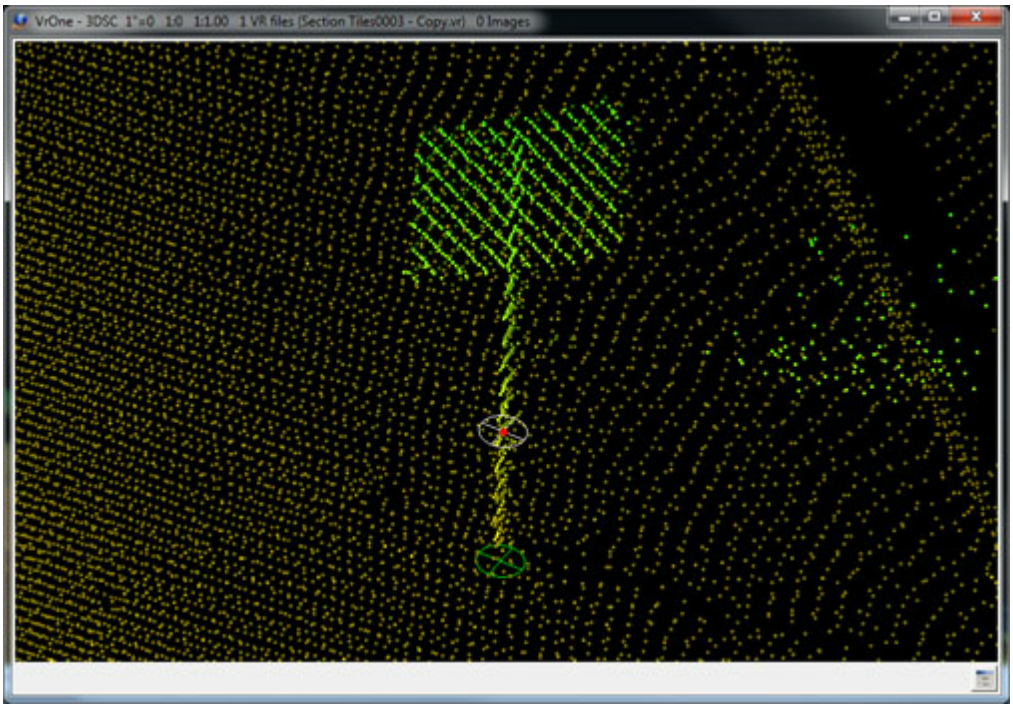
Mapping

High/Low Point Search

Type: Interactive addition for various insert applications



High/Low point searching is an addition to various insert applications such as Insert Line (InsLin) and Insert Symbol (InsSym). It selects the highest, lowest or mean elevation point from a group of VrPoints within a user defined radius of the point digitized. The points considered for selection are VrPoints (LiDAR) only. Options include the ability to use the elevation and/or the XY position of the found point and copy these coordinates as the current digitized position. High/Low Point Search may be turned on or off at any time.

This digitizing assistant is useful when placing features such as poles, posts, and single trees. It is also useful when placing line items such as the tops of curbs and fence lines.

Parameters

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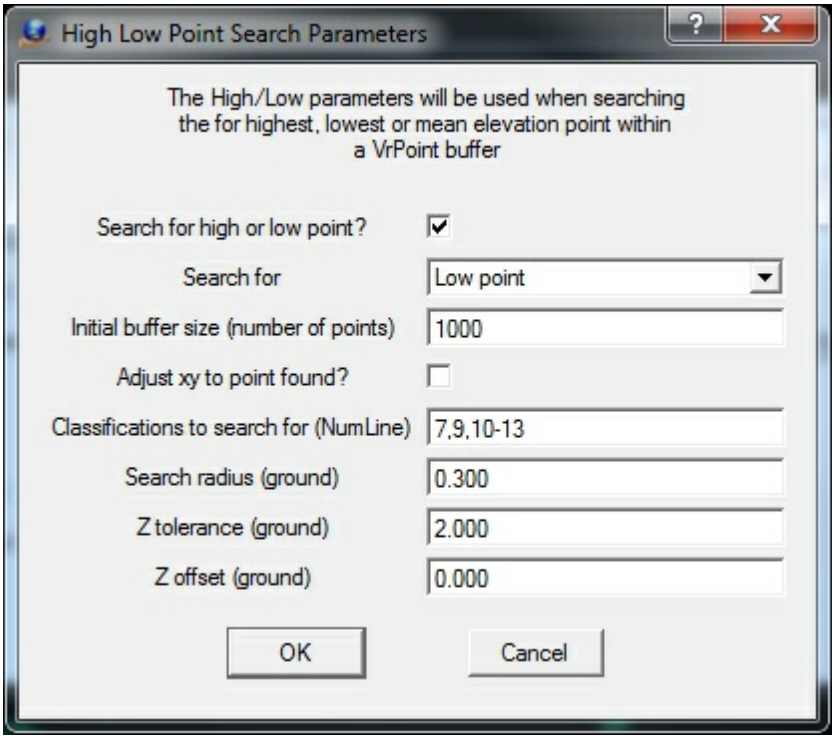

High/Low Point Search Parameters dialog

Search for high or low point?
Turns on/off high, mean or low point searching.

Search for
Specifies the search mode. Options are Low point, Mean point or High point.

Initial buffer size (number of points)
Each time a point is digitized, VrPoints that meet the search criteria are buffered before the high, mean or low point is selected. This parameter defines the initial buffer size in number of points. The buffer size is dynamic and will be made larger by this parameter as often as needed. The number of points in the buffer will be displayed in the console window each time a point is digitized.

Adjust xy to point found?
Specifies whether the X,Y position of the found VrPoint should be copied to the digitized point. This is useful if digitizing features such as hydro-graphic lines and the tops of items like fence lines.

Classification to search (Num Line)
Defines the VrPoint classifications to search when locating the high, mean or low VrPoint. This parameter is entered as a Number Line.

Search radius (ground)
Defines the radius in ground units of the digitized point within which which VrPoints are considered.

Z tolerance (ground)

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Defines the elevation range in ground units above and below the digitized point for which VrPoints are considered. This is useful when data at other elevations might interfere with the high-low process.

Z offset (ground)
Defines the Z offset to add to the resulting high, mean or low elevation. For example, the base of a fence could be digitized and a line added near the top.

Local Commands

The following commands will condition High/Low Point Search and may be keyed in any time it is active. Normally, these key-ins are placed in the Local Arguments field in a Function Key to set conditions when a key is started.

Key-in	Description	Range
HL_OFFON=	Turns on/off high, mean or low point searching	0=Off 1=On
HL_MOD=	Specifies the search mode	0=Low point 1=Mean point 2=High point
HL_BUFSIZ=	Initial buffer size	Number of points
HL_XYADJ=	Copy XY of point found to current location	0=No 1=Yes
HL_SEACLA=	Classifications to search	0-31, Number line may be used
HL_SEARAD=	XY search radius	Ground units
HL_ZTOL=	Z tolerance above and below source point	Ground units
HL_ZOFF=	Offset to add to Z result	Ground units

2.1.1.10.2 XYZ Drive

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XYZ Drive (Xyz)

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Type: Interactive Application Key-in

Drives 3D instrument.

Detailed Description

Drives 3D instrument to specified location. Supports argument operators that allow X, Y and Z values to be set to, added to, subtracted from, divided by, or multiplied by each axis argument. XYZ is a key-in; if it is a position that needs to be driven to often, such as the index point of the model, it is suggested that a macro be used.

Xyz supports the following operators

= or blank	Set axis to value specified
+	Add value specified to axis
-	Subtract value specified from axis
/	Divide axis by value specified
*	Multiply axis by value specified

Example: Xyz 837831.194 951352.037 303.82
Would drive the instrument to the XYZ specified.

Example: Xyz -10.0 -23.5 +20.0
Would subtract 10 units from the current X, subtract 23.5 from the current Y, add 20 units to the current elevation, and drive the instrument to that location.

Example: Xyz *3.28083333 *3.28083333 *3.2080333
Would convert the current instrument location from meters to feet and drive to that location.

To drive to a negative axis use the = operator.
Example: Xyz 837831.194 951352.037 =-1.23
Would drive the instrument to 837831.194 951352.037 -1.23.

To drive without changing an axis add zero to that axis.
Example: Xyz +0 +0 23.5
Would drive the instrument elevation to 23.5 and leave the XY unchanged.

A key-in of XYZ with no arguments allows the entering of an absolute coordinate value.

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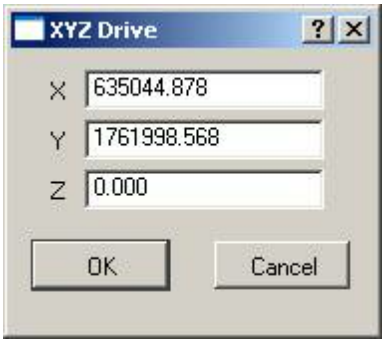

The operators =, +, -, /, and * are not supported in this mode.

2.1.1.10.3 Z Source

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Vr Mapping

Z Source (ZSou)

Type: Z input parameter definitions

Sets the method to determine the cursor elevation

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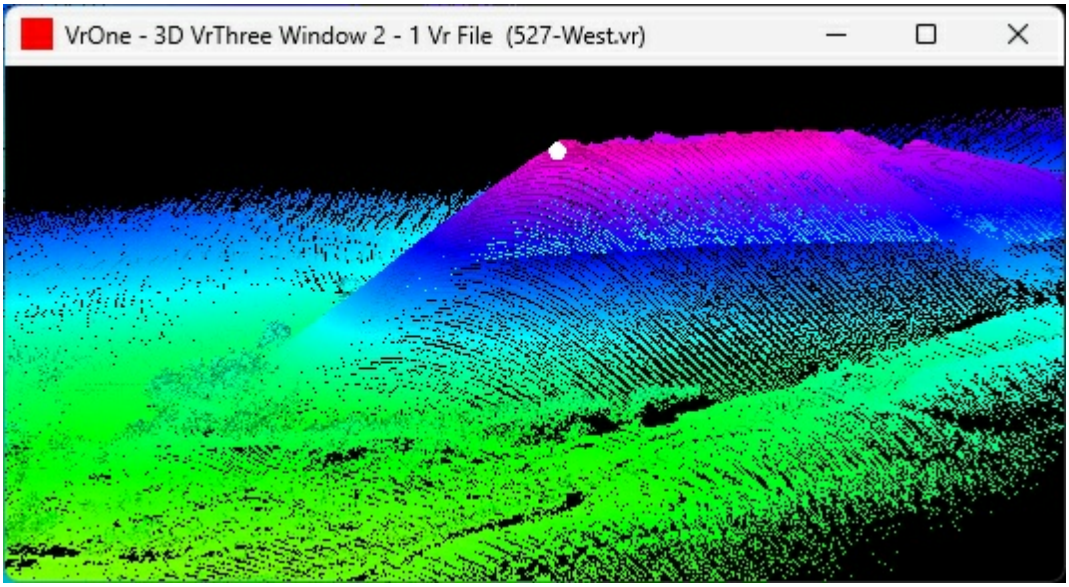

Detailed Description

The current X,Y position of the cursor in VrOne and VrTwo is normally defined by the input device such as the mouse or the 3D mouse. However, the definition of the elevation or Z can be obtained from one of several sources. These sources include the active digitizer, which includes the 3D mouse, the Active Z, the Digital Terrain Model (DTM) surface or from points such as LiDAR. The Z Source is used in VrOne and VrTwo while VrThree has its own methods of determining the current cursor elevation.

Note: In the following documentation, Z and elevation refer to the same value.

The Z Source Dialog

The Z Source dialog can be started using the ZSou key-in.

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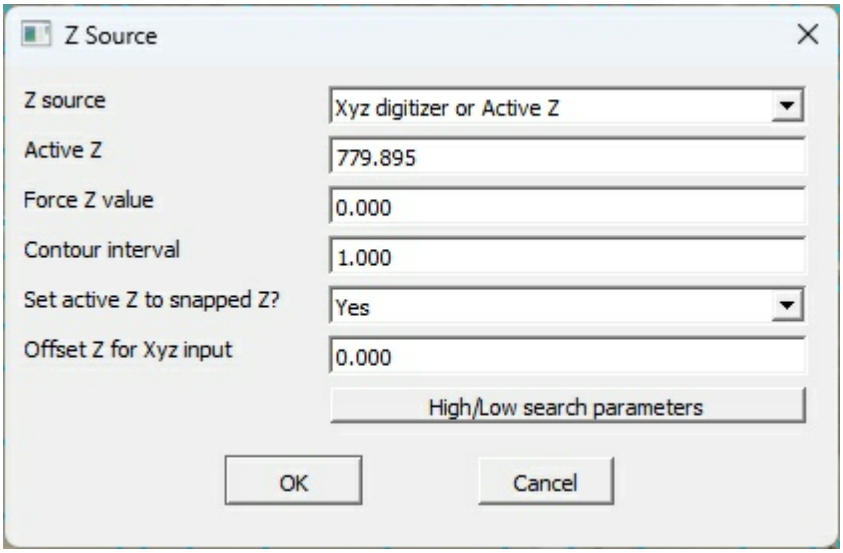

The Z Source Dialog

Z Source

Defines the current method of determining the elevation of the cursor.

- **Xyz digitizer or Active Z** - The Xyz digitizer is a 3D input device such as a stereo plotter. The active Z is the current elevation and in changed each time a 3D input device is read. It is also changed by the Z command and when an entity is locked onto. The key-in to make this parameter active is "ZSou ActZ".
- **DTM surface if active** – The elevation will be obtained from the current DTM surface if a model has been computed (RunDtm). The current Xy location is used to compute the Z. The key-in to make this parameter active is "ZSou DTM".
- **Force Z value** – The elevation will be set to the predefined Force Z value. The key-in to make this parameter active is "ZSou ForZ".
- **Point Drape (High/Low)** - When active the cursor is draped to points such as LiDAR or Digital Surface Model (DSM) points. The High/Low Point Search is used to determine this Z value. This is available in VrOne and VrTwo. The key-in to make this parameter active is "ZSou HL".
- **Point Drape (Triangle)** - When active the cursor is draped to points such as LiDAR or Digital Surface Model (DSM) points. The area within the search radius is triangulated to determine this Z value. This is available in VrOne and VrTwo. The key-in to make this parameter active is "ZSou Tri".

Active Z

Defines the Active Z (elevation). There are several ways this value can change in VrOne. One is the "Z value" key-in such as "Z 123.45".

Force Z value

The input or current elevation will forced to this value

Set Active Z to snapped Z

If set to yes then each time an entity is snapped to or locked onto, the Z will become the active Z

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Offset Z for Xyz input
This value will be applied to the input Z. This can be used to shift the Z input a constant amount when using a 3D input device.

High/Low search parameters
Pressing this button will display the global High/Low Search Parameters dialog. (see below) These values will be used when the Z Source is set to Point Drape.

The High/Low Search Parameters

See High/Low Point Search.

2.1.1.11 Environment Management

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Environment Management

Name	Key-in	Arguments	Description
Set Active Workspace	Aws	WsNum	Sets the active workspace (1-256).
Workspace Control	WsCon		Displays list of open workspaces and allows visibility to be controlled in each graphics window.
Set Parameters	SetPar		Set current window parameters.
Set Display Parameters	SetDis		Sets display parameters.
Point Density	PoiDen PD		Sets point density.
Edit Configuration	EdiCon		Edits Vr configuration.
Edit Toolbars	EdiToo		Edits toolbars.

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Display Toolbar	DisToo	Toolbar Name, On|Off	Displays (On) or hides (Off) a single toolbar using a key-in. Example: DisToo "LiDAR Data" Off
Search Radius	SeaRad	Ground	Sets current entity search radius.
Snap Set	SnaSet		Sets snap parameters.
Snap Toggle	SnaTog		Toggles snap on/off.
Snap On	SnaOn F11		Turns snap on.
Snap Off	SnaOff		Turns snap off.
Snap Workspace Current	SnaWsCur		Snaps to entities in current workspace only.
Snap Workspace All	SnaWsAll		Snaps to entities in all open workspaces.
Snap All	SnaAll		Snaps to all entities.
Snap Lines	SnaLin		Snaps to only lines.
Snap Symbols	SnaSym		Snaps to only symbols.
Snap Text	SnaTex		Snaps to only text.
Snap Point	SnaPoi SnaPnt		Returns line point.
Snap Intersect	SnaInt		Returns line intersection.
Snap End	SnaEnd		Returns line endpoint.
Snap Search Line	SnaSeaLin		Snaps Search Mode Lines.
Snap Search Line Point	SnaSeaPoi		Snaps Search Mode Line Points.
Snap 2D	Sna2d		Snaps 2-dimension.
Snap 3D	Sna3d		Snaps 3-dimension.
Snap Verify Off	SnaVOff		Turns snap verify off.
Snap Verify On	SnaVOn		Turns snap verify on.
Snap After Off	SnaAOff		After snap, turns it off.
Snap After On	SnaAOn		After snap, leaves it on.
Snap Ignore Fail On	SnaIOn		Ignores failed snaps allowing retries.

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Snap Ignore Fail Off	SnaIOff		Failed snaps return digitized position.

2.1.1.12 File Operations

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File Operations

Name	Key-in	Arguments	Description
Set Default Directory	DefDir	Directory	Sets the default (project) directory.
Close All Open Files	CloAll		Closes all open VrOne and image files.
New VrOne file	NewVr	[-p][-w][-t value][-u value][-c value][-s value][-z value][-d value] [Filename]	Creates new VrOne file using optional arguments. -p = Prompt for header -w = Don't change active workspace -t value = Set target scale to value -u value = Set units to value (0=feet,1=meters) -c value = Set coordinate format to value (0=State Plane, 1=UTM) -s value = Set state plane zone to value -z value = Set UTM zone to value -d value = Set description to value Filename = Create file with this name. Will prompt for filename if not given.
Open VrOne file	OpeVr		Opens VrOne files from dialog box.
Open VrOne file	OpeVr	File name	Opens VrOne file.
Close VrOne File	CloVr		Closes VrOne files.
Close VrOne File	CloVr	All	Closes all VrOne files.
Save As	SavAs		Saves the Active Workspace file with the ability to rename.

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Pack VrOne File(s)	PacVr	All | Cur	Packs VrOne file(s). All – Packs all open workspaces Cur – Packs the current workspace only
Sort VrOne File(s)	SorVr		Sorts and packs VrOne file(s) by the layer and the X or Y axis.
Backup VrOne File (s)	BacVr		Backs up the currently open VrOne files.
Backup parameters	BacPar	Format Time	Defines/edits backup parameters. Format - File format option (0-2) Time - Timed backup interval (seconds) If no parameters are passed then a dialog is opened
Edit VrOne Header	EdiVr		Edits Vr file header.
Set Passwords	SetPas		Sets Open and Read-Only access passwords that apply to VrLite only.
List Layer	LisLay		Lists Layers and modes used in Vr files.
List Workspaces	LisWs		Lists Workspaces currently open. Displays workspace number, file size, entity counts, and filename.
List Images	LisIma		Lists detailed information about Images currently open.
Open Image	OpeIma		Opens image files from dialog box.
Open Image	OpeIma	File name	Opens image file.
Close Image	CloIma		Closes image files.
Close Image	CloIma	All	Closes all image files.
Open Model	OpeMod		Opens two images that make up a model from a dialog box.
Open Model	OpeMod	File name	Opens two images that make up a model based on the model orientation (.vmo) file.
Load Symbols	LoaSym	File name	Loads VrOne symbol file.
Copy File	Copy	File1 File2	Copies disk File1 to File2.
Delete File	Delete	File	Deletes disk File.
Spawn	Spa	Argument List	Runs a command from the operating system.
Change Units	ChaUni		Changes file units (Meters<->Feet).

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Range Xy	RanXy		Shows Xy range of all open workspaces.
Undo	Undo		Undoes last operation in current workspace.
Undo All Workspaces	UndoAllWs		Undoes last operation in all workspaces.
Redo	Redo		Redoes last operation in current workspace.
Redo	RedoAllWs		Redoes last operation in all workspaces.
List Undo Information	LisUnd		Lists all undo information details.
Exit	Exi		Exits VrOne.
Quit	Qui		Exits VrOne.
End	End		Exits VrOne without confirmation.
File Information	FilInf		Displays information about open files.
Count Points	CouPoi		Counts the number of VrPoints (LiDAR) in a user defined area, at a user defined location.

2.1.1.12.1 Spawn

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Vr Mapping

Spawn (Spa)

Spawn runs a command from the operating system. The command must contain an operating system command and arguments, if any. Results of the command will be displayed in the VrOne/VrTwo Command Prompt window. Arguments that contain blanks such as filenames must be enclosed by double quotes. For more information on the command shell overview please visit the Microsoft help page at http://www.microsoft.com/resources/documentation/windows/xp/all/proddocs/en-us/ntcmds_shelloverview.mspx?mfr=true.

Examples:

Spa Dir

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Displays the contents of the active folder in the Command Prompt window.

Spa cd \Temp & Dir

Changes the current folder to \Temp and displays the contents of the folder in the Command Prompt window. The '&' character indicates multiple commands on a single line. Each command runs after the previous command on the line has been completed.

Spa cd \Temp & Dir > c:\TextFile.txt

Changes the current folder to \Temp and writes a list of the contents of this folder into a text file. The '&' character indicates multiple commands on a single line. Each command runs after the previous command on the line has been completed.

Spa "C:\Program Files\Internet Explorer\iexplore.exe" C:\vr\help\InsLine.html

Starts Internet Explorer and displays the VrOne/VrTwo help page for the interactive application Insert Line. The double quotes around the command name are used because this argument contains blanks. The text within the double quotes is considered a single argument.

2.1.1.12.2 Count Points

Vr Mapping

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Count Points (CouPoi)

Type: Interactive Application

Counts the number of VrPoints (LiDAR) in a user defined area and location. Count Points may be used to calculate the number of points per square ground unit at several user selected locations. The search shape can be defined as a circle or square.

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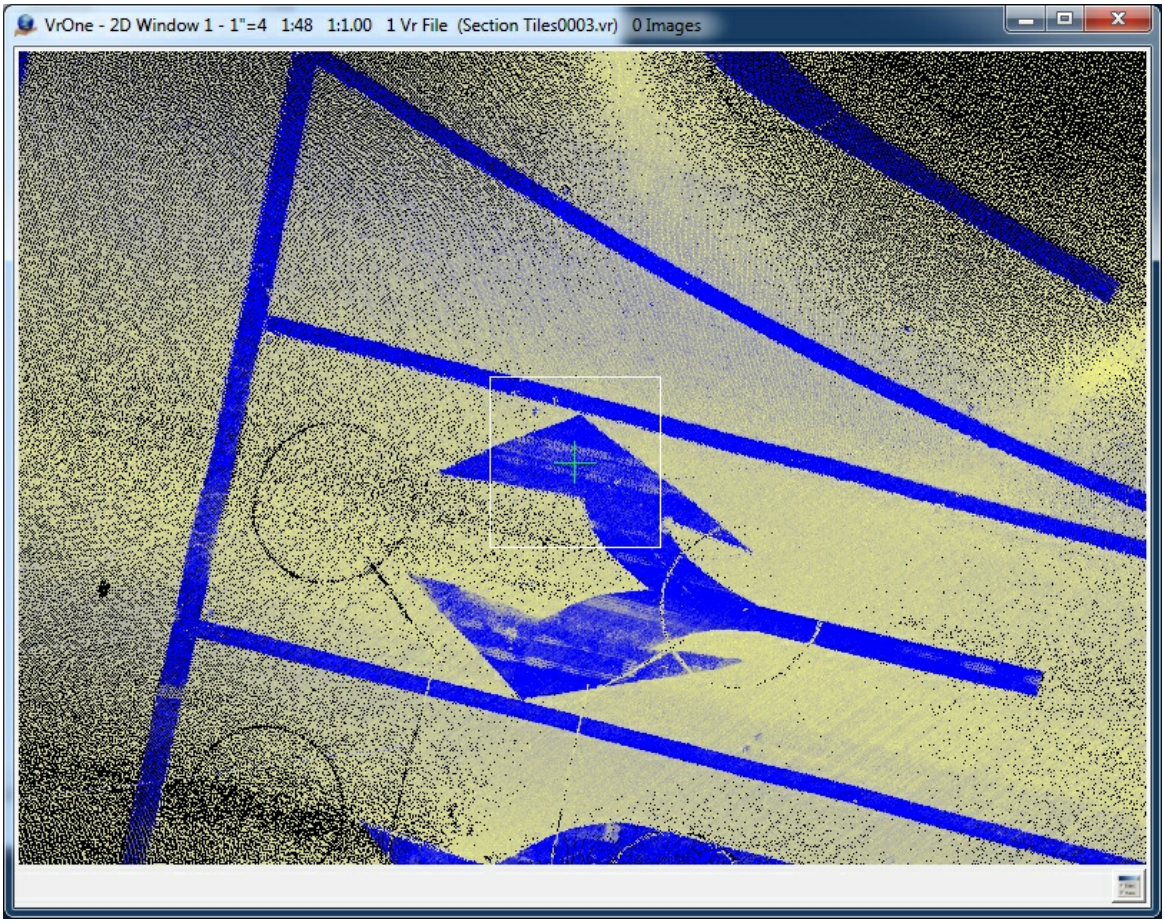

Button Assignments

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The Count Points Menu Keys

Drape Polygon – Main

	Button	Description
1	Digitize	Digitizes the center of the search area to find and count points.
2		
3		
4		
5		
6		
7	Parameters	Enter parameters.
8		
9		
*		
0	Toggle Snap	Toggles snap on/off.
#	End	Ends application.

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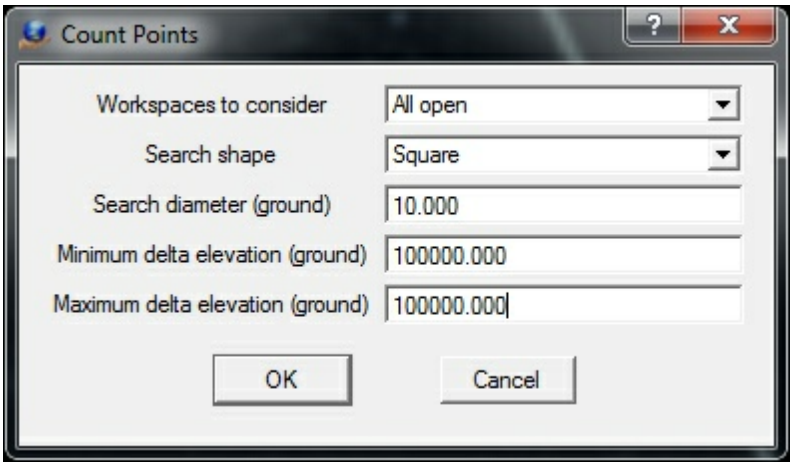
Parameters

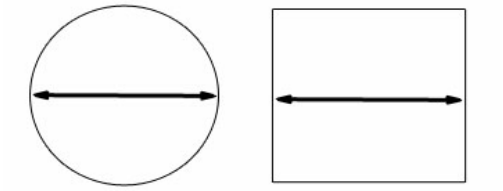


Drape To Points parameter dialog

Workspaces to consider - Defines the workspaces to consider when identifying points for change. This may be set to "Current only", or "All Open".

Search shape - When searching and counting points in a user defined area, the shape of the search area may be a Circle or Square

Search diameter (ground) - Defines the size of the search area in ground units. If a circle is chosen as the search shape, this value represents the diameter of the circle. If a square is chosen, this value represents the length of the each side. The Search



Minimum delta elevation (ground) - Defines in ground units the delta elevation below the digitized search point above which to search for points.

Maximum delta elevation (ground) - Defines in ground units the delta elevation above the digitized search point below which to search for points.

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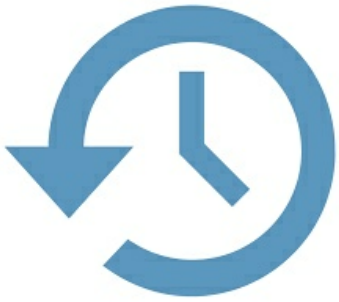
Vr Mapping

Backup VrOne File(s) (BacVr) Edit Backup Parameters (BacPar)



Type: Interactive Application and parameters

The Backup VrOne File(s) command backs up the currently open VrOne files (workspaces) in VrOne, VrTwo, and VrThree. Options for backing up VrOne files include the backup file name format and the definition of a backup time interval. If the backup time interval is non-zero then the Backup VrOne Files application will be run automatically each time interval. These parameters may be defined/edited in the Edit Backup Parameters (BacPar) command.

Backup VrOne File(s) (BacVr)

This command can be run using the "BacVr" key-in or can be run from the File pull-down menu.

Edit Backup Parameters (BacPar)

The Edit Backup Parameters command facilitates the definition/editing of the parameters used by Backup VrOne Files. This dialog may be started with the "BacPar" key-in or from the File pull

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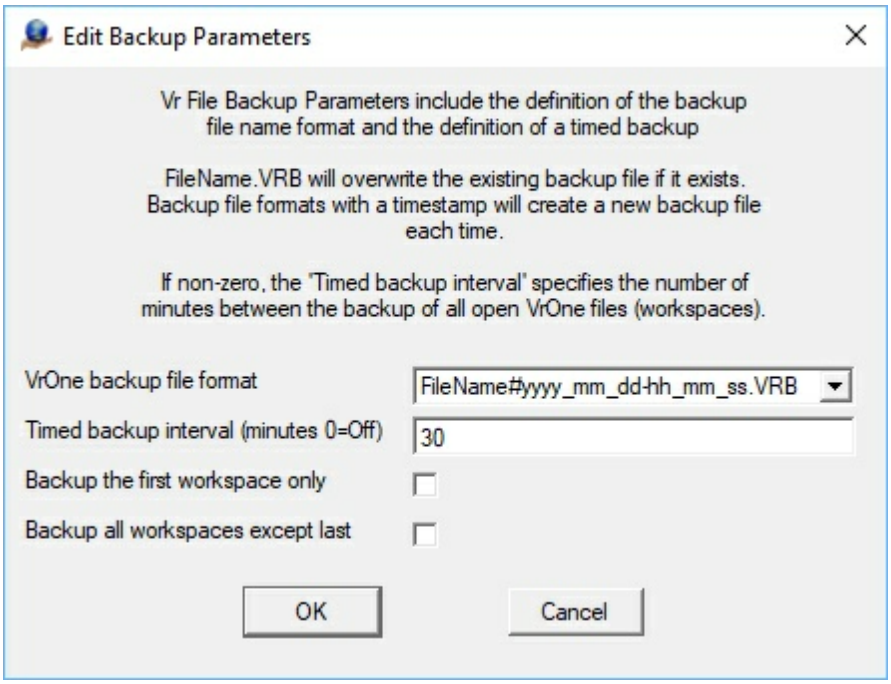
down menu or from the Vr Configuration program under the Configuration pull-down menu.

When setting the backup parameters using the "BacPar" key-in, two parameters may be specified. The FileFormatOption is a value from 0 to 3 (see below for definition) and the TimedBackupInterval is a value entered as minutes.

```
BacPar  FileFormatOption  TimedBackupInterval
```

For example, "`BacPar 1 30`" would define the backup file format of FileName#yyyy_mm_dd-hh_mm_ss.VRB and a Timed backup interval of 30 minutes. The keyin of BacPar with no parameters will start the Edit Backup Parameters dialog as follows.



The Edit Backup Parameters dialog

VrOne backup file format - Three backup file name formats are available as follows.

- **FileName.VRB** - The backup file name is the same as the original file except the file extension is .VRB instead of .VR. This option will overwrite the same backup file each time. Example: Original file name: m1703.vr - Backup file name: m1703.VRB
- **FileName#yyyy_mm_dd-hh_mm_ss.VRB** - The backup file name has a timestamp included which consists of the day and the time. This option will create a new backup file each time.
  Example: Original file name: m1703.vr - Backup file name: m1703#2019_02_23-11_23_45.VRB where the date is 2/23/2019 and the time is 11:23:45.
- **FileName#yyyymmddThhmmss.VRB** - The backup file name has a timestamp included

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which consists of the day and the time. This is similar to the previous timestamp format but is more compact but harder to read. This date/time format conforms to the ISO 8601 date/ time format specification. This option will create a new backup file each time.
Example: Original file name: m1703.vr - Backup file name: m1703#20190223T112345.VRB where the date is 2/23/2019 and the time is 11:23:45

Timed backup interval (minutes 0=off) - A value greater than zero will turn on the automatic backing up of open VrOne file(s). This value is entered as minutes.

Backup the first workspace only - When multiple workspaces are open, only the first workspace will be backup up if this parameter is checked. Checking this parameter will override the "Backup all workspaces except last" parameter (below).

Backup all workspaces except last - When multiple workspaces are open, all workspaces will be backed up except the last one. If only one workspace is open, it will be backed up. This parameter is ignored is the "Backup the first workspace only" parameter is checked.

Note: If a timestamp VrOne backup file format is selected, the backup of the VrOne files will generate a new files each time a backup is performed. This will occur even if the computer is idle with VrOne, VrTwo, or VrThree running. The user should perform disk maintenance and remove older backup files once they are not needed.

Document revised: March 2019 (2nd)

2.1.1.13 Graphics

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Vr Mapping

Graphics

Name	Key-in	Arguments	Description
Buffer XY/XYZ Input During Replot	BufXy	0=Off 1=On	Sets the buffering of XY or XYZ input during screen re-plotting. Digitizing may continue

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			but re-plotting will be slower.
Replot	Rep		Re-plots graphics to all windows.
Replot Off	RepOff		Turns off graphics replot in macros.
Toggle Roaming	TogRoa		Toggles between static and roaming modes in VrTwo.
Roaming On	RoaOn		Switches VrTwo from static mode to roaming mode.
Roaming Off	RoaOff		Switches VrTwo from roaming mode to static mode.
Toggle Roaming Cursor	TogRoaCur		Toggles whether main graphics window roams in VrTwo when cursor is in an overview window.
Toggle Window Shift	TogWin		Toggles window shift.
Set Window Origin	WinOrg	X Y Z	Sets the origin of the active window. Z is optional.
Set Window Scale	WinSca	Scale	Sets the scale of the active window. SetSca 1200 SetSca 1=100 SetSca 1:1200
Window Rotation	WinRot		Digitizes window rotation about Z axis.
Window Rotation X	RotX	Rotation value	Rotates current window about the X axis.
Window Rotation Y	RotY	Rotation value	Rotates current window about the Y axis.
Window Rotation Z	RotZ	Rotation value	Rotates current window about the Z axis. This value is expressed as Direction of North.
Window Align	WinAli		Aligns Z rotation of current graphics window with window 1. Useful in VrTwo.
Zoom Filter Pixel Smooth	ZooFil PixSmo		Engages zoom filter mode. Used to smooth pixels when zoomed below 1:1. Without any arguments, toggles between Nearest Neighbor and Bilinear, or can be set directly as shown below. ZooFil 0 = Nearest neighbor

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			ZooFil 1 = Bilinear (**VrTwo** roaming only)
Zoom Center	ZooC ZooCen		Centers the window at the current cursor location.
Zoom Window	ZooW ZooWin		Zooms by user-defined window.
Zoom All	ZooA ZooAll	1-8 (optional)	Places all open data into window.
Zoom Fit	ZooF ZooFit	1-8 (optional)	Places all open and non-deleted data into window.
Zoom Previous	ZooP ZooPre		Displays previous zoom.
Zoom Last	ZooL ZooLef		Shifts the window left.
Zoom Right	ZooR ZooRig		Shifts the window right.
Zoom Up	ZooU ZooUp		Shifts the window up.
Zoom Down	ZooD ZooDow		Shifts the window down.
Zoom In	Zoo	Scale_factor window (1-8, optional)	Zooms in by user-defined scale factor. Prompts for window selection if no window number given.
Zoom Out	Zoo	Scale factor	Zooms out by user-defined scale factor.
Zoom Visible	ZooV ZooVis	1-8 (optional)	Zooms to the extents of the visible vector graphics and images.
Plot	Plo		Hard copy plotting.
Set Display Flags On	SetAll		Sets all entities' display flag to ON.
Max Model Radius	ModRad	0.0-100.0% default =100	Percent of the image radius (distance from the center to the corner) to display for on-the-fly stereo models. This is used to force compilers to remain in the clean model area.

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NOTE: Care must be taken when using Window Scale (WinSca), Window Rotation X,Y,Z (WinRot), and Window Origin (WinOrg) in sequence without a screen replot. Since these key-ins are likely to be in a macro they do not redraw the graphics window. A replot (Rep) must be done to accomplish this. If two or more are used without a replot (which is likely to occur in a macro) they must be in the following order as this example shows:
WinSca 1=20
RotZ 80
WinOrg 3563188 232820

2.1.1.13.1 Plot

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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Plot (Plo)

Type: Utility application

Plots hardcopy or PDF files of VrOne vector and image files.

Plot Dialog	Notes	Suggested Settings
Transferring Plot files via FTP	Transferring Plot files via the Print Spooler	Long Axis Plots

Detailed Description

Plots VrOne vector and (or) image files to one of six available formats. These formats include HPGL (Hewlett Packard Graphics Language), HPGL/2, HPGL/2 and HP RTL (Raster Transfer Language), PostScript, PDF, or System Printer.

The following chart shows feature availability for each plot format:

Format	Vectors	Image	Color table	Sheet Orientation	Device DPI	Minimum Line Width	Render Mode
HPGL	Yes	No	No	No	No	No	No
HPGL/2	Yes	No	Yes	No	No	Yes	No

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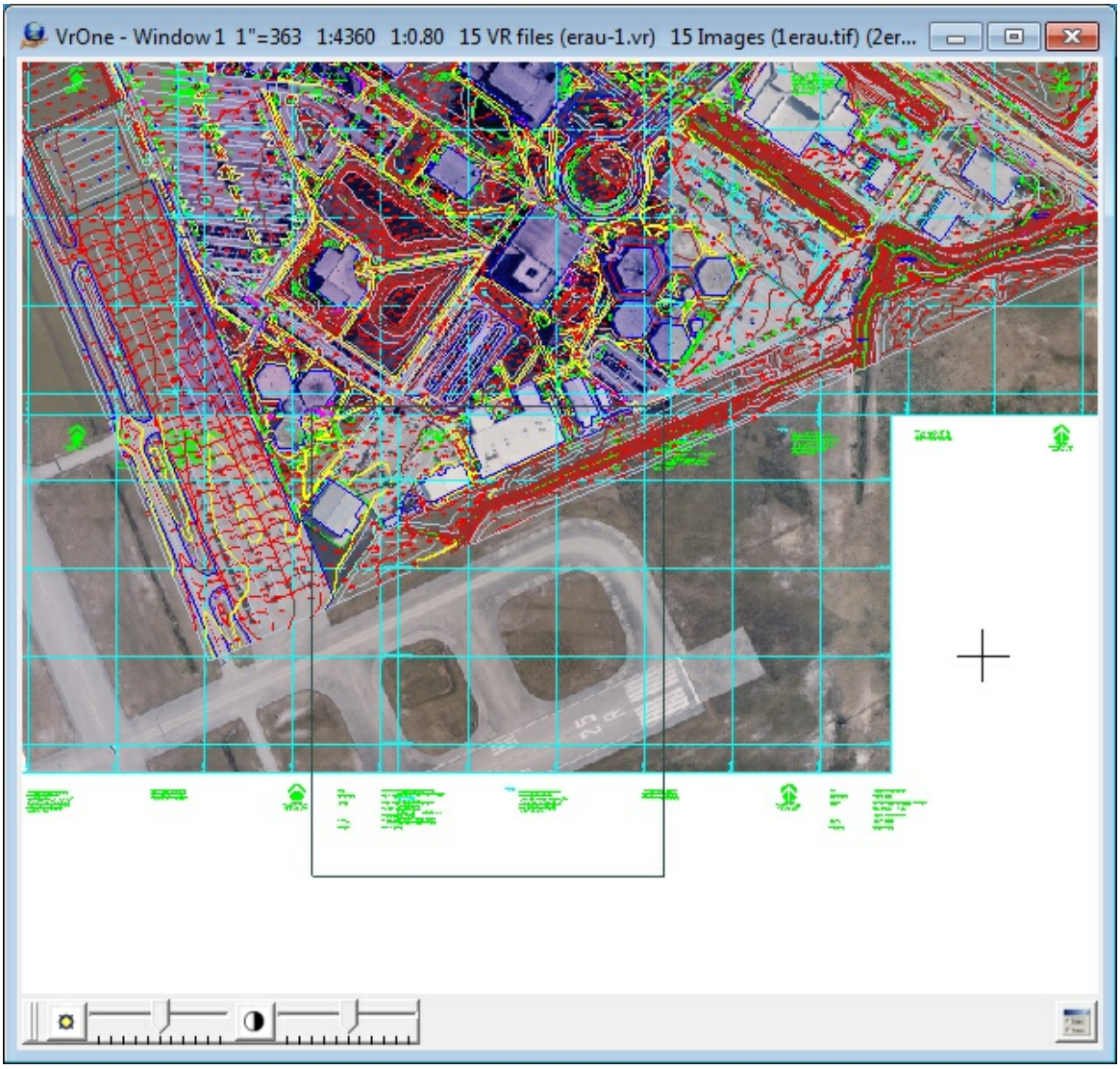
HPGL/2 and HP RTL	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Postscript	Yes	Yes	Yes	No	Yes	No	No
PDF	Yes	Yes+	Yes	No*	No	Yes	Yes
System Printer	Yes	Yes+	Yes	No*	No*	Yes	Yes

+ Plots multiple images
* May be set in the print preview dialog

If the PDF or System Printer options are selected, a print preview dialog is displayed before printing begins. In the following images, the first image is the VrOne graphics window. The black rectangle encloses the area to be plotted. The second image displays the preview window with PDF selected as the Plot format. Note that the preview does not display images, but they will be sent to the print device.



VrOne graphics window with plot area defined

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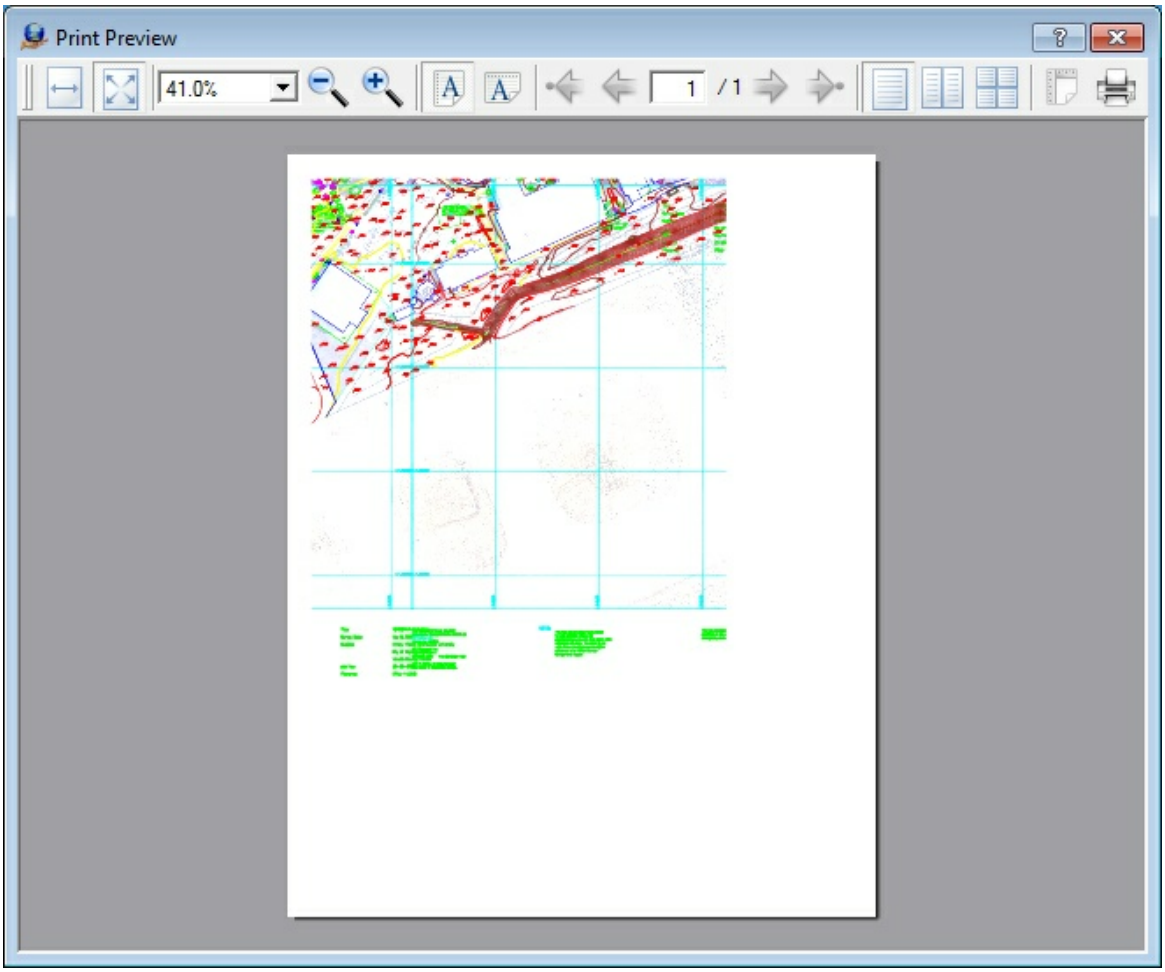

Plot preview window.

Available Key-ins

None

Plot Dialog

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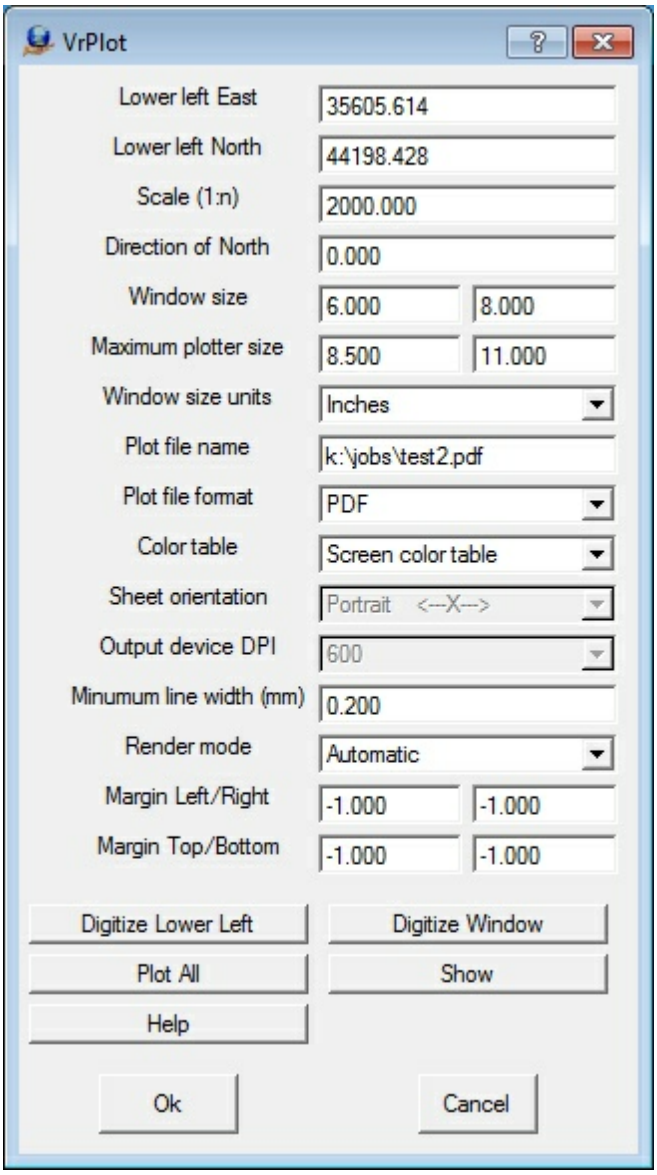

Lower left East, Lower left North

Defines the lower left East and North in ground units. Values for the lower left East and North may be typed in or may be defined by "Digitize Lower Left", "Digitize Window" or "Plot All" is active.

Scale

Defines the plot scale. The plot scale is normally a job constant and is entered as a map scale ratio.

Direction of North

Defines the direction of North in reference to the plot window. Please see Direction of North for more information about this parameter.

Window size

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Defines the plot window size in Inches or Millimeters. Values for the Window size may be typed or may be manually defined by "Digitize Window" if "Show" is active.

Maximum plotter size

Shows the maximum plotter sheet size. These parameters are displayed for information purposes and are not used by the plot application.

Window size units

Defines the units that the Window size and Maximum window size are displayed. Options are Inches and Millimeters.

Plot file name

Defines name of file in which to place plot information. This file may be later transferred to the plotter.

Plot file format

Defines output plot file format. Options are HPGL (Hewlett Packard Graphics Language), HPGL/2, HPGL2 and HP RTL (Raster Transfer Language), Postscript, PDF, and System Printer. When selecting System Printer, the default Windows system printer will be used, but may be changed by selecting the Printer icon in the print preview dialog.

Color table

Defines the color table to use during plotting. Options are:

- **None** – This setting is used when plotting HPGL files to older HP pen plotters such as the 7585 and DraftMaster series. With older pen plotters, the VrOne pen number will be used to pick up the corresponding plotter pen. It is possible to use this setting with newer raster plotters such as the HP DesignJet in which a VrOne pen number may be cross-referenced to a plotter pen number in the active pen palette. When using this mode with a newer raster plotter, the Palette setting must be set to Factory, Palette A, or Palette B.
- **Screen Color Table** – The colors defined in the screen color table will be transferred to the plotter. VrOne pen numbers will be cross-referenced to the proper colors on the plotter.
- **Plotter Color Table** – The colors defined in the plotter color table will be transferred to the plotter. VrOne pen numbers will be cross-referenced to the proper colors on the plotter. When plotting to a raster type plotter such as an HP DesignJet with HPGL/2 or HPGL/2 and RTL or PostScript this color table should be used.

NOTE: By default the only difference between the screen color table and the plotter color table is the definition of pen number one. On the screen color table it is white and on the plotter color table, it is black. VrOne always uses the screen color table when displaying vectors in a graphics window and using the plotter color table will give the best color matching of vectors on the graphics screen and the plotter. Also note that color tables are not supported in all formats and are not supported on all plotters.

Sheet orientation

Defines the rotation of the plot. Portrait defines the X-axis as being along the front edge of the

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plotter while Landscape defines the Y axis as being along the front edge of the plotter.

Output device DPI

Defines the output DPI (Dots Per Inch). This should be matched to the target plotter. Selecting a DPI setting which is too low or too high may affect plot quality when plotting images. See suggested settings below.

Minimum line width

Defines the line width for the thinnest lines during plotting. This parameter is set in millimeters and a value of zero sets the thinnest line possible. For vectors only plots this parameter is normally set to the smallest value but when plotting vectors over image a wider line such as .35 may be selected.

Render mode

Sets the image render mode. Options are Automatic, Grayscale, Color, or Don't specify. This parameter is available only for the HPGL/2 and RTL plot format. Normally the render mode is set to automatic in which Grayscale or Color is chosen depending on the pixel depth. Some plotters such as the HP DesignJet 1055 do not plot color vectors when plotting a grayscale image when the render mode is set to Automatic or Grayscale. In this case a render mode of "Don't specify" should be used.

Margin Left/Right

For PDF and System Printer modes, sets the left and right margins in inches or millimeters to use between the sheet edge and the selected plot window. A -1 indicates that the printer default should be used.

Margin Top/Bottom

For PDF and System Printer modes, sets the top and bottom margins in inches or millimeters to use between the sheet edge and the selected plot window. A -1 indicates that the printer default should be used.

Digitize Lower Left

Allows the digitizing of the lower left corner of the plot in the VrOne graphics window. The current window size and direction of north are used from the dialog box.

Digitize Window

Allows digitizing of the lower left corner and upper right corner of the plot in the VrOne graphics window. The lower left East, lower left North and window size are modified by this operation.

Plot All

Fits a plot window around all open VrOne and image data. The lower left East, lower left North and window size are modified by this operation

Show

Reads the current window data from the dialog box and displays a plot window in the VrOne graphics window. If values such as lower left East or North, scale, or window size are changed in the plot dialog box this button should be pressed to update the graphics window.

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Notes

NOTE: Plotters from the same manufacturer may behave differently using the same settings. It is suggested that test plots be performed to determine the best settings for the plotter being used.

NOTE: This plot application can plot images larger than the physical memory in the plotter when using HPGL/2 and RTL format. First defining the vectors and then rotating image memory so that the image scan lines are parallel with the X plotter head movement accomplishes this. Once a scan line has been received the plotter will process and plot it while still receiving plot data. Unfortunately, this feature limits the number of images that can be plotted to one.

NOTE: By default the only difference between the screen color table and the plotter color table is the definition of pen number one. On the screen color table it is white and on the plotter color table, it is black. VrOne always uses the screen color table when displaying vectors in a graphics window and using the plotter color table will give the best color matching of vectors on the graphics screen and the plotter. Also note that color tables are not supported in all formats and are not supported on all plotters.

Suggested Settings

Plotter	Color Table	Output DPI	Render Mode Grayscale Image	Render Mode Color Image
HP-7580/85	None	NA	NA	NA
HP-DraftMaster	None	NA	NA	NA
HP-650C	Plotter	300	Automatic	Automatic
HP-750C	Plotter	300	Automatic	Automatic
HP-755CM	Plotter	300	Don't specify	Don't specify
HP-1033	Plotter	300	Automatic	Automatic
HP-1050C	Plotter	600	Don't specify	Don't specify
HP-1055	Plotter	600	Don't specify	Automatic
HP-3500CP	Plotter	600	Don't specify	Don't specify

Transferring Plot Files to Plotter via FTP

The VrOne plot application creates a plot file on disk. This plot file must then be transferred to the plotter for hard copy output. Many of the newer plotters such as the HP 1055C can be connected to the network and run an FTP (File Transfer Program) server. This allows files to be transferred via FTP. Please find following an example of transferring a plot file to a HP 1055C. This operation is done from a Windows Command Prompt window. Items in ***bold italic*** are typed by the user and may be different on various systems. Return may be pressed when for

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User: and Password:, they are not required.

```
C:\> cd \jobs\job123
C:\jobs\job123>ftp 192.168.1.99
Connected to 192.168.1.99.
220 JD FTP Server Ready
User (192.168.1.99:(none)):
331 Username OK, send identity (email address) as password.
Password:
230- Hewlett-Packard J3113A FTP Server Version 1.0
Directory:     Description:
---------------------------
PORT1          Print to port 1 DesignJet 1055CM (C6075A)

To print a file, use the command: put <filename> [portx]
or 'cd' to a desired port and use: put <filename>.

Ready to print to PORT1

230 User logged in.
ftp> put sheet1.plt
200 PORT command successful.
150 Opening data connection.
226-  Ready
226-  Processing job
226 Transfer complete.
ftp: 2688079 bytes sent in 20.09Seconds 133.78Kbytes/sec.
ftp> bye
221 Goodbye
```

Transferring Plot Files Via the Print Spooler

The VrOne plot application creates a plot file on disk. This plot file must then be transferred to the plotter for hard copy output. Plotters may be connected to a network or may be connected to a computer with a printer cable. Files may be sent to the plotter using the print spooler. The print spooler must be set up before this can be done. Following are some notes on installing the necessary software to use print spooling on Windows NT 4.0. Note that IP addresses such as 192.6.1.82 will probably be different on various systems. This process is similar on Windows 2000 and is not possible on Windows 95/98/ME. The following information is provided as a guide. Please consult with your system administrator before using the following information.

Setting up LPR on Windows NT 4.0

```
My Computer -> Printers -> Add Printer
Select "My Computer" [Next>]
[Add Port] Highlight "LPR Port" [New Port]
(If LPR Port is not lised, install Microsoft TCP/IP Printing. See below)
Name or address of server providing lpd: 192.6.1.82
Name of printer or print queue on that server: djet_2
[OK] [Close]
Make sure that port just created has check next to it. [Next]
```

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```
Select plotter:
   Manufacturers: HP
   Printers:      Hewlett-Packard HP-GL/2 Plotter

usage: lpr -S192.6.1.82 -Pplot FILENAME
       lpr -Sdjet_2 -Pplot FILENAME
```

Installing Microsoft TCP/IP Printing on Windows NT 4.0

```
Right click Network Neighborhood -> Properties
Select Services Tab
Push Add button
Double click Microsoft TCP/IP Printing
```

(When loading from CD the directory should be: E:\I386)

Long Axis Plots

- Long axis plots (over 51 inches) is possible with the HPGL2 driver only.
- If the X-axis is greater than the Y-axis then the plotter rotation on the front panel should be set to zero.
- If the Y-axis is greater then the X-axis then the plotter rotation of the front panel should be set to 270.

2.1.1.14 Graphics – Grid

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Graphics – Grid Display and Grid/ Cursor Snapping

There are three user-alterable conditions dealing with grid points on the screen:

- Grid display, which controls the display of grid points;

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- Grid snapping, in which the cursor moves only between grid points;
- Cursor snapping, in which the cursor snaps to a grid point only when that point is digitized. Grid snapping must be turned on for cursor snapping to occur.

Name	Key-in	Arguments	Description
Grid Set	GriSet		Sets grid display and snapping using a dialog box.
Grid Display On	GriOn		Turns grid point display on.
Grid Display Off	GriOff		Turns grid point display off.
Grid Display Toggle	GriTog		Toggles grid point display.
Grid Resolution Set	GriRes	Distance	Sets grid point display resolution in ground units.
Grid Type	GriTyp	0 | 1	0 = Shows grid as points. 1 = Shows grid as lines.
Grid Snap if Displayed	GriSnaDis		Turns on grid snapping only if the grid display is on. (see Grid On)
Grid Snap On	GriSnaOn		Turns on grid snapping. The behavior of the cursor depends on the Cursor Snap setting.
Grid Snap Off	GriSnaOff		Turns off grid snapping.
Grid Snap Toggle	GriSnaTog		Toggles between the three grid snapping modes shown above.
Cursor Snap On	CurSnaOn		Sets the cursor to move only between grid points.
Cursor Snap Off	CurSnaOff		Sets the cursor to move with the current input device and snap to a grid point only when a point is digitized.
Cursor Snap Toggle	CurSnaTog		Toggles between Cursor Snap On and Cursor Snap Off.

2.1.1.14.1 Grid Set

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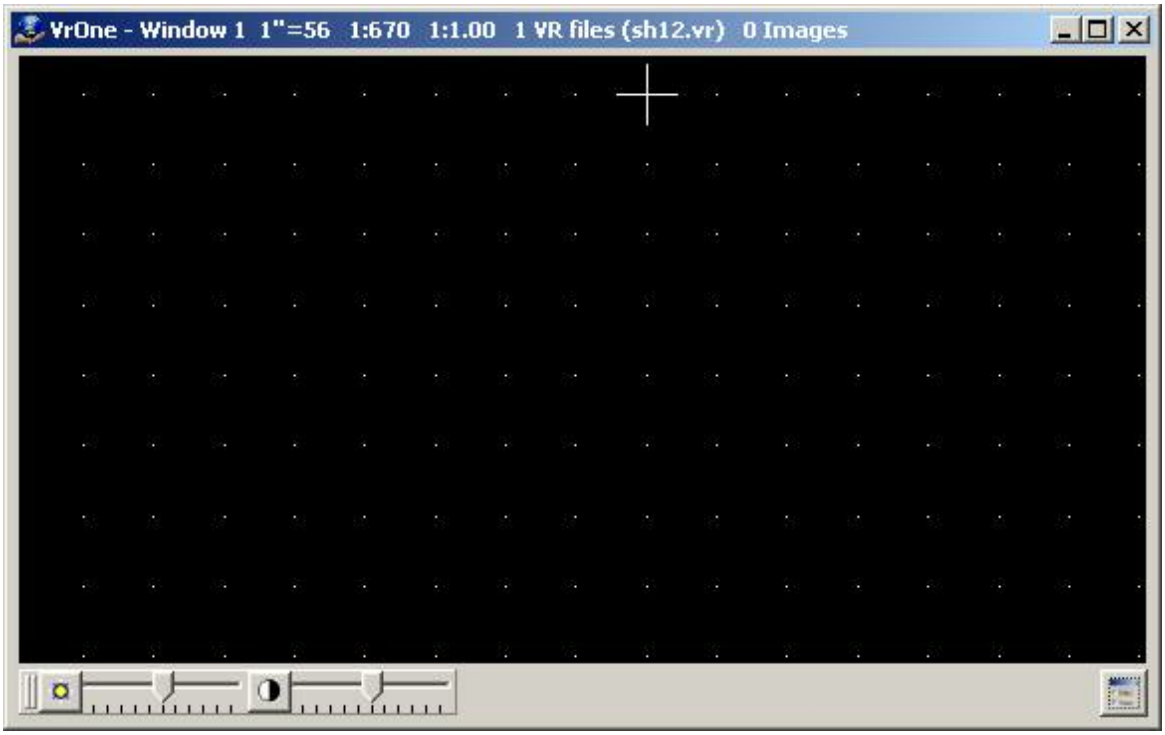
Mapping

Grid Display and Grid/Cursor Snapping

Description

There are three conditions dealing with the display and snapping of grid points in a graphics window:

1. Grid Display, in which grid points are displayed as points or lines on the graphics window;
2. Grid Snapping, in which the grid is turned on and cursor behavior depends on the Cursor Snap setting;
3. Cursor Snapping, which determines whether to force the cursor to move only between grid points or to snap to a grid when a point is digitized.



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Command Key-ins

Name	Key-in	Arguments	Description
Grid Set	GriSet		Sets grid display and snapping using a dialog box (see below).
Grid Display On	GriOn		Turns grid point display on.
Grid Display Off	GriOff		Turns grid point display off.
Grid Display Toggle	GriTog		Toggles grid point display.
Grid Resolution Set	GriRes	Distance	Sets grid point display resolution in ground units.
Grid Type	GriTyp	0 | 1	0 = Show grid as points. 1 = Show grid as lines.
Grid Snap if Displayed	GriSnaDis		Turns on grid snapping only if the grid display is on (see Grid On).
Grid Snap On	GriSnaOn		Turns on grid snapping. The behavior of the cursor depends on the Cursor Snap setting..
Grid Snap Off	GriSnaOff		Turns off grid snapping.
Grid Snap Toggle	GriSnaTog		Toggles between the three grid snapping modes listed above.
Cursor Snap On	CurSnaOn		Sets the cursor to move only between grid points.
Cursor Snap Off	CurSnaOff		Sets the cursor to move with the current input device and snap to a grid point only when a point is digitized.
Cursor Snap Tog	CurSnaTog		Toggles between Cursor Snap On and Cursor Snap Off.

Grid Set (GriSet)

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2.1.1.15 Graphics Shortcut Buttons

Vr Mapping

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Graphics Shortcut Buttons

The following keyboard key presses may be used for graphics window changes while the mouse is in the graphics window.

Name	Shortcut
Zoom Center	Home Key
Reload Graphics	Home Key (**VrTwo** roaming only)
Zoom Last	Left Arrow Key
Zoom Right	Right Arrow Key
Zoom Up	Up Arrow Key
Zoom Down	Down Arrow Key
Zoom In	Page Down (2x)
Zoom Out	Page Up (2x)

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Disengage Roaming	Insert Key (**VrTwo** roaming only)
Zoom up two pyramid levels (**VrTwo** roaming only)	Shift->PgUp
Zoom down two pyramid levels (**VrTwo** roaming only)	Shift->PgDn
Zoom to top pyramid level (**VrTwo** roaming only)	Ctrl->PgUp
Zoom to bottom (1:1) pyramid level (**VrTwo** roaming only)	Ctrl->PgDn
Toggle Cursor Mask	Delete Key (**VrTwo** only)
Toggle Cursor Mask 2x Zoom	Shift->Delete Key (**VrTwo** roaming only)
Disengage Mouse to Stereo Motion	Shift Key (**VrTwo** static only)
4x Z Motion Multiplier	Shift Key (**VrTwo** only)
Autocorrelate Toggle	Shift->Home Key
Delete oldest level cache	Ctrl->Shift->Delete Key (**VrTwo** roaming only)
Reload vectors	Home Key (**VrTwo** roaming only)
Toggle cursor constraint	Ctrl->F11 Key

2.1.1.15.1 Cursor Mask

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Vr Mapping

Cursor Mask (Del, Shift +Del)

A standard feature of VrTwo stereo viewing is the ability to display real-time 3D vectors over 3D imagery. Although this feature is beneficial it is possible that too may vectors make the positioning of the floating mark on the stereo imagery difficult. VrTwo offers a Cursor Mask mode in which vectors around the cursor are hidden, leaving the underlying imagery unobstructed.

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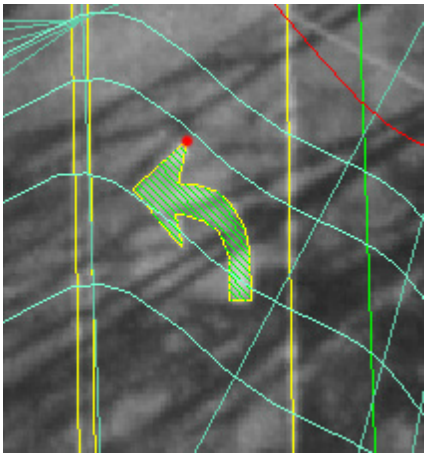
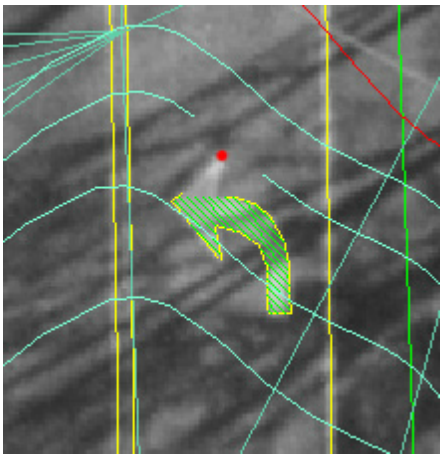


Cursor Mask off



Cursor Mask on with a size of 40 pixels

When lines, symbols or text are being collected or edited, the Cursor Mask does not affect the interactive graphics. This would include rubber-banded lines and dynamic graphics such as move, copy, rotate, expand and shrink. Vector data that is not being edited is always masked in this mode.

Pressing the Delete key on the system keyboard will toggle the Cursor Mask. The size of the Cursor Mask may be set in the Vr Configuration Program (VrCfig) under Xyz Digitizer. Cursor masking is available in VrTwo static and VrTwo roaming modes. Pressing Shift->Delete will toggle the Cursor Mask at a 2x zoom level in roaming mode.

2.1.1.16 Image Graphics

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Mapping

Image Graphics

Name	Key-in	Arguments	Description
Display Image	DisIma	0.5	Displays image at .5 to 1 pixel resolution.
Display Image	DisIma	1	Displays image at 1 to 1 pixel resolution.
Display Image	DisIma	2	Displays image at 2 to 1 pixel resolution.
Display Image	DisIma	4	Displays image at 4 to 1 pixel resolution.
Display Image	DisIma	8	Displays image at 8 to 1 pixel resolution.
Pixel Compute	PixCom		Computes image pixel size and file size.
Image Control	ImaCon		Sets contrast/brightness of image to file or plotter.
Image Flicker	ImaFli		Alternately displays two images (image flicker).
Toggle Image Edges	TogImE		Toggles the display of image information such as edges and image names.
Image Display Mode	ImaDis	0-2	Sets the display mode for images. 0–Draw 1-XOR 2-OR
Image Clean	ImaCle		Removes scratches from images.
Image Levels	ImaLev		Displays Image Levels dialog allowing color levels to be adjusted on open images.
Set Brightness	SetBri	Brightness (0-100, 50 = default)	Sets brightness level of images.
Set Contrast	SetCon	Contrast (0-100, 50 = default)	Sets contrast level of images.

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Set Brightness and Contrast	SetBriCon	Brightness Contrast (0-100, 50 = default)	Sets brightness and contrast level of images.

2.1.1.16.1 Image Clean

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Image Clean (ImaCle)

Type: Interactive/Batch Application

Cleans scratch marks on images.

Detailed Description

This application will clean scratch marks on images by allowing the user to place VrOne lines on top of the scratches. A blending technique tries to recreate the original pixels that were under the scratches. Scratches may be cleaned using a set blending width for all scratches, or by using the line width to allow a different blending width for each scratch. A preview mode allows instant viewing of the cleaned images before they are written out to new files. The following steps define a typical usage of the Image Clean application.

1. In VrOne, open images to be cleaned.
2. Open or create a new VrOne file to hold the lines that will be placed on top of the scratches.
3. Start the Image Clean application.
4. Display the Enter Parameters dialog box (button 7) and adjust the settings as needed.
5. Turn on Preview Mode (button 1) (optional).
6. Without exiting the Image Clean application, use the Insert Line application to place lines into the “clean” layer that was specified in the parameter dialog box. These lines should be placed directly on top of the scratches to be removed. These can be simple two point lines or more complex polygons. TIP: If Preview Mode is on, you may want to turn off the “clean” lines layer before starting to place the clean lines. When a layer is

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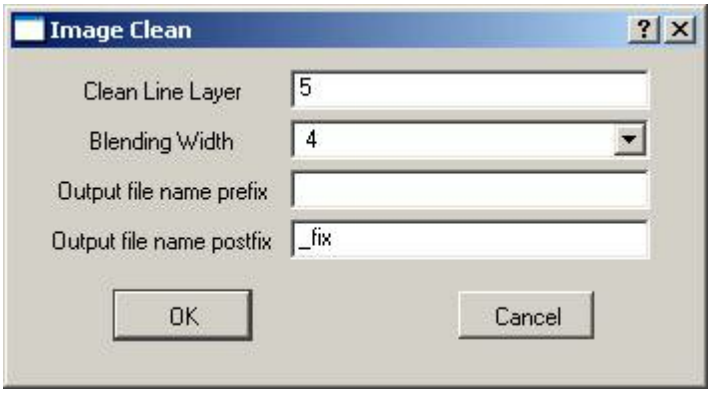
off in VrOne, you can still insert lines into it, and they will be displayed until a replot command is issued. When placing clean lines this way, you can issue a replot after each line is saved. The replot will remove the line from the display and instantly show the effects of the scratch removal.

7. After all clean lines have been placed and scratch removal has been verified using Preview Mode, the cleaned images may all be saved using the Output Images (button 2) command.

Parameters



Clean Line Layer

Specifies the layer to search for clean lines. All workspaces will be searched.

Blending Width

Specifies the pixel blending width to use when removing scratches. This is the width of pixels that will be changed along each clean line. If the "Same as line width" option is selected, then the blending width will be determined by each lines display width. This setting may take some experimentation, but you should always specify the smallest blending width that still removes the scratch completely. Larger blending widths will produce undesirable results when viewed up close. A width that is too small will require a more exact placement of the clean lines; therefore, a width of 3 is probably the smallest practical width that should be used.

Output file name prefix

Specifies the prefix to add to all output file names. Output files will always be placed in the same directory as the input files but will have this prefix added to the filename. If this is left blank, a postfix must be specified.

Output file name postfix

Specifies the postfix to add to all output file names. Output files will always be placed in the same directory as the input files, but will have this postfix added to the filename. If this is left blank, a prefix must be specified.

Button Assignments

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Image Clean – Main

	Button	Description
1	Tog Preview	Toggles preview mode.
2	Output Imgs	Outputs all images with scratches removed to new files.
3		
4		
5		Displays Edit Seams menu allowing seam line to be edited.
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

2.1.1.16.2 Pixel Compute

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Pixel Computations (PixCom)

Type: Information

Computes image pixel information.

Detailed Description

Computes and displays the real-world size of an image's pixels in feet and meters given an input of scan rate in microns/DPI and photo scale. This application is for information only and does not manipulate images.

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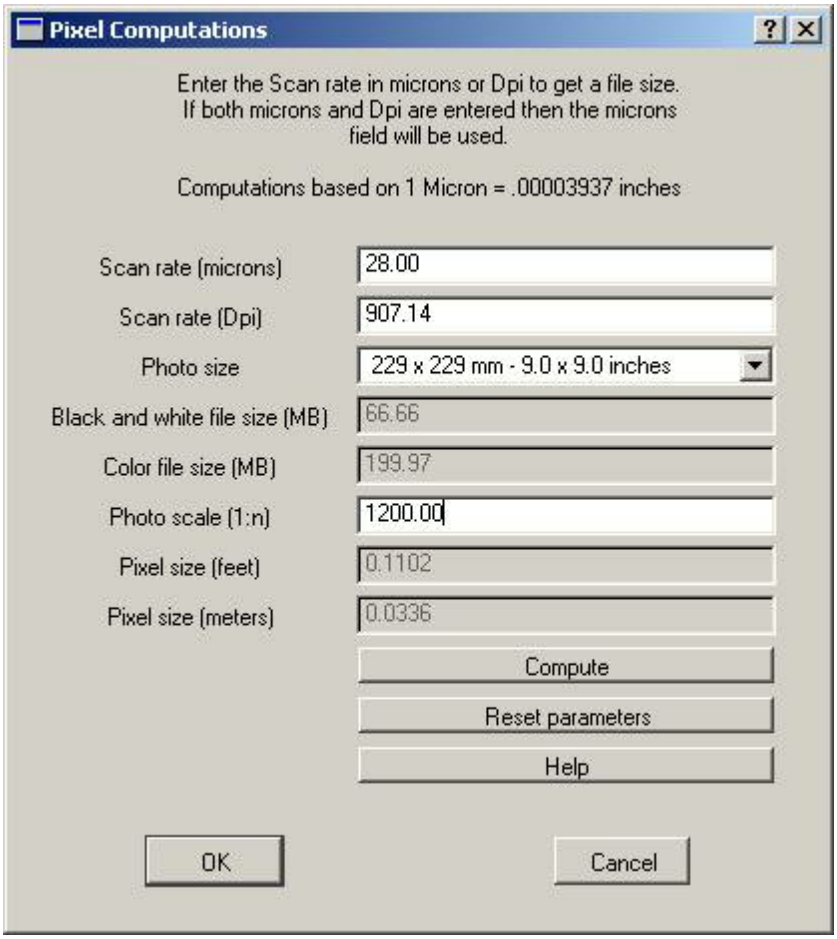

Scan rate (microns)

Specifies the scan rate in microns. If this field is entered, the Scan rate (DPI) field should be left blank and will be automatically computed.

Scan rate (Dpi)

Specifies the scan rate in dots per inch. If this field is entered, the Scan rate (microns) should be left blank and will be automatically computed.

NOTE: If both the Scan rate (microns) and the Scan rate (Dpi) fields are entered then the value in the microns field will be used and the dots per inch will be computed.

Photo size

Select a photo size to use to compute image file sizes. Options include:

- 229 x 229 millimeters (9 x 9 inches)
- 183 x 160 millimeters (7.2 x 6.3 inches)
- 160 x 91 millimeters (6.3 x 3.6 inches)

Black and white file size (MB)

Displays the resulting image file size for a black and white scan in mega-bytes.

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Color file size (MB)

Displays the resulting image file size for a color scan in mega-bytes.

Photo scale (1:n)

Specifies the photo scale as a ratio. This will be used to compute the pixel sizes.

Pixel size (feet)

Displays the image's pixel size in feet.

Pixel size (meters)

Displays the image's pixel size in meters.

Compute button

Computes output fields based on current input parameters. This button must be pressed after an input field, such as Scan rate, is entered to show revised values.

Reset button

Clears all fields.

Help

Starts the help page.

Computations

The following constants are used:

1 Micron = .00003937 inches
1 inch = 25.4 millimeters

2.1.1.17 Input Management

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Input Management

Name	Key-in	Arguments	Description

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Edit Toolbars	EdiToo		Allows creation and editing of toolbars and toolbar items.
Digitizer XY	DigXy		Sets input device to XY digitizer.
Digitizer XYZ	DigXyz		Sets input device to XYZ digitizer.
Digitizer Mouse	DigMou		Sets input device to mouse.
Toggle Digitizer Math	TogDig		Toggles between scratch and least squares input.
Load XY Transformation	LoaXy		Loads XYZ transformation parameters.
Z Offset	Zoff		Sets a Z offset that is applied when using XYZ input.
Offset ORP	OffOrp		Allows an x,y,z offset to be applied to a VrTwo Orientation Parameter (.orp) file.
Preset Encoders	Preset		Presets Analog instrument encoders at index point.
Device Controls	DevCon		Sets device dependent controls.
Device Mouse	DevMou		Sets device dependent controls for the Mouse/Stealth Mouse.
Device P3	DevP3		Sets device dependent controls for the Zeiss P1/P2/P3.
Device Hand Wheels	DevHan		Sets device dependent controls for VrTwo Hand Wheels.
Device TopoMouse	DevTop		Sets device dependent controls for the LH TopoMouse.
Device Joystick	DevJoy		Sets device dependent controls for Joysticks.
Device XY Scale Factor	DevSfXy	Scale factor 1=none	Sets the XY input scale factor for the active VrTwo 3D input device. (see note below)
Device Z Scale Factor	DevSfZ	Scale factor 1=none	Sets the Z input scale factor for the active VrTwo 3D input device. (see note below)
Z Source	Zsou	ActZ | Dtm | ForZ	Sets elevation source. No arguments will bring up a dialog box.

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Digitize Scratch	DigScr		Digitizes scratch orientation origin.
Digitizer Menu Board	DigMen		Digitizes menu board location.
Edit Menu Board	EdiMen		Edits menu board commands.
Edit Key Pad	EdiKey		Edits key pad commands.
Function Key Starter	FunKey		Starts function key starter.
Edit Function Keys	EdiFun		Edits function keys.
Load Cm Fkeys	LoaCad		Loads and translates CADMAP function keys to ASCII file.
Edit Macros	EdiMac		Edits macros.
Begin Macro	BegMac		Begins recording a macro.
End Macro	EndMac		Ends recording a macro.
Func Keys to Key Pad	CopKey		Copies function key assignments to key pad.
Func Keys To Layer Names	FunLay		Copies function key descriptions to layer names.
Write Kork Macros	WriKp3		Writes Kp300 file.
Read Kork Macros	ReaKor		Reads KORK macro file.
Convert Microstation Color Table	ConMic		Converts a Microstation Color Table (.tbl) to a Vr Mapping Color Table.

2.1.1.17.1 Edit Toolbars

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Edit Toolbars (EdiToo)

Type: User Interface

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Allows new toolbars to be created and defined.

Detailed Description

Toolbars are groups of command buttons that can be represented as icons or text. They may be used as stand-alone floating windows or may be docked with the VrOne Main and Graphics windows. The buttons on a toolbar may be used to start any Vr Mapping key-in command, Function Keys and Macros.

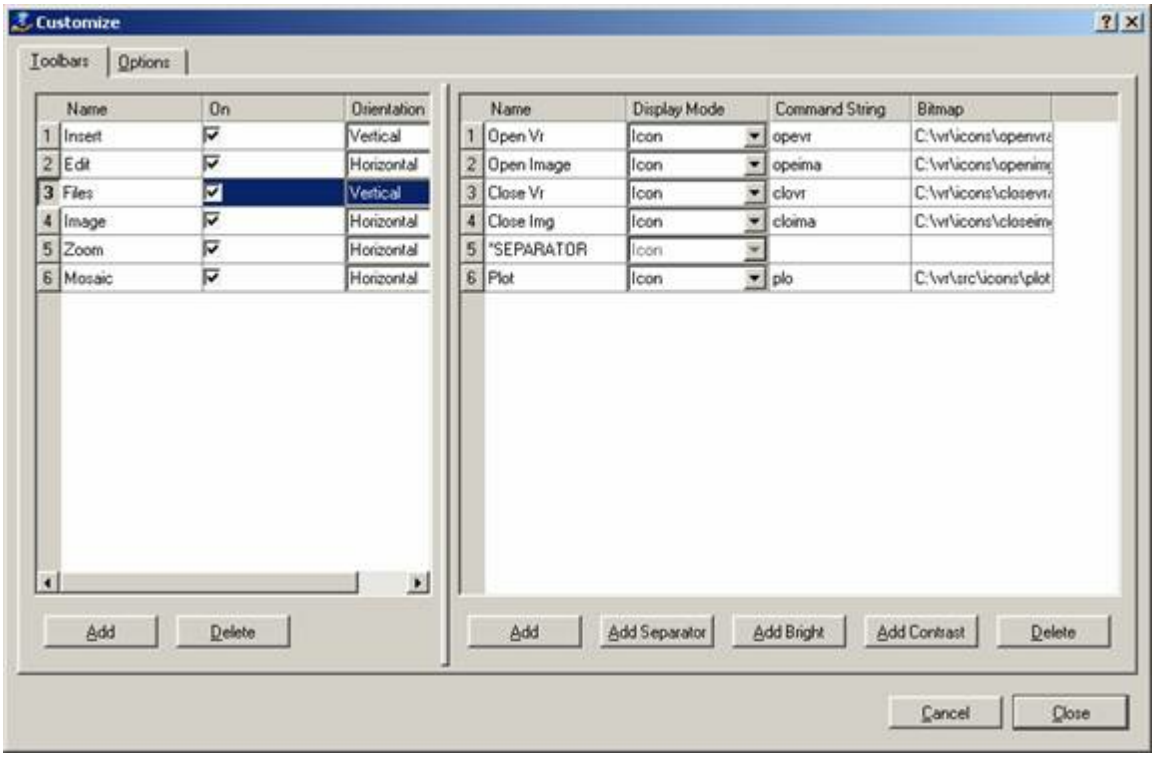
See also Display Toolbar



Example Toolbars with icons

Edit Toolbars Dialog
Creating a Toolbar Containing Brightness and Contrast Controls
Parameter Files

Edit Toolbars Dialog



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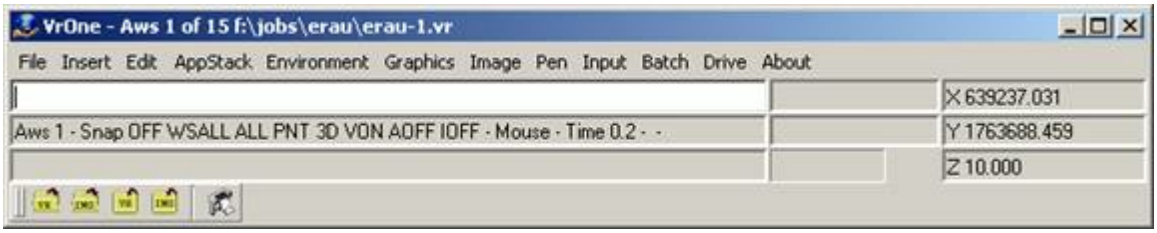
Displayed above is the Edit Toolbars dialog with six toolbars defined. The left side of the dialog displays the toolbars. The toolbar named “Files” is currently highlighted, and as a result, the right hand side of the dialog displays the command buttons that are assigned to the “Files” toolbar.

The image below shows the “Files” toolbar as a floating window (not docked). The Orientation on this toolbar is to Vertical, which only affects the toolbar when it is floating. Notice the use of the “SEPARATOR” item to place a line between the Close Img command button and the Plot command button.



The following image shows the “Files” toolbar docked in the VrOne main window.



Using the Edit Toolbars Dialog

Left Pane

The left hand pane displays a table of all currently defined toolbars. Whenever an item in the toolbar table is selected, the right hand pane displays the toolbar command buttons that are associated with the highlighted toolbar. Use the “Add” button to create new toolbars. Use the “Delete” button to delete the currently highlighted toolbar command button. The following items may be defined for each toolbar, and are edited by directly changing the items in the table.

Name	This is the name of the toolbar. Each toolbar should have a unique name, which will be displayed in the window title if the toolbar is not docked.
On	Determines whether the toolbar is displayed or not.
Orientation	The toolbar orientation may be set to Horizontal or Vertical. This only affects the toolbar when it is not docked.

Right Pane

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The right hand pane displays a table of command buttons that are defined for the currently highlighted toolbar. Use the “Add” button to create new command buttons. Use the “Delete” button to delete the currently highlighted command button. Three special purpose buttons are provided to make it easy to add Separators, Brightness Controls, and Contrast controls. The following items may be defined for each command button and are edited by directly changing the items in the table.

Name	This is the name of the command button. Each command button should have a unique name, which will be displayed on the command button if the display mode is “Text” or “Both”.
Display Mode	This determines if the command button displays an Icon (image), Text, or both an Icon and Text.
Command String	This is the command string that is used when the command button is pressed. This may be any valid VrOne command input, such as a normal command, macro command, or function key name.
Bitmap	This is the image that is displayed if Icon or Both is selected for Display Mode.

Creating a Toolbar Containing Brightness and Contrast Controls



The following steps may be used to create a Toolbar containing the brightness and contrast controls.

1. Run Edit Toolbar (EdiToo)
2. Press the "Add" button on the left pane to create a new toolbar. Change the name from "New" to "Image" and press the Tab key.
3. Press the "Add Bright" button on the right pane. This adds a brightness slider to the toolbar.
4. Press the "Add Contrast" button on the right pane. This adds a contrast slider to the toolbar.
5. Close the Edit Toolbars dialog.
6. A floating toolbar containing the image controls is now displayed. Dragging this toolbar over the bottom portion of the graphics window and releasing it will “dock” the toolbar to the window. The border changes to a thinner line when the toolbar is in a position to be docked.

Parameter Files

Vr Mapping versions prior to 05.05.20

The Toolbar parameter information is stored in two files; the `.vrt` and the `.vrtoollayout` files

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which are in the `\vr\hostdir` folder. The program name precedes the file name. For example, the toolbar parameters for the VrOne program are stored in `\vr\hostdir\vrone.vrt` and `\vr\hostdir\vrone.vrtoollayout`.

Vr Mapping versions 05.05.20 and above

The two predefined parameter files (.vrt and .vrtoollayout) have been replaced with a single user defined parameter file (.vrt). The first time running version 05.05.20 or later, the legacy parameter files will be automatically converted to the new parameter file.

The file name for the new parameter file is defined in the Vr Configuration program under Configuration -> General and defaults to \vr\data\default_vrone.vrt for the VrOne and VrTwo programs and \vr\data\default_vrmosaic.vrt for the VrMosaic program.

When the new parameter file is written, the two legacy files are also updated for backwards compatibility with older versions of Vr Mapping.

Document updated August 2024

2.1.1.17.2 Display Toolbar

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Display Toolbar (DisToo)

Type: Key-in

Allows individual toolbars to be turned on (displayed) or turned off (hidden).

Detailed Description

Toolbars are groups of command buttons that can be represented as icons or text. They may be used as stand-alone floating windows or may be docked with the VrOne Main and Graphics windows. The buttons on a toolbar may be used to start any Vr Mapping key-in command, Function Keys and Macros.

See also Edit Toolbars

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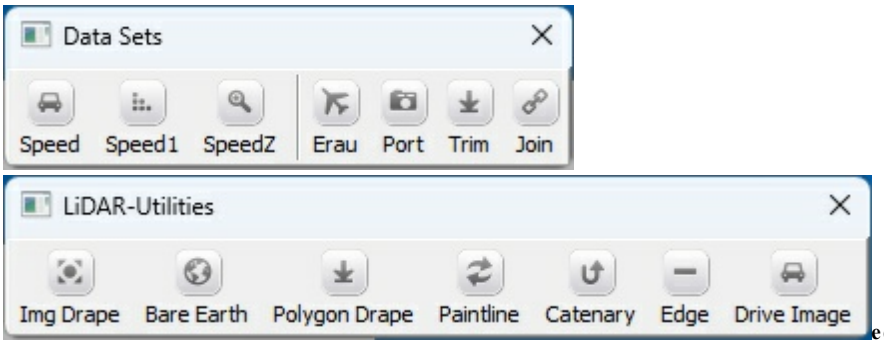

editooeoeoe

Example Toolbars with icons

Display Toolbar is a key-in only and is designed to display (On) or hide (Off) an existing Toolbar. There is no dialog box associated with this key-in. Being a key-in allows it to be placed on a cursor button or in a user designed Macro for versatile Toolbar display customization.

Syntax

```
DisToo ToolBarName On|Off
```

Example:

```
DisToo LiDAR-Utilities Off
```

If the ToolBarName contains one or more blanks then the name must be enclosed in double quotes.

Example:

```
DisToo "Data Sets" On
```

A key-in of DisToo with no arguments will display a usage dialog.

Display Toolbar added August 2024 - Version 07.01.24

2.1.1.17.3 Index ORP

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Index ORP (IndOrp)

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Type: Interactive application

Allows an x,y,z offset to be applied to a VrTwo Orientation Parameter (.orp) file.

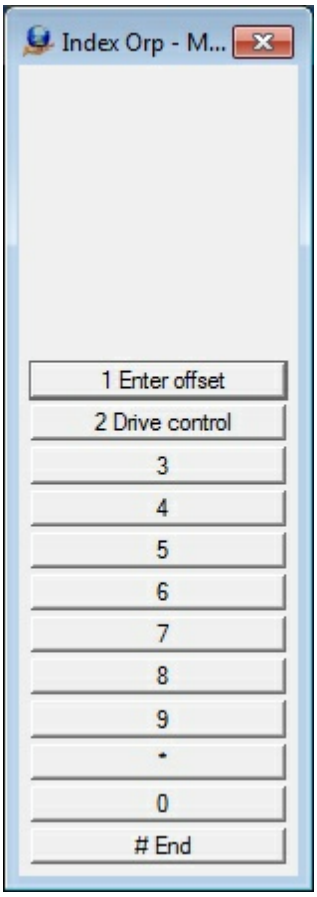
Detailed Description

The results of model orientations performed using the VrTwo Orientation program (vr2ori.exe) are placed in an Orientation Parameter (.orp) file. The Index ORP application allows an x,y,z offset to be applied to this file. The offset may be entered in or an offset may be digitized as a point from an existing control point.

Index ORP is available for VrTwo and is only available when using a stereo model that was set up using the VrTwo Orientation Program.

Button Assignments

Index Orp - Main



Index Orp - Main

1 Enter offset - Allows the entry of the x,y,z offsets from a dialog box. See Enter Offset

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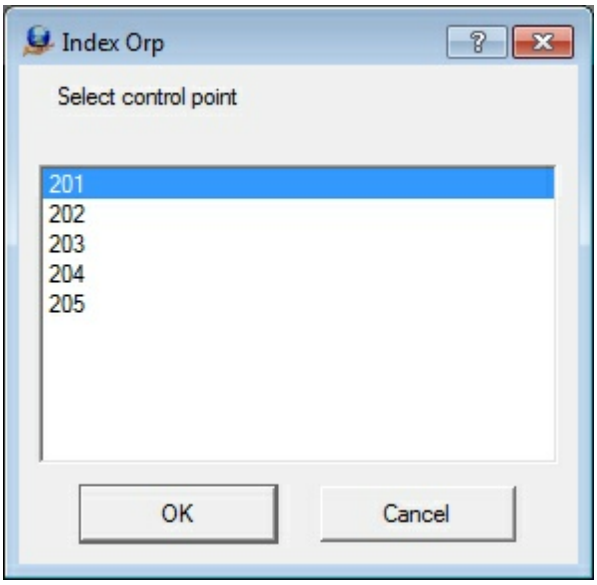
below.

2 Drive control - Allows a control point to be driven to and then an offset may be digitized as a point from that control point.

 # End - Ends application

Index Orp - Drive Control

Drive control displays a list of control points that are available in the current model space. Selecting a point drives the cursor to the point location. If there are are non zero offsets that are current, they will be considered when the selected control point is driven to.



Index Orp - Select control point to drive to

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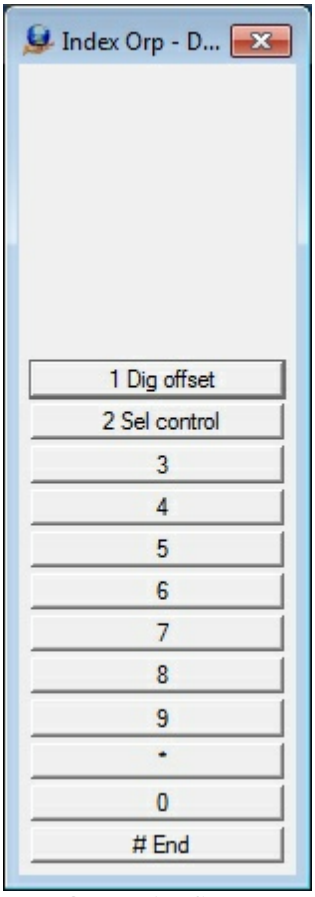

Index Orp - Drive Control

1 Dig offset - After a control point is driven to, the cursor may be moved to a new location and a point may be digitized. The x,y,z offsets will be computed from the control point to the point digitized. Once a point is digitized the "Enter Offset" dialog is displayed for verification and optional editing of the offset values.
2 Del control - Returns to the "Select control point" dialog.
 # End - Returns to the Main Menu.

Enter Offset

The Enter Offset dialog is displayed when "Enter offset" is selected from the Main Menu and when a control point is driven to and an offset is digitized. The offsets may be verified and optionally edited before setting the values in the current ORP file.

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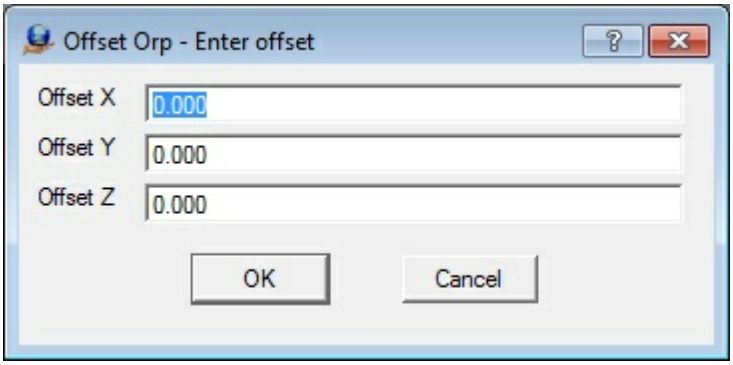

Index ORP - Enter Offset

2.1.1.18 Insert Applications

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Insert Applications

Name	Key-in	Description
Correlate Area	CorAre	Places points on the ground in user-defined area.
Create Symbols	CreSym	Creates symbol.
Manage Symbols	ManSym	Displays and manages symbols and line fonts.
Drive Grid	DriGri	Drives to grid and places points.
Insert Fly Line	InsFly	Inserts fly line.
Insert Line	InsLin	Inserts line.
Insert Line Text	InsLte	Inserts line text.
Insert Parallel Line	InsPar	Inserts parallel line.
Insert Road	InsRoa	Inserts up to nine parallel or offset lines from a digitized base line.

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Insert Multiple Parallel Line(s)	InsMul	Inserts multiple parallel line(s).
Insert Squared Line	InsSqu	Inserts squared line.
Insert Orthogonal Line	InsOrt	Inserts orthogonal line by reading line segments.
Insert Orthogonal Corner	InsOrc	Inserts orthogonal line by reading polygon corners.
Insert Symbol	InsSym	Inserts symbol.
Insert Text	InsTex	Inserts text.
Interpolate Contours	IntCon	Interpolates contours between two existing contours.
Label Point	LabPoi	Labels point with XY and/or Z
Digitize Control	DigCon	Digitizes coordinate points into a control file.
Plot Control	PloCon	Enables plot control.
Point On Line	Pol	Places a point on line on an existing line.
Scan P3	ScaP3	Drives the Zeiss P-Series stereoplotters along profile lines.
Sheet Grid	SheGri	Enables sheet grid.
Symbol Fill	SymFil	Fills polygon with symbols with drape option.
Insert File	InsFil	Inserts a VrOne file into the current workspace.

2.1.1.18.1 Correlate Area

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Correlate Area (CorAre)

Type: VrTwo Batch Application

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Automatically creates a grid of points inside an existing line using automatic image correlation.

Detailed Description

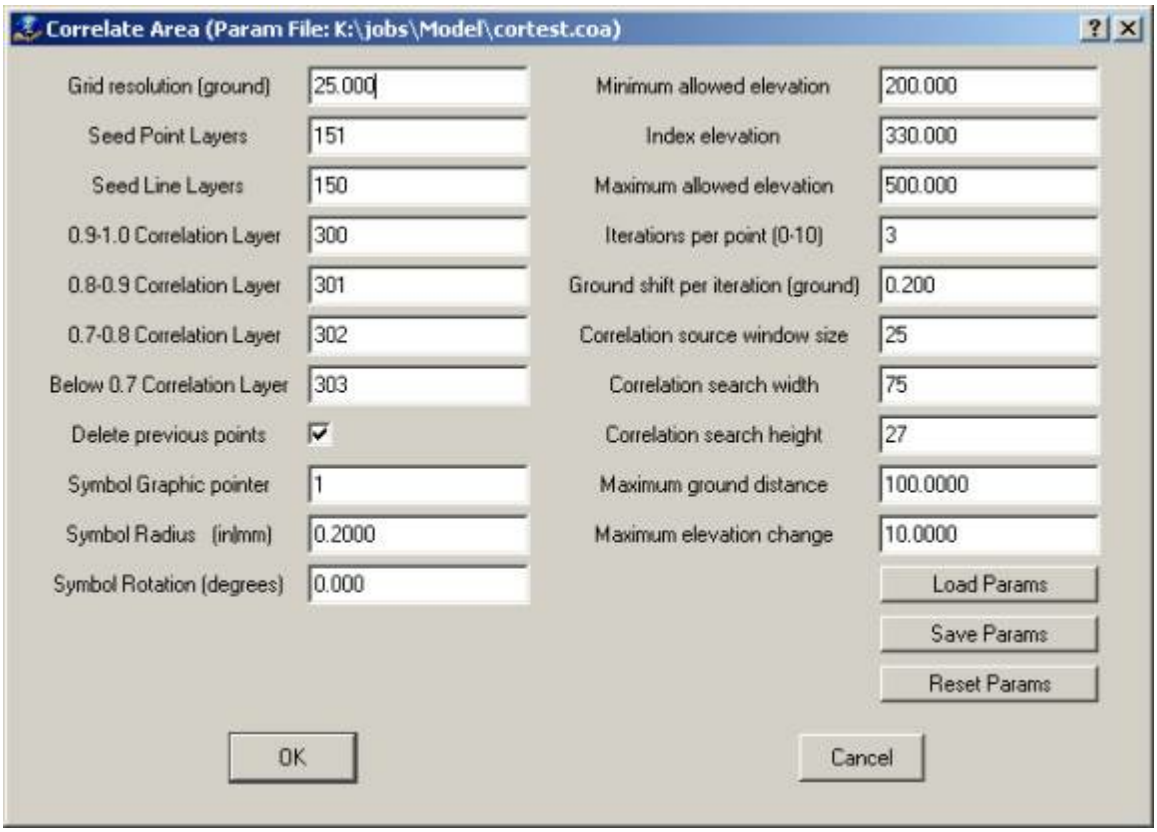
Automatically places grid points at ground locations inside an existing line. Points may be placed at any grid interval. The elevations of the points are determined using automatic image correlation techniques. The correlation algorithm may be fine-tuned using several control parameters. Points may be placed on up to four different levels to quickly identify problem areas. The correlation works by selecting a point in the left stereo image and finding the matching point in the right stereo image. Based on the separation of the two points, a ground elevation is computed.
NOTE: VrTwo must be running with a valid model open before using this application.

Local Commands

None

Parameters

The following parameters (button 7) are used when correlating.



Grid resolution (ground)

Defines the spacing in ground units between grid points.

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Seed Point Layers

Defines the layers in which seed points are located. Seed points are existing symbols that have already been placed at ground elevations. The seed points are used to help guide the correlation routine to prevent points from being located off the ground.

Seed Line Layers

Defines the layers in which seed lines are located. Seed lines are existing lines that have already been placed at ground elevations. The seed lines are used to help guide the correlation routine to prevent points from being located off the ground.

0.9-1.0 Correlation Layer

Defines the layer in which points are placed if 0.9= correlation factor =1.0. A layer value of 0 indicates that these points should not be placed.
NOTE: A correlation factor of 1.0 is a perfect match.

0.8-0.9 Correlation Layer

Defines the layer in which points will be placed if 0.8= correlation factor <0.9. A layer value of 0 indicates that these points should not be placed.

0.7-0.8 Correlation Layer

Defines the layer that points will be placed in if 0.7= correlation factor <0.8. A layer value of 0 indicates that these points should not be placed.

Below 0.7 Correlation Layer

Defines the layer that points will be placed in if correlation factor <0.7. A layer value of 0 indicates that these points should not be placed.

Delete previous points

Specifies whether any points in the above four correlation layers are deleted before the correlation process begins. Turning this setting on prevents duplicate points during multiple correlation runs.

Symbol graphic pointer

Specifies the graphic pointer used when placing points.

Symbol Radius (in|mm)

Defines the radius used when placing points.

Minimum elevation allowed

Defines the ground units value below which any elevations found are not used. If a point below this minimum is targeted, the current cursor elevation returns to the last good elevation or to the Index elevation if set.

Index elevation

Specifies the elevation to which the cursor should return if elevations are rejected because they fall outside the minimum and maximum allowed elevations. If this is 0.0, then the cursor elevation returns to the last good elevation.

Maximum elevation allowed

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Defines the ground units value above which any elevations found are not used. If a point below this maximum is targeted, the current cursor elevation returns to the last good elevation or to the Index elevation if set.

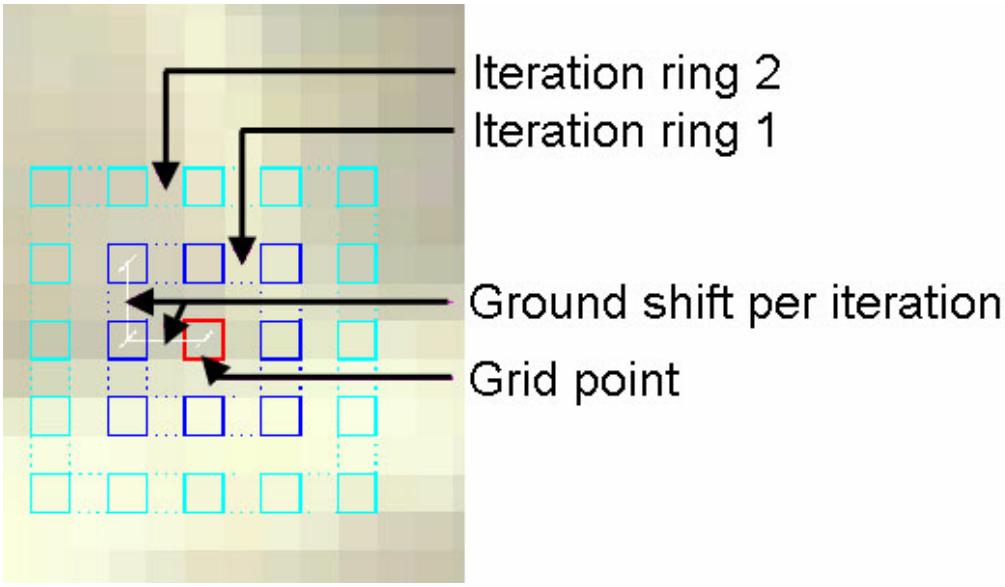
Iterations per point

Defines how many points are correlated at each grid location. A value of 0 results in only the single grid point being correlated. For each iteration, a ring of points surrounding the grid point are correlated. The point with the best correlation value is chosen for the final point placement. If a point is found with a correlation value greater than 0.9, the iteration process is stopped, and the point is chosen as the final location.

Ground shift per iteration (ground)

Defines how far each iteration ring is offset from the original grid point. This number should be at least as large as the pixel size in the stereo images.

The following illustration represents a single grid point with iterations set to 2. In this case a total of 35 points will be correlated at each grid location to determine the best correlation fit.



Correlation source window size

Defines in pixels the window size of the correlation source image patch. Will be matched to target image patch.

Correlation search width

Defines in pixels the width of the correlation target image patch. Determines width of area to search at each grid point.

Correlation search height

Defines in pixels the height of the correlation target image patch. Determines height of the area to search at each grid point. A value that is two pixels larger than source window height is

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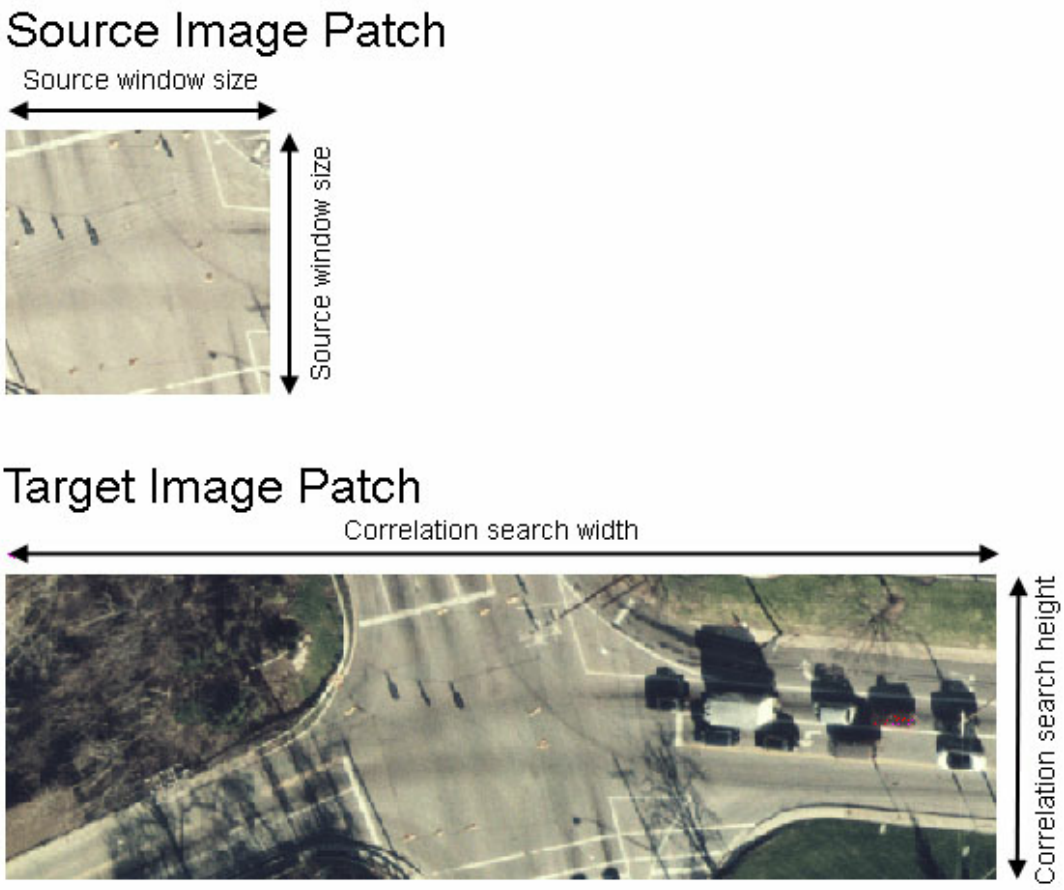
recommended.

The following illustration represents a source image patch taken from the left image, and the target image patch taken from the right image for a single grid point. The source image patch will be compared to the target image patch until the matching pixel is found.



Maximum ground distance

Defines the maximum allowed distance in ground coordinates. If the cursor must move a distance greater than this value, correlation is rejected.

Maximum elevation change

Defines the maximum allowed elevation change in ground coordinates. When each grid point is correlated, an approximate elevation is used based on the last successfully placed point elevation, the index elevation (if the last point was invalid), or the elevation from the seed data if available. If the elevation of the final correlated point is greater than the initial elevation approximation, the correlation is rejected. When using seed points and lines, this value should be made smaller to keep the correlated points close to the seed surface.

Button Assignments

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Correlate Area – Lock on

Allows searching for a line to edit.

	Button	Description
1	Id line	Identifies line to correlate. Displays Accept Menu.
2		
3		
4		
5		
6		
7	Enter params	Allow entry of correlation parameters. Displays Parameters dialog.
8		
9		
*		
0		
#	End	Ends application.

Correlate Area – Accept

Allows user to accept or reject selected line.

	Button	Description
1	Accept line	Accepts line, begins correlation, and displays Stop menu.
2	Reject line	Rejects line and displays Lock on menu.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#		

Correlate Area – Stop

Allows searching for a line to edit.

	Button	Description
1		
2	Stop	Stops current correlation and displays Lock on menu.
3	Pause	Pauses current correlation and displays Resume menu.

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4		
5		
6		
7		
8		
9		
*		
0		
#		

Correlate Area – Resume

	Button	Description
1	Resume	Resumes previously paused correlation and displays Stop menu.
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends correlation and display Lock on menu.

2.1.1.18.2 Create Symbol

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Create Symbol (CreSym)

Type: Interactive Application

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Creates a symbol or line font.

Detailed Description

Creates a symbol or line font by identifying existing line entities. Line entities to be used are identified by a user-defined window. Only line entities will be used. All points on the line entities must fall within the window for that entity to be used. Explode Symbol (ExpSym) and Explode Text (ExpTex) may be used to explode an existing symbol or text label into line entitles to include it in a symbol.

The order of the line entities found is not important. Lines will be sorted from the lowest to the highest x when the symbol or line font is created.
The size of the lines to be used is not important. Line fonts use a line font length and are scaled at plot time. Symbols are stored with a radius of one and are scaled at plot time. Since VrOne files contain a target scale, one symbol library may be used for many map scales.

As of VrOne version 1.75, the maximum number of symbols is 1000, the maximum number of line fonts is 1000 and the maximum number of points allowed on a symbol or line font is 1000.

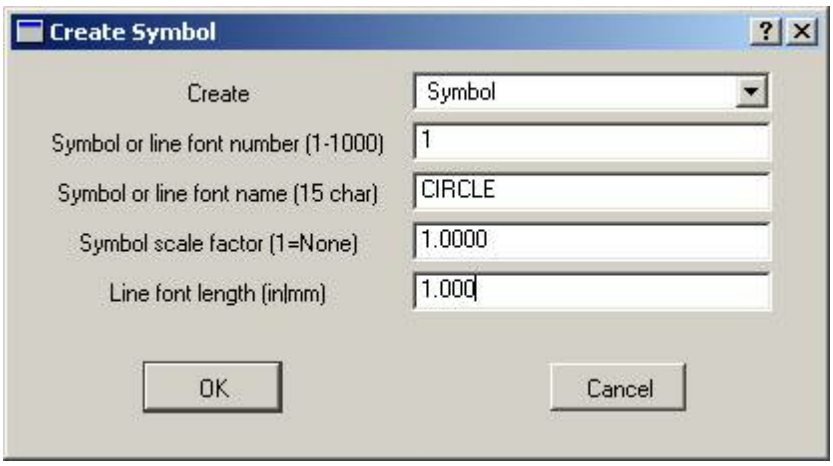
Local Commands

None

Procedure

Before starting Create Symbol the lines to be used for the symbol or line font should be drawn into the current file. Scale is not important. Symbols and Line fonts are scaled at plot time. The lines may be drawn anywhere in the current drawing as long as they can be identified with a window.

Parameters



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Create

Defines the symbol type to create. Options are Symbol or Line font.

Symbol or line font number

There may be up to 1000 symbols and up to 1000 line fonts in a symbol file. Range: 1-1000

Symbol or line font name

Defines the symbol or line font name. Range: 15 characters

Symbol scale factor

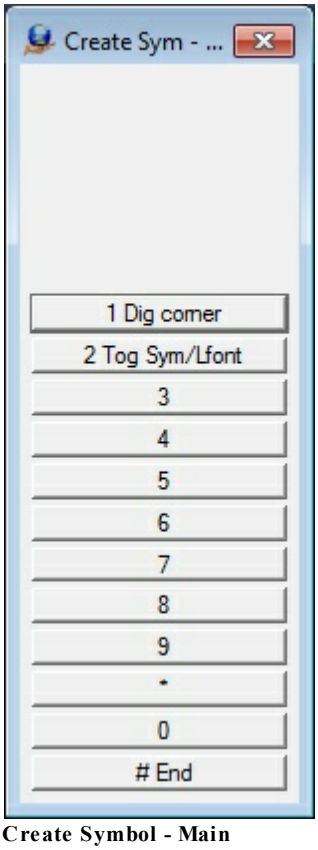
Defines the symbol scale factor. Normally, the symbol scale factor is 1, but a different scale factor may be entered so the symbol can be scaled to a different length. See Symbol Scale Factor for more information.

Line font length

Defines the plotting length for one line font segment when plotting the line font. This parameter is used when creating symbols. Range: Inches | Mm

Button Assignments

Create Symbol – Main



Create Symbol - Main

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1 Dig Corner - Defines a square window within which the line entities must fall.
2 Tog Sym/Lfont - Toggles between the creation of a symbol or a line font.
 # End - Ends application

Create Symbol – Origin

Digitizes the origin of the symbol or line font. The origin must fall within the symbol or line font range. If a line font is being created, only the Y direction of the origin is used. The X origin of a line font is always the left side of the font. After the origin is digitized the dialog box as shown above appears and parameters may be entered.



Create Symbol - Define Symbol Origin

1 Dig origin - Digitizes the origin of the symbol.
2 Center - Defines the center of the symbol space as the origin.
3 Top Left - Defines the top left of the symbol space as the origin.
4 Top Right - Defines the top right of the symbol space as the origin.
5 Bottom Left - Defines the bottom left of the symbol space as the origin.
6 Bottom Right - Defines the bottom right of the symbol space as the origin.
7 Top Center - Defines the top center of the symbol space as the origin.
8 Bottom Center - Defines the bottom center of the symbol space as the origin.
9 Center Left - Defines the center left of the symbol space as the origin.
*** Center Right** - Defines the center right of the symbol space as the origin.
0 Toggle snap - Toggles snap on/off

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Create Symbol – Sf

Defines the symbol scale factor. This menu is only active when a symbol (not a line font) is being created. See Symbol Scale Factor for more information.



Create Symbol - Define Scale Factor

1 Use 1.0 - Uses a scale factor of 1.0
2 Dig scl fac - Allows the digitizing of two points within the symbol space to define the symbol scale factor.
0 Toggle snap - Toggles snap on/off
 # End - Abandons the current create symbol function and returns to the Main Menu.

Create Symbol – Dig Sf

Digitizes the symbol scale factor. This menu is only active when a symbol (not a line font) is being created and when selected from the "Create Symbol - Sf" menu. See Symbol Scale Factor for more information.

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Create Symbol - Digitize Scale Factor

1 Dig SF pnt 1/2 - Digitizes two points within to define the symbol scale factor.
0 Toggle snap - Toggles snap on/off
 # End - Abandons the current create symbol function and returns to the Main Menu.

Symbol Scale Factor

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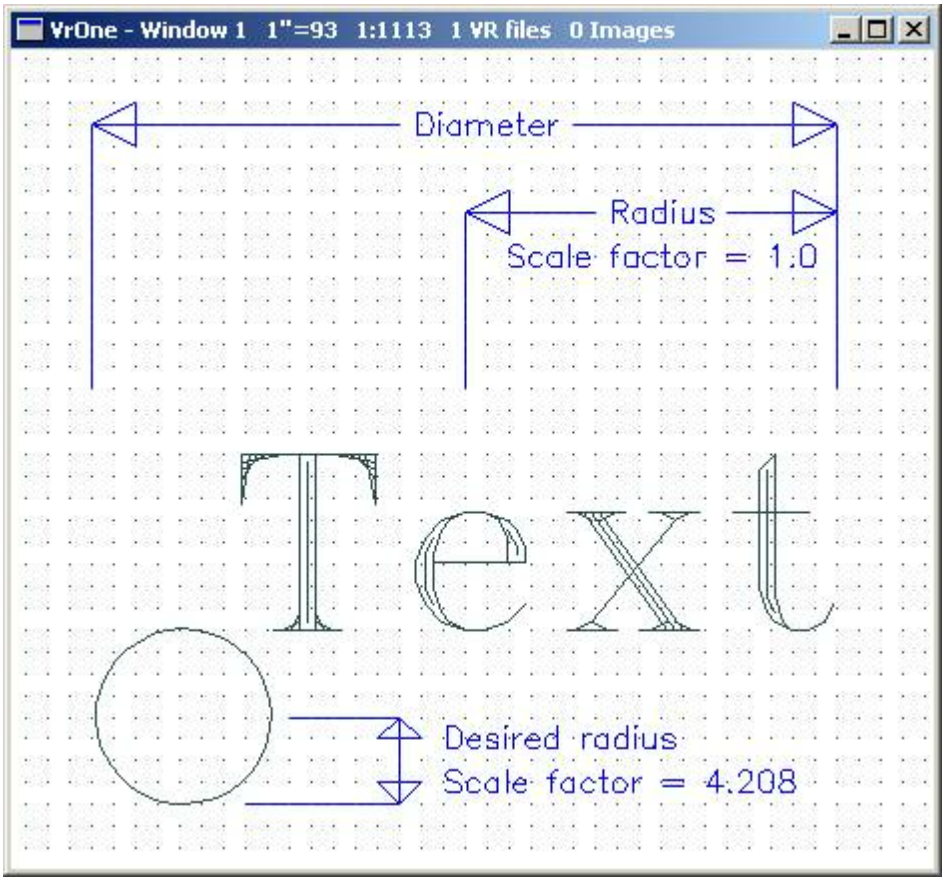

A symbol scale factor is useful in such cases as the above example, in which the symbol contains a symbol and a text label. The symbol and text label have been exploded into line entities by using Explode Symbol (ExpSym) and Explode Text (ExpText).

In a normal symbol, a scale factor of 1 is applied to one half of the longest axis shown above as "Radius". At plot time this radius would equal the symbol radius (RAD=) as it was inserted. This would make scaling the above symbol difficult. If a symbol scale factor were applied by digitizing two points such as the center of the circle and the edge of the circle, shown above as "Desired radius", then the circle radius would equal the symbol radius as it was inserted.

The easiest way to define a symbol scale factor is to digitize the two points that define the distance that will be used as the symbol radius. Digitizing these two points will automatically compute the proper scale factor. A symbol scale factor may be digitized after digitizing the symbol origin when using Create Symbol.

2.1.1.18.3 Digitize Control

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Mapping

Digitize Control (DigCon)

Type: Interactive Application

Digitizes control points from current input device and places them into a control file. Options include the ability to open, close, create and edit control files. Before each point is saved a name may be added and any coordinate may be changed. Duplicate point names are not allowed in Digitize Control.

Local Commands

None

Button Assignments

Dig Control - Main

	Button	Description
1	Dig point	Digitizes a coordinate to be placed in the current control file.
2	Open file	Opens an existing control file.
3	Close file	Closes the current control file.
4	Create file	Creates a new control file.
5	Update file	Updates the current control file to disk.
6		
7	Edit coords	Allows editing of the current control file.
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

When a control point is digitized, a dialog box will show the current point name and the digitized coordinate position. Any of these fields may be edited before accepting the coordinate position. Duplicate point names are not allowed in Digitize Control.

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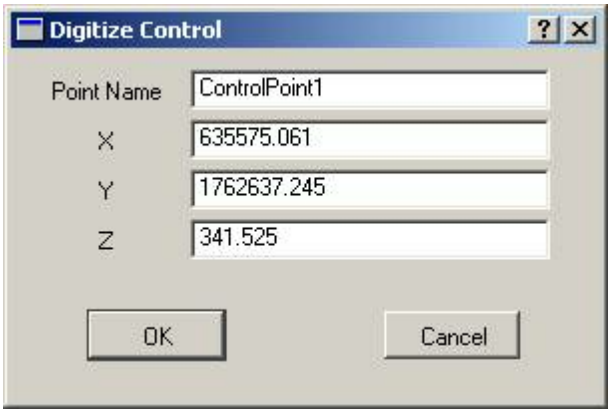

2.1.1.18.4 Drive Grid

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Drive Grid (DriGri)

Type: Interactive Application

Drives to grid points within a user-defined polygon and allows reading of those points as symbols, spot elevations, or text elevations. DTM may be run during the read process and the elevation from the DTM surface may be driven to when moving to new grid points.

Available Key-ins

Key-in	Description	Range
TYPE=	Point type to place when reading grid	0 = Symbol 1 = Spot Elevation 2 = Text only
GRIRES=	Grid resolution	Ground units
GRIOFSX=	Grid offset X	Ground units
GRIOFSY=	Grid offset Y	Ground units
TEXOFSX=	Text offset X (in|mm)	Inches | Mm
TEXOFSY=	Text offset Y (in|mm)	Inches | Mm
DECACC=	Decimal accuracy for Z text labels	
ZCON=	Z control	0 = Footdisk

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		1 = Right handwheel 2 = P3 Y tablet motion
READIR=	Read direction	0 = East ascending 1 = East descending 2 = East meander 3 = North ascending 4 = North descending 5 = North meander
DRIDTM=	Drive Z to DTM surface, if active	0 = No 1 = Yes
UPDGRA=	Update graphics when reading points in stereo roaming?	0 = No 1 = Yes

Symbol Parameters

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32bit
LNK=	Link number	32bit
FC=	Feature code	48 char
RAD=	Symbol radius	Inches | Mm
ROT=	Symbol rotation	Degrees
FKEY=	Set symbol and text parameters to Function Key	Function key name

Text Parameters

Key-in	Description	Range
KEY1=	Layer number	1-10001
GRP1=	Graphic pointer	1-60
PEN1=	Pen number	1-256
CON1=	Construction flag	0-1
NGR1=	Non graphic pointer	32bit
LNK1=	Link number	32bit
FC1=	Feature code	48 char
FNT=	Font number	1-12
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal
JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
ROT1=	Text rotation	Degrees

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SLT=	Text slant	Degrees

Parameter Notes

Grid Offsets

Defines X,Y distances to add when driving the instruments to the grid points.

Z Control

Defines location of Z motion. NOTE: Not available on all instruments.

Drive Z to DTM surface if active

If this parameter is set to "Yes", the elevation from the DTM surface will be used when driving to a grid point. It is possible to run DTM at any time and strengthen the surface based on previously read grid points. DTM may be run without exiting Drive Grid.

Example Scale Factors	Comment
1.0	No scale factor
-1.0	Reverse direction of Z motion
-2.5	Reverse direction and multiply speed by 2.5
.5	Divide Z motion speed by 2

Update Graphics (UpdGra=)

Specifies whether graphics should be updated when a point is read. Turning this flag off avoids pausing on slower computers when reading points in stereo roaming. Home may be pressed to manually update graphics.

Button Assignments

Drive Grid - Lock On

	Button	Description
1	Id line	Identifies grid area boundary line.
2		
3		
4		
5		
6		
7	Parameters	Enter grid parameters.
8	Symbol Params	Enter symbol parameters.
9	Text Params	Enter text parameters.
*		
0		
#	End	Ends Drive Grid.

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Drive Grid - Read

	Button	Description
1	Accept point	Reads grid point at current location.
2	Next point	Moves to next grid point.
3	Backup	Moves to previous grid point.
4	Drive back	Drives back to current grid point.
5	Resume	Allows ID of grid point to resume reading.
6		
7		
8		
9		
*		
0		
#	End	Returns to Lock On.

2.1.1.18.5 Insert Catenary

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Insert Catenary (InsCat)

Type: Semi-automatic interactive application

Detailed Description

Power lines are typically represented as catenaries. A catenary is the curve that an idealized hanging chain or cable assumes under its own weight when supported only at its ends. The curve has a U-like shape and mathematically, the curve is the graph of the hyperbolic cosine function.

Semi-automatic delineation of power lines and other isolated linear features given a single user

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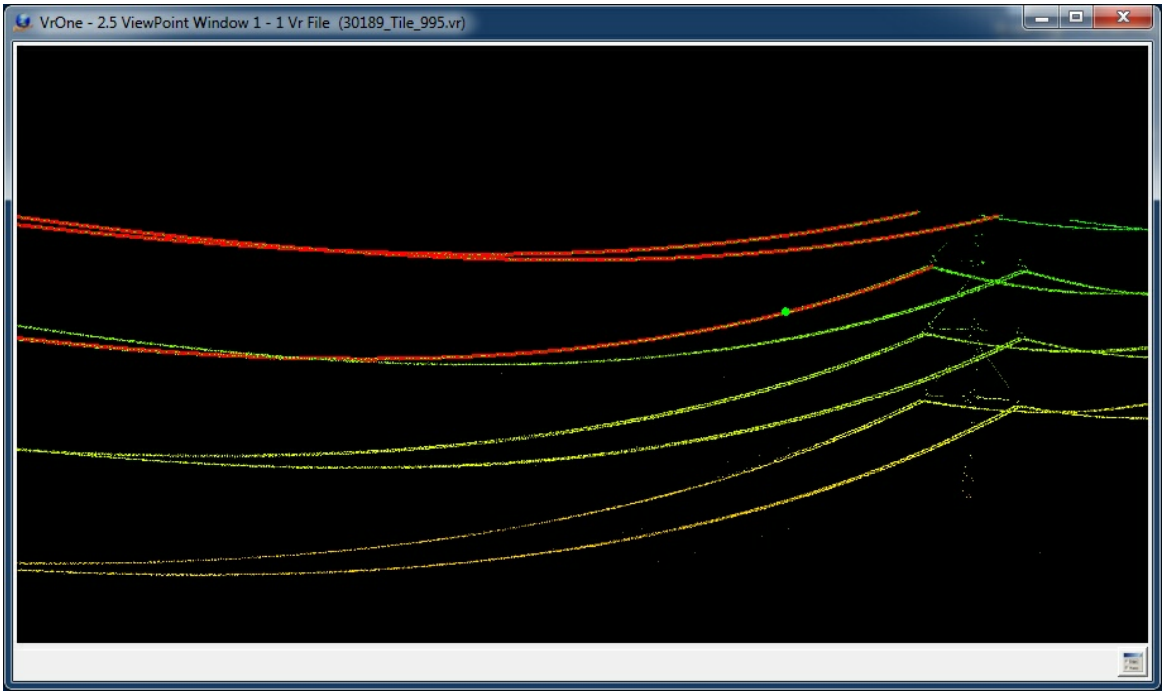
specified start point. The line terminates at peaks or obstructions (insulators, poles, etc.) in an attempt to isolate wire attach points at the end points of the catenaries. The algorithm is reasonably robust to sparse data. Quality control tools allow fast viewing and editing of line terminations.

Insert Catenary is designed to work with LiDAR and point cloud data. This application may be started from a Function Key.

Please see also Catenary to POA (Point of Attachment)



Power line catenaries

Button Assignments

Insert Catenary – Main

When Insert Catenary starts, an initial point or points along the catenary needs to be digitized. This initial data provides seed information so the application can follow the catenary and place a 3D line.

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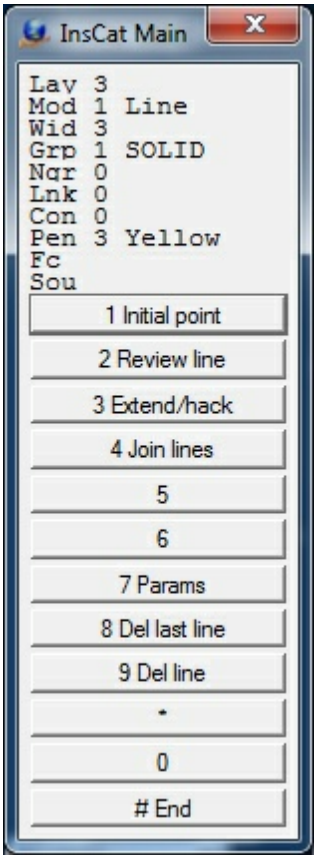

Main Menu

	Button	Description
1	Initial point	Identifies one, two or three points along a catenary to provide initial data to start the catenary line insertion
2		
3	Review line	Review an existing line
4	Extend/hack	Extend or hack an existing line
5	Join lines	Joins two existing lines using a user defined join point
6		
7	Enter params	Enter/edit Insert Catenary parameters (see Insert Catenary Parameters)
8	Del last line	Deletes the last saved line
9	Del line	Deletes a line by identifying an existing line
*		
0		
#	End	Ends application

Insert Catenary – Review

Review drives the cursor along an existing, user identified line.

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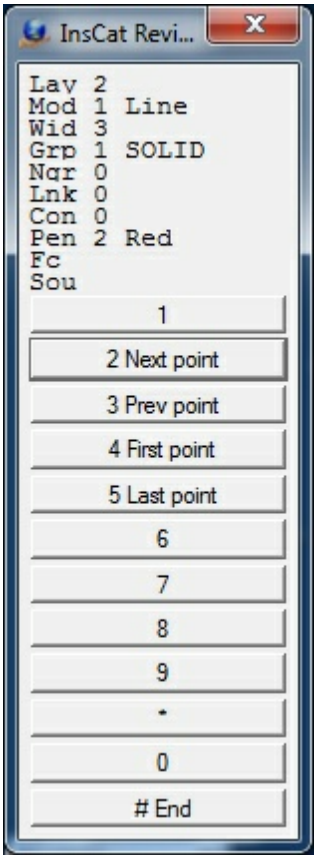

Review Menu

	Button	Description
1		
2	Next point	Moves cursor to the next line point
3	Prev point	Moves cursor to the previous line point
4	First point	Moves cursor to the first point on the line
5	Last point	Moves cursor to the last point on the line
6		
7		
8		
9		
*		
0		
#	End	Ends review and returns to the main menu

Insert Catenary – Extend/hack Line

The cursor may be placed near an existing line and the closest line will be extended to or hacked at the point digitized (the hack point). If the line is to be extended the endpoint on the line will be extended along the azimuth of the last line segment. If the line is to be hacked the shortest side

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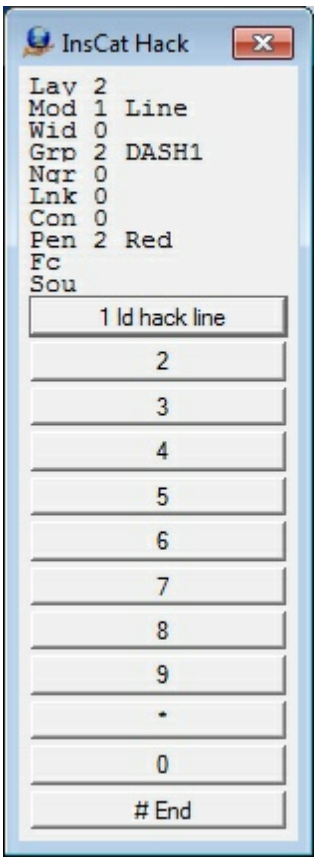
of the line will be hacked at a 90 degree offset from the hack point. After the hack point has been digitized and the line extended or hacked, the result may will be displayed and may be accepted or rejected before re-saving the line.



Extend/hack Menu

	Button	Description
1	Id hack line	Identifies line to be extended/hacked
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends Extend/hack and returns to the main menu

After the line to be extended or hacked is identified a hack or extend point is digitized and the

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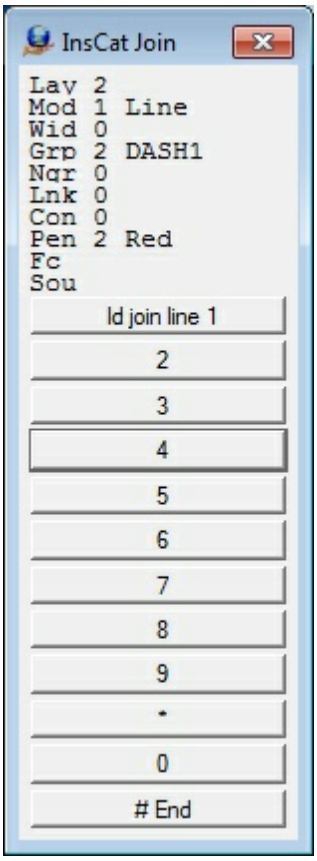
result may be accepted or rejected.

Insert Catenary – Join Lines

Two existing lines may be joined by placing the cursor near both lines and digitizing a point (the join point). The join point will be the common point between the two lines. Lines will be extended or hacked to the join point. After the join point has been digitized and the lines joined, the result may will be displayed and may be accepted or rejected before re-saving the lines.



Join Lines Menu

	Button	Description
1	Id join line N	Identifies the two lines to be joined
2		
3		
4		
5		
6		
7		
8		
9		
*		

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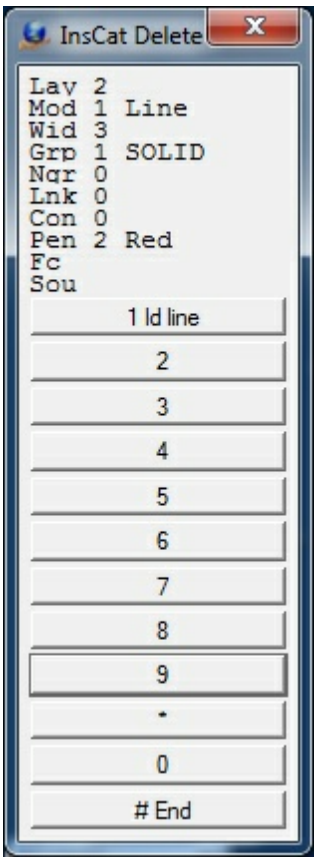
0		
#	End	Ends Join Lines and returns to the main menu

After the two lines to be joined are identified a join point is digitized and the results of the join may be accepted or rejected.

Insert Catenary – Delete Line

Deletes an existing line. When a line is identified to be deleted it may be accepted or rejected before deletion.



Delete Line Menu

	Button	Description
1	Id line	Identifies the line to delete
2		
3		
4		
5		
6		
7		

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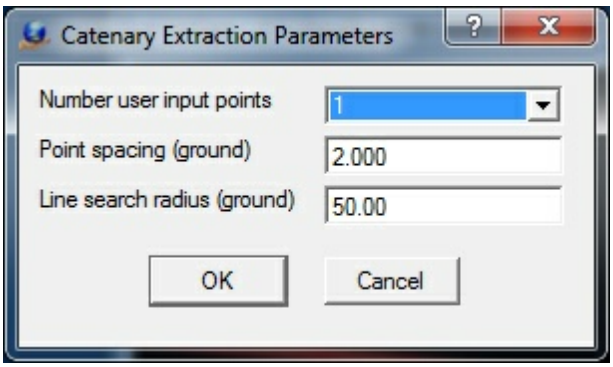
8		
9		
*		
0		
#	End	Ends Delete Line and returns to the main menu

Insert Catenary Parameters

The Insert Catenary parameters may be defined by pressing button 7 from the Main menu.



Parameters

Number user input points
Defines the number of user digitized points to use to provide initial data to starts the catenary line insertion. Catenary input given a single user input point is the default option. However, the adaptive methods used to determine the direction, radius and point spacing along the curve can fail. Failure is more probable in sparse data and closely space wires. In the event of failure switch to multiple input points.
When using two input points they are used to identify a linear section of the curve and hence should not be too far apart. When using three points, they are intended to define the curve, and hence should be widely spaced. Options include 1, 2 or 3.

Point spacing (ground)
Approximate distance between the points on the final catenary curve. (ground, default=1)

Line search radius (ground)
Search radius and endpoint extend distance when searching for lines to join or extend. (ground, default=10)

Local Commands

The following key-ins may be used to change run-time parameters. They may be keyed in, placed in macros or more commonly placed in the Local Args field in a Function Key.

Key-in	Description	Range

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Lay=	Layer number	1-32001
Mod=	Mode	1=Line 2=Spline
Grp=	Graphic pointer	1-1000
Wid=	Line width	0-255
Pen=	Pen number	1-256
Con=	Construction flag	0-1
Ngr=	Non graphic pointer	32-bit
Lnk=	Link number	32-bit
Fc=	Feature code	15 char
NumPts=	Number user input points	1-3
PntSpa=	Point spacing	ground (default=1)
LinSea=	Line search radius	ground (default=10)

2.1.1.18.6 Insert Cross Sections

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Insert Cross Sections (InsCro)

Type: Interactive Application

Creates cross section lines from LiDAR surface data and allows viewing the cross section line profiles. New lines may be digitized or existing lines may be selected. Existing lines may be draped to the surface or displayed as they exist without draping. There are options to automatically add points at breaks in the surface.

Once a cross section line has been digitized or selected, it is displayed in a 3D viewing window with optional stereo capabilities. Multiple passes may be taken on each cross section line using different point filter options. All passes will be displayed in the cross section viewing window.

A typical workflow for using Insert Cross Sections to place new cross section lines is as follows:

1. Start VrOne and open a .vr file containing VrPoints.
2. Start Insert Cross Sections application.
3. Select "Enter params" and make sure draping parameters are correct and passes are set up.
4. Digitize a two point line across the area where you would like a cross section line recorded.

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5. Cross section view window is displayed. The pass companion window enables Save buttons for each pass processed.
6. Examine the cross section(s) in the view window and determine which one you would like to save. Use the mouse wheel to zoom in and out. The cursor will track the cross section line and points by default, press the Del key to toggle tracking off.
7. When you are ready to save the cross section line to the workspace, press the Save button next to the pass you would like to record.

This application may also be used as a quick cross section viewing tool by using the above steps, but skipping the last one where the cross section is saved. You may continue to work in the main VrOne window while the cross section is displayed, and the cross section view cursor will follow your movements in the main graphics window.

Local Commands

Key-in	Description	Range
LAY?=	Layer number	1-10001. ? = Pass (1-5)
MOD?=	Mode	1=Line 2=Spline. ? = Pass (1-5)
GRP?=	Graphic pointer	1-60. ? = Pass (1-5)
WID?=	Line width	0-255. ? = Pass (1-5)
PEN?=	Pen number	1-256. ? = Pass (1-5)
CON?=	Construction flag	0-1. ? = Pass (1-5)
NGR?=	Non graphic pointer	32 bit. ? = Pass (1-5)
LNK?=	Link number	32 . ? = Pass (1-5)
FC?=	Feature code	15 char. ? = Pass (1-5)
FKEY?=name	Changes to function key parameters	Function key name. ? = Pass (1-5)
Z=	Set active Z	
DIG=	Digitize a point	

Button Assignments

Ins Cross Sections - Main

Button	Description
1 Digitize pt	Digitizes a single XYZ location.
2 Id line	Switches to Id line mode.
3 Backup	Deletes the last point on the current line.
4 End	Ends and saves the current line.
5 Rescan	Rescans the last digitized or selected line using latest parameters.
6	
7 Enter params	Allows the setting of parameters.
8	

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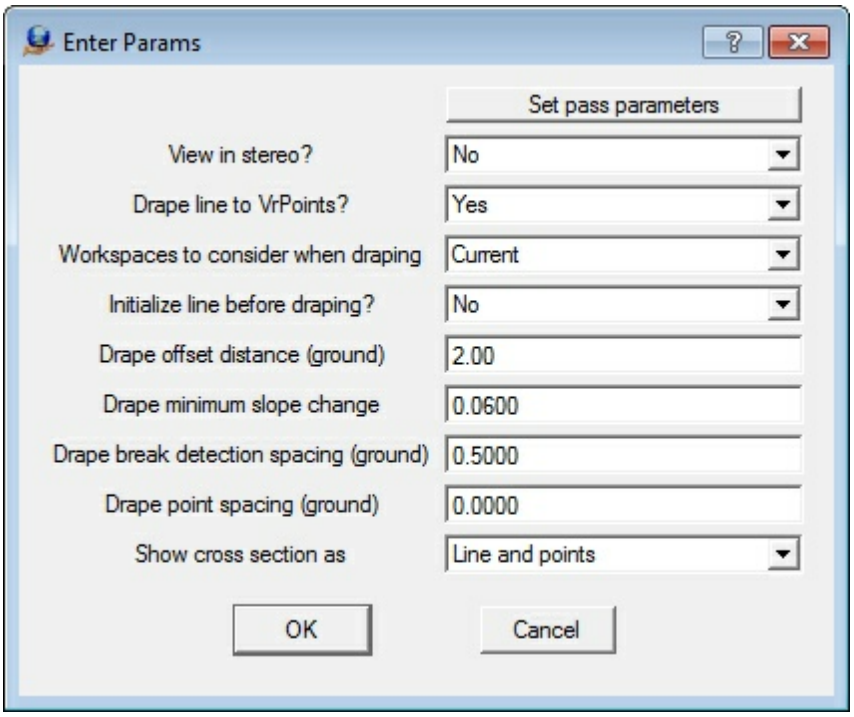
9 Reset display	Returns the cross section view display to the default orientation.
* Menu board	Makes selection from Menu Board.
0 Toggle snap	Toggles snapping on / off.
# End	Ends application.

Ins Cross Sections – Id line

Button	Description
1 Id line	Allows selection of an existing line.
2 Dig line	Switch to digitize line mode (Main menu).
3	
4	
5 Rescan	Rescans the last digitized or selected line using latest parameters.
6	
7 Enter Params	Allows the setting of parameters.
8	
9 Reset display	Returns the cross section view display to the default orientation.
* Menu board	Makes selection from Menu Board.
0	
# End	Ends application.

Parameters



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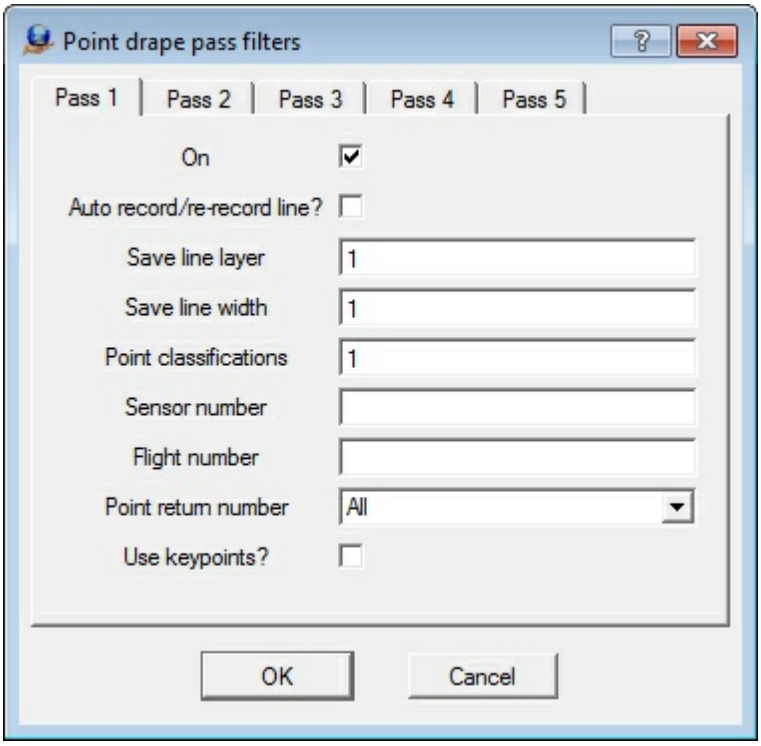
Set pass parameters

Set the parameters for each pass. Passes are used to display multiple versions of the same cross section line draped to different sets of points The following dialog is displayed when this button is selected:



Up to five passes may be taken on the cross section line. Each pass may use filters to define a unique set of VrPoints. This allows for quick comparison of profiles between different data sets.

Pass Parameters

Unless otherwise noted, any empty pass parameter behaves as a wildcard.

On

Determines if this pass is used. Only passes that are on are processed and displayed in the view window.

Auto record/re-record line

If on, this pass will be automatically saved

Save line layer

Specifies layer to which to save cross section line. -1=Same as identified line, or xx if line is digitized. (where xx = Pass number)

Save line width

Specifies width to assign to cross section line. -1=Same as identified line, or 1 if line is digitized.

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Point classifications

Defines point classifications. A number line may be used. Point classification range: 0-31

Sensor number

Specifies sensor number. number line may be used. Point classification range: 0-31

Flight number

Specifies flight number. A number line may be used. Point classification range: 0-31

Point return number

Specifies point return number. Select a point return number from 1-5 or All.

Use keypoints?

Specifies whether only keypoints should be used.

View in stereo

Yes = Displays the cross section view window in stereo mode.

No = Displays the cross section view window in standard mode.

Drape line to VrPoints

Yes = Line is draped to VrPoints

No = Line is not draped. It is assumed that the line has already been draped or follows the surface.

Workspaces to consider when draping

Current = Only uses points in current workspace.

All open = Uses points from all open workspaces.

Initialize line before draping

Yes = All points except the line end points are removed before draping the line.

No = Existing points on line will remain

Drape offset distance (ground)

Defines in ground units the distance from the left and right of the cross section line to search for points to use to define the cross section.

Drape minimum slope change

Defines the minimum slope change for break detection when draping to VrPoints. Surface slopes range from 0.0 to 1.0. 0.0 is a flat line and 0.5 is a 45 degree slope.

Drape break detection spacing (ground)

Defines in ground units the search spacing when detecting breaks in surface.

Drape point spacing (ground)

Sets in ground units the point spacing when draping to VrPoints. 0=No set point spacing - Use slope change and insert points at surface breaks.

Show cross section as

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Default viewing mode of cross section line.

Lines = Only shows cross section line.

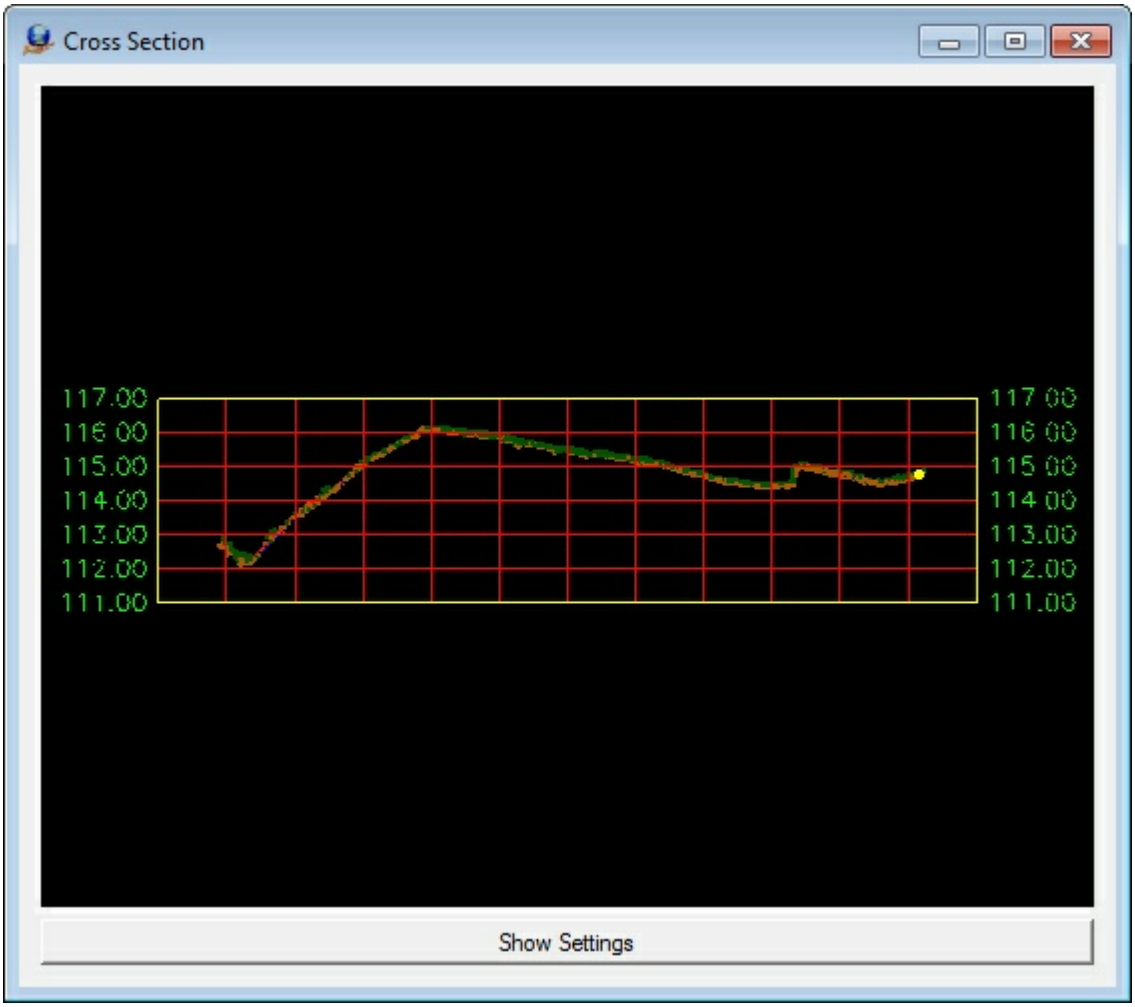
Points = Only shows points along section line

Line and points = Shows points and cross section line

Cross Section View

The cross section viewer window is used to display the cross section profile. The viewer has many options to control how the cross section profile is displayed. A companion window is used to control the display of each pass and to allow the cross section lines from each pass to be saved. Passes are used to display multiple versions of the same cross section line draped to different sets of points.

Below is the main cross section view with a cross section line and points displayed and the companion pass control dialog. Two passes have been taken and the lines are ready to be saved.



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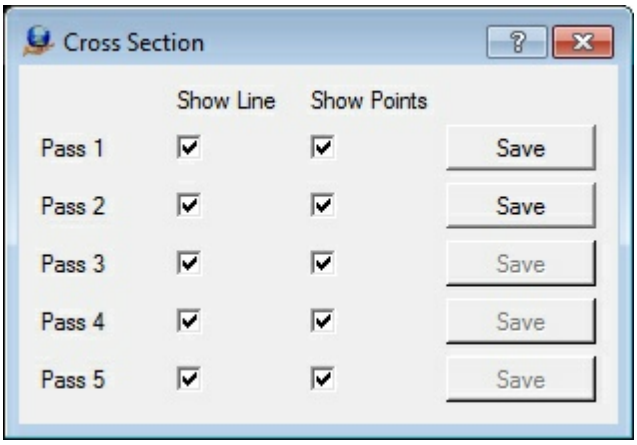

The display settings are altered by pressing the Show Settings button. To configure settings outside the Insert Cross Sections application you may use the Configure Cross Sections (ConCro) application .

Show Settings Parameters

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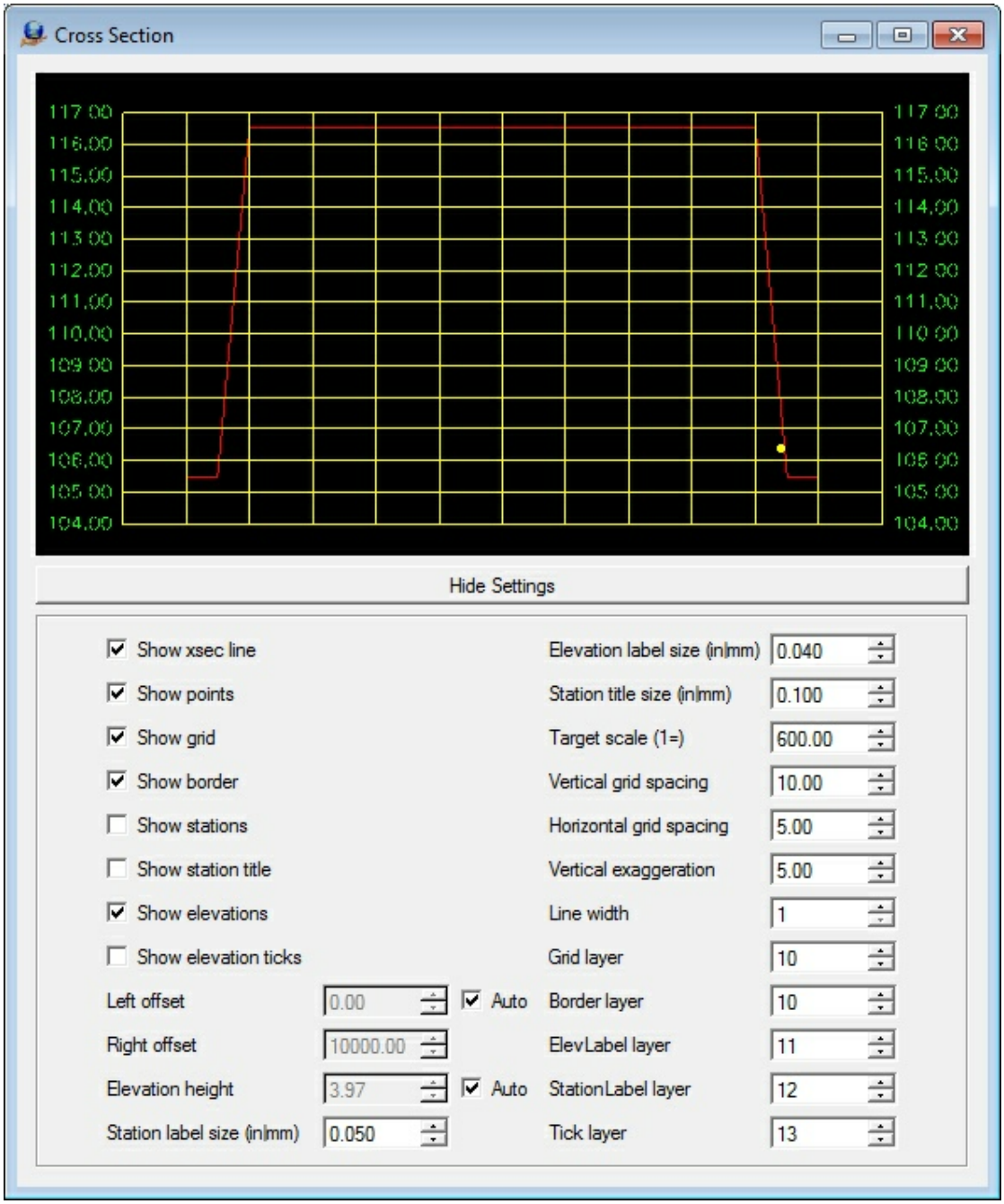

Show xsec line

Specifies whether to show the cross section line.

Show points

Specifies whether to show the VrPoints used when draping cross section line.

Show grid

Specifies whether to show grid lines.

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Show border

Specifies whether to show the border around grid.

Show stations

Specifies whether to show station labels.

Show station title

Specifies whether to show the station title.

Show elevations

Specifies whether to show elevation labels.

Show elevation ticks

Specifies whether to show elevation ticks on border.

Left offset

Defines the offset distance to left of cross section center for display of grid lines.

Right offset

Defines the offset distance to right of cross section center for display of grid lines.

Elevation height

Defines the height of grid if displaying elevations labels or grid lines.

Target scale (1=)

Defines the target scale used to determine size of labels.

Vertical grid spacing

Defines in ground units the spacing of vertical grid lines.

Horizontal grid spacing

Defines in ground units the spacing of horizontal grid lines.

Vertical exaggeration

Specifies a multiplier to apply to exaggerate the elevation of the cross section data.

Station label size (in|mm)

Defines the station label size in inches/millimeters. Target scale will be applied to compute final size.

Elevation label size (in|mm)

Defines the elevation label size in inches/millimeters. Target scale will be applied to compute final size.

Station title size (in|mm)

Defines the station title size in inches/millimeters. Target scale will be applied to compute final size.

Line width

Defines the default width to display cross section lines.

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Grid layer

Specifies the layer from which to take the color used for displaying the grid lines.

Border layer

Specifies the layer from which to take the color used for displaying the border line.

Elev Label layer

Specifies the layer from which to take the color used for displaying the elevation labels.

Station Label layer

Specifies the layer from which to take the color used for displaying the station labels.

Tick layer

Specifies the layer from which to take the color used for displaying the tick lines.

2.1.1.18.7 Insert Edge

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Insert Edge (InsEdg)

Type: Semi-automatic interactive application

Detailed Description

Semi-automatic tracing of lines along edges in LiDAR data. The user roughly identifies two points along the edge and the algorithm traces it in both directions until termination/failure. The result can be interactively navigated for quality control and possible editing.

Insert Edge is designed to work with LiDAR and point cloud data. This application may be started from a Function Key.

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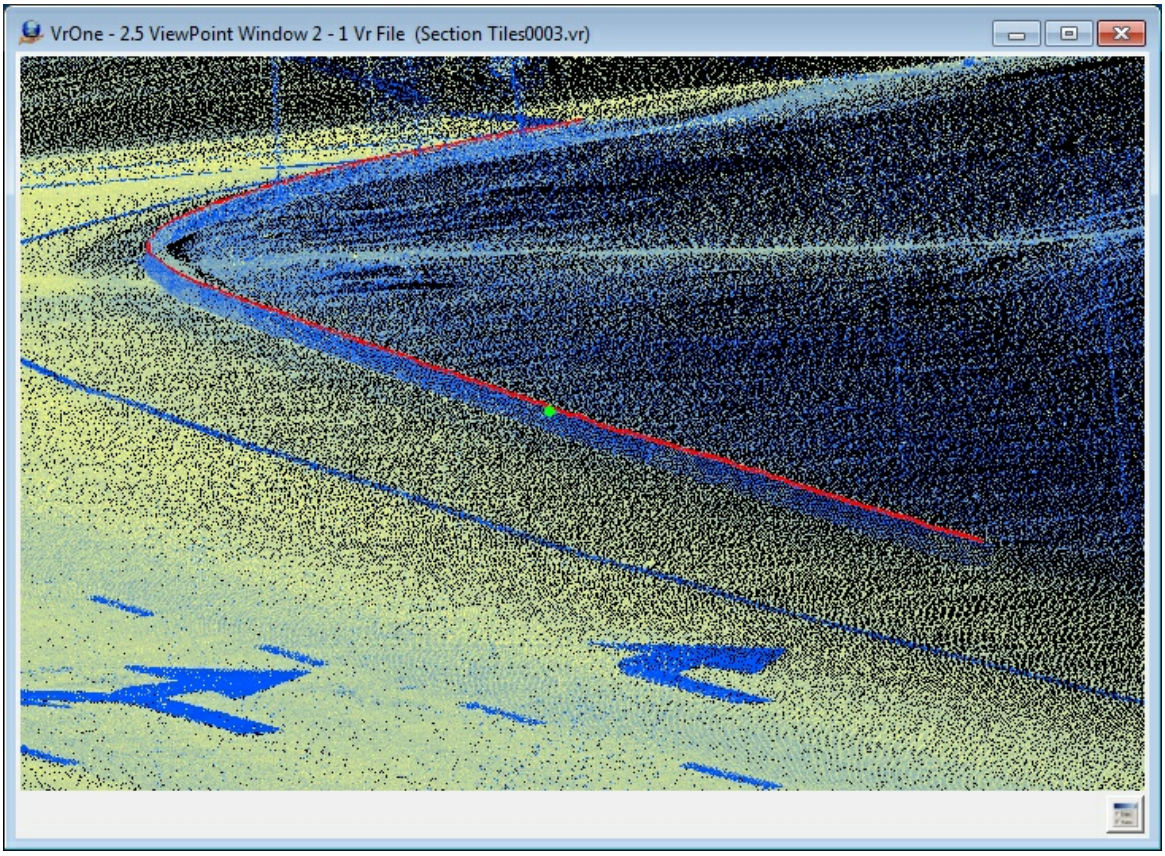

Top of curb edge

Button Assignments

Insert Edge – Main

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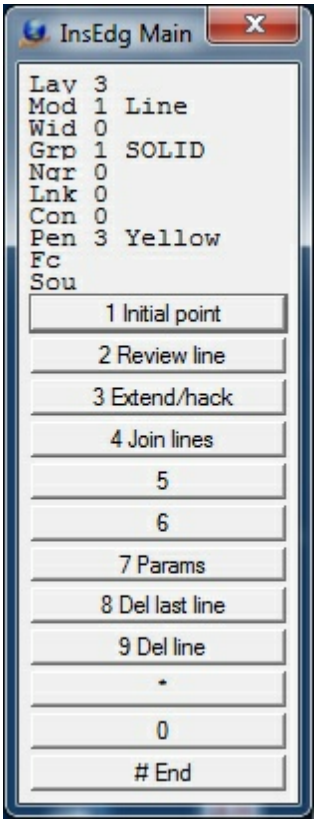

Main Menu

When Insert Edge starts, initial points along the edge line need to be digitized. This initial data provides seed information so the application can follow the edge and place a 3D line.

	Button	Description
1	Initial point	Identifies two points along the edge to provide initial data to start the edge line insertion.
2		
3	Review line	Review an existing line
4	Extend/hack	Extend or hack an existing line
5	Join lines	Joins two existing lines using a user defined join point
6		
7	Enter params	Enter/edit Insert Edge parameters (see Insert Edge Parameters)
8	Del last line	Deletes the last saved line
9	Del line	Deletes a line by identifying an existing line
*		
0		
#	End	Ends application

Insert Edge – Review

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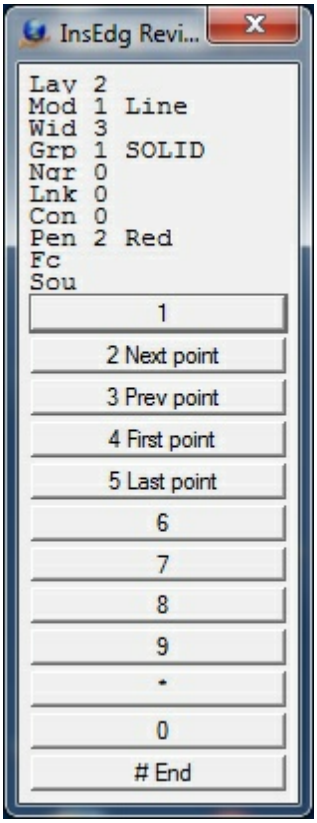
Review drives the cursor along an existing, user identified line.



Review Menu

	Button	Description
1		
2	Next point	Moves cursor to the next line point
3	Prev point	Moves cursor to the previous line point
4	First point	Moves cursor to the first point on the line
5	Last point	Moves cursor to the last point on the line
6		
7		
8		
9		
*		
0		
#	End	Ends review and returns to the main menu

Insert Edge – Extend/hack Line

The cursor may be placed near an existing line and the closest line will be extended to or hacked at the point digitized (the hack point). If the line is to be extended the endpoint on the line will be

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extended along the azimuth of the last line segment. If the line is to be hacked the shortest side of the line will be hacked at a 90 degree offset from the hack point. After the hack point has been digitized and the line extended or hacked, the result may will be displayed and may be accepted or rejected before re-saving the line.



Extend/hack Menu

	Button	Description
1	Dig hack pt	Digitizes the hack point when extending or hacking a line
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends Extend/hack and returns to the main menu

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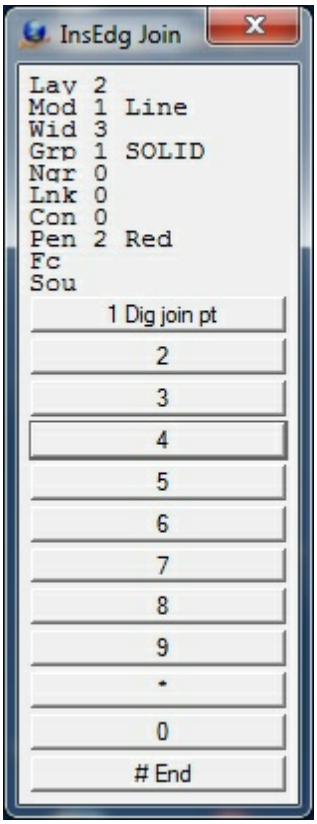
Insert Edge – Join Lines

Two existing lines may be joined by placing the cursor near both lines and digitizing a point (the join point). The join point will be the common point between the two lines. Lines will be extended or hacked to the join point. After the join point has been digitized and the lines joined, the result may will be displayed and may be accepted or rejected before re-saving the lines.



Join Lines Menu

	Button	Description
1	Dig join pt	Digitizes the join point when joining two lines
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		

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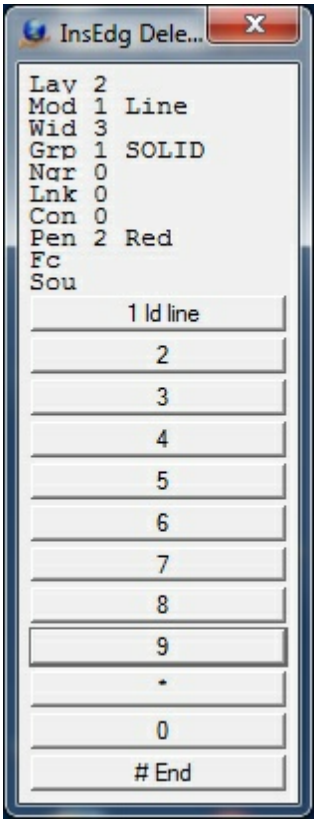
#	End	Ends Join Lines and returns to the main menu

Insert Edge – Delete Line

Deletes an existing line. When a line is identified to be deleted it may be accepted or rejected before deletion.



Delete Line Menu

	Button	Description
1	Id line	Identifies the line to delete
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		

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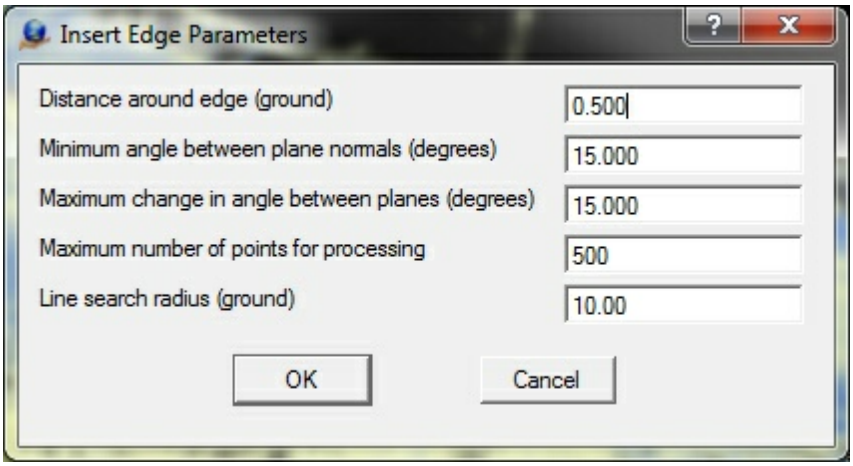
#	End	Ends Delete Line and returns to the main menu

Insert Edge Parameters

The Insert Edge parameters may be defined by pressing button 7 from the Main menu.



Parameters

Distance around edge (ground)
Defines a cylinder around the edge line used for processing. The planar faces of the break should extend somewhat beyond this distance. (ground, default=0.5)

Minimum angle between plain normals (degrees)
Provides a limit to how close planes on either side of the edge line are allowed to get to parallel. (degrees, default=15)

Maximum change in angle between planes (degrees)
The algorithm follows an edge line by modeling it as intersecting planes. The angle between the plane normals describes the shape of the edge. The Maximum Change parameter limits how much change in the shape will be tolerated before stopping. (degrees, default=15)

Maximum number of points for processing
The maximum number of points to use in processing a segment of an edge line. This allows the processing to remain reasonably time stable in very dense data. (default=500)

Line search radius (ground)
Search radius and endpoint extend distance when searching for lines to join or extend. (ground, default=10)

Local Commands

The following key-ins may be used to change run-time parameters. They may be keyed in, placed in macros or more commonly placed in the Local Args field in a Function Key.

Key-in	Description	Range

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Lay=	Layer number	1-32001
Mod=	Mode	1=Line 2=Spline
Grp=	Graphic pointer	1-1000
Wid=	Line width	0-255
Pen=	Pen number	1-256
Con=	Construction flag	0-1
Ngr=	Non graphic pointer	32-bit
Lnk=	Link number	32-bit
Fc=	Feature code	15 char
MaxDis=	Distance around edge	ground (default=0.5)
MinAng=	Minimum angle between plain normals	degrees (default=15)
MaxCha=	Maximum change in angle between planes	degrees (default=15)
MaxPts=	Maximum number of points for processing	(default=500)
LinSea=	Line search radius	ground (default=10)

2.1.1.18.8 Insert Fly Line

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Insert Fly Line (InsFly)

Type: Interactive Application

Digitizes a line in fly mode, in which the line is drawn freehand in stream mode. Places the proper number of points on the line as determined by user parameters to make the line smooth. This is useful for digitizing contours, water lines and DTM break lines. A manual mode, which allows points to be digitized manually, may be engaged when in stream digitizing mode.

Both the VrOne key layout and the old style key layout are supported. The key layout may be set in Enter Parameters from the Main Menu.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1 – 10001
MOD=	Mode	1 = Line 2 = Spline

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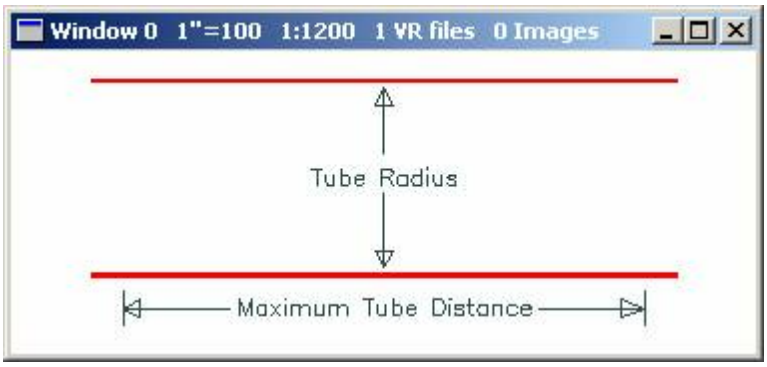
GRP=	Graphic pointer	1 – 60
WID=	Width	0 – 255
PEN=	Pen number	1 – 256
CON=	Construction flag	0 – 1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	15 characters
DIG=	Digitized point at location specified	X Y Z
FKEY=	Change to function key properties	Function Key Name
TUBRAD=	X,y tube radius	Inches | Mm
MAXDIS=	Maximum tube distance	Inches | Mm
DITDIS=	Dither distance	Inches | Mm
ZTUB=	Z tube radius	Ground value 0 = Disabled
DITBUF=	Maximum dither point buffer size	100-10,000
LAKLIN=	Makes Lake Line in which all the elevations on the line are the same as the first point.	0=Off 1=On
KEYLAY=	Key layout	0=Normal 1=Old style

PARAMETERS

Tube Filter

When filtering lines, two parameters determine which points are kept:



When a data point falls outside the current tube, the last point within the tube is saved and a new tube direction is set based on the new point and the last point. If a line is straight and points do not move out of the tube, the Maximum tube distance is used to save points.

When setting these parameters, the Maximum tube distance should always be larger than the Tube radius.
Example:

Tube radius	02 inches or 0.5 mm

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Maximum tube distance	0.5 inches or 12 mm

Dither Distance

When collecting a line, all the points are first placed in a buffer. When the line is ended the points are then filtered using the current parameters. The Dither distance specifies how far the floating mark or cursor must travel before a point is placed in the buffer.
Example:
Dither distance: .05 inches or 1.3 mm

Z Rube Radius

Specifies in ground units the elevation filter to apply to points in the input buffer. If set to 0, no elevation filter is applied.

When a line is being collected, points are stored in a temporary buffer using the Dither Distance. When the line is saved, the points in the buffer are filtered using the Tube Radius, Z Tube Radius and Maximum Distance. Points that are "Forced" during collection pass through the filter unmodified.

Dither Buffer Size

This parameter defines the maximum number of points that may be stored in the dither buffer. When this buffer is full, the points are filtered and the resulting line is saved. If the line is not yet complete input will continue seamlessly. Setting the dither buffer size to a smaller value will typically produce multiple lines that make up the entire line. The interactive application Join Lines (JoiLin) or the batch application Batch Join (BatJoi) may be used to join the multiple lines into a single line. The default value for the dither buffer size is 10,000.

Button Assignments

Ins Fly Line – Main

	Button	Description
1	Start	Starts the line.
2	Z +	Increments the current elevation by the contour interval.
3	Z -	Decrements the current elevation by the contour interval.
4	Z Round	Rounds the current elevation to the nearest contour interval.
5		
6		
7	Enter Params	Enter parameters from dialog box.
8		
9		
*		
0	Toggle Snap	Toggles snap on/off.
#	End	Ends Edit Line.

The contour interval may be set in Z Source (Zsou).

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Ins Fly Line – Stream (VrOne layout)

	Button	Description
1	Force	Forces a point into the buffer.
2	Close	Closes and saves the current line.
3	Backup	Backs up one point and drives the instrument to that point if possible.
4	End line	Ends and saves the current fly line.
5	Dig manual	Allows manual point digitization.
6	Splice/Pause	Starts Splice menu.
7		
8		
9		
*		
0	Toggle Snap	Starts Snap menu.
#	End	Ends Edit Line.

Ins Fly Line – Stream (Old style layout)

	Button	Description
1	End line	Ends and saves the current fly line.
2	Close	Closes and saves the current line.
3	Backup	Backs up one point and drives the instrument to that point if possible.
4	Force	Forces a point into the buffer.
5	Dig manual	Allows manual point digitization.
6	Splice/Pause	Starts Splice menu.
7		
8		
9		
*		
0	Toggle Snap	Starts Snap menu.
#	End	Ends Edit Line.

Ins Fly Line – Splice (VrOne layout)

When this menu is entered, point collection stops and the operator may look around. This is often used when pulling contours or break-lines through dense vegetation. Splice may be used to remove the end portion of the line and continue from that point.

	Button	Description
1	Force	Forces a point into the buffer.
2	Resume	Resumes line collection.

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3	Splice	Digitizes the splice point. The line from this point to the end of the line will be erased, the instrument will be driven to the closest point on the current line, and digitizing will resume.
4	End line	Ends and saves the line.
5		
6		
7		
8		
9		
*		
0	Toggle Snap	Toggles snap on/off.
#	End	Ends Edit Line.

Ins Fly Line – Splice (Old style layout)

When this menu is entered, point collection stops and the operator may look around. This is often used when pulling contours or break-lines through dense vegetation. Splice may be used to remove the end portion of the line and continue from that point.

	Button	Description
1	Splice	Digitizes the splice point. The line from this point to the end of the line will be erased, the instrument will be driven to the closest point on the current line, and digitizing will resume.
2	Resume	Resumes line collection.
3	End line	Ends and saves the line.
4	Force	Forces a point into the buffer.
5		
6		
7		
8		
9		
*		
0	Toggle Snap	Toggles snap on/off.
#	End	Ends Edit Line.

Ins Fly Line – Snap

This menu will be used if snap is turned on from the Stream menu. It is a modified version of snap that allows snapping and ending a line. Due to the nature of Fly Line, snapping to end a line requires this menu.

	Button	Description
1	Snap and End	Snaps and ends the line.

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2	Resume	Resumes line by returning to the Stream menu.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#		

Ins Fly Line – Dig Manual

Points may be digitized manually when button 5 is pressed when in Stream mode.

	Button	Description
1	Dig point	Digitizes a new point.
2	Resume	Resumes stream digitizing.
3		
4	End line	Ends and saves the current line.
5		
6		
7		
8		
9		
*		
0		
#	Resume	Resumes stream digitizing.

2.1.1.18.9 Insert Line

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

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Insert Line (InsLin)

Type: Interactive Application

Places multiple point lines at user-determined locations.

Features and options include:

- Splicing the digitized line to an existing line or lines. Click here for more on Splicing
- Support of hydro-enforcement, forcing lines to flow up or downstream, during the collection of line points.
- Point distance control, as determined by the Maximum Segment Length parameter which ensures no two points are further apart than a user defined ground distance. This process is also referred to as densification.
- Support for High/Low point searching in which the lowest, mean or high VrPoint (LiDAR) is found and used according to user defined parameters. Please see High/Low Point Search for more information.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-32001
MOD=	Mode	1=Line 2=Spline
GRP=	Graphic pointer	1-1000
WID=	Line width	0-255
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32-bit
LNK=	Link number	32-bit
FC=	Feature code	15 char
DIG=x y z	Digitizes point	X Y Z
FKEY=name	Changes to function key parameters	Function key name
ARCMOD=	Arc flag mode	0 = Don't place arc flags 1 = Place arc flags
ENDMOD=	Sets the behavior of the end button	0=End 1=Digitize point at current location then end line. 2=Save line after collecting 2 points. 3=Create circle from the 3 points.
ATTZRU=	Attaches Z Rule	0 = Original

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		1 = Mean 2 = Line 1 (Same as original) 3 = Line 2 (Line attached to)
ATTNOD=	Nodes when attaching	0 = No 1 = Yes
DRIBAC=	Drives input device to the previous line point when Backup is pressed	0 = No 1 = Yes
RUNONCE=	If 1 then Insert Line will exit after the next line is saved	0 = No 1 = Yes
SPL=	Turns splicing on/off	0 = Off 1 = On
SPLSEA=	Sets splicing search distance	Splicing search distance in ground units
SPLZ=	Splices Z mode	0 = Blend elevations from splice line into base line(s) 1 = Inherit the first elevation of the base line for all points on the line after splice 2 = Slope the elevations on the splice line from blend points into the base line(s)
LAKLIN=	Makes a Lake Line in which the elevations of the line are set to the first point	0 = Off 1 = On
EXPSPL=	Explodes splined lines. If line mode is splined will place extra points on the line to approximate the spline curve.	0 = Off 1 = On
EXPFON=	Explodes fonted lines. If the line used a non solid line font, multiple lines will be placed to generate the line font graphics.	0 = Off 1 = On
EXPSF=	Explode line scale factor	If the explode spline option is on, this controls how many points are placed on the line. 1.0 = use normal Spline chord distance. Large numbers add more points, smaller numbers add fewer points.
MAXSEG=	Maximum line segment length. Maximum length of any segment on final line. Points will be added to segments longer than this length. All collected points on the line will be kept. See Maximum Segment Length	Distance in ground units. 0=Do not add points.
SEGZ=	Method of interpolating elevations of	0=Interpolate from existing points

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	points added. See Maximum Segment Length	1=Interpolate from existing DTM surface. 2=Use High/Low point search.
CLOTWO=	Allows lines to be closed with only two existing points.	0=No. Line must have three or more points before it can be closed. 1=Yes. Line can be closed when it has two or more points.
HYDENF=	Turns on/off the hydro-enforcement of lines during collection.	0=Off 1=On
SCMOD=	Defines coordinate to be set as Saved Coordinate	0=First point 1=Last point 2=Lowest point 3=Mean coordinate 4=Highest point
HYDDIR=	Defines the flow direction of lines during collection if hydro-enforcement is active.	0=Downstream 1=Upstream

Button Assignments

Ins Line - Main

Button	Description
1 Digitize pt	Digitizes a single XYZ location.
2 Close	Closes the current line but does not save the line.
3 Backup	Deletes the last point on the current line.
4 End	Ends and saves the current line.
5 Attach	Attaches to an existing line.
6 Arc	Fits an arc through the last three line points.
7 Enter	Allows entry of line properties or parameters. Also allows the placement of a point by coordinate, azimuth/distance or bearing/distance.
8 Enter Z	Allows entry of an elevation.
9 Attach & run	Attaches and runs along an existing line copying common points. See Z Rules when using Attach and Run for more information.
* Menu board	Makes selection from Menu Board
0 Toggle snap	Toggles snapping on / off.
# End	Ends Insert Line.

Ins Line – Enter

Button	Description
1 Properties	Allows entry of line properties such a layer, mode and graphic pointer.

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2 Coordinate	Allows the placement of a point by entering a coordinate position.
3 Azimuth	Allows the placement of a point by azimuth and distance.
4 Bearing	Allows the placement of a point by bearing and distance.
5	
6	
7 Params	Allows the setting of parameters.
8	
9	
*	
0	
#	

Z Rules when using Attach and Run

The following information describes how the Z is handled when using Attach and Run.

If noding is on, then the two node points added to the original line (the one being attached to) are always interpolated from the surrounding original line points.

The Z rule applies to the points added to the new line depending on the current Z rule settings as follows:

- **Original:** The beginning and ending attachment points on the new line are set to whatever the Z value was when digitizing the attachment points. The points added that run along the original line are set to same Z as the original line points.
- **Mean:** The beginning and ending attachment points on the new line are set to the mean of the active Z and the interpolated Z from the surrounding original line points. The points added that run along the original line are set to same Z as the original line points.
- **Line 1:** Behaves the same as Original.
- **Line 2:** The beginning and ending attachment points on the new line are set to the interpolated Z from the surrounding original line points. The points added that run along the original line are set to same Z as the original line points.

Splicing

It is possible to splice the current line into another existing line. It is also possible to splice the current line into two existing lines. Parameters may be set to splice automatically based on the position of the end points of the current line. When using Insert Line for splicing, it is not necessary to set any of the line properties such as Layer and Graphic Pointer. The resulting spliced will have the properties from the existing line. If a splice is made between two existing lines, the properties for the new line will be inherited from the first existing line which is the line

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closest to the start point on the new line.

Splicing is set up by turning on the splicing mode. This can be done from the Enter button (Button 7) then the Params button (Button 7). The splice search distance may be set here also. The splice flag and search distance may also be set from the Spl= and SplSea= key-ins. For example; a key-in of Spl=1 SplSea=20 would turn splicing on and set the search distance to 20 ground units. These key-ins may be placed on a Function Key so Insert Line may be started with splicing set.

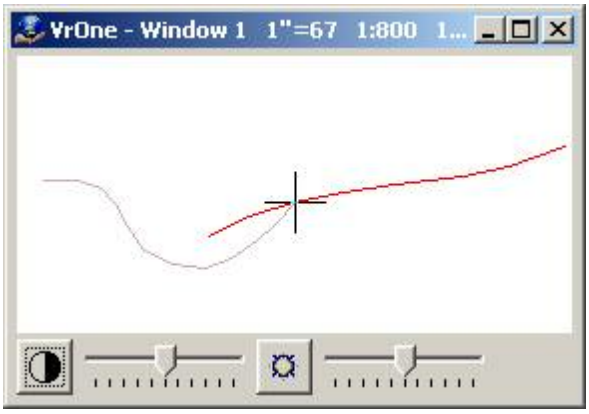
One of three splicing elevation modes may be selected when splicing. The splicing Z mode may be set in Parameters (button 7, button 7) in "Splice elevation mode" or may be set with the SplZ= key-in.

- **Blend (SplZ=0)** – The elevations of the end point(s) on the splice line will be blended into the existing line(s). The elevation(s) of the existing line will be used and the elevation(s) of the end points on the splice line will be modified to match.
- **Inherit (SplZ=1)** – The elevation of the fist point on the existing line will be inherited by all points on the resulting line. After splicing the elevations of all the points on the line will be the same. This is a useful setting when splicing contour lines and should only be used when splicing features such as contours where a constant line elevation is assumed.
- **Slope (SplZ=2)** – The splice line elevations will be sloped based on the first and last point elevations of the splice line. The first and last points on the splice line will first be blended into the existing line(s) as described in Blend (above), then the remainder of the points on the splice line will be interpolated based on these two elevations. NOTE: Both splice line end points must be blended into an existing line or lines for this option to take effect. If only one end of the splice line is blended, the Blend option will be used for the elevation of that line.

The results of splicing may be undone using the Undo command.

Following are several examples of splicing:

Example 1 – Undershoot Splice



The red line is the existing line and the grey line is the new line. The end point on the new line is

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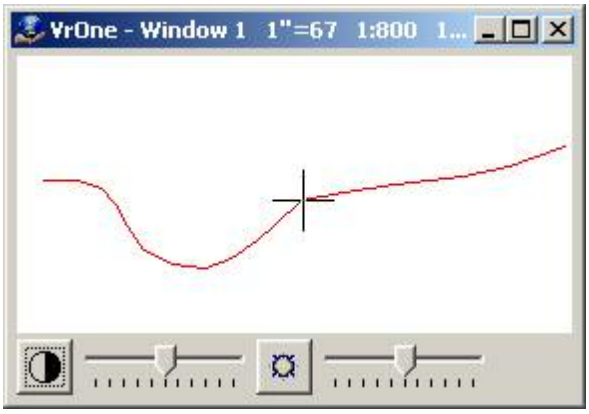
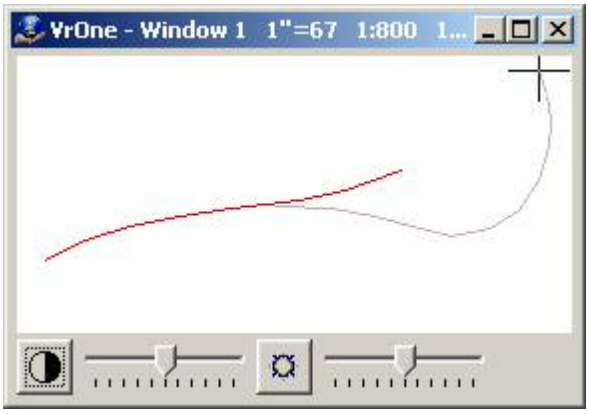
within the Splice Search Distance (SplSea=) of the existing line. The first point on the new line is not within the range of an existing line so this end of the line will not be spliced.

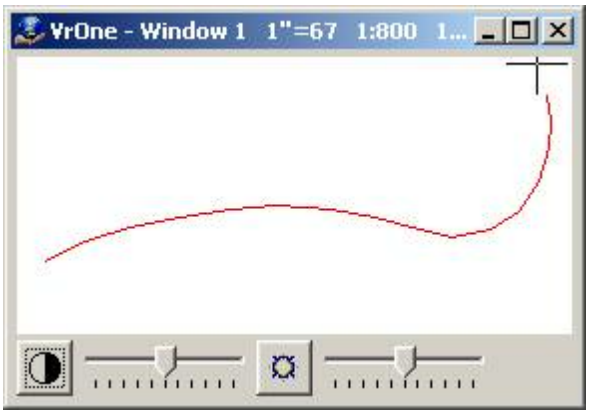


When the new line is ended it is spliced into the existing line. The new line inherits the properties of the existing line.

Example 2 – Overshoot Splice



The red line is the existing line and the grey line is the new line. The first point on the new line is within the Splice Search Distance (SplSea=) of the existing line. The last point on the new line is not within the range of an existing line so this end of the line will not be spliced.



When the new line is ended, it is spliced into the existing line. The new line inherits the properties

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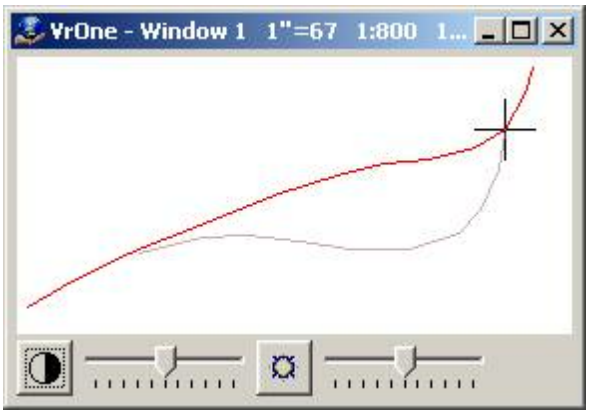
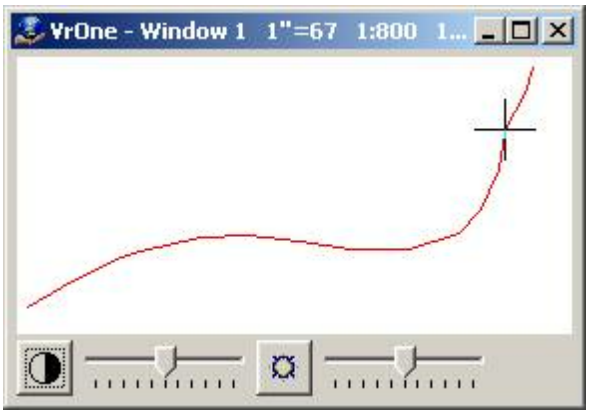
of the existing line.

Example 3 – Two Point Splice

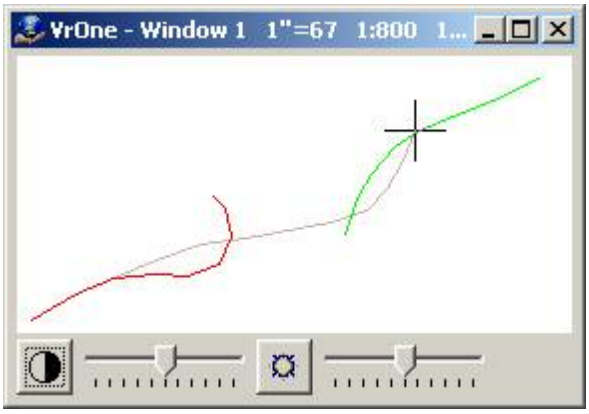


The red line is the existing line and the grey line is the new line. Both the first point and end points on the new line are within the Splice Search Distance (SplSea=) of the existing line.



When the new line is ended, it is spliced into the existing line.

Example 4 – Two Line Splice



The red and green lines are existing lines and the grey line is the new lines. The first point is within the Splice Search Distance (SplSea=) of the red line and the end point is within the range of the green line.

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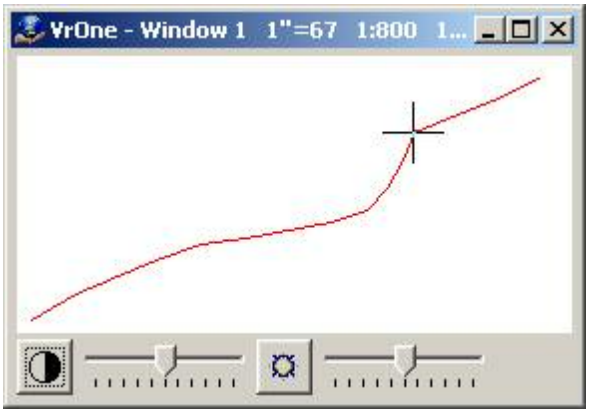

When the new line is ended, it is spliced into the existing lines. Notice the spliced line assumes the line properties of the first existing line.

Maximum Segment Length

It is possible to set a parameter so that no two points are further apart than a user specified distance. The Maximum Segment Length definition will add points to the line for segments longer than this distance. The distance is specified in ground units and a value of zero does not insert any points.
An additional parameter of "Maximum segment length elevation mode" determines how the elevations of the interpolated points are to be computed. Options are as follows:

- "**Interpolate**" : Computes the elevation from the points before and after the added point;
- "**Use Z Source**": Interpolates the elevation from the active DTM surface if the Z Source is set to "DTM Surface if Active";
- "**Use High/Low search**": Uses the current High/Low VrPoint search parameters and applies the results to the interpolated point.

NOTE: If High/Low searching is turned off or there are no VrPoints in the currently open Workspaces, the "Interpolate" option will be used.

Hydro Enforcement

When hydro-enforcement is active, each newly digitized point must conform to the specified elevation flow of the line. If the new point would cause the line to flow in the wrong direction, the alert beep is sounded and the point is ignored. The alert beep sound may be set in Edit Beep (EdiBee). Hydro-enforcement and the flow direction is set in Enter (Button 7) -> Params (Button 7) dialog or may be set using the HydEnf= and HydDir= key-ins.

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Vr Mapping

Insert Line Text (InsLte)

Type: Interactive Application

Inserts text on an existing line. The line to place text on and the location of the text are identified by the user. Options include several ways to handle the broken portion of the line. Insert Line Text allows the digitization of an intersect line for placement of multiple line labels.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal
JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
SLT=	Text slant	0-180 degrees
TEXSOR=	Source of text	0=Elevation on line 1=Other text
OTHTEX=	Other text	511 characters
DEC=	Decimal accuracy for elevation	0-10
LAYMOD=	Layer mode	0=Use line layer 1=Use text layer
TEXLAY=	Text layer	1-10001
ROTMOD=	Rotation mode	0-2 0=Rotate along line points increasing 1=Rotate along line points decreasing 2=Rotate window right reading

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OFFSET=	Text offset	Inches | Mm
BREMOD=	Break mode	0-4 0=Break line into two lines 1=Hide line under text 2=Place break points on line only 3=Place broken section in another layer 4=Don't break line
BRELAY=	Layer for line break.	1-10001
TARLAY=	Layers containing lines to label after digitizing an intersect line	Number Line (1-10001)
ROTPER	Rotate the text labels perpendicular to the digitized line	0-1 0=No 1=Yes

PARAMETERS

Source of Text (TexSor=)

Defines the source of the text to label. The elevation of the line is normally placed as a label, but it is possible to place other text.

Other Text (OthTex=)

Defines text to be used as the line text label if Source of Text is defined as other (TEXSOR=1).

Decimal Accuracy (Dec=)

Defines the number of places to the right of the decimal point to display in elevation line text labels.

Layer Mode (LayMod=)

Specifies the layer in which to place the line text label. Either the layer of the line or a user-defined layer may be used.

Text Layer (TexLay=)

Specifies the layer to use for the line text label if the Layer Mode is set to Use text layer (LAYMOD=1).

Rotation Mode (RotMod=)

Defines the rotation mode to be used when placing line text labels. The following options are supported:

0=Rotate along line points increasing

1=Rotate along line points decreasing

Text Offset (Offset=)

Defines in inches or millimeters the distance from the center of the line to place the text. A negative number places the text below the line.

Break Mode (BreMod=)

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Specifies the action to take when breaking a line to place line text:

0=Break line into two lines.

1=Hide line under text.

2=Place break points on line only.

3=Place broken section in another layer.

4=Do not break line.

Break Layer (BreLay=)

Specifies layer in which to place broken portion of line if the Break Mode is set to 3.

Target Layer (TarLay=)

Specifies the layer(s) whose lines should be labeled after an intersect line is digitized. These layers normally contain contour lines.

Rotate Perpendicular (RotPer=)

Specifies whether text labels are rotated perpendicularly to the digitized line when using the Dig Line mode. If set to "No", the Rotation Mode will be used to rotate the text labels.

Button Assignments

Ins Lte – Lock On

	Button	Description
1	Id line	Identifies the line on which to place text.
2	Dig line	Overlays Insert Line and allows an intersect line to be digitized.
3	Batch	Places text labels in batch mode. (see below)
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends application.

Ins Lte – Break

	Button	Description
1	Dig break point	Identifies the line break point.
2	Abandon	Abandons Break and returns to the Lock On menu.
3		

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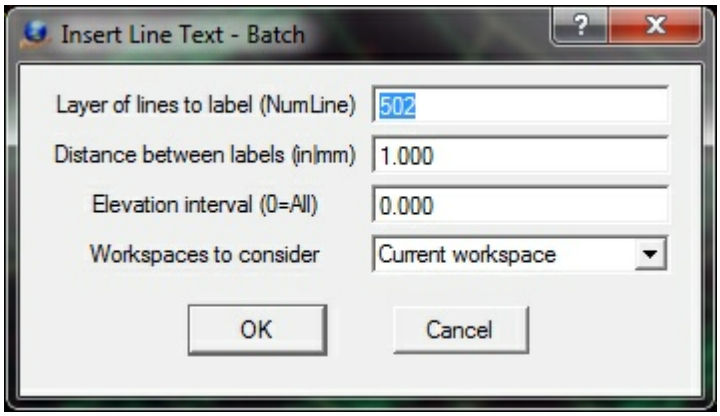
4		
5		
6		
7	Enter params	Enter parameters from dialog box.
8		
9		
*		
0		
#	Abandon	Abandons Break and returns to the Lock On menu.

Ins Lte – Batch

Line-based text labels may be placed on lines in a batch mode. Linear distance is used to set the spacing between labels on each line. Other parameters control the layers to be considered and an optional elevation interval.



The Insert Line Text Batch label dialog.

Layer of lines to label (NumLine)

Defines the layer(s) on whose lines to place text labels. A number line may be used to define multiple layers.

Distance between labels (in|mm)

Defines in inches or millimeters the distance between text labels.

Elevation interval (0=All)

Sets a contour interval to determine, based on elevation, the lines on which to place text. Setting this parameter to zero will cause all the lines in specified layers to be used.

Workspaces to consider

Defines the workspaces to consider when running batch node.

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Vr Mapping

Insert Multiply Parallel Lines (InsMul)

Type: Interactive/Batch Application

Inserts up to 10 parallel lines from an existing base line.

Detailed Description

Inserts up to ten parallel lines with known XYZ offsets from an existing base line. The lines to be paralleled are defined and saved in a Parallel parameter file. Insert Multiple Parallel Lines offers the following modes:

- Interactive – The base line is identified by the user and parallel lines are placed based on the current Parallel parameter file.
- Batch – Lines within layer(s) are used as base lines. These layers may be in the current workspace or all open workspaces. This application may be run in batch mode from a macro.
- From OnEnd Command – The last line saved is used as the base line. This is useful to place parallel lines each time a base line is saved. The OnEnd command is defined from a VrOne Function Key.

When running in batch mode, layers that are turned off will not be used even if they have been specified. Insert Multiple Parallel lines is undoable.

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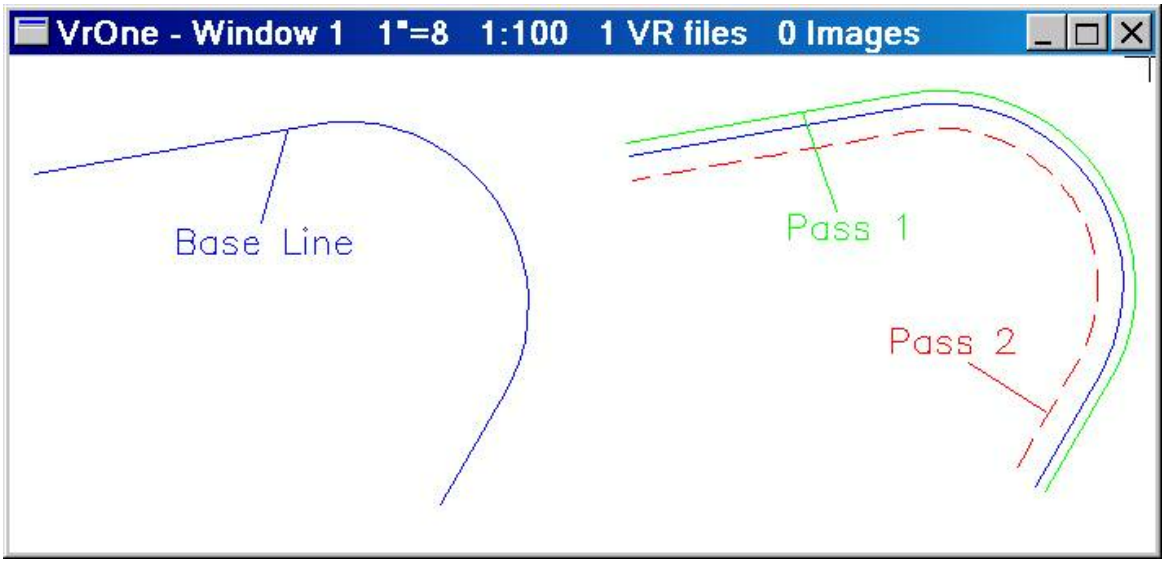

The original line to be paralleled is called the base line. The new parallel lines are placed as passes from the parallel parameter file.

Local Commands

Key-in	Description	Range
WS=, WSTC=	Workspaces to consider when running in batch	0-1
LAY=	Layers containing lines to parallel when running in batch.	1-10,001 (Number line)
PARFIL=	Loads a previously defined parallel parameter file.	File name with path. Example: C:\jobs\param\CurbGutter.mpp
RUN	Runs Insert Multiple Parallel in batch mode with current parallel parameters.	
DIGLAST	Inserts parallel lines using the last saved line as the baseline.	

Workspaces to consider (WS= or WSTC=)

Defines the workspaces to consider when running in batch mode.

Layers containing base lines (Lay=)

Defines the layer(s) to search for existing base lines when running in batch mode.

Parallel parameter file (ParFil=)

Loads a previously defined parallel parameter file.

Run (Run)

Runs application in batch mode using the current Workspace to consider, Layers to consider, and Parallel parameter file. This application will end after placing the parallel lines when using the Run command.

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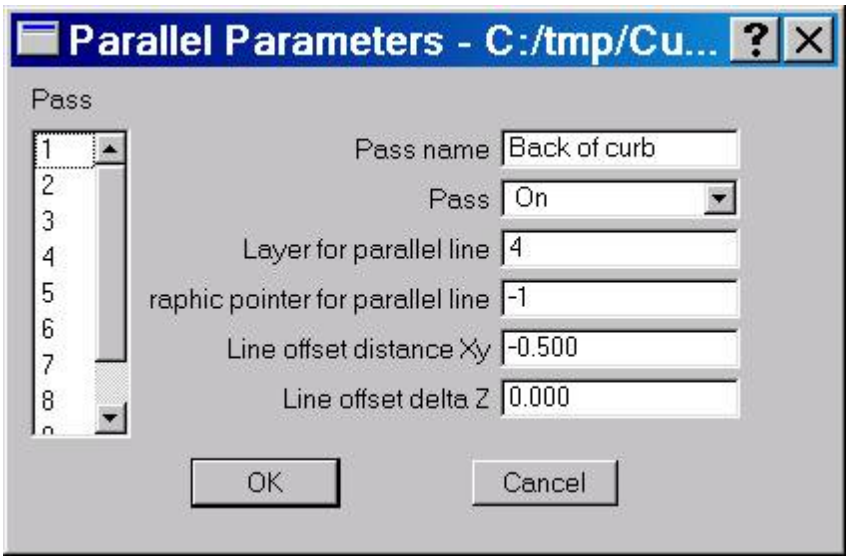
Use last saved line (DigLast)

Inserts parallel lines using the last save lines as the base line. This is useful when running Insert Parallel Lines from a Function Key's OnEnd command. This application will end after placing the parallel lines when using the DIGLAST command.

Parallel Parameters



Pass

Allows entry/edit of up to 10 parallel passes.

Pass name

Specifies the name of each parallel pass (informational purposes only; does not modify image).

Pass

Turns individual passes on or off.

Layer for parallel line

Specifies the layer into which to place the line created by the current pass. An argument of -1 specifies that the new line should be placed in the same layer as the base line.

Graphic pointer of parallel line

Specifies the graphic pointer for the line placed by the current pass. An argument of -1 specifies that the new line should use the same graphic pointer as the base line.

Line offset distance Xy

Defines the distance in ground units from the base line to place the new parallel line. Positive numbers place the line to the right of the base line; negative numbers to the left.

Line offset delta Z

Defines in ground units the delta elevation to apply to each point on the parallel line.

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Button Assignments

Rev Line – Lock on

	Button	Description
1	Id line	Identifies base line from which to create parallel lines.
2	Parallel layer	Runs in batch mode.
3	Load params	Loads parallel parameter file.
4	Save params	Saves current parameters as parallel parameter file.
5		
6		
7	Enter params	Enter/edit parallel parameters.
8	Init params	Initializes parallel parameters.
9		
*		
0		
#	End	Ends application.

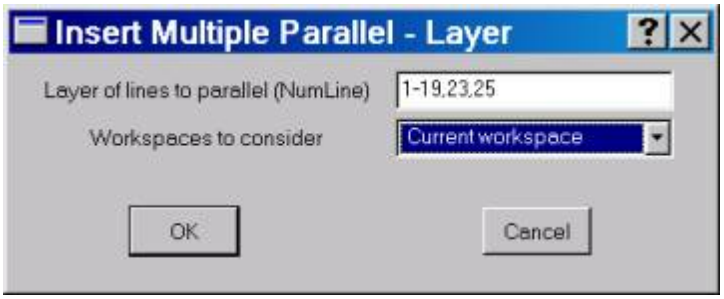
MODES

Interactive Mode

Allows a base line to be identified. After the base line identified is confirmed, the parallel lines are placed based on the current parameters. Insert Multiple Parallel Lines starts in Interactive Mode.

Batch Mode

Reads baselines from user-defined layers. Workspaces to consider include the current workspace or all open workspaces.



From OnEnd Command

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Insert Multiple Parallel lines may be run unattended from a VrOne Function Key OnEnd command. Using this mode allows parallel lines to be placed after a line is saved. Following is and example of using an OnEnd command.

```
InsMul,ParFil=c:\jobs\01-345\CurbGutter.mpp,DigLast
```

`InsMul` – Starts application
`ParFil=c:\jobs\01-345\CurbGutter.mpp` – Loads a previously defined parallel parameter file. The file postfix for a parallel parameter file is .mpp.
`DigLast` – Uses the last saved line as the base line. The application exits after the new parallel line(s) are placed.

Running from a macro

Insert Multiple Parallel Lines can be run in batch mode from a macro. The following is an example of a macro that runs the application in batch mode:

```
InsMul
ParFil=c:\jobs\01-345\CurbGutter.mpp
Ws=0
Lay=1-19 23 25
Run
```

After the new parallel lines are placed, Insert Multiple Parallel Lines ends.

2.1.1.18.12 Insert Orthogonal Corner

Vr Mapping

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Insert Orthogonal Corner (InsOrc)

Type: Interactive Application

Inserts an orthogonal line which results in a squared polygon based on the first two points read and subsequent polygon corner points. The line may be closed back to the original line segment or left open. Each squared polygon is started by reading two corner points along one side of the

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polygon. This is normally the longest or most visible side. Subsequent points are read on polygon corners. The polygon must be read in a clockwise or counterclockwise direction from the base line.

A Squaring Tolerance may be specified. If the next corner point is within this tolerance the resulting line will be orthogonal to the original line segment. If the next corner point is outside this tolerance then the line point will fall where digitized resulting in an un-squared side. Each corner point my turn 0, 90, 180 or 270 degrees from the previous segment. If a corner point is 0 degrees from the previous line segment then the new line will be a straight line from the previous line.

While digitizing, a rubber-banded line will show the direction and location of the next point. If the current cursor position is within the Squaring Tolerance then the line will be shown orthogonal to the first line on the polygon.

There are three polygon squaring applications in Vr. See Insert Square Line (InsSqu) and Insert Orthogonal Line (InsOrt) for more information about the other two available polygon squaring applications.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
MOD=	Mode	1=Line 2=Spline
GRP=	Graphic pointer	1-60
WID=	Line width	0-255
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	15 char
DIG=x y z	Digitizes point	X Y Z
FKEY=name	Changes to function key parameters	Function key name
SQUTOL=	Sets the Squaring Tolerance	5 - 40 degrees

Button Assignments

Ins Orthog Cor - Main

Button	Description
1 Dig	corner 1 – Digitize the first corner point of the base line. corner 2 – Digitize the second corner point of the base line. corner – Digitize a point on the next polygon corner.

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2 Close	Closes the polygon to the first vertex and saves.
3 Backup	Deletes the last point on the current line.
4 End	Ends and saves the current line without closing.
5	
6	
7	
8	
9	
* Menu board	Makes selection from Menu Board.
0 Toggle snap	Toggles snapping on / off.
# End	Ends Insert Orthogonal Corner.

Point Measurement Sequence



Points 1 and 2 define the base line and are read on the corners' longest side in this example. These points establish the azimuth of the squared polygon. Points 3 through 6 are observed on subsequent polygon corners. The polygon may be read in clockwise or counterclockwise direction and corners must be read in sequential order. After point 6 has been read the polygon may be closed.

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NOTE: When closing a polygon, the last point observed (point 6 in this case) is adjusted to be orthogonal with the first point observed if it is within the Squaring Tolerance.

Vr Button Presses



The observation of the base line and the subsequent polygon corners are made with the Vr button 1. To close the polygon after the final line corner has been observed, Vr button 2 is pressed. Note the last line corner must be observed before Vr button 2 can be pressed. To leave a polygon open, Vr button 4 may be pressed.

2.1.1.18.13 Insert Orthogonal Line

Vr Mapping

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Insert Orthogonal Line (InsOrt)

Type: Interactive Application

Inserts an orthogonal line in which results in a squared polygon based on the first two points read and subsequent segment points. The line may be closed back to the original line segment or left open. Each line segment assumes a 90 degree turn from the previous line segment. Each squared polygon is started by reading two points along one side of the polygon. This is normally the longest or most visible side. Subsequent points are read anywhere along following line segments. The polygon must be read in a clockwise or counterclockwise direction from the base line.

Since each line segment must turn 90 degrees from the previous, it is not possible to have un-squared segments using Insert Orthogonal Line. See Insert Square Line (InsSqu) for squaring ability with un-squared line segments. See also Insert Orthogonal Corner (InsOrc) which is similar to this application in which the polygon corners are read and allows un-squared segments.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
MOD=	Mode	1=Line 2=Spline
GRP=	Graphic pointer	1-60
WID=	Line width	0-255
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	15 char
DIG=x y z	Digitizes point	X Y Z
FKEY=name	Changes to function key parameters	Function key name
ZMOD=	Sets the elevation mode	0 = Interpolate 1 = Use elevation of first point 2 = Mean elevations

Button Assignments

Ins Orthog - Main

Button	Description

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1 Dig	base pnt 1 – Digitize the first point of the base line. base pnt 2 – Digitize the second point of the base line. vertex pnt – Digitize a point on the next vertex.
2 Close	Closes the polygon to the first vertex.
3 Backup	Deletes the last point on the current line.
4 End	Ends and saves the current line without closing.
5	
6	
7	
8	
9	
* Menu board	Makes selection from Menu Board.
0 Toggle snap	Toggles snapping on / off.
# End	Ends Insert Orthogonal Line.

Point Measurement Sequence



Points 1 and 2 are used to define the base line and are read on the longest side in this example. These points do not need to be read on the corners and are used to establish the azimuth of the squared polygon. Points 3 through 7 are observed anywhere on each side segment. The polygon may be read in clockwise or counterclockwise direction. Segments must be read in sequential order, each turning 90 degrees from the previous segment.

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Vr Button Presses



Observation of the base line and subsequent line segments are made with the Vr button 1. The Vr button 2 closes the polygon after the final line segment has been observed. The last line segment must be observed before Vr button 2 can be pressed. Pressing Vr button 4 allows a polygon to be left open. Before pressing Vr button 4, the final corner should be observed instead of the line segment so the location and end of the open line segment can be computed.

2.1.1.18.14 Insert Paint Line

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Vr Mapping

Insert Paint Line (InsPai)

Type: Semi-automatic interactive application

Detailed Description

Semi-automatic tracing of linear intensity features particularly suited for road paint lines in dense

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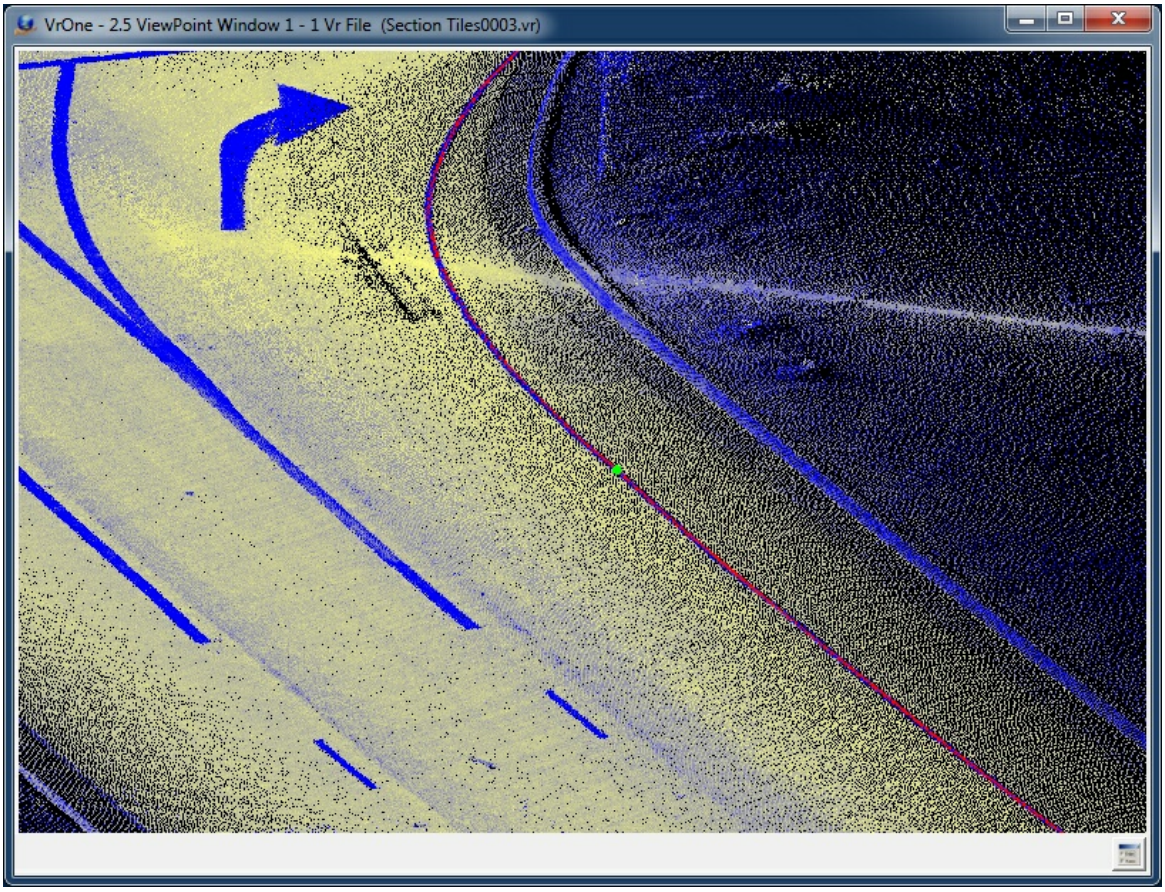
LiDAR and point cloud data. The user roughly identifies a single point on the feature and the algorithm traces it in both directions until termination/failure. The user is able to specify requirements for line continuity, which allow interpolation over breaks in the line due to obstruction, worn paint, or intentional voids (as in dashed lines). The result can be interactively navigated for quality control and possible editing.

Insert Paint Line is designed to work with LiDAR and point cloud data which must include intensity attribute data for each point. This application may be started from a Function Key.



Paint lines

Button Assignments

Insert Paint Line – Main

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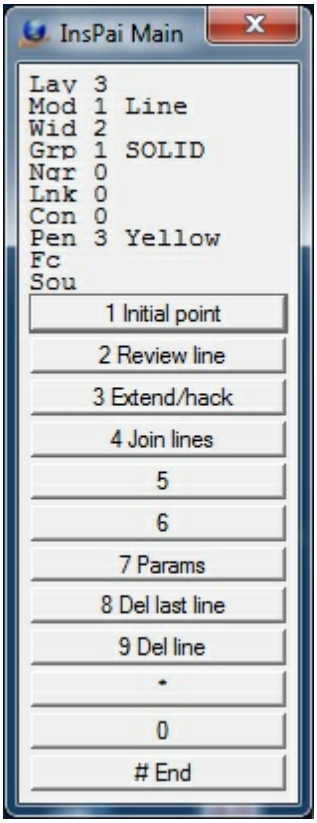

Main Menu

When Insert Paint Line starts, an initial point or points along the paint line needs to be digitized. This initial data provides seed information so the application can follow the paint line and place a 3D line.

	Button	**Description**
1	Initial point	Identifies one or points along a paint line to provide initial data to start the paint line insertion.
2		
3	Review line	Review an existing line
4	Extend/hack	Extend or hack an existing line
5	Join lines	Joins two existing lines using a user defined join point
6		
7	Enter params	Enter/edit Insert Paint Line parameters (see Insert Paint Line Parameters)
8	Del last line	Deletes the last saved line
9	Del line	Deletes a line by identifying an existing line
*		
0		
#	End	Ends application

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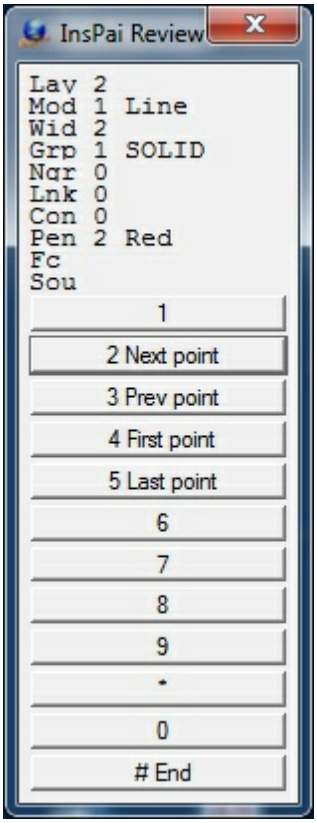
Insert Paint Line – Review

Review drives the cursor along an existing, user identified line.



Review Menu

	Button	Description
1		
2	Next point	Moves cursor to the next line point
3	Prev point	Moves cursor to the previous line point
4	First point	Moves cursor to the first point on the line
5	Last point	Moves cursor to the last point on the line
6		
7		
8		
9		
*		
0		
#	End	Ends review and returns to the main menu

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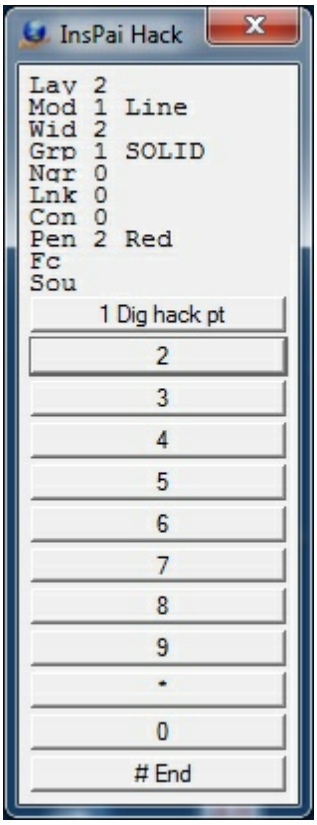
Insert Paint Line – Extend/hack Line

The cursor may be placed near an existing line and the closest line will be extended to or hacked at the point digitized (the hack point). If the line is to be extended the endpoint on the line will be extended along the azimuth of the last line segment. If the line is to be hacked the shortest side of the line will be hacked at a 90 degree offset from the hack point. After the hack point has been digitized and the line extended or hacked, the result may will be displayed and may be accepted or rejected before re-saving the line.



Extend/hack Menu

	Button	Description
1	Dig hack pt	Digitizes the hack point when extending or hacking a line
2		
3		
4		
5		
6		
7		
8		
9		
*		

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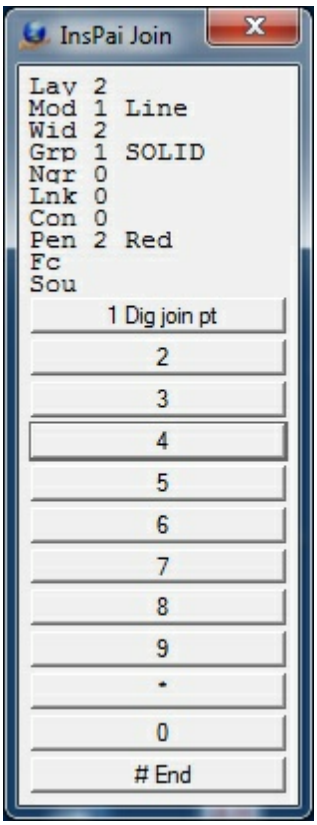
0		
#	End	Ends Extend/hack and returns to the main menu

Insert Paint Line – Join Lines

Two existing lines may be joined by placing the cursor near both lines and digitizing a point (the join point). The join point will be the common point between the two lines. Lines will be extended or hacked to the join point. After the join point has been digitized and the lines joined, the result may will be displayed and may be accepted or rejected before re-saving the lines.



Join Lines Menu

	Button	Description
1	Dig join pt	Digitizes the join point when joining two lines
2		
3		
4		
5		
6		
7		
8		

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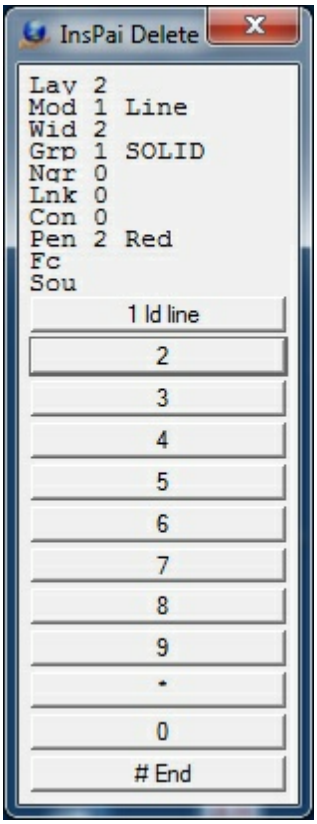
9		
*		
0		
#	End	Ends Join Lines and returns to the main menu

Insert Paint Line – Delete Line

Deletes an existing line. When a line is identified to be deleted it may be accepted or rejected before deletion.



Delete Line Menu

	Button	Description
1	Id line	Identifies the line to delete
2		
3		
4		
5		
6		
7		
8		

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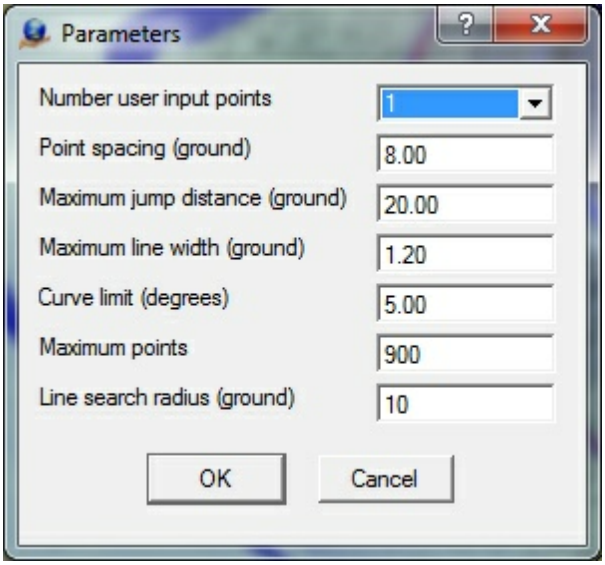
9		
*		
0		
#	End	Ends Delete Line and returns to the main menu

Insert Paint Line Parameters

The Insert Paint Line parameters may be defined by pressing button 7 from the Main menu.



Parameters

Number user input points

The user may select to start a paint line trace with either one or two input points. One point starts are usually successful, but are somewhat more sensitive to other parameters. If a data set is noisy, sparse and/or has lines that vary widely in width it may simply be easier use a single wide 'Max line width' and do two point starts. (default=1)

Point spacing (ground)

The typical distance between points on the line. Rapid curvature, noise, lines ending etc. may cause the point density to increase. (ground, default=8)

Maximum jump distance (ground)

The maximum acceptable void in the the line's signal. Voids are caused by vegetation, debris, spare data, dashed lines, etc. As long as these voids are less than 'Max jump distance' across, the algorithm will try to bridge across them. (ground, default=20)

Maximum line width (ground)

The maximum acceptable width (measured edge to edge) of the paint line. (ground, default=1.2)

Curve limit (degrees)

The maximum allowed change in direction for a new line segment in degrees. The smaller the curve limit the more points will be included while the line changes direction. (degrees, default=5)

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Maximum points
This parameter limits the number of points that are used in processing each line segment. This prevents lag when processing very dense data. (default=300)

Line search radius (ground)
Search radius and endpoint extend distance when searching for lines to join or extend. (ground, default=10)

Local Commands

The following key-ins may be used to change run-time parameters. They may be keyed in, placed in macros or more commonly placed in the Local Args field in a Function Key.

Key-in	Description	Range
Lay=	Layer number	1-32001
Mod=	Mode	1=Line 2=Spline
Grp=	Graphic pointer	1-1000
Wid=	Line width	0-255
Pen=	Pen number	1-256
Con=	Construction flag	0-1
Ngr=	Non graphic pointer	32-bit
Lnk=	Link number	32-bit
Fc=	Feature code	15 char
NumPts=	Number user input points	1 or 2 (default=1)
PntSpa=	Point spacing	ground (default=1)
MaxJum=	Maximum jump distance	ground (default=20)
MaxWid=	Maximum line width	ground (default=1.2)
MaxAng=	Line curve limit	degrees (default=5)
MaxPts=	Maximum points	number of points (default=300)
LinSea=	Line search radius	ground (default=10)

Vr Mapping

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Insert Parallel Line (InsPar)

Type: Interactive Application

Places a parallel line from a user-defined baseline. The distance from the base line may be specified by a digitized point or an entered offset distance. The elevation difference from the base line or previous line may also be specified. Parameters for the new line may be obtained from the base line or a user-defined Function Key.

Local Commands

Key-in	Description	Range
PARMOD=	Parameter mode	Specifies where to get line parameters for the parallel line. 0 = Base line 1 = Function Key
XYOFF=	X,Y Offset distance	Ground units
ZOFFMOD	Z offset mode	Specifies which parameter to use for the Z offset 0 = User-defined Z offset 1 = Z offset from digitized point
ZOFF=	Z offset distance	Ground units
FKEY=	Function key name	64 characters

PARAMETERS

Parameter Mode (ParMod)

Specifies the location of the line parameters for the new offset line. Entering 0 copies the line parameters from the baseline. Entering 1 copies the line parameters from the specified function key. If the function key does not exist, parameters from the base line are used.

Offset Distance (Off)

Defines offset distance in ground units to place the new line from the base line. If this parameter is entered from a dialog box by pressing "Enter Offset", the line is placed immediately. If this parameter is entered from a key-in (i.e. OFF=12.5), it is used only as a default.

Z Offset Mode (ZOffMod)

Specifies the mode by which Z Offset is determined, either user-defined or computed from the base line to the digitized point.

Z Offset Distance (ZOff)

Defines the vertical distance by which to offset each new line from the base line or the previous line. If the parallel is repeated using button 3, the vertical offset accumulates. This makes it

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possible to parallel items such as steps.

Fkey Name (Fkey)

Specifies the function key whose parameters are used for the new line. Note that the Parameter Mode must be set to 1 for the function key to be used. If Insert Parallel Line is started from a function key, this parameter is automatically set to the function key name.

Button Assignments

Ins Par Line - Lockon

	Button	Description
1	Id line	Identifies the line to parallel.
2		
3		
4		
5		
6		
7	Enter Params	Enter parameters from dialog box.
8		
9		
*		
0		
#	End	Ends Insert Parallel Line.

Ins Par Line – Offset

	Button	Description
1	Dig offset	Digitizes the location for the new line.
2	Enter offset	Allows entry of an offset in ground units. After the distance is entered the new line is placed.
3	Repeat last	Repeats the last offset. The offset distance and Z offset accumulate if the action is repeated.
4	New base line	Allows the identification of a new base line.
5		
6		
7		
8		
9		
*		
0		
#	End	Ends Insert Parallel Line.

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2.1.1.18.16 Insert Road

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Insert Road (InsRoa)

Type: Interactive/Batch Application

Inserts up to 9 parallel lines with real-time, user-determined offsets from a digitized base line.

Detailed Description

The offset lines are displayed in real-time as a base line is digitized. The distance from the base line to the offset line(s) may be chosen manually through point digitization. The elevation (Z) offset from each digitized point along the base line to the point on the offset line may be determined by a digitized point or by a user defined Z offset.

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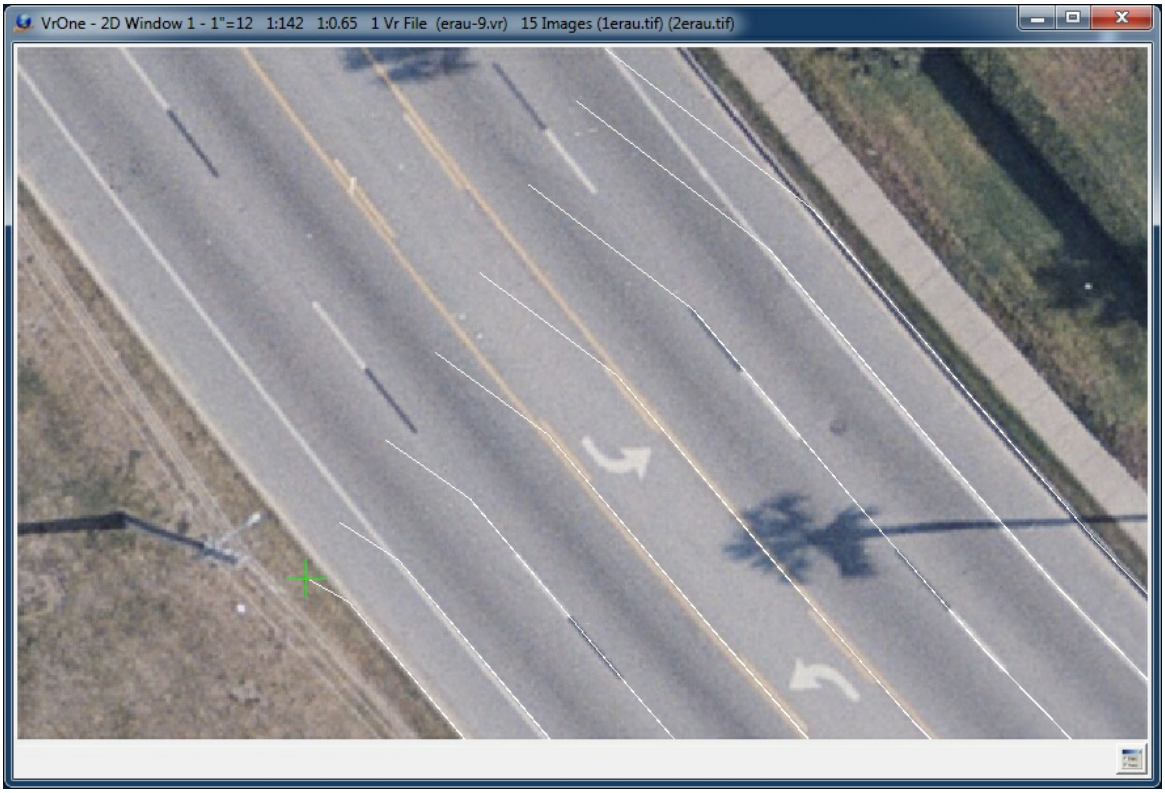

An example of digitizing eight lines.

In the example above, seven lines are being offset from a digitized base line (shown with a green cross). The cursor is shown off the intended road edge to highlight the interactive display of the base line and offset lines during the collection process.

Button Assignments

Insert Road – Start

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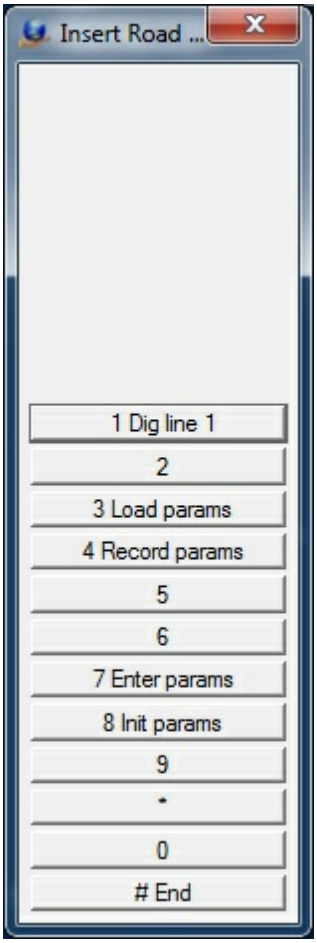

The Insert Road Start dialog

When Insert Road starts, initial points for the base line and offset lines need to be digitized. These initial points provide the XY offset (and, if specified, Z offset). Even if a line's XYZ offset is defined, the initial point on the offset line must be digitized.

	Button	**Description**
1	Dig line n	Identifies the initial line point to digitize (n= 1-number of lines specified in parameters)
2		
3	Load params	Loads an Insert Road parameter file.
4	Save params	Saves current parameters as an Insert Road parameter file with a user-defined file name
5		
6		
7	Enter params	Enter/edit Insert Road parameters (see Insert Road Parameters)
8	Init params	Initializes the Insert Road parameters
9		

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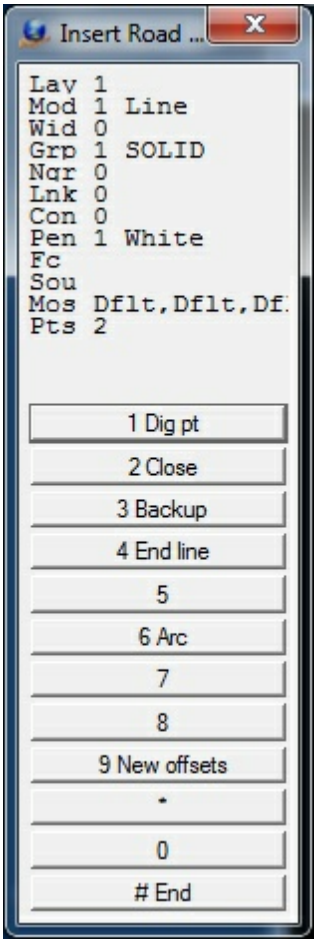
*		
0		
#	End	Ends application

Insert Road – Main



The Insert Road Main dialog

After the initial offset points have been digitized, points along the base line may be digitized. The corresponding points along the user defined offset lines will be computed and displayed in real-time. This menu will remain active until "New offsets" or "End" is selected. When lines have been saved by pressing the "End line" button, new lines may be digitized using the current line offset parameters.

	Button	Description
1	Dig pt	Digitize point on base line
2	Close	Closes the current line but does not save the line
3	Backup	Deletes the last pint on the current line

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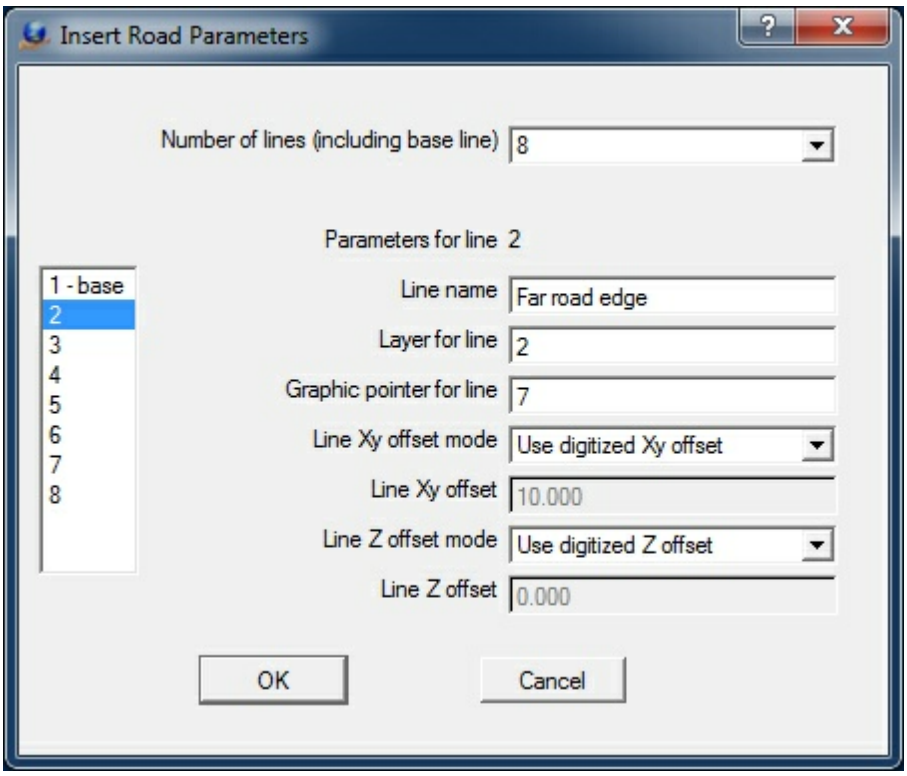
4	End line	Ends and saves the base line and offset lines
5		
6	Arc	Fits an arc through the last three line points on the base line and the offset line
7		
8	New offsets	Allows new line offsets to be digitized by returning to the Start menu
9		
*		
0		
#	End	Ends application

Insert Road Parameters



The Insert Road parameter dialog

The Insert Road parameters may be defined by pressing button 7 on the startup Menu Keys. The list box on the far left displays the currently active lines. Selecting a line number allows the entry/edit of the parameters for that line. The first line is always the base line.

Number of lines (including base line)
Specifies the number of lines to place (including the base line).

Line name
Defines the name of each line for user reference. This name is not stored with the line entity.

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Layer for line
Specifies the layer into which to place each line. If the layer number is set to -1 for any of the offset lines, the base line's layer is used. Layer number ranges from 1 to 32,000.

Graphic pointer for line
Specifies graphic pointer to use for each line. If the graphic pointer is set to -1 for any of the offset lines, the graphic pointer of the base line is used.

Line Xy offset mode
Determines the method by which the current line's XY offset is set. Options are:

- **Use digitized Xy offset:** Uses the distance from the first digitized base line point to the first digitized point on the offset line.
- **Use line Xy offset:** Uses the value in the "Line Xy offset" field.

Line Xy offset
Defines in ground units the XY offset of the line from the baseline if f "Line Xy offset mode" is set to "Use Line Xy offset".

Line Z offset mode
Specifies how the z offset distance is set for the current line. Options are:

- **Use digitized Z offset:** Uses the elevation difference from the first digitized base line point to the first digitized point on the offset line.
- **Use Line Z offset:** Uses the value in the "Line Z offset" field.

Line Z offset
Defines in ground units the Z offset of the line from the baseline if "Line Z offset mode" is set to "Use Line Z offset".

2.1.1.18.17 Insert Squared Line

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Insert Squared Line (InsSqu)

Type: Interactive Application

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Inserts a line and squares the line to one of several parameters. Supports squared and un-squared segments and helps with hidden corner placement. Lines may be closed and squared or left open and squared.

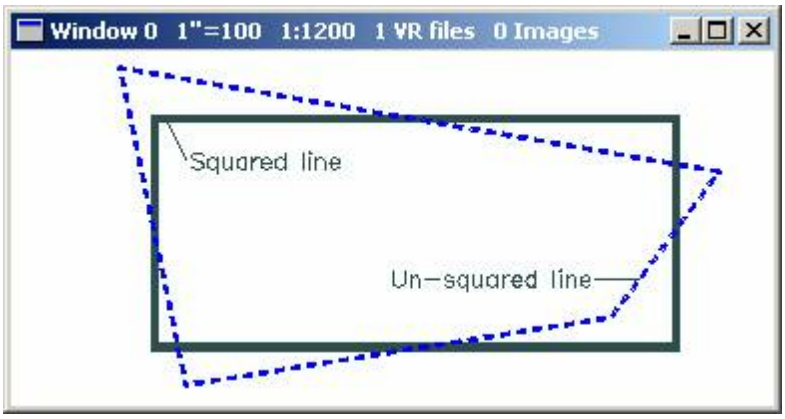
Detailed Description

Line segments are rotated about their midpoints to the Square to Azimuth at 0, 90, 180 or 270 degrees and re-intersected with the previous and next segments to square a polygon. Line segments greater than the Squaring Tolerance are not squared. Please note the example below is exaggerated.

Capabilities include:

- A hidden corner function, which reads visible tangent line points;
- Support for Attach,which allows the current line to be attached, trimmed, closed, and squared to an existing line.
- Interpolation of a closed, three-point polygon based on the two existing line segments. The resulting squared polygon is a four segment, five-point line.

See Insert Orthogonal Line (InsOrt) for an interactive application that inserts a squared polygon by observing line segments instead of polygon corners. See Insert Orthogonal Corner (InsOrc) for an interactive application that inserts a squared polygon by reading polygon corners.



During squaring conformation the following colors are used:

Cyan	Un-squared line
White	Squared line segments
Red	Un-squared

Sequential parallel line segments are removed before squaring.
The squaring tolerance is used to determine parallel lines.

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Local Commands

Key-in	Description	Range
LAY=	Layer number (1-10001L)	1-10001
MOD=	Mode (1=line 2=spline)	1=Line 2=Spline
GRP=	Graphic pointer (1-60)	1-60
WID=	Width (0-255)	0-255
PEN=	Pen number (1-256)	1-256
CON=	Construction flag (0-1)	0-1
NGR=	Non graphic pointer (32bit)	32 bit
LNK=	Link number (32bit)	32 bit
FC=	Feature code (15 char)	48 characters
FKEY=	Change to function key properties	Function key name
STF=	Square to flag.	0-3 0=Longest side 1=Square to azimuth 2=First side 3=Mean of all sides NOTE: This should NOT be used if there are un-squared sides on the polygon.
AZI=	Azimuth to square to	0-360 degrees
TOL=	Squaring tolerance	0-30 degrees
ATTMOD=	Allow attaching to existing lines	0-1
ATTDIS=	Attach search distance	Ground units
ATTCOP=	Close attached line by copying common points	0-1
ATTNOD=	Node existing line when attaching	0-1
ATTZRU=	Attach Z Rule	0-3
DRIOPT	Drive option after squaring	0=None 1=Drive to first point 2=Drive to last point 3=Drive to centroid

PARAMETERS

Square to Flag (Stf=)

Specifies the azimuth to which to square the polygon. The available Square to flags are as follows:

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0=Longest side

1=Use “Square to azimuth”

2=First side

3=Mean of all sides

NOTE: Flag 3 should NOT be used if there are unsquared sides on the polygon.

Square to Azimuth (Azi=)

The Square to Azimuth is the base azimuth to which all line segments are squared. Each line segment is rotated 0, 90, 180 or 270 degrees from its midpoint to the Square to Azimuth. Line segments outside the Squaring Tolerance are left unsquared.

Squaring Tolerance (Tol=)

Defines the degree measure of a line segment's azimuth greater than which that line segment is left unsquared.

Fkey Name (Fkey=)

Specifies function key from which the new line inherits line parameters. Normally, a function key starts this application and this key-in is not needed.

Attach Mode (AttMod=)

Turns attach mode on/off. If attach in turned on and the first point read on a polygon is within the search distance of an existing line, attach will become active.

Attach Distance (AttDis=)

Defines in ground units the distance that the first point read on a polygon must be within to activate the attach mode.

Attach Copy (AttCop=)

Specifies whether the attached line will be closed by copying common points from the “attach to” line to the new line.

Attach Mode (AttNod=)

Specifies whether the “attach to” line will be noded with one or two points from the end of the new line.

Attach Z Rule (AttZRu=)

Specifies the Z Rule to use when attaching.

Drive Option (DriOpt=)

Specifies the drive action after a line has been squared.

Button Assignments

Ins Square - Main

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	Button	Description
1	Digitize	Digitizes a line point.
2	Close	Closes, squares and saves line. If the current line has three points, the fourth is interpolated based on the two existing line segments.
3	Backup	Backs up to the previous point.
4	End line	Squares the line open and saves the line.
5	Hidden corner	Computes a hidden corner (see below).
6	Dig azimuth	Digitizes the Square to Azimuth.
7	Enter params	Enter parameters from dialog box.
8	Toggle squ to	Cycles through the available Square To options.
9	Toggle squaring	Turns squaring on/off.
*	Menu board	Make selection from the Menu board.
0	Toggle snap	Toggles snap on/off.
#	End	Ends Insert Parallel Line.

Ins Square – Verify

Once a line is squared, the verify step determines the action to take on the squared and non-squared line

	Button	Description
1	Accept	Accepts the squaring solution and saves the squared line.
2	Reject	Rejects the squaring solution discards the collected points.
3	Reject-Continue	Rejects the squaring solution and returns to the main Insert Squared Line menu.
4	Reject-Save	Rejects the squaring solution and saves the un-squared line.
5		
6		
7		
8		
9		
*		
0		
#		

Hidden Corner

The following sequence places a hidden hidden corner. The first button 1 press is read on the building corner. The next two button 1 presses are on the visible roof edge. A final button 5 press computes the hidden corner based on the three previous points.

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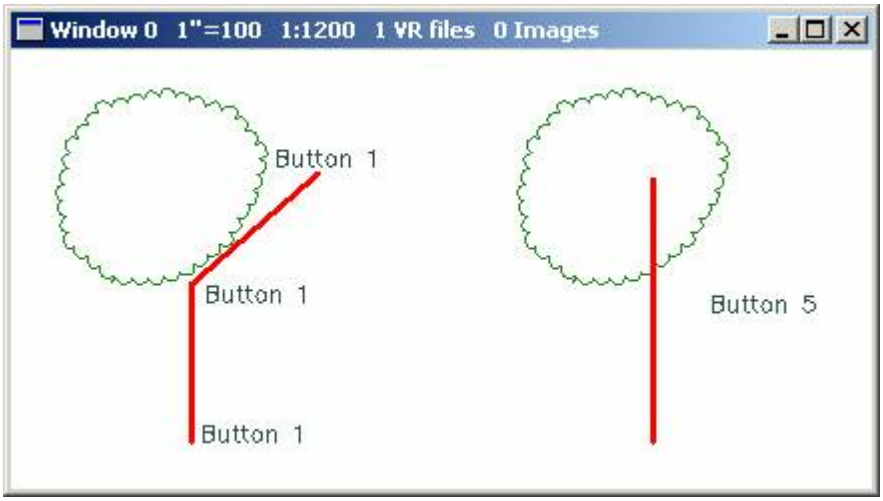

Attach

Attach allows the new line to be attached, trimmed and squared to an existing line. Options include:

- Specification of a search distance;
- Ability to close the new line by copying common points from the "Attach to" line;
- Ability to node the "Attach to" line;
- Support for Z Rules.

To enable attach, the Attach Mode must be turned on (AttMod=1). If the first point read is within the search distance of an existing line, the attach mode is activated. The line segment of the "Attach to" line closest to the first point will be used to as the "Square to" azimuth for the new line.

NOTE: The last point must be a button 4 (End line) to attach the new line.

Example 1:
The first and last points are within the search distance of an existing line. The resulting new line is attached, trimmed, and squared to this line. Copy common points is turned off, so the new line is be closed.

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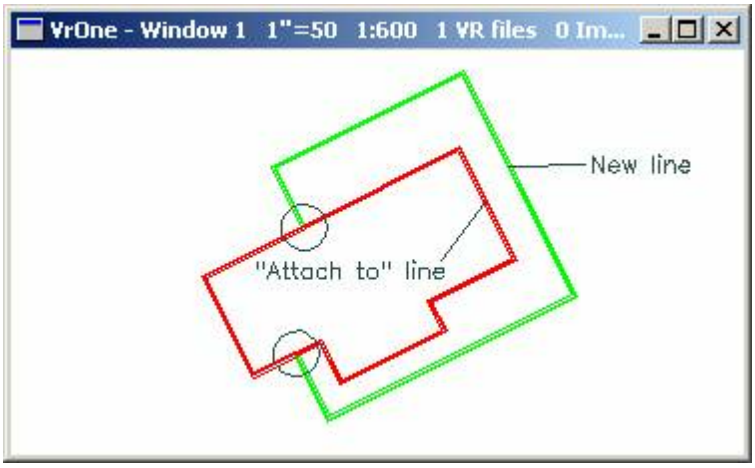
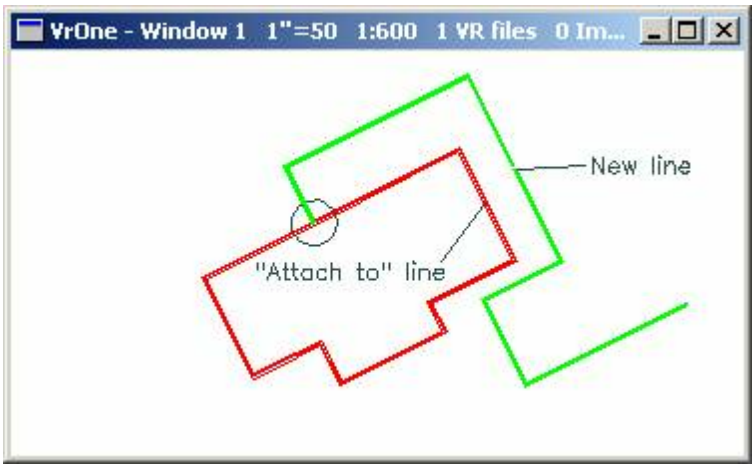


Example 2:
The first point is within the search distance. The resulting new line's first point is attached and trimmed and the line is squared to the "Attach to" line. The Copy common points parameter is ignored since the last point does not return to the "Attach to" line.



Example 3:
The first and last points are within the search distance of an existing line. The resulting new line is attached, trimmed and squared to this line. Copy common points is turned , so the new line is closed by copying common points from the "Attach to" line.

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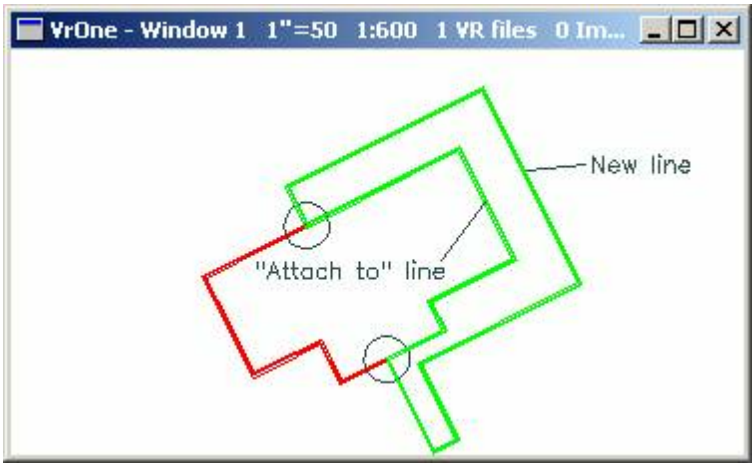

2.1.1.18.18 Insert Symbol

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DOCUMENTATION
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Vr Mapping

Insert Symbol (InsSym)

Type: Interactive Application

Places symbols.

Supports High/Low point searching in which the lowest, mean or high VrPoint (LiDAR) is found and used according to user defined parameters. Please see High/Low Point Search for more information.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1

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NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
RAD=	Symbol radius	Inches | Mm
ROT=	Symbol rotation	0-360 degrees
INSMOD=	Number of points to use to place symbol	1-3
ROTMOD=	Interactive rotation mode	0=Off 1=On
KEYZ=	Key-in elevation mode	0=No 1=Yes, from Menu Keys 2= Yes, from dialog box
DIG=	Places symbol at location specified	X Y Z

Parameters

NOTE: Each time Insert Symbol saves a symbol, the symbol's location is stored as the saved coordinate. This coordinate may then be used by the Insert Text application.

Insert Mode (INSMOD=)

Defines the number of points to use when placing a symbol:

- **1:** Places one-point symbol with one digitized point using the current radius.
- **2:** Places a two-point symbol with two digitized points. The first dig is the symbol's origin; the second is the radius. If symbol interactive rotation is on (Rotation Mode), the scaling and rotation of the symbol is handled as a single step.
- **3:** Places a three-point symbol with three digitized points along its edge. The three-point symbol is useful for placing items such as large tanks with a symbol where the center of the tank cannot be determined.

Rotation Mode (ROTMOD=)

When rotation mode is on (ROTMOD=1) the symbol will be placed with two digs. The first dig defines the symbol origin; the second, symbol rotation. This is useful when placing symbols with directional ticks. The rotation of this type of symbol normally changes between each symbol. If the number of points to use when placing a symbol is set to two (Insert Mode), the scaling and rotation of the symbol is handled as a single step.

Key-in Elevation Mode (KEYZ=)

It is possible to enter a symbol elevation after a symbol location has been digitized but before the symbol is saved. This is useful when digitizing spot elevations from an existing map on a large digitizing tablet.

There are three possible settings:

0	Don’t prompt for elevation
1	Prompt for elevation using the Menu Keys. This mode is normally used when digitizing spot elevations from a Xy digitizing tablet and it is easier to enter the Z from the tablet

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	cursor keypad instead of the system keyboard. While the elevation is entered it is displayed in a dialog box in large letters so it can be seen from the digitizing tablet.
2	Enter the elevation from the keyboard into a standard dialog box.

Button Assignments

Ins Symbol - Main

	Button	Description
1	Digitize point	Digitizes a symbol point.
2	Incr # points	Increments the number of points needed to place the symbol.
3	Enter radius	Enter the symbol radius from a dialog box.
4	Enter rotation	Enter the symbol rotation from a dialog box.
5	Ins keyboard	Enter a symbol location from the keyboard.
6	Tog dig sym rot	Toggles the symbol mode on/off.
7	Enter params	Allows entry/edit of current parameters.
8		
9		
*	Menu board	Make selection from the Menu board.
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

2.1.1.18.19 Insert Text

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Insert Text (InsTex)

Type: Interactive Application

Places text labels.

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Detailed Description

Places text interactively or from another Function Key. When used interactively, a rich set of options enable precise text placement in most situations. When run from another Function Key, options allow the application to be started and a text label to be placed without user intervention. Text labels are typed in using a dialog box, keyed-in from the key-in area, or drawn from a text file.

Curved Text

It is possible to place text along an existing VrOne line (base line) as “curved text”. In this mode, each text character will be placed as a single entity. The “Place Curved Text” mode is turned on the “Curved Text Search Distance” is set to enable this feature. The curved text direction and character rotations will be based on the direction of the base line. If the display North is up and a line is increasing from right to left then the text will be upside down in reference to the viewer. Lines in layers that are turned off will not be considered when searching for lines along which to curve text. Curved text can be offset from the baseline.

Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
FNT=	Font number	1-12
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal
JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
SIZE=	Text height and width	Inches | Mm
ROT=	Text rotation	0-360 degrees
SLT=	Text slant	0-180 degrees
TXT=	Text label	511 characters
=	Text label	511 characters
OFSX=	Text offset X	Inches | Mm
OFSY=	Text offset Y	Inches | Mm
OFSZ=	Text offset Z	Inches | Mm
SNAMOD=	Snap mode	0=Snap point as normal

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		1=Get elevation only when snapping
ZMOD=	Elevation for text entity	0=Use current elevation 1=Use saved elevation
COPZ=	Copy the elevation to the text label?	0=No 1=Yes
DECACC=	Decimal accuracy to use when copying elevation to text label	0-10
PROMOD=	Prompt for text label (0=No 1=Yes)	0=No 1=Yes
INCVAL=	Value to increment numeric text label after each save	Double precision
CURTEX=	Curve text along existing line	0=No 1=Yes
CURDIS=	Curved text search distance	Ground units
CUROFF=	Curved text offset distance from base line	Inches | Mm
RUNONCE=	Exits insert text after one text label has been placed	0=No 1=Yes
DIG=	Places symbol at location supplied	X Y Z
DIGLAST	Places text at the saved coordinate.	None

Parameters

NOTE: Each time Insert Symbol saves a symbol, it stores the location of the symbol as the saved coordinate. The saved coordinate may be used here as the last elevation for the Z Mode parameter or the last coordinate for the Digitize Last command.

Set Current Text Label (=)

Sets the current text label. This is a shortcut for the Txt= key-in. The two following key-ins have the same meaning:
=This is text
Txt=This is text

Size (Size=)

Sets both the text height and the text width to the size specified.

Offset X, Offset Y, Offset Z (OfsX=, OfsY= OfsZ=)

Places the text the distance specified in inches or millimeters from the digitized point. These parameters are often used to place text next to another object, like a symbol.

Snap Mode (SnaMod=)

Specifies the coordinate axis to get when snapping. If the Snap Mode were set to "Get elevation only" then it would be possible to snap to an existing symbol and retrieve its elevation only. This can be used to place the elevation of a spot elevation 'X'.

Z Mode (ZMod=)

Defines the source of the elevation for the text label. Elevation can be set to the current elevation (0) or to the elevation of the last symbol placed (1).

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Copy Z (CopZ=)

Determines whether the text entity's elevation is copied to the text label. This is necessary when labeling spot elevations.

Decimal Accuracy (DecAcc=)

Specifies the number of places to the right of the decimal point that are included in an elevation level if Copy Z is enabled.

Prompt Mode (ProMod=)

Specifies whether Insert Text prompts for a new text label when the function is called and after each label is saved.

Increment Value (IncVal=)

If the current text label is a numeric value, specifies a value to add to it each time it is saved. This is useful when labeling items that are sequential numbers. Increment Value may be an integer or double precision number. A value of zero turns this feature off.

Place Curved Text (CurTex=)

Turns the curve text placement mode on or off. If this mode is on and the digitized text location is within the "Curved text search distance" (see below) of an existing line, the text will be placed along that line. Each text character will be placed as a single entity.

Curved Text Search Distance (CurDis=)

Specifies in ground units the line attach search distance to existing lines when placing curved text along an existing line. See "Place Curved Text" above.

Curved Text Offset Distance (CurOff=)

Specifies the distance to offset curved text from the base line. A negative number will offset the text to the left of the base line and a positive number will offset the text to the right. This parameter is entered in Prompting Units which is inches or millimeters (in|mm).

Run Once (RunOnce=)

Specifies whether Insert Line will exit after a text label has been placed. Setting RUNONCE to 1 is the same as placing the Pop command as the On-end command in a function key that starts Insert Line. For consistency, the Pop command should be used instead of this parameter.

Digitize Last (DigLast)

Places the current text label at the saved coordinate position. This command is used when a symbol function key calls Insert Text and places a text label without any user intervention.

Text Rotations

Rotates text in degrees counterclockwise, with the X-axis representing 0 as shown below.

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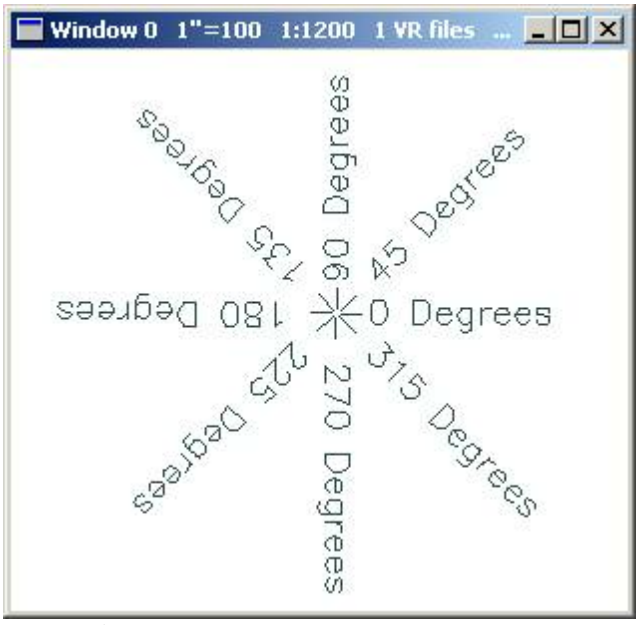
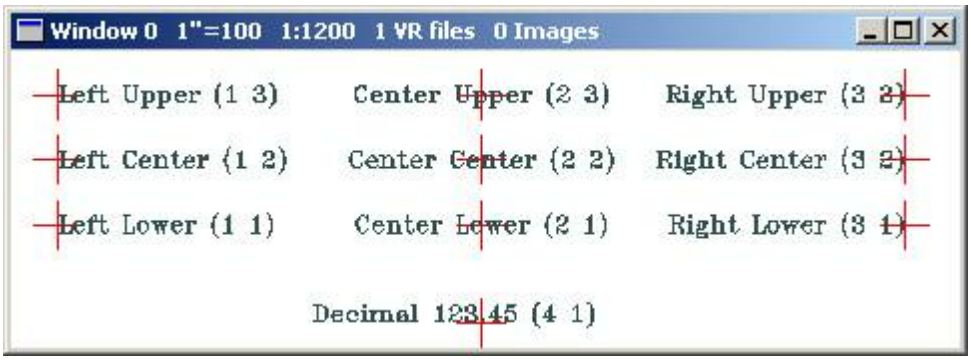


Text rotations

Text Justifications

VrOne supports ten text label justifications.



Ten supported Text Justifications

Button Assignments

Ins Text – Main

	Button	Description
1	Digitize	Digitizes the text origin.
2	Rotate	Rotates the text label. Starts Rot menu.
3	Expand	Expands or shrinks the text label. Starts Expand menu.
4	File text	Allows text to be input from file. Starts File menu.
5	Justification	Sets text justification. Starts Just menu.
6	Enter text	Enter text label from dialog box.
7	Enter params	Enter parameters from dialog box.

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8	Dig rotation	Sets text label rotation from two digitized points.
9	Enter offsets	Enter XY text label offsets from dialog box.
*	Menu board	Make selection from the Menu board.
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Ins Text – Rot

	Button	Description
1	Accept rot	Accepts current rotation. Returns to Main menu.
2	Dig 1 point	Digitizes the text rotation based on the text origin and the current XY position.
3	Dig 2 points	Digitizes the text rotation based on two digitized locations.
4		
5	Rotate - fine	Rotates text label counterclockwise 1 degree.
6	Rotate + fine	Rotates text label clockwise 1 degree.
7	Zero rotation	Sets current text label rotation to zero.
8	Rotate 45 deg	Rotates text label 45 degrees.
9	Rotate 90 deg	Rotates text label 90 degrees.
*		
0		
#		

Ins Text – Expand

	Button	Description
1	Accept size	Accepts current size. Returns to Main menu.
2	Shrink	Shrinks the current text label size by 1%.
3	Expand	Expands the current text label size by 1%.
4		
5		
6		
7		
8		
9		
*		
0		
#		

Ins Text – Just

	Button	Description

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1	Upper left	Sets the current text label justification to upper left (3,1).
2	Upper center	Sets the current text label justification to upper center (3,2).
3	Upper right	Sets the current text label justification to upper right (3,3).
4	Center left	Sets the current text label justification to center left (2,1).
5	Center center	Sets the current text label justification to center center (2,2).
6	Center right	Sets the current text label justification to center right (2,3).
7	Lower left	Sets the current text label justification to lower left (1,1).
8	Lower center	Sets the current text label justification to lower center (1,2).
9	Lower right	Sets the current text label justification to lower right (1,3).
*		
0	Decimal	Sets the current text label justification to decimal (1,4).
#	End	Ends this menu and returns to the Main menu.

Ins Text – File

It is possible to obtain text labels from a text file. This is useful when labeling items such as coordinate lists.

	Button	Description
1	Digitize	Digitizes the current text label.
2	Open file	Opens a text file.
3	Close file	Closes the current text file.
4	Next line	Retrieves the next line from the text file.
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends File menu and returns to the Main menu.

2.1.1.18.20 Interpolate Contours

Vr Mapping

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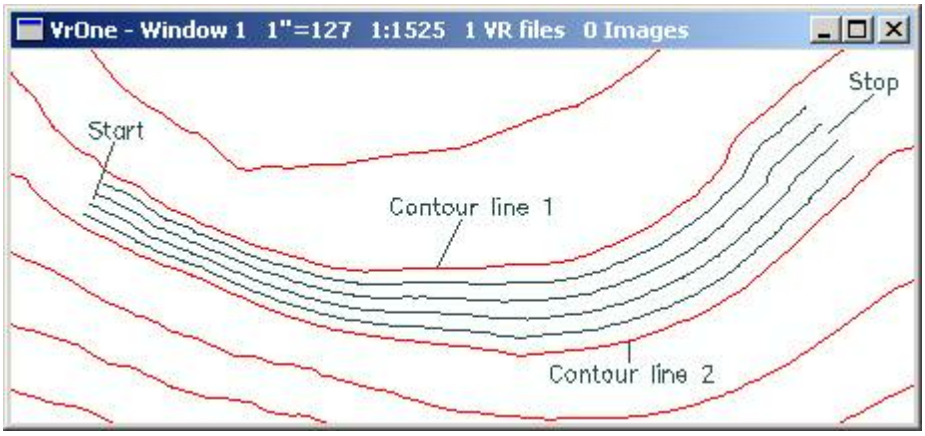
Interpolate Contours (IntCon)

Type: Interactive Application

Interpolates contours between two existing contours.

Detailed Description

Interpolates the required contour lines between two existing contour lines. The lines to be used are user-identified along with the start and stop contour limits. A user-defined contour interval determines the number of contour lines to create. The elevations of the new contour lines are automatically assigned.



Local Commands

Key-in	Description	Range
CONINT=	Contour interval	Ground value
LAYMOD=	Layer mode	0-1
NEWLAY=	New layer number	1-10,001
SMOMOD=	Line smoothing mode	0-2
BSPINC=	B-Spline increment	1-10

Contour Interval (ConInt=)

Defines the contour interval, which will determine the number of contours to be placed between the user-defined contours.

Layer Mode (LayMod=)

Determines how the layer into which to place new contour lines is chosen. "0" uses the layer of the first user-defined contour line; "1" uses the "New Layer" specification.

New Layer (NewLay=)

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Defines the layer into which to place new contour lines. This parameter is used if the Layer Mode (LAYMOD=) is set to 1.

Smoothing Mode (SmoMod=)

Defines the smoothing mode as follows:

0	Use no line smoothing. Lines will be set to VrOne mode 1.
1	Use VrOne spline display mode. Lines will be set to VrOne mode 2.
2	Use B-Spline. B-Spline points will be added to the line. The VrOne line mode will be set to 1. This is the recommended parameter for new contour lines.

B-Spline Increment (BSPIncB=)

Defines the smoothness when creating a B-Splined line. This parameter is from 1 to 10 and 4 or 5 is recommended. This parameter is a multiplier for the number of points placed on the new line. For example, if the original, unsmoothed line has 100 points and this parameter is 4, then the new line will consist of 400 points.

Button Assignments

Interp Cont – Id 1-2

Button	Description
1 Id line 1-2	Identifies contour lines with two key presses.
2 Re-id line 1	Allows re-identification of the first line.
3	
4	
5	
6	
7 Enter params	Allows entry of parameters.
8	
9	
*	
0	
# End	Ends application.

Interp Cont – Id Start - Stop

Button	Description
1 Id start - stop	Identifies the start and stop points that define contouring limits.
2 Re-id lines	Allows re-identification of the contour lines.
3	
4	

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5	
6	
7 Enter params	Allows entry of parameters.
8	
9	
*	
0	
# End	Ends application.

Interp Cont – Confirm

Button	Description
1 Accept	Accepts the contour interpolation results and returns to Id 1-2.
2 Reject	Rejects the contour interpolation results and returns to Id 1-2.
3	
4	
5	
6	
7	
8	
9	
*	
0	
#	

2.1.1.18.21 Label Point

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

Label Point (LabPoi)

Type: Interactive Application

Labels a digitized or snapped point with its coordinate.

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Local Commands

Key-in	Description	Range
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
FNT	Font number	1-12
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal
JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
ROT=	Text rotation	0-360 degrees
SLT	Text slant	-180 to 180 degrees
TXT=	Text label	511 characters
AXIS=	Axis order to label	0=Xyz 1=Xy 2=Z 3=Yxz 4=Yx
PREX=	Text to place before X label	31 characters
POSTX=	Text to place after X label	31 characters
PREY=	Text to place before Y label	31 characters
POSTY=	Text to place after Y label	31 characters
PREZ=	Text to place before Z label	31 characters
POSTZ=	Text to place after Z label	31 characters
OFSX=	Distance to offset labels X	Inches | Mm
OFSY=	Distance to offset labels Y	Inches | Mm
OFFSETS=	Use offsets flag	0=Use offsets 1=Digitize text location
DECXY=	Decimal accuracy for X,Y	0-10
DECZ=	Decimal accuracy for Z	0-10
COMMAS=	Place commas on text	0=No 1=Yes

Parameters

Axis Order to Label (AXIS=)

Defines which axes to label and the order in which to do so.

Text Prefix (PREX=, PREY=, PREZ)

Defines prefix strings before each axis label. For example, the words North, East, Elevation may be placed before the coordinate values.

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Text Postfix (POSTX=, POSTY=, POSTZ=)

Defines postfix text string that will be placed after each axis label.

Text Offset Distances (OFSX=, OFSY=)

Specifies distance from the digitized point to the text labels.

Use Offsets Flag (OFFSETS=)

Specifies whether text labels are placed at the digitized point ("0") or offset by Text Offset Distances ("1"). If "1" is selected, the text still must be placed with a digitized point.

Decimal Accuracy for XY Axis (DECXY=)

Defines the displayed number of digits to the right of the decimal point for the X and Y-axes.

Decimal Accuracy for Z Axis (DECZ=)

Defines the displayed number of digits to the right of the decimal point for the Z-axis.

Place Commas On Text (COMMAS=)

Specifies whether commas are placed on the coordinate labels. If enabled, 12123456.123 is labeled as 12,123,456.123.

Button Assignments

Label Point - Main

	Button	Description
1	Dig point	Digitizes the coordinate to be labeled.
2		
3		
4		
5		
6		
7	Text params	Enter parameters from a dialog box.
8	Label params	Enter label parameters from a dialog box.
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

Label Point – Dig Text

If Offsets is on then the location of the text labels will be digitized from this menu.

	Button	Description
1	Dig text loc	Digitizes the location for the text labels.
2		

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3		
4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

2.1.1.18.22 Plot Control

Vr Mapping

Plot Control (PloCon)

Type: Interactive/Batch Application

Plots and labels a control file into the current VrOne Workspace.

Description

Control may be plotted into the current workspace, all open workspaces or a user-defined window. Functions include symbol and coordinate text label placement.

Local Commands

Key-in	Description	Range
AREA=	Area to place control	0 = Current workspace 1 = All open workspaces 2 = Id line
PLASYM=	Place symbols?	0=No 1=Yes
LABNAM=	Label point names?	0=No 1=Yes
LABXY=	Label Xy coordinate?	0=No 1=Yes

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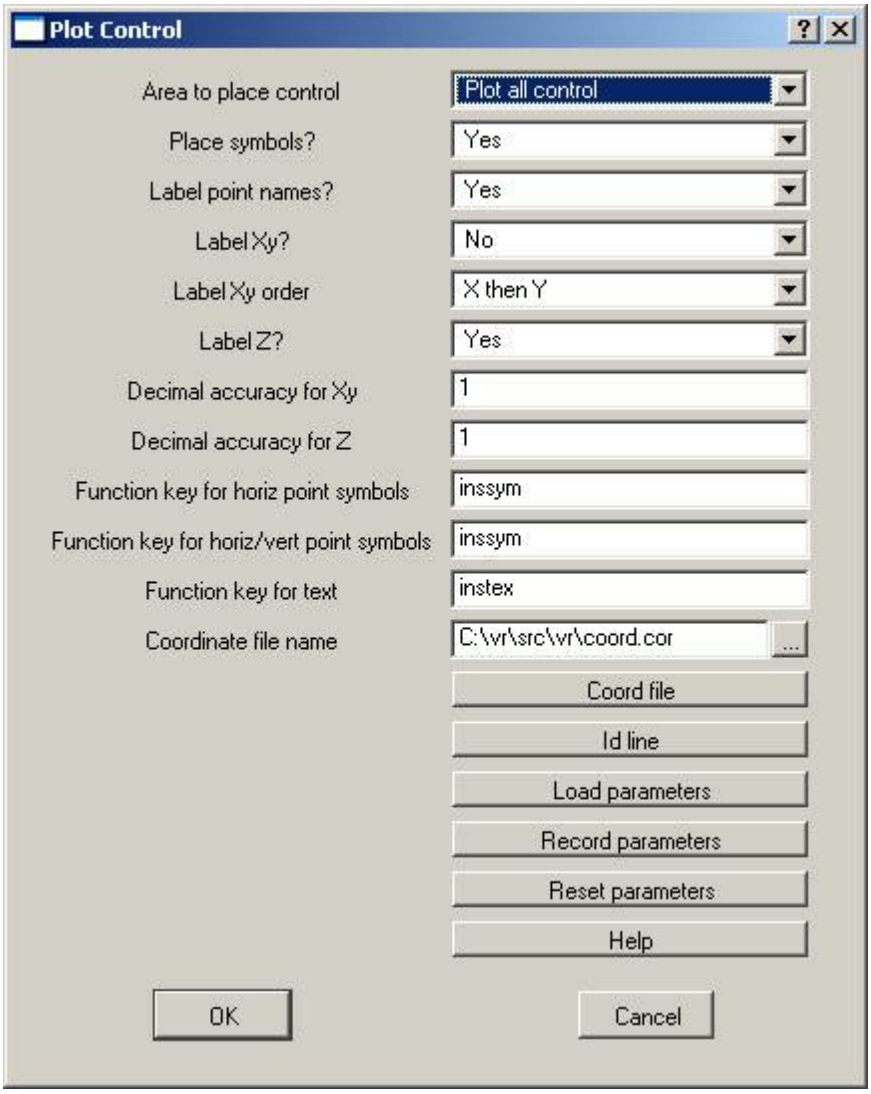
LABXYO=	Label Xy order	0=Xy 1=Yx
LABZ=	Label elevation?	0=No 1=Yes
DECXY=	Decimal accuracy for Xy label	0-10
DECZ=	Decimal accuracy for Z label	0-10
FKEYH=	Function key for horizontal point symbols	Function key name
FKEYHV=	Function key for horizontal/vertical point symbols	Function key name
FKEYTEX=	Function key for text labels	Function key name
COOFIL=	Coordinate file name to retrieve points from	Coordinate file name
PARFIL=	Load parameter file	Plot control parameter file name (.plc)
RUN	Run Plot Control	None

Parameters



Area to place control (AREA=)

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Defines an area into which to plot control. Options include the current workspace, all open workspaces, or a user defined line.
NOTE: When using options 0 or 1, Pack File (PacVr) should be performed prior to Plot Control to get an accurate workspace boundary.

Place symbols? (PLASYM=)

Specifies whether to place symbols.

Label point names (LABNAM=)

Specifies whether to place coordinate name text labels.

Label Xy coordinate? (LABXY=)

Specifies whether to place coordinate North and East text labels.

Label Xy order (LABXYO=)

Specifies the order to label the X and Y coordinates. Options are "X then Y" or "Y then X". From a key-in, the options are LabXy=0 (X then Y) or LabXy=1 (Y then X).

Label elevation? (LABZ=)

Specifies whether to place coordinate elevation text labels.

Decimal accuracy for Xy label (DECXY=)

Defines the number of places to the right of the decimal point to display for North and East text labels.

Decimal accuracy for Z label (DECZ=)

Defines the number of places to the right of the decimal point to display for elevation text labels.

Function key for horizontal point symbols (FKEYH=)

Defines the function key name for coordinate point symbols that represent horizontal control points.

Function key for horizontal/vertical point symbols (FKEYHV=)

Defines the function key name for coordinate point symbols that represent horizontal and vertical control points.

Function key for text labels (FKEYTEX=)

Defines the function key name to use for coordinate text labels.

Coordinate file name to retrieve points from (COOFIL=)

Defines the coordinate file name from which to run Plot Control. The default file extension for control file is .plc.

Load parameter file (PARFIL=)

Loads the previously defined and saved plot control parameter file.

Run Plot Control (RUN)

Runs the application.

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Button Assignments

Find line

When the Id line button is pressed on the Plot Control dialog box, this menu is started. It allows identification of a polygon that defines the area within which to plot control. The Area to place control (AREA=) must be set to Id line (2) for this line to be used when plotting control.

	Button	Description
1	Identify line	Identifies the line within which to plot control.
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Abandons this menu and returns to Plot Control.

2.1.1.18.23 Point On Line

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Vr Mapping

Point On Line (Pol)

Type: Interactive Application

Places a point on a line.

Detailed Description

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Places a point on an existing line. This point is placed on the nearest line segment to the digitized point and is placed at a 90 degree offset to the nearest line segment. The elevation of the new point will be interpolated based either on current elevation or the point before and after.

Edit Line (EdiLine) also includes a Point On Line function.

Point on line is undoable.

Local Commands

Key-in	Description	Range
ZMOD=	Z Mode	0 – Interpolate Z 1 – Use current Z

Parameters

None

Button Assignments

PointOnLine – Lock on

	Button	Description
1	Id line	Identifies the line on which to place the point.
2		
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends application.

Hack Line – Dig hack

	Button	Description
1	Dig POL	Digitizes the point on line.
2	New line	Returns to Lock on.
3		

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4		
5		
6		
7		
8		
9		
*		
0	Toggle snap	Toggles snap on/off.
#	End	Ends application.

2.1.1.18.24 Scan P3

ON-LINE REFERENCE DOCUMENTATION
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www.cardinalsystems.net

Vr Mapping

Scan P3 (ScaP3)

Type: Interactive Application

Drives the Zeiss P Series stereoplotters along user-defined scan lines for XYZ profiling. During scanning, the operator keeps the floating mark on the ground and points are stored by distance and/or elevation change. The speed the instrument travels is determined by the speed knob.

Available Key-ins

Key-in	Description	Range
LAY=	Layer for scan lines	1-10,001
SHIFT=	Scan line shift width	Ground units
MINDIST=	Minimum recording distance	Ground units
DELTAZ	Delta Z recording distance	Ground units
ZCON=	Z control	0 = Footdisk 1 = Right handwheel 2 = P3 Y tablet motion
BEEP=	Beep when a point is stored?	0=No 1=Yes

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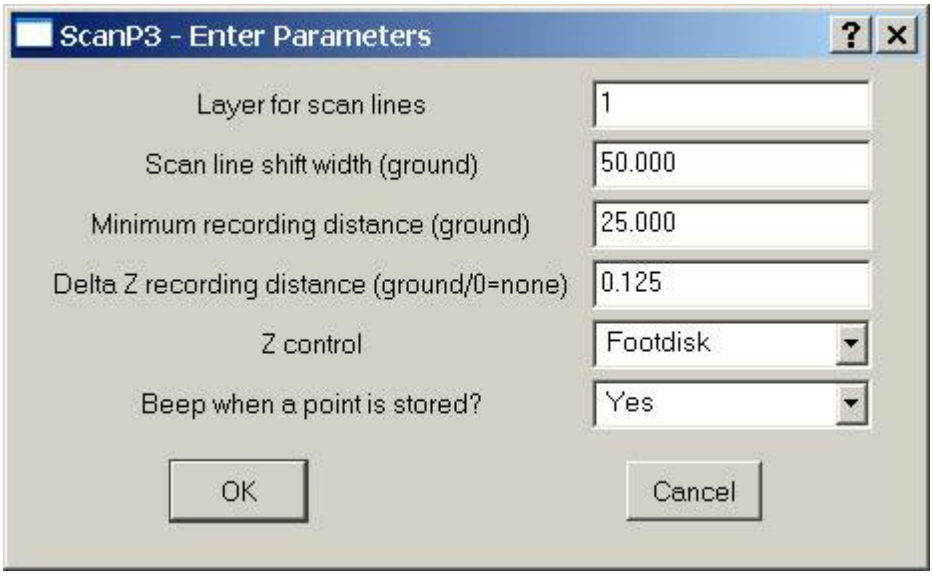
ScanP3 Parameters



Layer for scan lines

Specifies the layer in which to store scan lines as VrOne lines.

Scan line shift width

Once the first scan line has been defined, multiple scan lines may be read based on its start point and azimuth. The shift width defines the distance between scan lines. The Move+ and Move- buttons in the Begin Scan menu move the scan start point by this distance.

Minimum recording distance

Defines the distance along the scan line to store points during scanning. The resulting distance may not be exact depending on the speed of the stereoplotter. This parameter should be slightly smaller than the stereoplotter's specification to ensure a sufficient number of points. The batch routine Grid Lines (GriLin) may be used to place precisely spaced points on existing lines.

Delta Z recording distance

Specifies delta elevation at which to store points during scanning. Depending on the speed of the stereoplotter, the distance may not be precise. This parameter should be slightly smaller than stereoplotter specification to ensure a sufficient number of points. Setting this parameter to zero will turn off Delta Z point collection.

Z control

Defines the location of Z motion during scanning. Options are Footdisk, Handwheel and P3 Y Tablet motion. If the P3 Y Tablet motion is selected, a positive y P-Cursor movement will lower the elevation and a negative y P-Cursor movement will raise the elevation.

Beep when a point is stored?

Specifies whether to emit the Vr Normal Beep wave sound each time a point is stored during scanning. The Normal Beep sound may be configured in the Vr Configuration program (VrCfig).

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Button Assignments

ScanP3 - Main

	Button	Description
1	Dig scan pt1	Digitizes the location of the start of the first scan line.
2	Enter coord	Enter the coordinate of the end of the first scan line.
3		
4		
5		
6		
7	Params	Enter parameters.
8		
9		
*		
0	Toggle Snap	Toggles snap.
#	End	Ends ScanP3.

ScanP3 - Main

	Button	Description
1	Dig scan pt2	Digitizes the location of end of the first scan line.
2	Enter coord	Enter the coordinate of the end of the first scan line.
3	Enter azi/dist	Computes the end of the first scan line from an azimuth and distance from the start on the scan line.
4		
5		
6		
7	Params	Enter parameters.
8		
9		
*		
0	Toggle Snap	Toggles snap.
#	End	Returns to the previous menu.

ScanP3 – Begin Scan

	Button	Description
1	Start scan	Starts scanning the current line.
2	Move+	Moves to the next positive direction scan line.

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3	Move-	Moves to the next negative direction scan line.
4	Drive to start	Drives to the start of the current scan line.
5	Drive to end	Drives to the end of the current scan line.
6		
7	Params	Enters parameters.
8		
9		
*		
0	Toggle Snap	Toggles snap.
#	End	Returns to the previous menu.

ScanP3 – Scan Line

	Button	Description
1	Force point	Forces a point onto the scan line at the current location.
2	End	Ends the current scan line.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Ends the current scan line.

ScanP3 – Confirm

	Button	Description
1	Accept scan	Accepts the current scan line and stores the line.
2	Reject scan	Rejects the current scan line.
3		
4		
5		
6		
7		
8		
9		
*		
0		
#	End	Returns to the main menu.

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2.1.1.18.25 Sheet Grid

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Vr Mapping

Sheet Grid (SheGri)

Type: Interactive Application

Grids and labels a user-defined polygon.

Local Commands

None

Parameters

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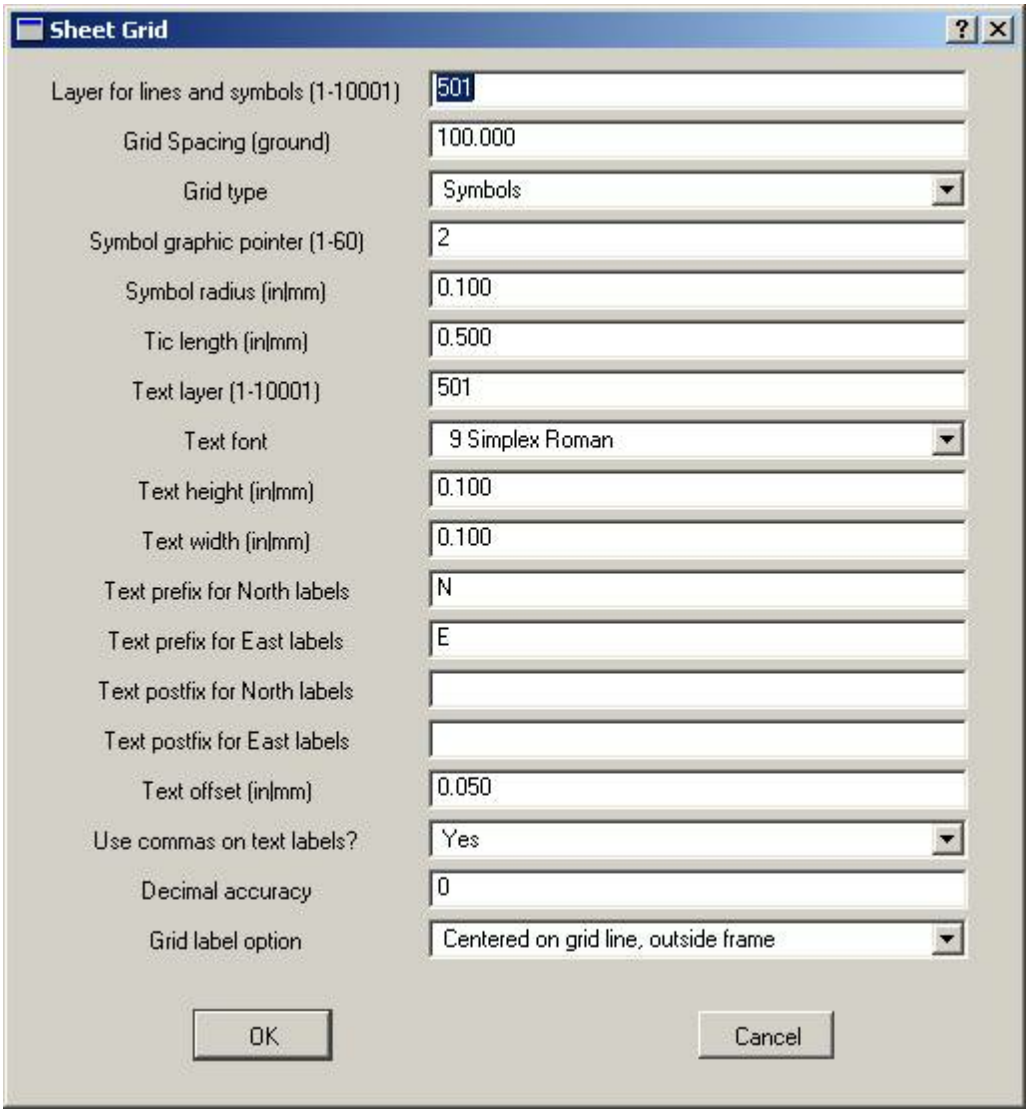

Layer for lines and symbols

Specifies layer into which to place grid lines or grid intersection symbols. Range: 1-10001

Grid spacing

Defines in ground units the distance between grid line or grid intersections.

Grid type

Specifies whether to use grid lines or grid symbols.

Symbol radius

Sets in inches or millimeters the radius of the grid intersection symbols if the grid type is set to symbols.

Tic length

Sets in inches or millimeters the tic length if the grid type is set to symbols and edge ticks are selected.

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Text layer

Specifies layer into which to place grid value text labels. Range: 1-10001

Text font

Specifies text font to use for grid value text labels. Range: 1-12

Text height

Defines in inches or millimeters the height for grid value text labels.

Text width

Defines in inches or millimeters the width for grid value text labels.

Text prefix for North labels

Defines prefix to place before each North grid value text label. Range: 10 characters

Text prefix for East labels

Defines prefix to place before each East grid value text label. Range: 10 characters

Text postfix for North labels

Defines postfix to append to each North grid value text label. Range: 10 characters

Text postfix for East labels

Defines postfix to append to each East grid value text label. Range: 10 characters

Text offset

Defines in inches or millimeters the distance to place grid value text labels from the grid frame.

Use commas on text labels?

Specifies whether commas will be placed on the North and East grid values.

Decimal accuracy

Defines the number of digits to the right of the decimal point to display for the North and East grid values.

Grid label option

Options for the placement of the grid value text labels:

- On top of grid, inside frame;
- On bottom of grid, inside frame;
- Centered on grid, outside frame;
- Rotated along frame, outside frame.

Button Assignments

Sheet Grid - Main

	Button	Description

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1	Id line	Identifies the line to grid.
2		
3		
4		
5		
6		
7	Text params	Enter parameters from a dialog box.
8		
9		
*		
0		
#	End	Ends application.

2.1.1.18.26 Symbol Fill

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Symbol Fill (SymFill)

Type: Interactive/Batch Application

Fills a user-defined polygon with symbols or spot elevations.

Description

Specified spacing is used to place symbols or spot elevation or elevation text labels in a user-defined polygon. If the area has been modeled using DTM, the points placed may be draped onto the current DTM surface.

Local Commands

Key-in	Description	Range
TYPE=	Point type	0=Symbol 1=Spot Elevation 2=Text only
GRIRES=	Grid resolution	Ground units

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GRIOFSX=	Grid offset X	Ground units
GRIOFSY=	Grid offset Y	Ground units
TEXOFSX=	Text offset X	Inches | Mm
TEXOFSY=	Text offset Y	Inches | Mm
DECACC=	Decimal accuracy for Z text labels	0-10
FILDIR=	Fill direction	0=East ascending 1=East descending 2=East meander 3=North ascending 4=North descending 5=North meander
Symbol Parameters		
LAY=	Layer number	1-10001
GRP=	Graphic pointer	1-60
PEN=	Pen number	1-256
CON=	Construction flag	0-1
NGR=	Non graphic pointer	32 bit
LNK=	Link number	32 bit
FC=	Feature code	48 characters
RAD=	Symbol radius	Inches | Mm
ROT=	Symbol rotation	0-360 degrees
FKEY=	Set symbol and text parameters to function key parameters	Function key name
Text Parameters		
LAY1=	Layer number	1-10001
GRP1=	Graphic pointer	1-60
PEN1=	Pen number	1-256
CON1=	Construction flag	0-1
NGR1=	Non graphic pointer	32 bit
LNK1=	Link number	32 bit
FC1=	Feature code	48 characters
FNT=	Font number	1-12
JX=	Justification X	1=Lower 2=Center 3=Upper 4=Decimal
JY=	Justification Y	1=Left 2=Center 3=Right
HGT=	Text height	Inches | Mm
WDT=	Text width	Inches | Mm
ROT1=	Text rotation	0-360 degrees
SLT=	Text slant	-180 – 180 degrees

Parameters

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Point type (TYPE=)

Defines the type of point that will be placed. Options are symbol, spot elevation, or text elevation, a text label of the elevation using decimal justification.

Grid resolution (GRIRES=)

Defines the grid resolution to fill line.

Grid Offsets (GRIOFSX=, GRIOFSY=)

Defines X,Y distances to add to the current grid value when filling. They are commonly used when filling an area that has already been filled to place new points in between existing ones.

Text Offsets (TEXOFSX=, TEXOFSY=)

Defines the distance from the grid point to place the text label. These values are normally non-zero when spot elevations are being placed.

Decimal Accuracy (DECACC=)

Defines the number of places to the right of the decimal point to display for elevation text labels.

Fill direction (FILDIR=)

Specifies the order in which points are placed within the polygon. Options are East ascending, East descending, East meander, North ascending, North descending and North meander.

Elevations

The elevations for symbols, spot elevation or text placed by Symbol Fill are obtained from the current Z Source. If the DTM engine is active, the elevations will be based on the current DTM surface if the Z Source is set accordingly.

Button Assignments

Symbol Fill

	Button	Description
1	Id line	Identifies the line to fill with symbols.
2		
3		
4		
5		
6		
7	Parameters	Enter fill parameters from a dialog box.
8	Symbol params	Enter symbol parameters from a dialog box.
9	Text params	Enter text parameters from a dialog box.
*		
0		
#	End	Ends this application.

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2.1.1.18.27 Symbol Manager

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Symbol Manager (ManSym)

Type: System Management

Allows user to view and manage symbol libraries.

Detailed Description

The Symbol Manager dialog displays all symbol and line font definitions in the current symbol library. The user can page through all of the symbols in the library or jump directly to a specified symbol. After selecting a symbol, the user has the option to change the symbol name and size, create a new symbol, edit the symbol, clear the symbol, or copy the symbol. The symbol library can be saved to a new name. Existing symbol libraries can be loaded and edited and new symbol libraries can be created. The number of symbols displayed per page and the symbol display size can be customized. Double clicking on a symbol will start the Insert Symbol or Insert Line command with the graphics pointer set to the selected symbol.

Symbol Manager Dialog

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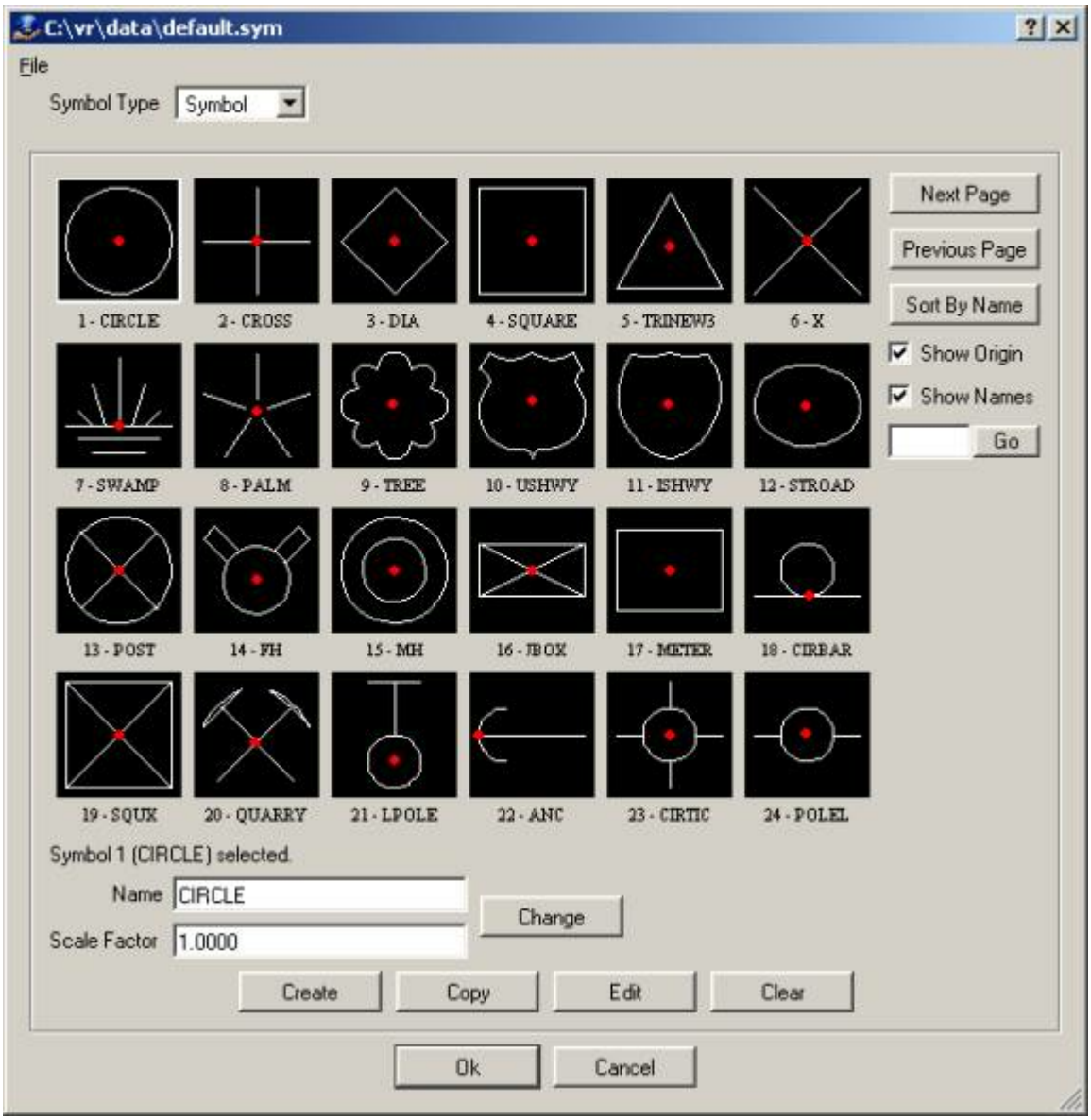

The caption at the top of the dialog displays the name of the symbol library that is being edited. When the symbol manager loads, this is set to the active VrOne symbol library. The symbol type can be toggled between Symbol and Line Font mode. The user can select individual symbols to make them active. The active symbol name and scale factor or line length is displayed and can be edited. The box to the left of the Go button can be used to quickly search for symbols by name or number.

File pull down menu

The file pull down menu has options for opening existing symbol libraries, creating new symbol libraries, saving the active symbol library, saving a copy of the active symbol library, or viewing more options. There is also a selection that brings up the Options dialog.

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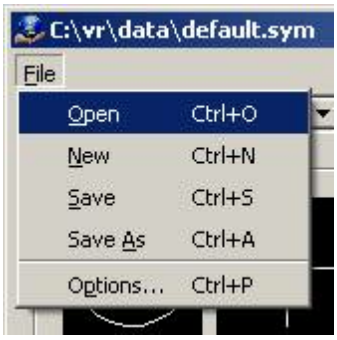
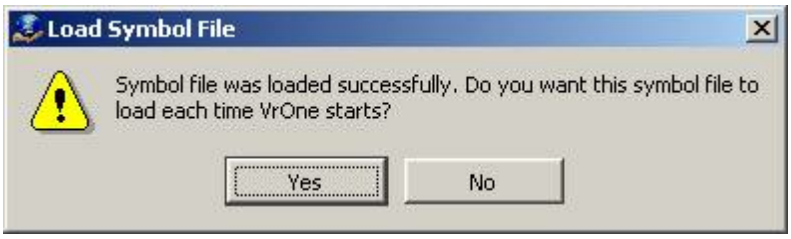


File->Open

Opens an existing symbol library. This will display a file open dialog. If the user selects an existing symbol library and it is loaded successfully, the symbols in the library will be displayed. The top caption of the dialog will change to show the currently loaded symbol library. The user will also be asked if this should become the default symbol library used by VrOne in the future. If "No" is selected, the library is still loaded and made active, but if VrOne is restarted it will not load by default. If "Yes" is selected, the VrOne configuration is changed to make it the new default symbol library.



File->New

Creates a new symbol library. This will display a file creation dialog box. Navigate to the appropriate folder where the user would like to create the new symbol library, and type in a new name. An empty symbol library will be created using the name specified. All of the symbol display windows should now be blank and each symbol will be labeled “EMPTY”.

File->Save

Saves the active symbol library. This will save any changes that have been made to the current symbol library. The top caption of the dialog will display (Changed…) if any changes have been made to the active symbol library. The symbol manager prompts the user to save changes when the dialog is closed or a different file is loaded.

File->Save As

Saves the active symbol library to a new name. This will display a file save dialog box. The symbol library is made the active symbol library and is saved to the new file name, and it will be made the active symbol library. The old library is not changed.

File->Options

Displays the options dialog.

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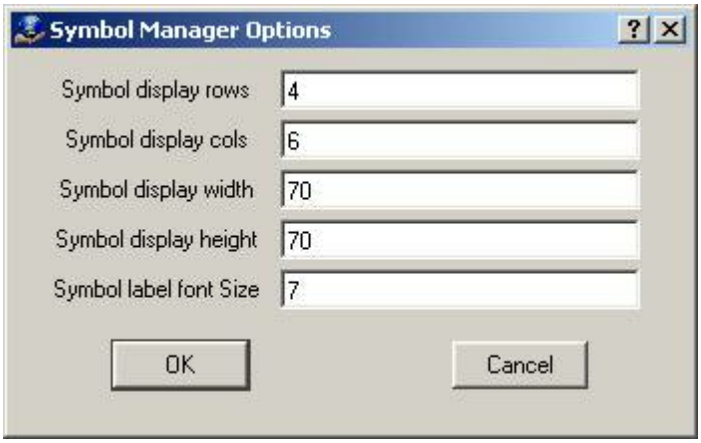

Symbol display rows	Enter the number of rows of symbols to display on each page (1-100)
Symbol display cols	Enter the number of cols of symbols to display on each page (1-100)
Symbol display width	Enter the width of the drawing area for each symbol (Pixels) (5-5000)
Symbol display height	Enter the height of the drawing area for each symbol (Pixels) (5-5000)
Symbol label font Size	Enter the size of the font to use for the symbol labels (Points)

Symbol Display Area

The symbol display area displays the symbols a page at a time, and contains controls for navigating through the symbols. Left click on any symbol to make it active. Double click on any symbol to start the Insert Symbol or Insert Line commands with the symbol set as the active graphics pointer.

Next Page
Displays the next page of symbols.

Previous Page
Displays the previous page of symbols.

Sort By Name / Sort By Number
The function of this button changes based on the current sort mode. If the symbols are sorted by number, then the button will be labeled “Sort By Name”, and pressing it will sort the symbols by name. If the symbols are sorted by name, then the button will be labeled “Sort By Number”, and pressing it will sort the symbols by number. When sorted by name, EMPTY symbols will always be sorted to the end of the list.

Show Origin
If this checkbox is on, then a red dot will be displayed on each symbol, indicating the origin location.

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Show Names
If this checkbox is on, then names will be displayed in addition to numbers under each symbol. If it is off, then only numbers will be displayed. Holding the cursor over a symbol will always display its name whether this option is off or on.

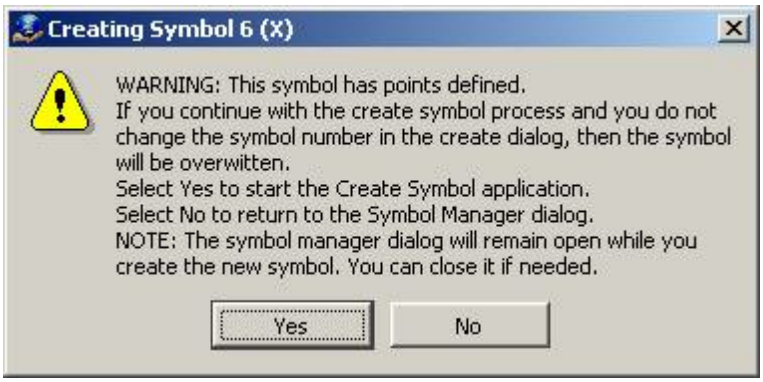
Go
Type in a symbol name or number and press the Go button to jump directly to the symbol. The symbol will be made active and ready for editing. If the symbol name or number is not found, nothing will happen.

Symbol Command Area

The symbol command area, used to perform all symbol editing tasks, is located below the symbol display area. The top of this area always displays the number and name of the symbol that is being edited.

Change
The change button applies any changes that have been made to the symbol name, scale factor, or line length, to the active symbol.

Create
This starts the Create Symbol command and allows a new symbol to be created to replace the active symbol. If the active symbol is not empty, then a confirmation dialog will be displayed:



- **Yes:** Starts the Create Symbol application.
- **No:** Abandons the Create command.

The Symbol Manager dialog will remain open while the user is creating the new symbol. See the Create Symbol help file for detailed instructions on creating new symbols. Once the symbol has been created and the Create Symbol application closed, the Symbol Manager will be updated to reflect the new symbol. If needed, the user can close the Symbol Manager after the Create Symbol application has started.

Copy
Copies the active symbol definition to another symbol. The user will be prompted for the symbol number of the target symbol. If the target symbol is not empty, the user will be asked to confirm

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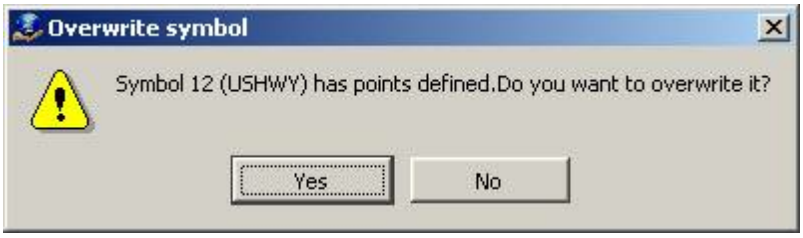
the copy.



If the answer is Yes, the existing symbol will be overwritten with the current symbol definition.

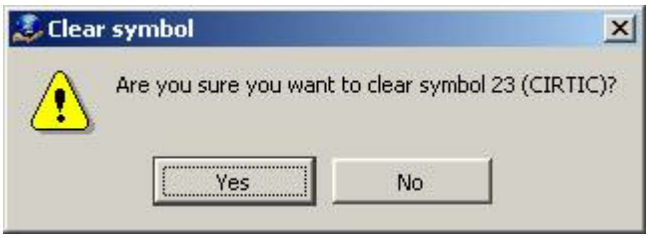
Edit

Editing a symbol consists of plotting the existing symbol definition, making changes, and then using the Create Symbol command to replace the existing symbol. The Edit command simplifies this process by doing most of the work for the user. After selecting Edit, the active symbol is plotted to the current VrOne vector file. The graphics window is zoomed to show the boundaries of the symbol. Then, the Create Symbol command is started. Use the standard VrOne commands to edit the symbol definition, then use the already running Create Symbol command to define the new symbol. After selecting the symbol entities, the symbol create dialog will already be filled in with the appropriate symbol number and name to replace the symbol being edited.

The Symbol Manager dialog will remain open while the user is editing the symbol entities and creating the replacement symbol. See the Create Symbol help file for detailed instructions on creating new symbols. Once the symbol has been created and the Create Symbol application closed, the Symbol Manager will be updated to reflect the edited symbol. If needed, the user can close the Symbol Manager after the symbol has been plotted and the Create Symbol application has started.

Clear

Clears the active symbol definition. Removes all points from the active symbol and sets its name to EMPTY. The user will be asked for confirmation before the symbol is cleared.



Dialog exit buttons

Ok

Press Ok to exit the Symbol Manager dialog. If changes have been made and not saved, the user will be shown the following dialog:

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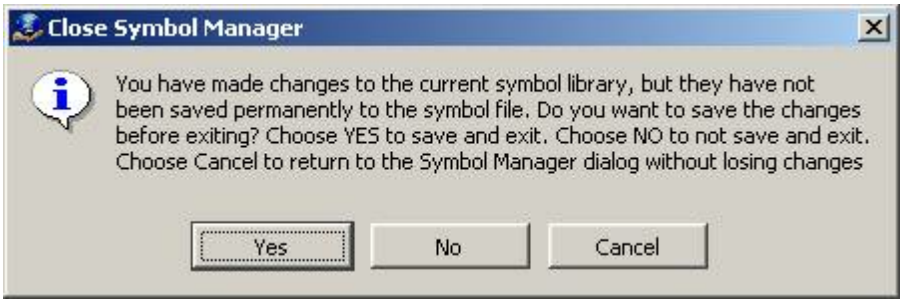
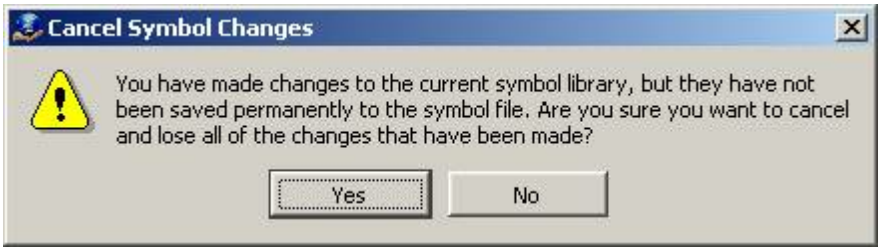


- **Yes:** Saves the changes and exits.
- **No:** Discards the changes and exits.
- **Cancel:** Returns to the Symbol Manager dialog without losing the changes.

Cancel

Press Cancel to exit the Symbol Manager dialog. If changes have been made and not saved, the user will be shown the following dialog:



- **Yes:** Exits without saving the changes that were made.
- **No:** Returns to the Symbol Manager dialog without losing the changes.

2.1.1.19 Keyboard Key Assignments

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

System Keyboard Key Assignments

Name	Key-in	Argument	Description

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		s	
Function Keys F1-F12			F1-F9 – VrOne Keys 1-9 F10 – VrOne Key * F11 – VrOne Key 0 F12 – VrOne Key #
Keypad			0-9 – VrOne Keys 0-9 Del (.) – VrOne Key * Enter – VrOne Key # **NOTE**: These VrOne Keys are active when Num Lock is OFF
Number Lock control	NumLoc	On | Off | 1 | 0	Conditions the system keyboard number lock.

See Also VrOne Keys

2.1.1.19.1 VrOne Keys

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrOne/VrTwo Keys (0-9, *, #)

Type: Information

The keys 0-9, *, and # are used to control the functionality of any applications running in Vr programs. This allows for much more functionality per application and is responsible for program consistency. For example, in Insert Line VrOne Key 1 is used to digitize points, Key 2 is used to close and Key 3 is used to backup. Most applications display these VrOne Key assignments in the Menu Keys dialog box.

There are several ways to press VrOne Keys depending on the current input device and configuration:

- Pressing a button in the Menu Keys dialog;
- Pressing an input device button on a mouse, digitizer, stereo plotter footswitch, P-mouse or Stealth 3D mouse;
- Pressing an input device button 0-9, *, # button on the Keyport 300 or Keyport 252;

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- System keyboard function keys;
- System keyboard keypad when NumLock is OFF;
- Key-in.

Menu Keys Dialog



VrOne Keys 0-9, * and # may be pressed in the VrOne Menu Keys dialog. This is not the most efficient way to use VrOne and these buttons are primarily shown to remind the user of the proper input. If using a mouse for editing, pressing these buttons requires the user to move from the graphics window to the Menu Keys dialog and then back to the graphics window.

Input Device Buttons

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Most input devices have some buttons. The system mouse has at least two buttons that may be used to activate two of the 12 VrOne Keys. Input devices such as the Polytel Keyport 300 and the Keyport 252 have a 12-button keypad defined in the lower right corner of the menu. Digitizers have a 12 or 16 button cursor that is used to press VrOne Keys.

If available for the current configuration, Device Control (DevCon) may be used to cross-reference device buttons to VrOne Keys. Many XY and XYZ digitizers have the ability to cross-reference device buttons to VrOne Keys by editing a .key file. These .key files are located in the \vr\hostdir directory and are named according to the current driver. For example, the .key for the SD2000 stereo plotter driver is called sd2000.key.

Keyboard Function Keys



The VrOne keys 0-9 * and # are always available for all input devices from the system keyboard function keys F1-F12. While the mouse is in the graphics window F1-F12 may be pressed. F10 is VrOne Key *, F11 is VrOne Key 0 and F12 is VrOne Key #.

Keyboard Keypad

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Most system keyboards have a 17-button keypad with the NumLock function controlling the output of these keys. When NumLock is OFF, the keypad buttons 0-9 output VrOne Keys 0-9, the Del (.) key outputs VrOne Key *, and the Enter Key (Enter) outputs VrOne Key #. When NumLock is ON, the keypad outputs normal numbers.

VrOne Keys from the system keyboard keypad are always available for all input devices.

It is possible to condition the state of the system number lock depending on the status of the VrOne Application Stack. If this parameter is set to Yes then NumLock will be turned off when an application is started and turned on when there are no applications on the stack. When NumLock is off the system keyboard keypad may be used for VrOne buttons 0-9, * and #. If this parameter is set to No then NumLock is not conditioned. This parameter may be set with a key-in of "NumCon 0" or "NumCon 1". If NumCon is keyed in without an argument a dialog box is presented. NumLock Control may also be entered from the Application Stack (AppStack) pull down menu or from the Vr Configuration program VrCfig.

The condition of the system number lock may be changed from a VrOne key-in. Number lock may be turned on with a key-in of NumLoc On or NumLoc 1. Number lock may be turned off with a key-in of NumLoc Off or NumLoc 0.

Key-in

The key-ins of b0-b9, b* and b# may be executed to simulate a VrOne key press. This is useful for placing VrOne Key presses in macros or function keys. For example, the following macro would start Insert Symbol, turn snap verify off, turn snap on, digitize a point at the current cursor location, and end Insert Symbol.

```
inssym
snavoff
snaon
b1
```

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pop

2.1.1.20 Layer Management

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrMapping

Layer Management

Name	Key-in	Arguments	Description
Edit Layer Names	EdiLay		Edits layer names.
Set Layers On/Off	SetLay		Conditions layers using dialog box.
Change Layer	ChaLay		Allows interactive layer changing.
Layer Off	LayOff	NumLine	Turns off layers specified in number line.
Layer On	LayOn	NumLine	Turns on layers specified in number line.
Layer Off Plus	LayOff+	NumLine	Turns only layers specified in number line off.
Layer On Plus	LayOn+	NumLine	Turns only layers specified in number line on.
Layer Reset	LayRes		Turns all layers on.
Snap Layer Off	SnaLayOff	NumLine	Turns snapping off for the layers specified.
Snap Layer On	SnaLayOn	NumLine	Turns snapping on for the layers specified.
Snap Layer Off Plus	SnaLayOff+	NumLine	Turns snapping off for only the layers specified.
Snap Layer On Plus	SnaLayOn+	NumLine	Turns snapping on for only the layers specified.

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Snap Layer Reset	SnaLayRes		Turns snapping on for all layers.
Delete Layers	DelLay	NumLine	Deletes layer(s).
Copy Layers	CopLay	NumLine TarLayer	Copies layer(s).
Move Layers	MovLay	NumLine TarLayer	Moves layer(s).
Layer Control	LayCon		Displays layer control dialog.

2.1.1.20.1 Set Layers On/Off

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Set Layers (SetLay)

Type: Parameter dialog box

Turns VrOne layers on/off.

Using a number line as input, this dialog box turns VrOne layers on or off. Options include turning all layers on or off or turning only the specified layers on or off. It is possible to save up to 10 layer lists (number lines) and condition modes for later use.

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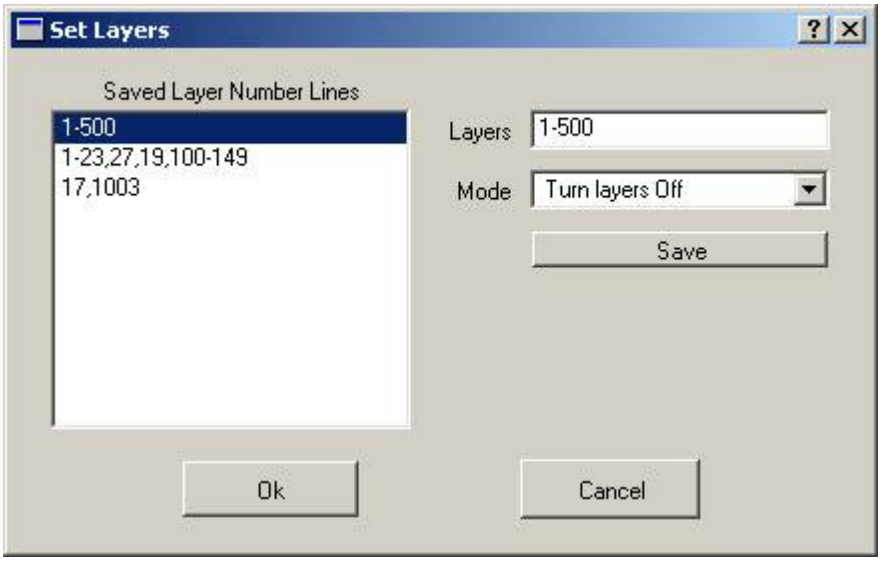

Layers

Specifies which layers to toggle via Number Line.

Mode

Specifies the condition mode, which defines the action to perform. Condition modes are as follows:

- Turn layers Off;
- Turn layers On;
- Turn only these layers Off;
- Turn only these layers On;

Save button

Saves the current Layer and Mode fields into one of 10 locations as highlighted in the "Saved Layer Number Lines" area.

Saved Layer Number Lines

Lists saved number lines. When a line is selected in this area the contents are copied to the Layer and Mode fields for editing. There are 10 locations to store the current Layer and Mode fields for later use. To save, first highlight a line in the "Saved Layer Number Lines" window and then press the Save button.

2.1.1.20.2 Change Layer

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Mapping

Change Layer (ChaLay)

Type: Interactive Application

Changes entity layers by pointing at the entity.

Detailed Description

There are several procedures in VrOne that will change the layer of an entity, including Edit Line, Edit Symbol, Edit Text, and Global Change. Sometimes, though, it is more convenient to change the layers of entities by pointing at them. Change Layer is a quick way to touch an entity and change its layer.

Local Commands

Key-in	Description	Range
LAY=	Set the target layer	1-10,001
SEALIN=	Search for Lines	0=No 1=Yes
SEASYM=	Search for Symbols	0=No 1=Yes
SEATEX=	Search for Text	0=No 1=Yes

Button Assignments

Fast Delete – Line/Symbol/Text

	Button	Description
1	Id entity	Identifies entity.
2	Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3		
4	Toggle lines	Toggles searching for lines.
5	Toggle symbols	Toggles searching for symbols.
6	Toggle text	Toggles searching for text labels.
7		
8		
9		
*		

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0		
#	End	Ends application.

2.1.1.20.3 Delete Copy Move Layers

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

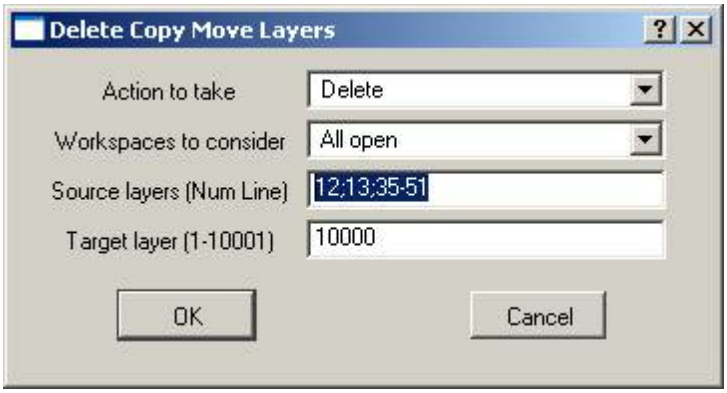
Delete Layers (DelLay)

Copy Layers (CopLay)

Move Layers (MovLay)

Deletes, copies or moves layers.

Layers may be deleted, copied or moved using one of these three applications. Entering an operation without any arguments results in a dialog box to enter parameters. Each operation may be entered as a key-in followed by one or more arguments. (see Running From a Key-in)



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Action to take

Defines the action to take on the source layers. Options are:

- Delete;
- Copy;
- Move.

Workspaces to consider

Defines the workspaces to consider. Options are:

- Current only;
- All open.

Source layers

Defines the layers to delete, copy or move. A Number Line describing the source layers may be entered here.

Target layer

Defines the layer to which to copy or move source layers. If only one target layer is defined and the Source Layers specify more than one layer, the source layers will be merged into the Target Layer during a copy or move.

Running From a Key-in

It is possible to delete, move or copy layers by entering the command name and arguments from a command line. The ability to run these operations from a key-in allows them to be placed in a Vr Macro. This is useful when running the same operation many times for different layers on different jobs. The following are sample key-ins:

```
DelLay 12;13;35-51
```
Deletes layers 12, 13 and 35 through 51

```
CopLay 12;13;35-51 4001
```
Copies layers 12, 13 and 35 through 51 into layer 4001

```
MovLay 12;13;35-51 4001
```
Moves layers 12, 13, and 35 through 51 into layer 4001

In the Copy Layer and Move Layer examples, 12;13;35-51 are source layers and 4001 is the target layer. By default, Delete Layer, Copy Layer and Move Layer work on all open workspaces when started from a key-in. Notice the first argument in each example above uses a number line with semi-colons. This is so each field is not interpreted as a new Vr command on the key-in line. See Number Lines for more information.

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VrMapping

Layer Control (LayCon)

Type: Utility application

Detailed Description

Layer control allows control of VrOne layer settings.
The layer control dialog displays a table containing either the layers used in the currently open workspaces or all layers available. Several items in the table may be changed interactively by the user. For each layer, the following items are displayed:

- Layer Number;
- Layer Name;
- Layer display status Off/On;
- Layer snap status Off/On;
- Pen Numbers for each entity type;
- Counts for each entity type (optional),

The layer name may be changed by clicking on the layer name.

The Pen Numbers may be changed by clicking on the colored button that represents the current pen color. This will display a list of all pen numbers and the colors defined for each pen from the current color table. A new pen number may be selected for any given entity type. It is also possible to change all entity types for a single layer with one selection.

NOTE: Any changes made in the Layer Control dialog are not reflected on the graphics windows until a replot is performed.

Available Key-ins

None

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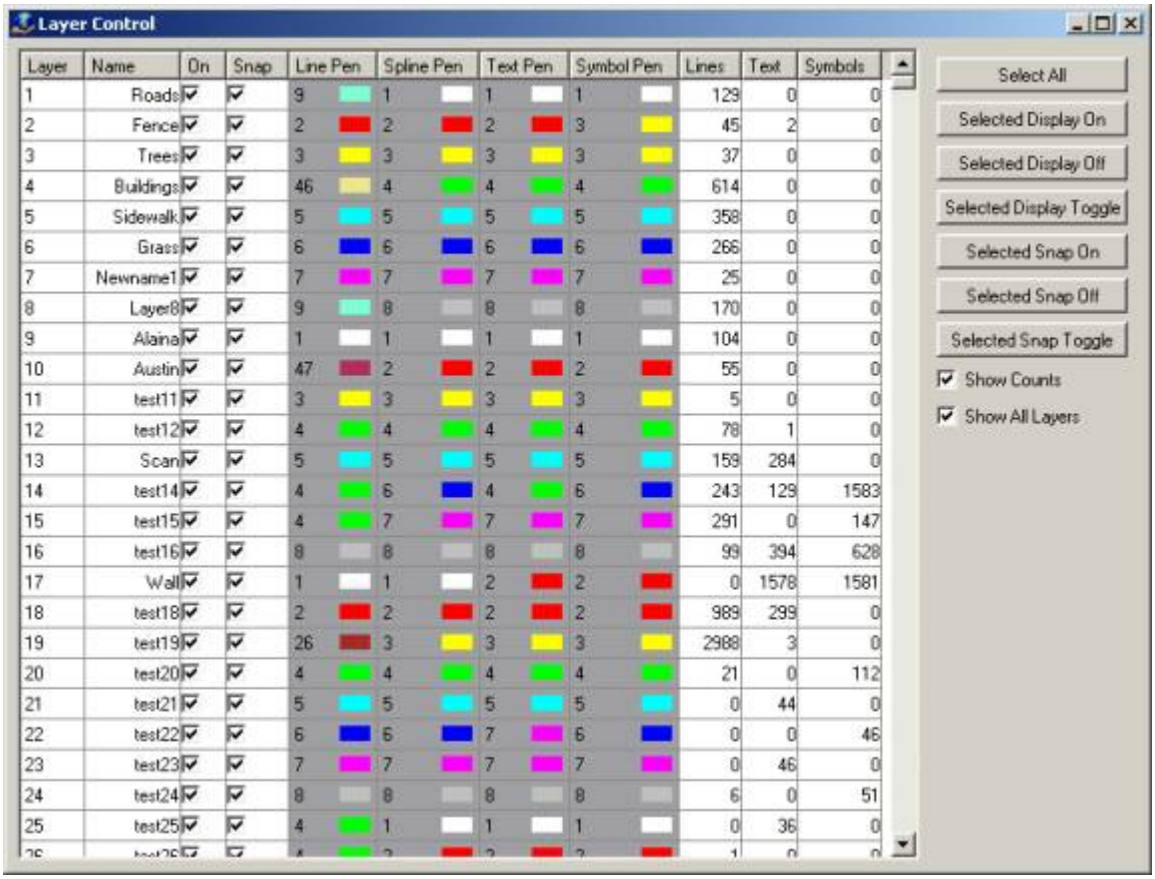
Layer Control Dialog



Layer	Name	On	Snap	Line Pen	Spline Pen	Text Pen	Symbol Pen	Lines	Text	Symbols
1	Roads	☑	☑	9	1	1	1	129	0	0
2	Fence	☑	☑	2	2	2	3	45	2	0
3	Trees	☑	☑	3	3	3	3	37	0	0
4	Buildings	☑	☑	46	4	4	4	614	0	0
5	Sidewalk	☑	☑	5	5	5	5	358	0	0
6	Grass	☑	☑	6	6	6	6	266	0	0
7	Newname1	☑	☑	7	7	7	7	25	0	0
8	Layer8	☑	☑	9	8	8	8	170	0	0
9	Alaina	☑	☑	1	1	1	1	104	0	0
10	Austin	☑	☑	47	2	2	2	55	0	0
11	test11	☑	☑	3	3	3	3	5	0	0
12	test12	☑	☑	4	4	4	4	78	1	0
13	Scan	☑	☑	5	5	5	5	159	284	0
14	test14	☑	☑	4	6	4	6	243	129	1583
15	test15	☑	☑	4	7	7	7	291	0	147
16	test16	☑	☑	8	8	8	8	99	394	628
17	Wall	☑	☑	1	1	2	2	0	1578	1581
18	test18	☑	☑	2	2	2	2	989	299	0
19	test19	☑	☑	26	3	3	3	2988	3	0
20	test20	☑	☑	4	4	4	4	21	0	112
21	test21	☑	☑	5	5	5	5	0	44	0
22	test22	☑	☑	6	6	7	6	0	0	46
23	test23	☑	☑	7	7	7	7	0	46	0
24	test24	☑	☑	8	8	8	8	6	0	51
25	test25	☑	☑	4	1	1	1	0	36	0

Select All

Selects all rows in the layer table.

Selected Display On

Turns the layer display mode on for all currently selected layers.

Selected Display Off

Turns the layer display mode off for all currently selected layers.

Selected Display Toggle

Toggles the layer display mode for all currently selected layers.

Selected Snap On

Turns the layer snap mode on for all currently selected layers.

Selected Snap Off

Turns the layer snap mode off for all currently selected layers.

Selected Snap Toggle

Toggles the layer snap mode for all currently selected layers.

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Show Counts

Specifies whether to calculate and display entity counts. Turning this on also enables the "Show All Layers" option. If this is off, then all layers are shown because the layer dialog does not determine which layers have entities and which ones do not. Whenever the layer dialog is first displayed with this checkbox on, or whenever the checkbox is toggled on, all open workspaces will be examined to determine entity counts. This may take some time if there is a large amount of data open.

Show All Layers

Specifies whether to display all layers in the dialog. If it is off, then only layers containing entities will be displayed. This can only be turned off or on if the Show Counts option if on. If the Show Counts option is off, then all layers will be displayed.

Selecting a New Pen

When using pen tables in VrOne, each layer can be assigned a unique pen number for each entity type within the layer. The pen number determines the color the entity will be displayed on the screen. The color for each pen is taken from the current color table. It is not possible at this time to change the colors defined in the color table using the layer control dialog. This must be done by editing the color table file directly.

For example, layer 1 may have a pen number of 1 for all lines entities, and a pen number of 2 for all text entities. Depending on the color table RGB (Red, Green Blue) settings, this may mean that lines are displayed in blue, and text entities are displayed in yellow.

A new pen may be assigned to a specified entity type for a layer by first clicking on the box containing the pen number and colored button, and then clicking on the color button itself. This will display the following dialog box:

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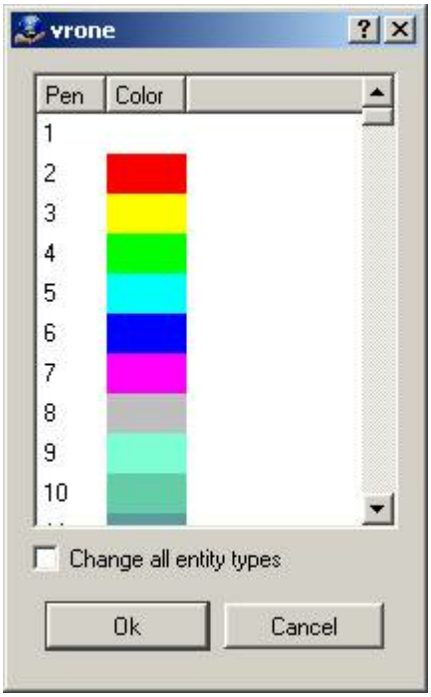

The colors displayed in this dialog depend on the currently defined color table. When a pen number is selected and the Ok button pressed, the selected pen will be assigned to the selected entity type for the selected layer. If the "Change all entity types" checkbox is selected, then all entity types for the selected layer will be changed to the selected pen number.

2.1.1.21 Stereo Model Management

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Stereo Model Management

Name	Key-in	Arguments	Description
Model Manager	ModMan		Prompts for a VrTwo Orientation project and opens a Model Manager window displaying the models in the project.

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Model Manager	ModMan	VrTwo orientation project file name	Opens a Model Manager window displaying the models in the specified project.
Auto Switch Configuration	AutSwi		Displays configuration dialog for Model Manager auto switching
Auto Switch	AutSwi	0 or 1	Turns Model Manager auto switching off/on.
Auto Switch	AutSwi	2-40	Sets Model Manager auto switch percent.
Model, Center	ModCen		If model manager is in use, the stereo model that the cursor is furthest from the edge of, is opened. The cursor location is unchanged.
Model, Next	ModNex		If model manager is in user, it moves through all models that observe the current cursor location without moving the cursor.
Model Precision	ModPre		A tool to measure the precision of feature measurements in all the models that observe it.
Model, Drive Control	ModDrC		Drives to all control points in all models. Measurements of the control points are compiled into a report.

2.1.1.21.1 Model Manager

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Model Manager (ModMan)

Type: File Operations

Displays a graphical view of multiple model footprints and provides automatic and manual model switching capabilities.

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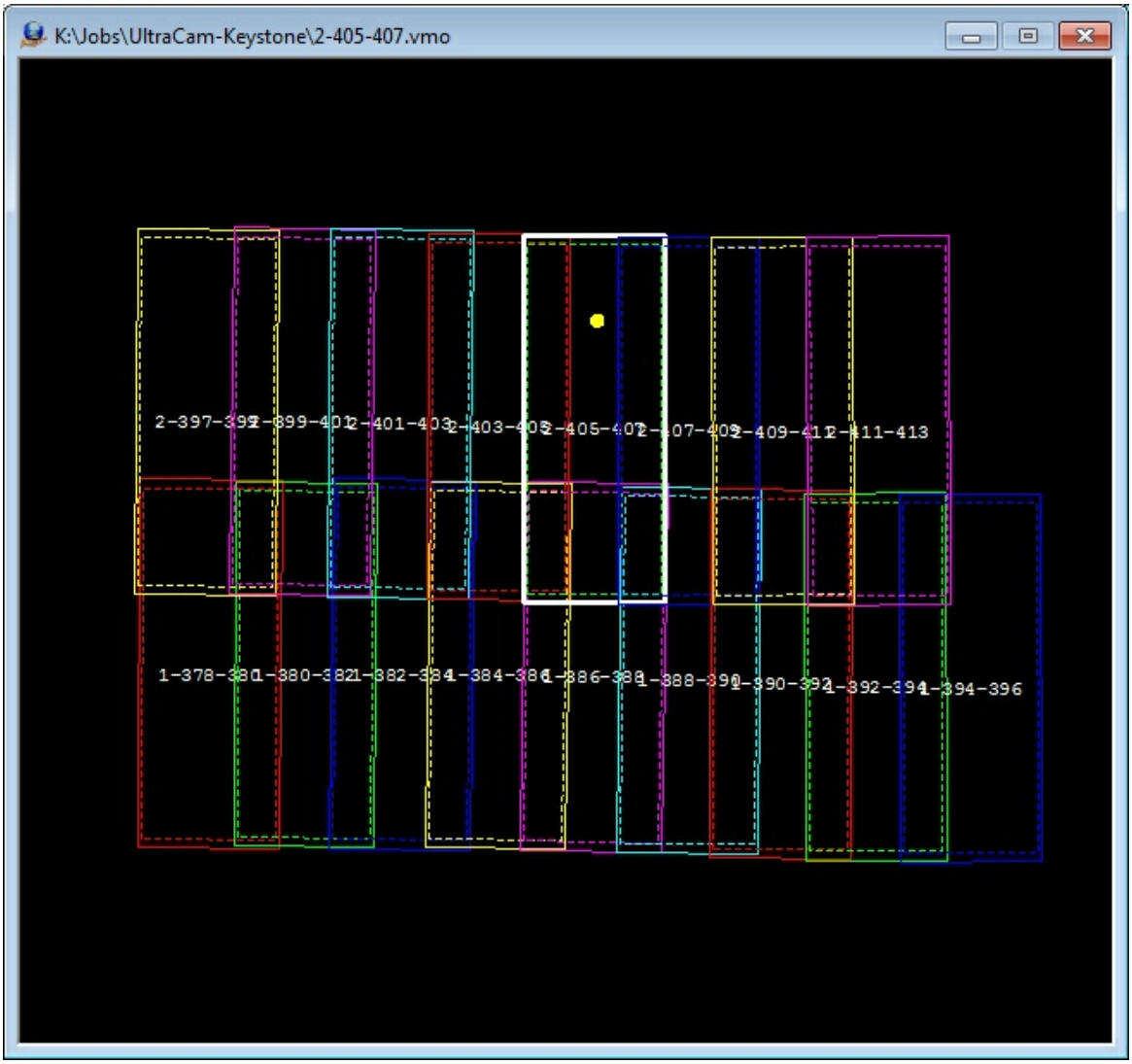
Detailed Description

The Model Manager provides the user with a visual overview of multiple models. It can also be used to automatically or interactively switch between models. The image below shows a typical project loaded by Model Manager. The solid colored lines represent the model footprints; the dashed lines represent the auto switch margin areas. The model with the thick white outline is the current model open in VrTwo and the yellow round cursor is the current cursor position in VrTwo. The model names are displayed at the center of each model, and the active model is displayed in the window caption area.



When the Model Manager command is started, it will prompt for a list of VrTwo Orientation model (.vmo) files. In order for Model Manager to determine the model footprints, the original .orp files must be present and must match the path in the .vmo files. Once the models are loaded, the model footprints will be displayed in the Model Manager window.

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The Model Manager may be started using a key-in with an argument. The argument may be a file name or a folder name. For example the key-in of "ModMan K:\Jobs\LiDAR-MRG\LiDAR-MRGImages" would start the Model Manager and the Open Model Files dialog would start in the "K:\Jobs\LiDAR-MRG\LiDAR-MRGImages" folder.

By default, automatic model switching is enabled in the Model Manager window. Whenever the cursor goes into the margin area delineated by the dashed lines within a model, VrTwo automatically switches over to the adjoining model. Automatic switching may be turned off or on, and the auto switch percent may be set using the Auto Switch (AutSwi) command. The dashed auto switch lines will only display if auto switching is on.
NOTE: When auto switching between models, the cursor ground location stays at the same location. This allows for seamless roaming across an entire project area.

In addition to automatic switching, pressing the Control and Alt keys together with one of the arrow keys will cause VrTwo to switch to the adjoining model. The cursor will move into the new model and will be placed along the crossing edge.

At any time, the system mouse may be used to select a new model within the Model Manager window. This will cause VrTwo to switch to the selected model. A different point may also be selected within the currently active model, in which case VrTwo will drive to that location in the model.
NOTE: When manually switching between models, the cursor Z location stays the same. The cursor may be placed above or below the ground in the newly selected model.

Multiple Model Manager windows may be started at the same time. Models from any open Model Manager window can be selected.

2.1.1.21.2 Model Precision

Vr
Mapping

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Model Precision (ModPre)

Type: Stereo Model Management

Measures the precision of models by walking the user through measuring a selected feature in all the models that show it. Model manager must be active to use this tool.

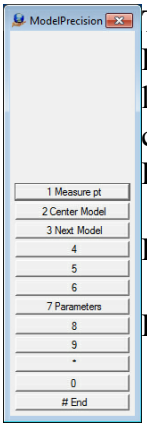
Detailed Description

The model precision allows a user to select a feature of interest in the current stereo model. It then searches for all other models that show that feature and open each in sequence to allow additional measurements of the same feature. After all observations have been made the comparison is reported in a textbox and optional to a file. In order to use the tool you must first open multiple models in the Model Manager (ModMan).

Procedure

1. Open multiple models in Model Manger (ModMan).

2. Open the Model Precision Application (ModPre). Optionally, before beginning the measure sequence, you can search for a better starting model using the "Center Model" and "Next Model" buttons.



The model precision application menu.
F1, or Pick a feature to measure in the models.
left
click
F2 Re-center the view in the best model.

F3 Toggle the view through all the models that show the current location.

F7 Allows acces to the user parameters discussed above. Parameter descriptions are given in step 3 below.

3. You may also wish to change the output parameters:

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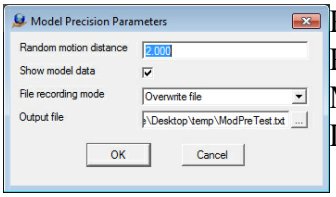
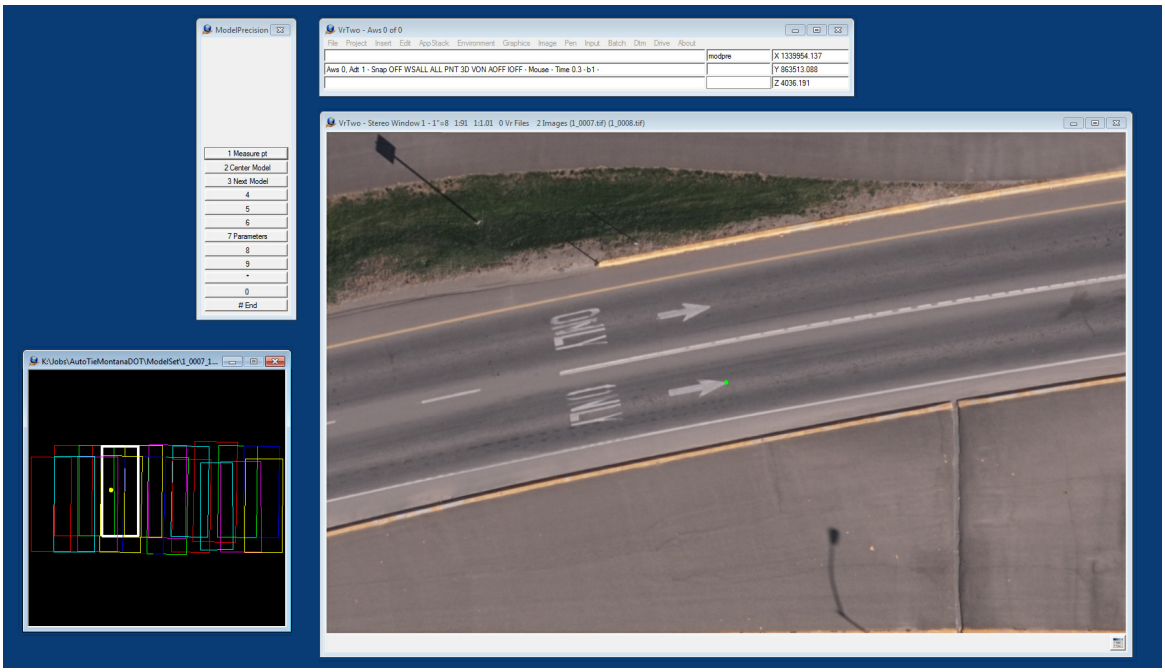


Parameters:

Random Motion Distance	When swapping models the cursor is shifted randomly in all three axes in order to keep measurements independent. This can be disabled by setting this value to zero, but leaving it at least several times the GSD is highly recommended.
Show model data	There is an optional block of data that shows the model name, the residuals from the mean measurement, the pixel radius (percent of the distance from the image center to the corner), and the image names for each model (see the example in step 6).
File recording mode	User can chose to record nothing to the output file, append to output file, or overwrite the output file
Output file	The path to the output file

4. Pick a feature that can be repeatedly measured. In the example below the user pick the head of the traffic arrow.



5. After measuring the first feature the application will drive to other models for additional measurements. The menu options change for remeasurement of the feature.

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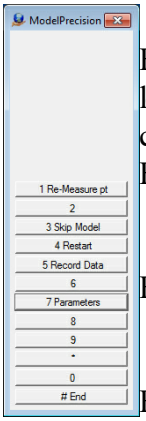


F1, or left click — Re-observe the feature at the cursor location, and then move to the next model.

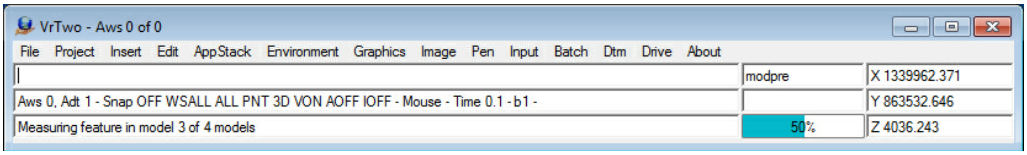
F3 — If a point is too close the edge of the model or obscured you can skip a model.

F4 — If a point is determined to be undesirable this restarts the application without saving data.

F5 — This restarts the application, but saves the data that had been recorded.

F7 — Allows access to the user parameters discussed in step 3 above.

Your progress through the stack of models is show on the main window as shown below.



6. The precision statistics are shown in the text box (and optional saved or appended to a file). Below is an example with model specific data turned on. Root mean squared error, or RMSE, is with regard to the differences of individual measurements from the mean. The maximum differences are the maximum deviations from the mean in each axial direction. RadL and RadR are descriptions of how far a point was away from the center of the raw image. 100% is as far away as possible, 0% is exactly in the center.

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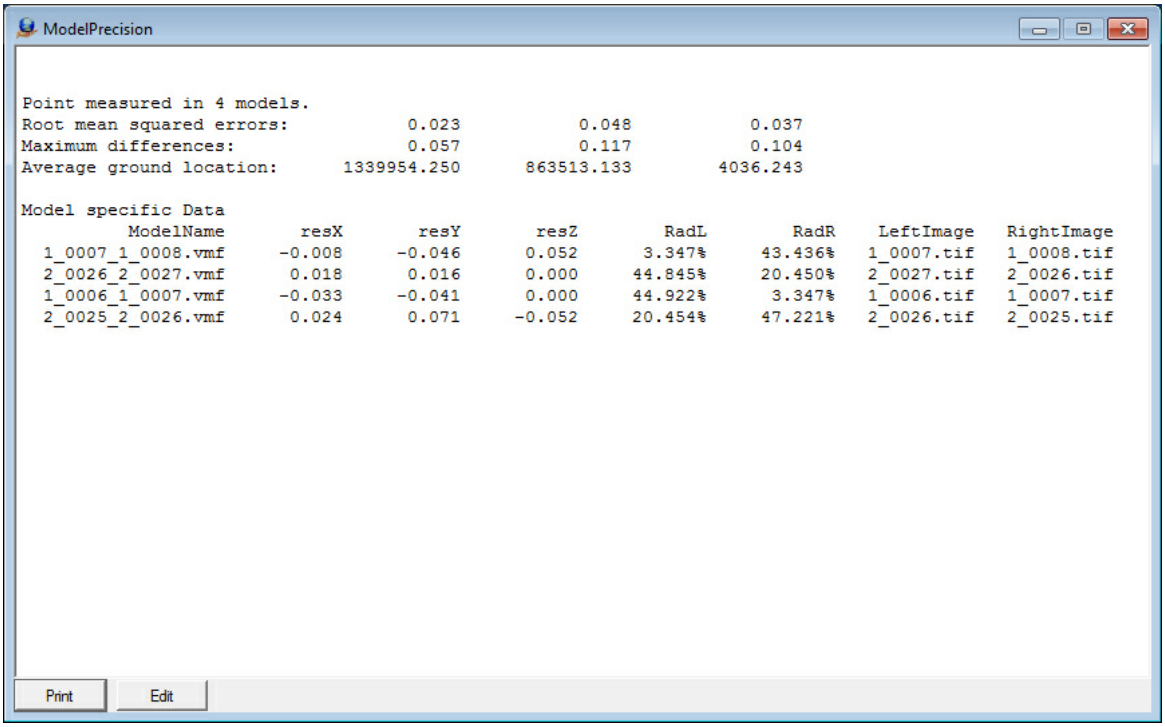

2.1.1.21.3 Model, Drive Control

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Model, Drive Control (ModDrC)

Type: Stereo Model Management

Drives to all control points in all models to generate a report of control point measurements in models.

Detailed Description

This application drive the operator from model to model to measure all the control points in the block

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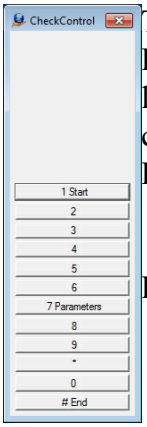
in every model that see them. The measurements are used to generate a report of the accuracy of the models. In order to use the tool you must first open multiple models in the Model Manager (ModMan).

Procedure

1. Open multiple models in Model Manger (ModMan).

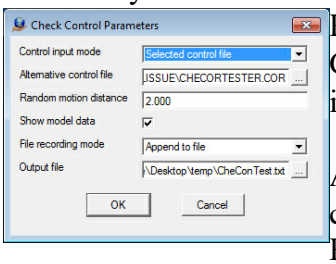
2. Start Model, Drive Control (ModDrC). The first menu allows the user to edit the parameters and chose a control file before beginning the measurement process.



The model precision application menu.
F1, or Start the measurements
left
click
F7 Allows access to the user parameters discussed above. Parameter descriptions are given in step 3 below.

F12 Close application

3. You may also wish to change the parameters:



Parameters:

Control input mode — When model files are created, the active control point are saved. The application can use these saved points or a different selected control file.

Alternative control file — If the control input mode is "Selected control file", the control in this file will be used.

Random Motion Distance — When driving to points the cursor is shifted randomly in all three axes in order to keep measurements independent. This can be disabled by setting this value to zero, but leaving it at least several times the GSD is highly recommended.

Show model data — There is an optional block of data that shows the model name, the residuals from the mean measurement, the pixel radius (percent of the distance from the image center to the corner), and the image names for each model (see the example in step 6).

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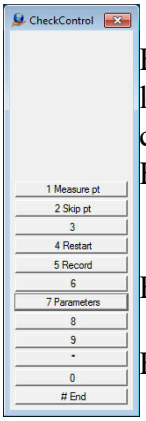
File recording mode	User can chose to record nothing to the output file, append to output file, or overwrite the output file
Output file	The path to the output file

4. Left click or push F1 to start measuring. The application will drive to all the points to measure. The menu options during this phase.



F1, or left click — Measure the control point at the cursor location, and then move to the next point.

F2 — If a point is too close the edge of the model or obscured you can skip a model.

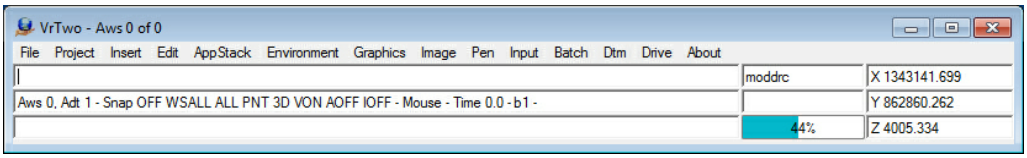
F4 — A bail out to restart the process (all measurements will be lost).

F5 — Records the data collected so far to the output file. This does not delete any data or prevent the process from continuing.

F7 — Allows access to the user parameters discussed in step 3 above. Note that change the "control input mode" or the the "alternative control file" will cause the process to restart and all measurements will be lost.

F12 — Exit the application. All measurements will be lost.

Your progress through the stack of models is show on the main window as shown below.



6. The accuracy statistics are saved to the output file. Below is an example with model specific data turned on. Root mean squared error, or RMSE, is with regard to the differences of individual measurements from the control coordinate. The maximum differences are the maximum deviations from the mean in each axial direction. RadL and RadR are descriptions of how far a point was away from the center of the raw image. 100% is as far away as possible, 0% is exactly in the center.

```
Combined Measurement Statistics
Total Control Points:  9
Total Measurements:    27
Root mean squared errors:          0.066          0.100          0.126
Maximum differences:               0.154          0.013          0.057
Minimum differences:              -0.108         -0.192         -0.260
```

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```
Point: 6096047 measured in 4 models.
Root mean squared errors:           0.074          0.107          0.125
Maximum differences:                0.100         -0.081          0.057
Maximum differences:                0.100         -0.081          0.057
Control location:             1341430.407      863156.506        4016.130

Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
  1_0009_1_0010.vmo      0.100     -0.123     -0.163     44.649%     31.224%   1_00
  1_0010_1_0011.vmo      0.015     -0.122     -0.091     31.228%     60.627%   1_00
  2_0022_2_0023.vmo     -0.108     -0.095     -0.155     11.108%     52.828%   2_00
  2_0023_2_0024.vmo      0.008     -0.081      0.057     31.456%     11.101%   2_00



Point: 656 measured in 4 models.
Root mean squared errors:           0.066          0.150          0.156
Maximum differences:                0.120         -0.103         -0.003
Maximum differences:                0.120         -0.103         -0.003
Control location:             1343154.058      862869.793        4005.250

Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
  1_0012_1_0013.vmo      0.120     -0.155     -0.260     62.483%     50.704%   1_00
  1_0013_1_0014.vmo     -0.008     -0.103     -0.111     50.705%     65.060%   1_00
  2_0019_2_0020.vmo      0.012     -0.192     -0.131     24.920%     53.391%   2_00
  2_0020_2_0021.vmo      0.055     -0.136     -0.003     38.747%     24.917%   2_00



Point: 6156047RESET measured in 4 models.
Root mean squared errors:           0.066          0.085          0.064
Maximum differences:                0.089         -0.055          0.029
Maximum differences:                0.089         -0.055          0.029
Control location:             1343310.210      864008.182        3978.440

Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
  1_0012_1_0013.vmo      0.089     -0.098      0.023     63.483%     38.545%   1_00
  1_0013_1_0014.vmo      0.064     -0.079      0.029     38.545%     52.193%   1_00
  2_0019_2_0020.vmo     -0.043     -0.055     -0.112     62.599%     72.354%   2_00
  2_0020_2_0021.vmo      0.061     -0.100     -0.046     79.413%     62.599%   2_00



Point: 6086047RESET measured in 4 models.
Root mean squared errors:           0.090          0.104          0.118
Maximum differences:                0.154         -0.082         -0.011
Maximum differences:                0.154         -0.082         -0.011
Control location:             1340546.900      862936.033        4054.010

Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
```

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1_0007_1_0008.vmo	0.154	-0.130	-0.202	70.131%	50.225%	1_00
1_0008_1_0009.vmo	0.085	-0.085	-0.110	50.224%	62.514%	1_00
2_0024_2_0025.vmo	-0.016	-0.082	-0.056	24.135%	43.869%	2_00
2_0025_2_0026.vmo	0.030	-0.109	-0.011	52.021%	24.138%	2_00

Point: 6136047RESET measured in 1 models.

Root mean squared errors:	0.007	0.114	0.041
Maximum differences:	0.007	-0.114	-0.041
Maximum differences:	0.007	-0.114	-0.041
Control location:	1338584.006	863196.732	4060.290

Model specific Data

ModelName	resX	resY	resZ	RadL	RadR	
2_0028_2_0029.vmo	0.007	-0.114	-0.041	16.280%	26.182%	2_00

Point: 6116047 measured in 3 models.

Root mean squared errors:	0.024	0.053	0.126
Maximum differences:	0.038	0.013	0.005
Maximum differences:	0.038	0.013	0.005
Control location:	1340660.240	864082.595	3999.920

Model specific Data

ModelName	resX	resY	resZ	RadL	RadR	
1_0008_1_0009.vmo	0.038	0.013	-0.084	44.698%	51.758%	1_00
2_0024_2_0025.vmo	-0.016	-0.000	-0.202	65.695%	71.952%	2_00
2_0025_2_0026.vmo	0.002	-0.090	0.005	82.368%	65.696%	2_00

Point: 45YRESET measured in 4 models.

Root mean squared errors:	0.077	0.076	0.119
Maximum differences:	0.103	-0.061	-0.006
Maximum differences:	0.103	-0.061	-0.006
Control location:	1340052.418	863570.699	4037.670

Model specific Data

ModelName	resX	resY	resZ	RadL	RadR	
1_0006_1_0007.vmo	0.085	-0.089	-0.177	52.765%	7.645%	1_00
1_0007_1_0008.vmo	0.103	-0.068	-0.037	7.647%	35.497%	1_00
2_0025_2_0026.vmo	0.031	-0.082	-0.006	25.852%	43.126%	2_00
2_0026_2_0027.vmo	0.069	-0.061	-0.155	53.661%	25.852%	2_00

Point: C5133 measured in 2 models.

Root mean squared errors:	0.033	0.065	0.214
Maximum differences:	0.047	-0.047	-0.189
Maximum differences:	0.047	-0.047	-0.189
Control location:	1342293.507	863449.485	4005.610

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```
Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
  1_0011_1_0012.vmo      0.047     -0.047     -0.189     15.175%     28.342%   1_00
  2_0021_2_0022.vmo      0.001     -0.080     -0.237     24.088%     40.927%   2_00


Point: 6126047RESET measured in 1 models.
Root mean squared errors:            0.047          0.101          0.030
Maximum differences:                 0.047         -0.101          0.030
Maximum differences:                 0.047         -0.101          0.030
Control location:              1338565.774     864105.968     4021.140

Model specific Data
          ModelName       resX       resY       resZ        RadL        RadR
  2_0028_2_0029.vmo      0.047     -0.101      0.030     65.589%     69.976%   2_00
```

2.1.1.22 Macros

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Vr Mapping

Macros

Although any key-in may be placed in a macro, the following commands are useful when programming macros.

Name	Key-in	Arguments	Description
Wait for application exit	Wait		Waits until the current application has terminated before processing any more commands. Should be used from Vr Macros only.
Sleep	Sleep	Microseconds 1000=1second	Pauses the program for a user specified time.

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Print	Print	String	Prints message to Command Window.
Verbose	Verbose	Off | On	When on, all commands received echo to the Command Window.

2.1.1.23 Window Management

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Vr Mapping

Window Management

Name	Key-in	Description
2D Window	OpeWin	Displays the 2D window.
2.5D VrThree	3DC	Displays the 2.5D VrThree window.
3D Stereo VrThree	3DSC or Vr3 or VrThree	Displays the 3D VrThree window in stereo.
3D Viewing Window	3DS	Displays the 3D viewing window in stereo.
Save Window	SavWin	Saves graphics window to a file.
Capture Window	CapWin	Captures graphics window to the clipboard.
Close Window	CloWin	Closes the last opened graphics window.

2.1.1.23.1 3D Viewer

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Vr

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Mapping

3D Stereo Viewer (3DS)

Type: Graphics Tools

Allows user to view VrOne vector data dynamically using 3D stereo perspectives.

Detailed Description

The 3D viewer is a display-only window that allows vector data to be viewed from any perspective. The vector data may be scaled and rotated in real-time, allowing quick analysis of the vector data. The Z value of the vectors can be exaggerated to give a clearer view of terrain changes. When viewing triangles (any closed line with 3 points), hidden lines may be removed from view.

This is intended for small to medium datasets. Trying to load 10 million LiDAR points for viewing will probably make the viewer unresponsive.

The following mouse controls can be used to change the view.

Left button	Up/Down movement=X rotation, Left/Right movement=Y rotation
Right button	Up/Down movement=Z rotation
Shift-Left button	Pan
Scroll	Zoom In/Out
Shift-Scroll	Faster Zoom In/Out
Ctrl-Scroll	Exaggerate Z scale

3D Viewer

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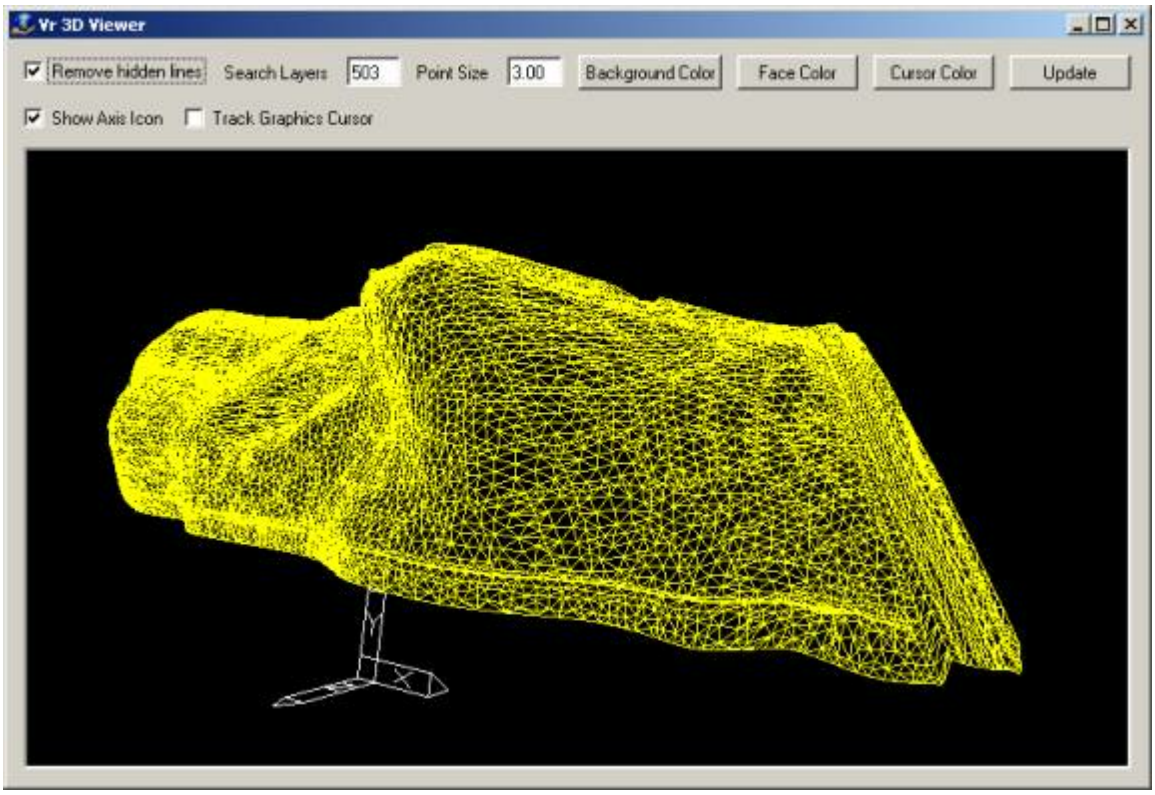

Remove hidden lines
Specifies whether triangles (closed lines with 3 points) hide lines that are behind them..

Show Axis Icon
Specifies whether any axis icon will be displayed in the bottom left hand corner of the window. The above sample dialog has the icon turned on, showing the current direction of X,Y,Z.

Track Graphics Cursor
Specifies whether a cross-shaped cursor is displayed at the current ground location of the VrOne graphics cursor. The cursor will be displayed dynamically as the VrOne graphics cursor is moved in one of the VrOne graphics windows.

Search Layers
Specifies which layers in the currently open workspaces are displayed.

Point Size
Controls the size (in pixels) that points are to be displayed. All VrOne symbols are displayed as single points in the 3D viewer.

Background Color
Displays a color selection dialog to select a color for the background of the 3D viewer display area.

Face Color
Displays a color selection dialog to select a color for the face of triangles.

Cursor Color
Displays a color selection dialog to select a color for the cursor (if cursor tracking is on).

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Update
Press this button after changing the search layers to reload the vectors using the current layer number line.

2.1.1.24 Pen Management

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Vr Mapping

Pen Management

Name	Key-in	Arguments	Description
Change Pen	ChaPen		Interactive change entity pen number
Load Pen Table	LoaPen		Loads pen table. Prompts with dialog box
Load Pen Table	LoaPen	File name	Loads pen table
Load Alternate Pen Table	LoaAltPen		Loads alternate pen table. Prompts with dialog box
Load Alternate Pen Table	LoaAltPen	File name	Loads alternate pen table
Reset Pen Table	ResPen		Resets all pen numbers to 1 in the current pen table
Reset Alternate Pen Table	ResAltPen		Resets all pen numbers to 1 in the alternate pen table
Random Color File	RanCol		Random color file by changing pen numbers

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2.1.1.24.1 Change Pen

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Vr Mapping

Change Pen (ChaPen)

Type: Interactive Application

Changes entity pen numbers (colors) by pointing at individual entities.

Detailed Description

Changes an entity's Pen Number. If VrOne is using a Pen Table then changing the pen number of an existing entity modifies that entry in the current Pen Table. If VrOne is not using a Pen Table then only the Pen Number of the current entity is changed. If a Pen Table is not being used, the "Change like" option changes all entities like the current one to the current Pen Number. If, for example, the current entity is a line in layer 23 and the current Pen Number is 2, pressing 'Change Like' will change all lines in layer 23 to Pen Number 2.

Local Commands

Key-in	Description	Range
SEALIN=	Search for Lines	0=No 1=Yes
SEASYM=	Search for Symbols	0=No 1=Yes
SEATEX=	Search for Text	0=No 1=Yes

Button Assignments

Change Pen – Id

	Button	Description
1	Id entity	Identifies entity to change.

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2	Cycle ent type	Cycles entity type from Lines to Symbols to Text.
3		
4	Toggle lines	Toggles searching for lines.
5	Toggle symbols	Toggles searching for symbols.
6	Toggle text	Toggles searching for text labels.
7		
8		
9		
*		
0		
#	End	Ends application.

Change Pen – Confirm

	Button	Description
1	Search	Stores current pen value and returns to previous menu.
2	Pen +1	Increments the current pen number by one.
3	Pen –1	Decrements the current pen number by one.
4	Pen =1	Sets the current pen number to one.
5	Pen +5	Increments the current pen number by five.
6	Pen -5	Decrements the current pen number by five.
7	Pen +10	Increments the current pen number by ten.
8	Pen -10	Decrements the current pen number by ten.
9	Replot	Replots the graphics window to show new pen numbers. If a Pen Table is not being used, this button is labeled “Change like” and changes like entities to the current pen number.
*		
0		
#	End	Ends application.

2.1.1.25 Translators

Vr Mapping

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Translators

Name	Key-in	Description
ASCII Out	AscOut	VrOne to ASCII list
ASCII In	AscIn	ASCII list to VrOne
CAiCE In	CaiIn	CAiCE to VrOne
CAiCE Out	CaiOut	VrOne to CAiCE
Dxf In	DxfIn	Drawing Exchange Format to VrOne
Dxf Out	DxfOut	VrOne to Drawing Exchange Format
Grid In	GriIn	Translates grid point formatted files to VrPoints in VrOne files.
Grid Out	GriOut	Translates VrPoints in VrOne files to grid point (GridFloat) formatted files.
Cm2Vr	Cm2Vr	CADMAP to VrOne (External program)
Vr2Cm	Vr2Cm	VrOne to CADMAP (External program)
KLM Out	KlmOut	VrOne to KML (Google Earth)
MicroStation Out	MstOut	VrOne to MicroStation
MicroStation In	MstIn	MicroStation to VrOne
Shape Out	ShpOut	VrOne to ArcView Shape file
Shape In	ShpIn	ArcView Shape file to VrOne
Survey Points Out	SurOut	VrOne to Survey Points format
DSFL Out	DsfOut	VrOne to Danish DSFL format
DSFL In	DsfIn	Danish DSFL format to VrOne
LAS Out	LasOut	VrOne Points to LAS format
LAS In	LasIn	LAS format to VrOne Points
Points Out	PoiOut	VrOne Points to ASCII Points files (.pts)
Points In	PoiIn	ASCII Points files (.pts) to VrOne Points
XML In	XmlIn	LandXML schema based surface XML files into VrOne data files
XML Out	XmlOut	VrOne lines and symbols into a LandXML schema based XML file.

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Create Font	CreFon	Converts VrOne symbol file or .mst cells to font characters.
Import Function Key file	ImpFun	Imports a generic feature key (.csv) file and creates skeleton Function Keys.
Import CAiCE Profile Table	ImpCai	Imports a CAiCE Profile Table and creates skeletal Function Keys.

2.1.1.25.1 ASCII In

Vr Mapping

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ASCII IN (AscIn)

Type: Translator

Translates ASCII files to VrOne files.

ASCII file formats are exported by many software packages including the ASCII Out application. This provides a method to import simple data into VrOne. The ASCII In translator allows the user to specify a variety of input formats, and supports Lines, Splines, Text, and Symbols. Files may be translated into the current open VrOne file or may be translated in a batch mode into multiple VrOne files.

Load Parameters	Record Parameters	
Parameters	Pen Codes	Field Positions
Translate		

ASCII In

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Load Parameters

Loads previously recorded ASCII IN (.asi) parameter file.

Record Parameters

Records current translation parameters to a ASCII IN (.asi) parameter file.

Define Input Filenames

Allows all ASCII input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .asc by default, but will attempt to read in any file chosen.
The VrOne output filenames will only be used if the "Translate to separate VrOne files" option is on.

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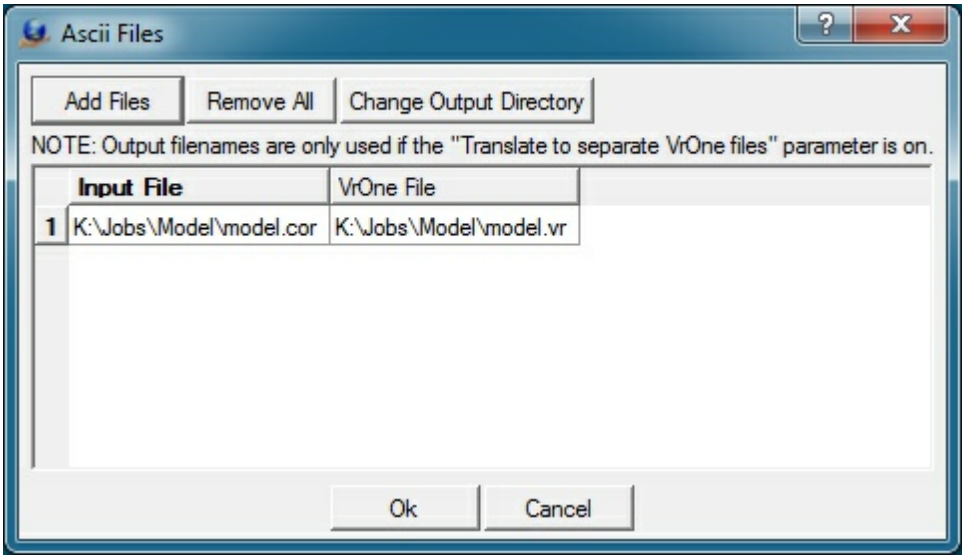

Add Files
Displays a standard VrOne file selection dialog. All files selected will be added to the list of Input files. A VrOne output filename will be generated based on each input filename.

Remove All
Removes all files from the Input file table.

Change Output Directory
Allows changing the output directory (folder). By default the output directory is the same as the input file directory

Parameters

Allows editing general translation parameters.

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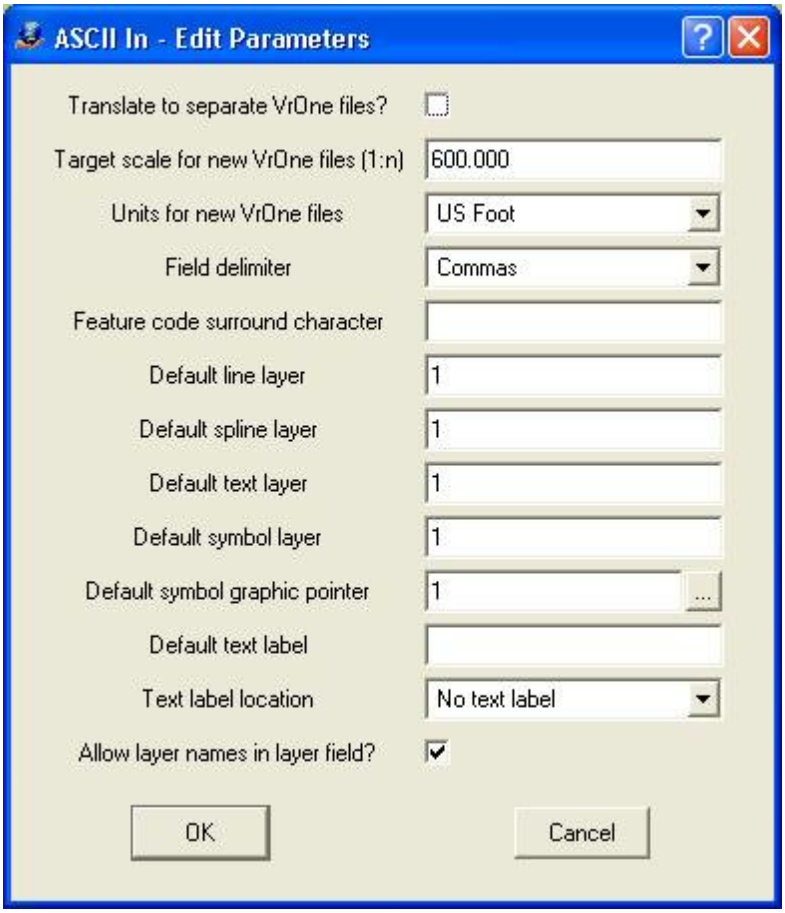

Translate to separate VrOne files?
Specifies whether each ASCII input file is translated to a separate VrOne file. The Input to Output filename cross-reference is set in the "Define Input Filenames" dialog.

Target scale for new VrOne files (1:n)
Defines a target scale to use when creating the new VrOne file if the "Translate to separate VrOne file?" is on and a VrOne file does not exist during translation.

Units for new VrOne files
Specifies units to use when creating the new VrOne file iff the "Translate to separate VrOne file?" is on and a VrOne file does not exist during translation. The options are "US Foot", "Meters", and "Intl Foot".

Field Delimiter
Specifies the delimiter character that separates items on each line of the input file. The options are “Spaces” or “Commas”. Files that are “Space” delimited may have one or more spaces or tabs between the fields.

The following is an example of a "Comma" delimited file:

```
1179628.12,353045.78,4958.23
1179627.64,353044.99,4958.32
```

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```
1179628.06,353048.43,4958.12
1179627.43,353048.44,4958.78
1179627.26,353058.37,4958.85
1179627.81,353058.38,4958.21
1179627.05,353067.99,4958.76
1179627.59,353068.04,4958.46
1179626.06,353102.36,4959.36
1179626.68,353102.37,4958.89
1179626.28,353097.43,4959.22
1179663.07,353046.12,4957.01
```

The following is an example of a "Blank" delimited file:

```
1179628.12   353045.00   4958.23
1179627.64   353044.99   4958.32
1179628.06   353048.43   4958.10
1179627.43   353048.44   4958.78
1179627.26   353058.37   4958.85
1179627.81   353058.30   4958.21
1179627.05   353067.99   4958.76
1179627.59   353068.04   4958.46
1179626.06   353102.36   4959.36
1179626.68   353102.37   4958.89
1179626.28   353097.43   4959.22
1179663.07   353046.12   4957.01
```

Feature Code Surrounding Character

Specifies the character that surrounds feature codes. This is only used if a Feature Code field position is specified. This can only be a single character, such as a quote. If the Feature Codes contain blanks and the input file is blank delimited then a surround character must be used so the parser does not get confused by the blanks in the Feature Code. If the input file is comma delimited, the surround character is optional if there are no commas in the Feature Codes.

Following is an example of a line from a "Blank" delimited input file containing a Feature Code (`Feature 7723`) at the last field position.

```
734370.0   4069560.0   620.0   Sym   "Feature 7723"
```

Following is an example of a line from a "Blank" delimited input file containing a Feature Code (`Feature7723`) without any blanks at the last field position. Without any blanks in the Feature Code, the surround character is not needed.

```
734370.0   4069560.0   620.0   Sym   Feature7723
```

Following is an example of a line from a "Comma" delimited input file containing a Feature Code (`Feature 7723`) at the last field position.

```
734370.0,4069560.0,620.0,Sym,Feature 7723
```

Following is an example of a line from a "Comma" delimited input file containing a Feature Code (`Feature,7723`) that contains a comma at the last field position. Since the Feature Code contains a comma, the surround character is needed for proper line parsing.

```
734370.0,4069560.0,620.0,Sym,"Feature,7723"
```

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Default line layer
Defines the layer that will be used for all lines if a layer field is not in the input file.

Default spline layer
Defines the layer that will be used for all splined lines if a layer field is not in the input file.

Default text layer
Defines the layer that will be used for all text if a layer field is not in the input file.

Default symbol layer
Defines the layer that will be used for all symbols if a layer field is not in the input file.

Default symbol graphic pointer
Defines the graphic pointer that will be used for all symbols.

Default text label
Defines the text label that will be used if no text labels are in the input file.

Text label location
Defines the location of the text label field on lines that define text locations in the input file. The options are "No Text Label", "End of the record", or "Record following". If the "No Text Label" option is chosen, then the text is placed with the default text label. If the "End of the record" option is chosen, the text label is taken from the last field of the current text record. If the "Record following" option is chosen, the text label is taken from the next line in the input file (the entire line is read as text label).

Allow layer names in Layer field?
Specifies whether any layer names found in the layer name field are looked for in the current layer name table. If this setting is on and a match is found, the entity will be placed in the layer that matches the layer name. If this is off, then all layers must be numeric.

Pen Codes

This allows the user to define the pen codes for lines vertices, symbols, or text. Each line in the input file must contain a pen code that identifies the type of information it contains. For example, text elements may be defined by the Pen code "Text". Lines and Splined Lines are created by using different pen codes to indicate when a new line should be started (Pen down), and when it should be ended (Pen Up or Pen end). **NOTE:** The pen up, pen down, and pen end codes should all be different or AscIn will not translate the lines correctly.

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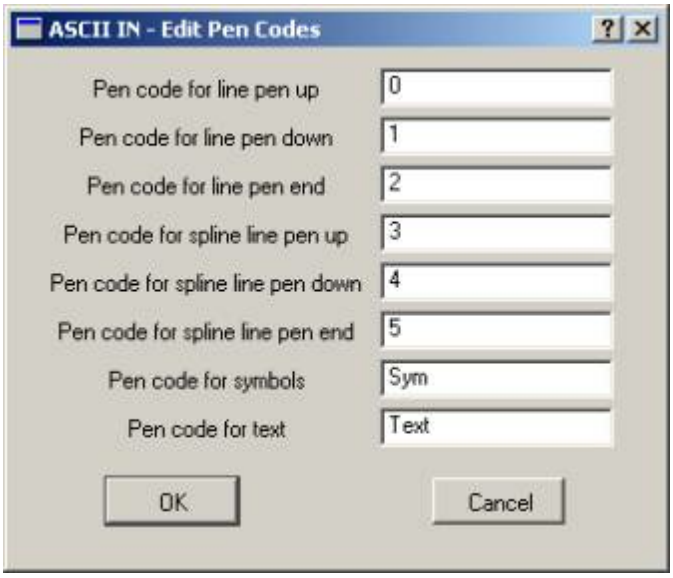
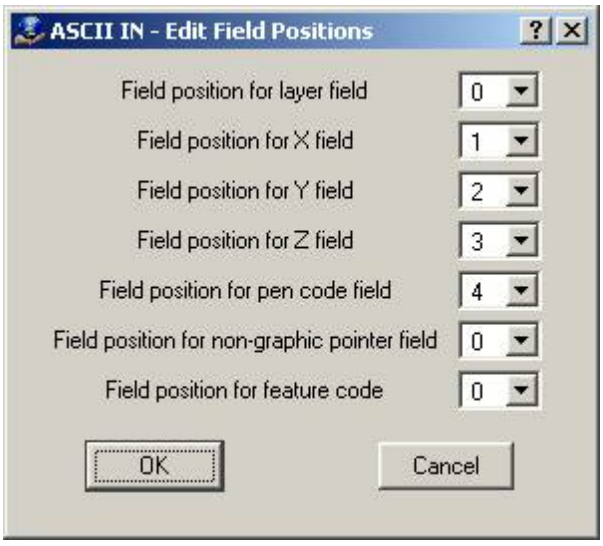


Field Positions

Defines the field positions of each data item in the ASCII input file. Each line in the ASCII file must contain data that matches the fields positions defined in this dialog box. A 0 field position indicates that the field is not present.



The dialog box shown above defines a very basic ASCII file format. In this case, the file only contains the X,Y,Z and pen code information for each record. A sample line from a comma-delimited file that matches this format would look as follows:

123.45,154.43,12.54,Sym

If the Pen Code field in set to zero and the input file contains no pen codes then each record will be translated as a Vr Symbol.

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NOTE: ASCII In will ignore any lines in the ASCII file that contain less fields than specified here.

Translate

Begins the file translation process. All files that were defined by the “Define input Filenames” option will be imported.

Help

Starts the browser and displays the current help document.

Quit

Quits ASCII In and gives an option to save the current parameters if they have been changed.



2.1.1.25.2 ASCII Out

Vr Mapping

ASCII Out

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2.1.1.25.3 CAiCE In/Out

Vr

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Mapping

CAiCE In/Out

Type: Translator

Translates vector and point data to and from the CAiCE (Computer Aided Civil Engineering) .srv files.

The Autodesk CAiCE software system is used to automate civil engineering design and surveying tasks and is used by surveyors in consulting firms, county and municipal agencies, and departments of transportation (DOT). With the Vr Mapping CAiCE In and CAiCE Out translators, map data can be imported from and exported to the CAiCE system.

Map data is exchanged using .srv ASCII files. CAiCE Feature key information can be read into a Vr Mapping Function Key file using the .tbl ASCII file.

CAiCE is a trademark of Autodesk, Inc.

CAiCE Profile Tables and Vr Function Key Files
CAiCE In
CAiCE Out
The CAiCE Profile Table File
The CAiCE .srv File
CAiCE / VrOne Database Notes

CAiCE Profile Tables and Vr Function Key Files

CAiCE and Vr Mapping share a somewhat common concept for the definition of mapping features. CAiCE uses Profile Tables (.tbl) and Vr Mapping uses Function Keys in which mapping features are described with applicable attributes. Although all the attributes are transferable, Vr Mapping offers the ability to read a CAiCE Profile Table and convert the attributes to a Vr Mapping Function Key file. Since all the attributes are not common and transferable, the user needs to refine the Function Key file using Edit Function Keys (EdiFun) after the conversion.

The the CAiCE Profile Table should be converted and the Vr Mapping Function Key file should

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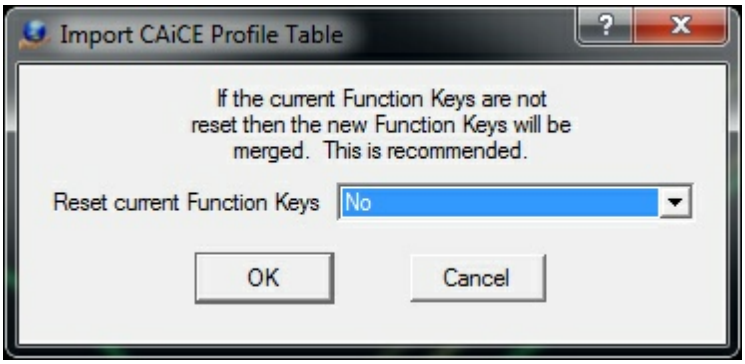
be edited before translations from (to) the CAiCE .srv file are performed.

The conversion for a CAiCE Profile Table to a Vr Mapping Function Key file may be performed by using the "Import CAiCE Profile Table" (ImpCai) application. This may be started by using the ImpCai key-in or from the Input pull-down in VrOne or VrTwo.



Import CAiCE Profile Table warning dialog

On starting the Import CAiCE Profile Table application, a dialog is displayed with information about the conversion and the current Function Key file name. The Function Key file is defined in the Vr Configuration (\vr\bin\vrcfig.exe) program.



Reset Function Keys option dialog

If this is the first time importing a CAiCE Profile Table, the current Vr Mapping Function Key file may be reset. Resetting the Function Key file erases the existing Vr Mapping Function Key definitions. Entering "No" merges the new CAiCE Profile Table attributes with existing Vr Mapping Function Key definitions. This is the recommended setting.

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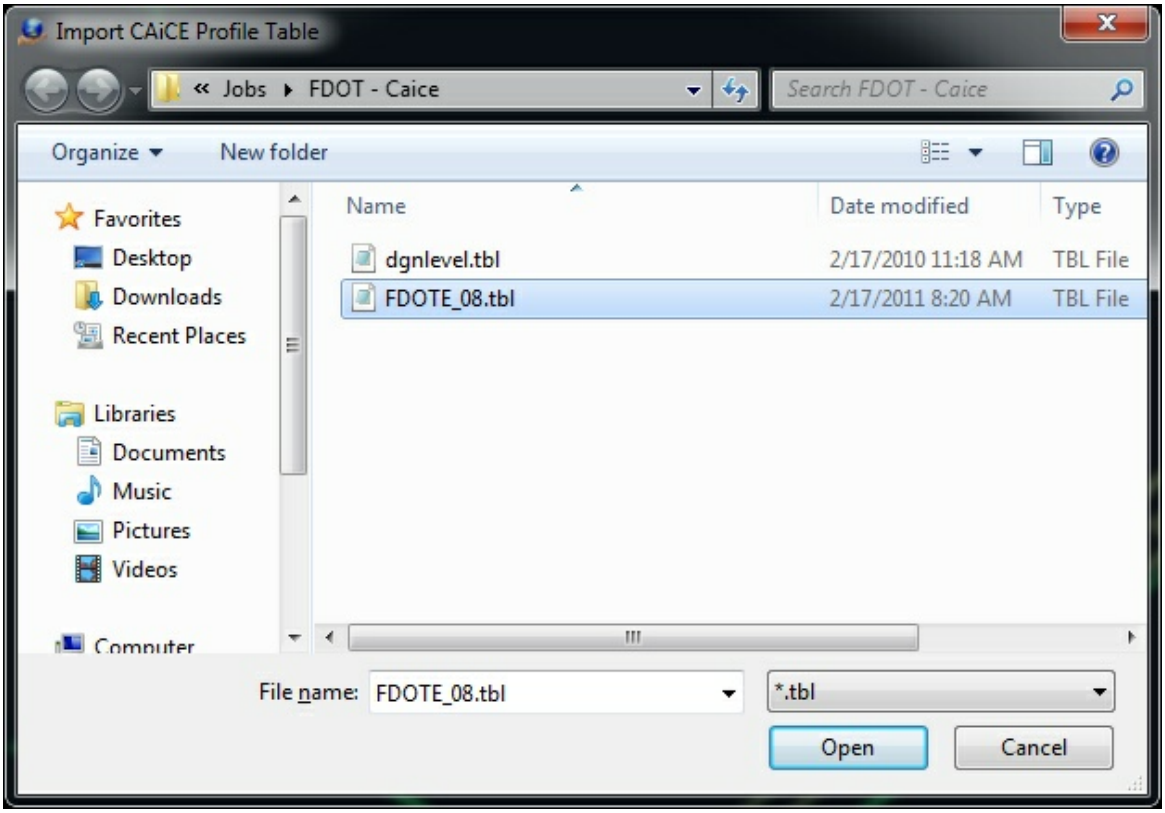

Import CAiCe Profile Table file definition

The "Import CAiCE Profile Table" file dialog allows selection of the .tbl file that will be converted into a Vr Mapping Function Key file.



Function Key import result dialog

After conversion, the number of CAiCE Profile Table that were converted to Vr Mapping Function Keys is displayed. These Function Keys may now be refined and edited using the "Edit Function Key" (EdiFun) application in VrOne or VrTwo. The Vr Mapping Function Keys that were converted should be edited before conversions from (to) CAiCE .tbl files are attempted.

CAiCE In

The CAiCE In translator converts CAiCE .srv files to one or more VrOne vector files. The translator may be started using the CAiCE In (CaiIn) command or the File -> Import pull-down

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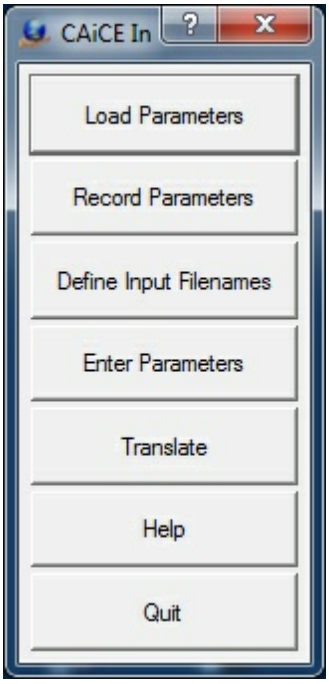
menu in VrOne or VrTwo.



The CAiCE In main dialog

To perform a translation, parameters should be entered using "Enter Parameters" or, if they have been previously created, loaded using "Load Parameters". Input file names must be defined using "Define Input Parameters". Once the parameters and filenames have been defined the parameters may be recorded for later use.

Load Parameters

Allows loading previously recorded translation parameters. The CAiCE In parameter files use .cai as the file extension.

Record Parameters

Records the current translation parameters to a CAiCE In parameter file. The CAiCE In parameter files use .cai as the file extension.

Define Input Filenames

The CAiCE In translator has the ability to translate more than one file at a time. The input and output files are defined using this command. The input filenames must be defined before a translation can be performed.

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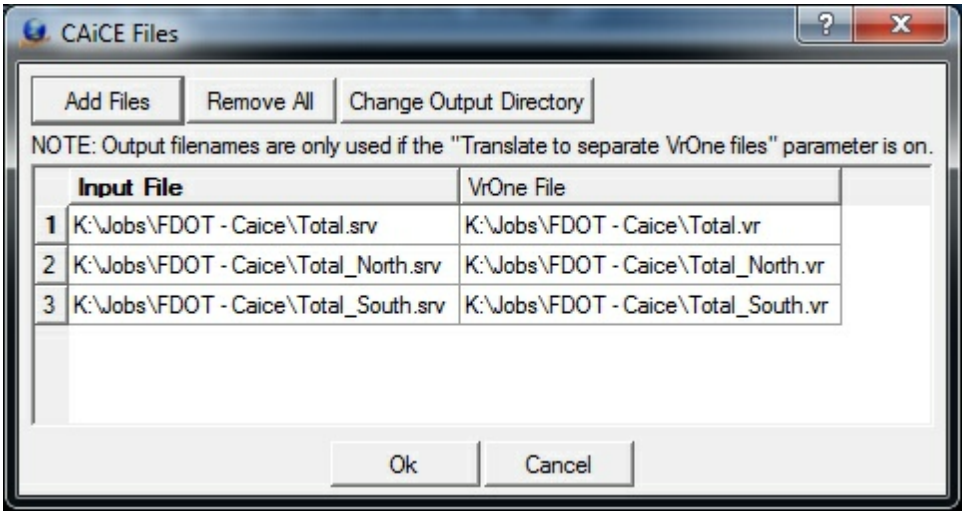

The input and output file definition dialog

The input.srv files and the corresponding output VrOne files are displayed in the main panel of this dialog. The filenames in the VrOne File column may be edited from the keyboard.

Add Files
Allows definition of input .srv files. The corresponding output VrOne files are automatically assigned and use the same filename as the input file but with a .vr file extension.

Remove All
Removes all input and output file definitions after confirmation.

Change Output Directory
Allows a new output directory to be defined. All VrOne File names are updated.

The output file names are only used if the "Translate to separate VrOne files" parameter is checked in the "Edit Parameters" menu. If this option is turned off, the input files are translated into the current Vr Workspace.

Enter Parameters



The CAiCE In Edit Parameters dialog

Translate to separate VrOne files?
Specifies whether each input file is translated into a seperate VrOne file. If the target file does

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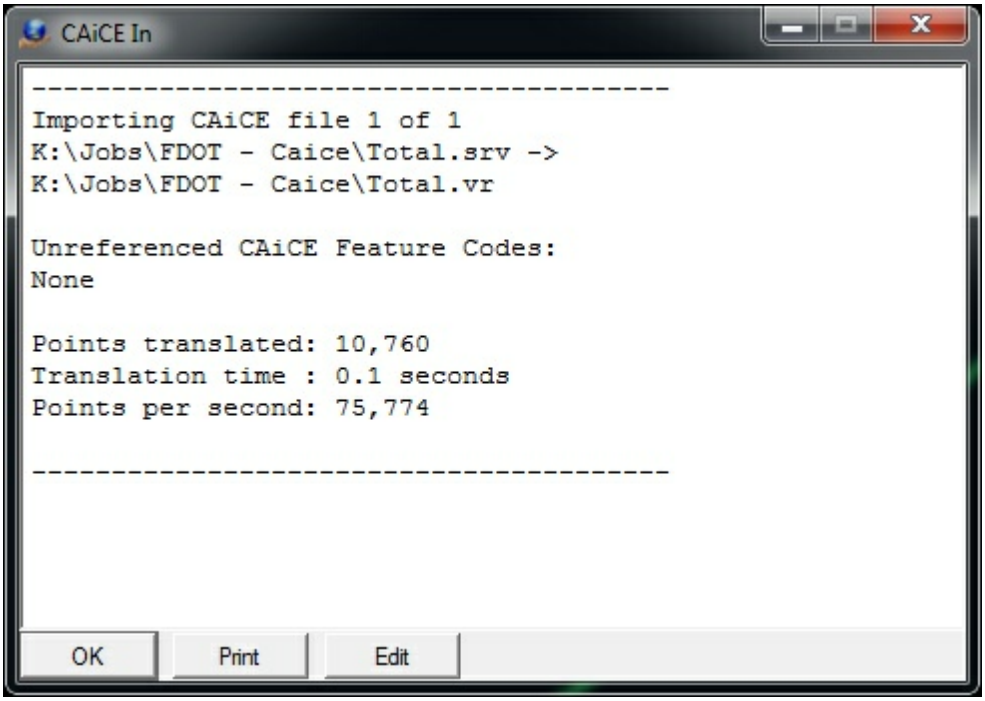
not exist, it is created. If this parameter is unchecked, the input files are translated into the current Vr Workspace.

Target scale for new VrOne files (1:n)

Defines the target scale to create VrOne files if input files are being translated into separate VrOne files and the new VrOne file does not exist. The target scale is entered in ratio form. For example, 1:1200 is the same as 1 inch equals 100 feet.

Translate

Performs the translation from .srv files to VrOne files.



Translation status window

The translation status window displays the source and target files as they are being translated along with the number of points translated, total translation time, and the number of points translated per second.

During translation, each CAiCE Feature Code must have a corresponding Vr Function Key. If a Function Key is missing, the CAiCE Feature Code name will be listed under "Unreferenced CAiCE Feature Codes" and default values will be used when creating the entity in VrOne.

Help

Displays this help page.

Quit

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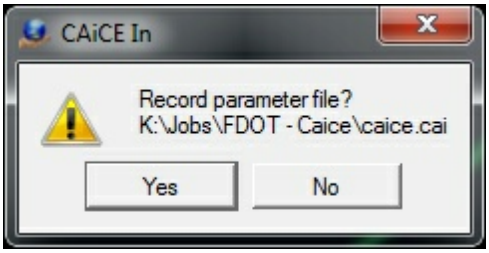
Quits the CAiCE In translator. If the translation parameters have been modified, the user will be prompted to record them when exiting the application.



Record parameter file when exiting CAiCE In

CAiCE Out

The CAiCE Out translator converts one or more VrOne vector files into a CAiCE .srv file. The translator may be started using the CAiCE Out (CaiOut) command or from the File -> Export pull-down menu in VrOne or VrTwo.



The CAiCE Out main dialog

To perform a translation, parameters should be entered using "Enter Parameters" or, if they have been previously created, loaded using "Load Parameters". Once the parameters and filenames have been defined, the parameters may be recorded for later use.

Load Parameters

Allows loading previously recorded translation parameters. The CAiCE Out parameter files use .cao as the file extension.

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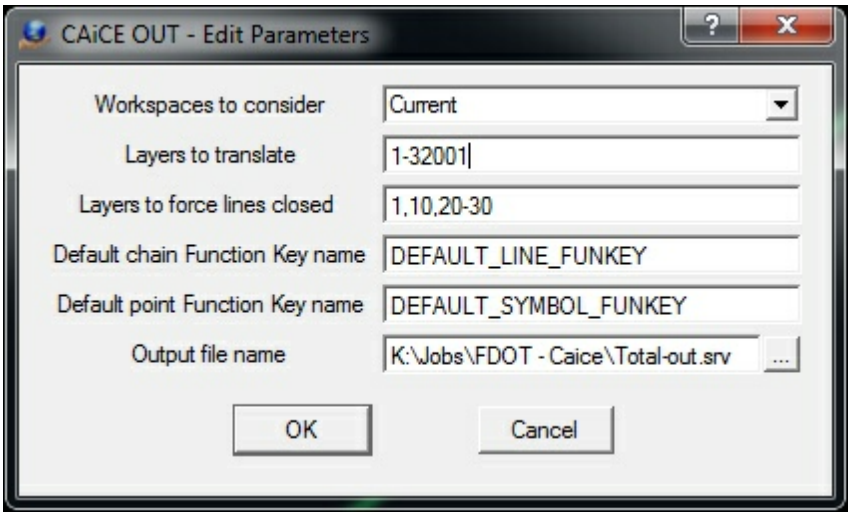
Record Parameters

Records the current translation parameters to a CAiCE Out parameter file. These files use .cao as the file extension.



The CAiCE Out Edit Parameters dialog

Workspaces to consider

Specifies the workspaces to use when translating VrOne data to a CAiCE .srv file. Options are "Current" or "All open". When "All open" is used all open workspaces will be translated into a single CAiCE .srv file.

Layers to translate

Specifies the VrOne layers to translate. Multiple layers can be selected using a Number Line

Layers to force lines closed

Specifies the layers whose lines are forced closed by adding a line segment between the first and last point on the line. The closed line is translated into the .srv file but is not modified in the VrOne file.

Default chain Function Key name

During translation, each VrOne line entity should be linked to a Vr Function Key through the entity Source Id. Lines that are placed without using a Function Key will not have a Source Id assignment. For example, Insert Line will not assign a Source Id. Lines that do not have this Id will use the Vr Function Key specified with this parameter. The Function Key name specified must exist in the Function Keys database. Edit Function Keys (EdiFun) may be used to edit and define these keys.

Default point Function Key name

During translation, each VrOne symbol entity should be linked to a Vr Function Key through the entity Source Id. Symbols that are placed without using a Function Key will not have a Source Id assignment. For example, Insert Symbol will not assign a Source Id. Symbols that do not

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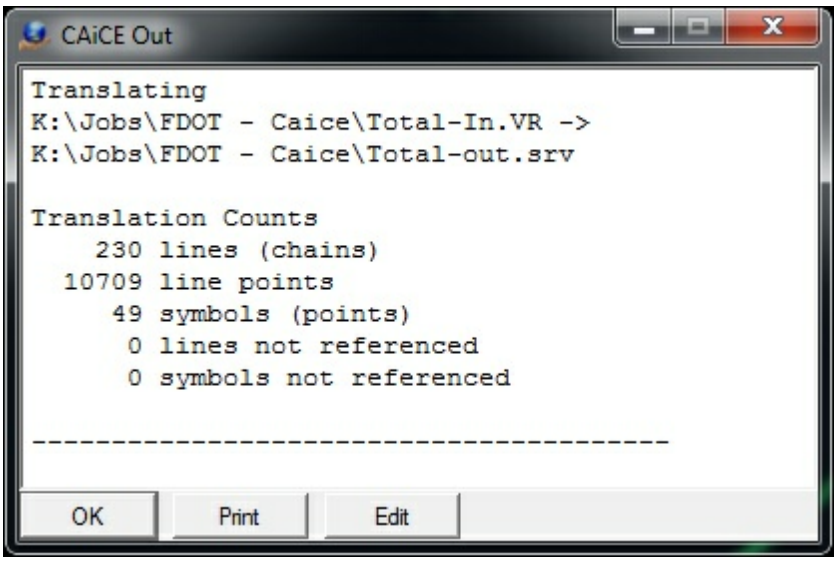
have this Id will use the Vr Function Key specified with this parameter. The Function Key name specified must exist in the Function Keys database. Edit Function Keys (EdiFun) may be used to edit and define these keys.

Output file name

Defines the name of the output CAiCE .srv file that is created by this translation. The .srv file extension will automatically be added to the end of the file name if it does not exist. The browse button on the right side of the file name field may be used to browse the file system.

Translate

Performs the translation from one for more VrOne files opened in workspaces to a CAiCE .srv file.



Translation status window

The translation status window displays the source and target files as they are being translated along with the number of lines (chains), line points, symbols (points) that were translated.

The status windows also shows the number of lines (chains) and symbols (points) that were not cross referenced to a Vr Function key. Each Vr entity to be translated must be referenced to a Function Key, which provides feature information about the entity.

Help

Displays this help page.

Quit

Quits the CAiCE Out translator. If the translation parameters have been modified, the user will be prompted to record them when exiting the application.

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The CAiCE Profile Table File

The CAiCE Profile Table file defines map features and their associated parameters. Vr Mapping uses a similar method of defining these parameters using Function Keys. The conversion from a CAiCE Profile Table to a Vr Mapping Function Key file may be performed with the "Import CAiCE Profile Table" (ImpCai) application. This may be started by using the ImpCai key-in or from the Input pull-down in VrOne or VrTwo. This conversion should be performed before translating to or from CAiCE .srv files.

The following is an example of one entry in a Profile Table and the definition of the records and fields in the CAiCE Profile Table and how they are used in the Vr Function Key definitions. A dash ('-') in the "Vr Function Key Usage" row indicates the CAiCE Profile Table field is not used in the Vr Function Key definition. The .srv file is an ASCII file and may be viewed in any text editor.

Each entry in the profile table consists of five records.

```
# Asphalt Pavement Edge
L AP 1082  0  1  3 0.125 0.125 0.125  3 PLC_CHN 0.000
48 1.000 1.000 1148  0  0  0
AP 25 0.000 0.000  1147  3  0  1 0.000 G 4 H
I
```

Record 1 - Description

Field	1	2
Example	#	Asphalt Pavement Edge
CAiCE Description	Record Id	Feature description
Function Key Usage	-	Key description

Record 2 - Primary Feature

Fiel	1	2	3	4	5	6	6	7	9	10	11	12
Exam	L	AP	1082	0	1	3	0.12	0.12	0.12	3	PLC_	0.00
CAiCI Desc	Feat Type L - P -	Feat Name	Leve	Colo	Weig	Line Styl	X Scal Fact	Y Scal Fact	Z Scal Fact	Symb Numb	Funct	Rotat
Vr Fu	Enti	Func	Line	Line	Line	-	Symb	Symb	-	-	-	Symb

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Fiel	1	2	3	4	5	6	6	7	9	10	11	12
Key	Mode L - 1 P - S	Key Name	Laye:	Pen Numbe	Widtl		Radiu	Radiu				Rotat

Record 3 - Font

Field	1	2	3	4	5	6	7
Example	48	1.000	1.000	1148	0	0	0
CAiCE Descript	Name	X Scale Factor	Y Scale Factor	Level	Color	Weight	Line Style
Vr Funct Key Usag	-	-	-	-	-	-	-

Record 4 - Cell

Fiel	1	2	3	4	5	6	7	8	9	10	11	12
Exam	AP	25	0.00	0.00	1147	3	0	1	0.00	G	4	H
CAiCI Desc:	Name		X Scal Fact	Y Scal Fact	Leve	Colo:	Weigl	Line Styl	Gap	Attri G - F -	Zone	DTM
Vr Fu Key	Symb Name	-	-	-	Symb Laye:	Symb Pen Numb	-	-	-	Featu Code Char	Featu Code Chars 1,2	-

Record 5 - I

Field	1
Example	I
CAiCE Description	
Vr Function Key Usage	-

The CAiCE .srv File

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The CAiCE .srv file contains map entities such and lines and symbols. CAiCE refers to line as a chain and a symbol as a point. This file is used to translate mapping data to and from Vr Mapping. The .srv file is an ASCII file and may be viewed in any text editor.

Chain (Vr Line)

The first record in a chain is the chain header and starts with the keyword BEGIN. Following the header record are coordinate records and the chain is ended with the END record. Following is an example of a chain and the definition of the records and fields in the CAiCE.srv file and how they are used in a VrOne line entity.

```
BEGIN SWK20 G 1 0.000000 SWK
P G 1 1607929.6592 434321.6222 34.631 -1 SWK20-1
P G 1 1607932.6378 434323.0420 34.631 -1 SWK20-2
P G 1 1607940.3385 434328.9837 34.631 -1 SWK20-3
P G 1 1607951.6325 434337.7703 34.631 -1 SWK20-4
P G 1 1607962.2865 434346.5626 34.631 -1 SWK20-5
P G 1 1607970.7555 434353.4236 34.631 -1 SWK20-6
P G 1 1607973.0998 434355.4889 34.631 -1 SWK20-7
P G 1 1607974.4911 434357.9313 34.631 -1 SWK20-8
END
```

Header Record

Field	1	2	3	4	5	6
Example	BEGIN	SWK20	G	1	0.000000	SWK
CAiCE Descripti	Beginning of chain keyword	Feature C and chain sequence	Attribute G - Groun F - Featu	Zone	Station Value	Feature Code
Vr Line Entity Us	-	-	Defined i Function	Defined i Function	-	Cross ref to Functi

Coordinate Point Record

Field	1	2	3	4	5	6	7	8
Example	P	G	1	1607929	434321.	34.631	-1	SWK20-1
CAiCE Descrip	Geometr P - Poi C - Spl	Attribu G - Gro F - Fea	Zone	X Coordin	Y Coordin	Z Coordin	Feature Code -1=None	Feature with Ch sequenc point s
Vr Line Entity	Saved	Defined Functio	Defined Functio	Line X Coord	Line Y Coord	Line Z Coord	-	-

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End Record

Field	1
Example	END
CAiCE Description	End of chain keyword
Vr Line Entity Usage	-

Point (Vr Symbol)

The CAiCE point record in the .srv file consists of one record.
Following is an example of a point record and the definition of the fields in the CAiCE.srv file and how they are used in a VrOne symbol entity.

```
P G 3 1601971.6863 429546.8393 28.411 MH MH1
```

Point Record

Field	1	2	3	4	5	6	7	8
Example	P	G	3	1601971	429546.	28.411	MH	MH1
CAiCE Descrip	Geometr P - Poi	Attribu G - Gro F - Fea	Zone	X Coordin	Y Coordin	Z Coordin	Feature Code	Feature with po sequenc
Vr Symb Entity	-	Saved	Defined Functio	Symbol X Coord	Symbol Y Coord	Symbol Z Coord	Cross r to Func	-

CAiCE / VrOne Database Notes

Attribute and Zone

The CAiCE Attribute and Zone numbers are stored in the Vr Feature Code as the first three characters. The first character is the Attribute and may be G for ground or F for feature. The two digit Zone number is stored in characters 2 and 3, giving a Zone number a range of 0 to 99.

Coordinate Point Geometry

The CAiCE chain coordinate point geometry may be a P, indicating a point vertex, or a C, indicating a point on a spline. In a CAiCE chain, coordinate points may switch between P (point) and C (spline) within the chain. The Vr Line entity does not allow this switching between spline and non-spline points and a line may be a vertex line (Vr Mode 1) or a splined line (Vr

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Mode 2). When a CAiCE chain is translated to a Vr Line, the line is a vertex line (Vr Mode 1) and the CAiCE chain geometry definition is stored in the Vr Line Code field. Although the Vr Mapping graphics do not display the line with alternating geometry, the point geometry flags are maintained and are supported when translating to CAiCE .srv files.

Coordinate Point Feature Code

Within a CAiCE chain, it is possible to define multiple CAiCE Feature Codes. This is not supported in Vr Mapping and the CAiCE Feature Code defined in the chain header is used for all the coordinate points in the Vr Line entity. This is field 7 of the Coordinate Point Record and is set to -1 when writing a CAiCE .srv file.

Descriptions

At the present, Vr Mapping is not importing the optional description fields at the end of the Chain Header record, the Coordinate Point record or the Point record. When this feature is added, the description at the end of the Chain Header record and the Point record will be stored in the Vr entity in the Feature Code attribute. The description at the end of the Coordinate Point record will be ignored.

2.1.1.25.4 DSFL In

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Vr Mapping

DSFL In (DsfIn)

Type: Translator

Translate DSFL formatted files to VrOne files.

The DSFL format is widely used in Denmark for the exchange of Geographic Information (GIS) data between computer systems. The user should have some familiarity with the DSFL format

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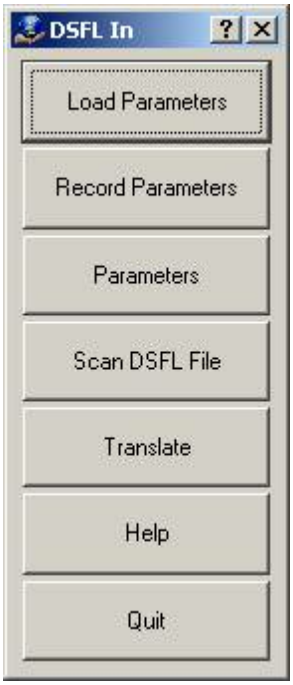
before using the translator.
Although the VrOne database is not considered a GIS structured system, it maintains several non-graphic attributes in the entity headers to allow the storage and re-output of GIS type data.

Load Parameters	Record Parameters	Parameters
Scan DSFL File	Translate	DSFL Attributes and the VrOne File

DSFL In



Load Parameters

Loads previously recorded DSFL In (.dsi) parameter file.

Record Parameters

Records current translation parameters to DSFL In (.dsi) parameter file.

Parameters

Allows editing general translation parameters.

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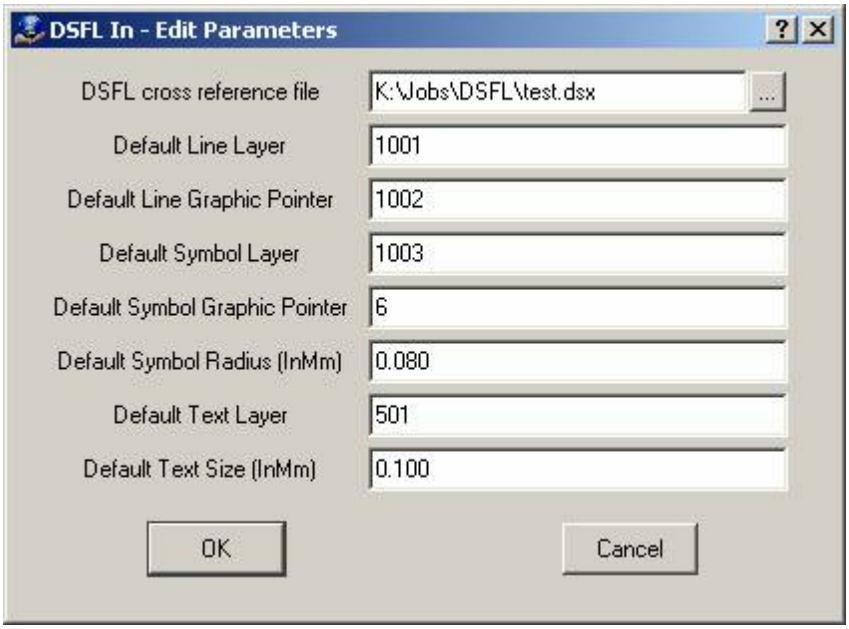

DSFL cross-reference file

A DSFL Cross-Reference file (.dsx) is used to cross-reference VrOne layer numbers to DSFL %KG and %U codes. This ASCII file must exist before the translation is started. If a %KG and %U codes are not cross-referenced, the default Layer and Graphic pointer are used. An example of the format of the DSFL Cross-Reference follows:

```
** LINES **
1, 82, 125, SKILTEPORTAL
1, 17, 17, BUMP
2, 11, 18, KOMMUNEGRÆNSE
3, 101, 520, VEJ BEFÆSTET
3, 102, 521, VEJ UBEFÆSTET
3, 14, 35, CYKELSTI(BY)
3, 16, 40, VEJMIDTE
3, 168, 42, INDKØRSELSVEJMIDTE
** AREA **
1, 19, 46, FÆLLES KOMMUNEGRÆNSE
2, 111, 45, LEVERANCEGRÆNSE
4, 1, 10, BYGNING TAG
4, 31, 12, DRIVHUS
4, 312, 502, FOT-DRIVHUS
4, 52, 13, BYGNING SILO
** SYMBOLS **
1, 1, 21, STOPHANE
1, 2, 136, PLANFIKSPUNKT
1, 3, 138, HØJDEFIKSPUNKT
1, 4, 140, NATURLIGT PASPUNKT
1, 725, 114, SIGNALSTANDER
1, 65, 14, PLAKATSØJLE
1, 94, 15, GADELYSAMATUR
** TEXT **
```

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```
131, 130, VEJNAVN
132, 131, HUSNUMMER
115, 132, Bygningsnummer
121, 135, STEDNAVN
51012, 137, Planfikspunkt tekst
51013, 139, HØJDEFIKSPUNKT TEKST
**END**
```

Each section begins with two asterisks and the LINES and AREAS sections are considered lines in VrOne. The first two fields are the %KG and %U codes; the third field is the VrOne layer number. The fourth field is the description field and is not used. The text area does not carry the same attributes as the lines, area and symbols areas and is not used. The default %KG and %U codes are used to translate VrOne text entities.

Default Line Layer
Defines the default VrOne Line Layer to use if one cannot be determined.

Default Line Graphic Pointer
Defines the default VrOne Line Graphic Pointer to use if one cannot be determined.

Default Symbol Layer
Defines the default VrOne Symbol Layer to use if one cannot be determined.

Default Symbol Graphic Pointer
Defines the default VrOne Symbol Graphic Pointer to use if one cannot be determined.

Default Symbol Radius (InMm)
Defines the default Symbol Radius to use during translation. This parameter is entered as inches or millimeters based on the VrOne file Target Scale.

Default Text Layer
Defines the default VrOne Text Layer. Since the format of the DSFL Cross-Reference file does not define Text, this parameter is used always used when translating VrOne text entities.

Default Text Size
Defines the default VrOne Text size to use during translation. This parameter is entered as inches or millimeters based on the VrOne file Target Scale.

Scan DSFL File

This function scans DSFL files and extracts the DSFL %KG and %U codes and the DSFL % KT and %U codes used to cross-reference VrOne layers. The default layers defined in Parameters are used for the VrOne layers in the DSFL Cross-Reference file. Selecting "Yes" when starting the scan will load the current cross-reference file as defined in Parameters, append to it, then re-save. Selecting "No" when starting the scan will reset the current cross-reference file.

NOTE: Selecting No when starting the scan will overwrite the current cross-reference file.

Translate

Translates DSFL file(s) to the current VrOne Active Workspace.

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Help

Displays this page.

Quit

Quits DSFL Out and gives an option to save the current parameters if they have been changed.



DSFL Attributes and the VrOne file

Several DSFL non-graphic attributes are stored in the VrOne entities' headers. These values may be set during collection in VrOne or may be translated using DSFL In and will be translated to the DSFL output file with the DSFL Out translator.

%N Record

DSFL In reads this code and stores its value in the VrOne Non-Graphic Pointer. During collection, the Non-Graphic Pointer may be conditioned and DSFL Out will translate this field into a %N record in the DSFL output file.

%D Record

DSFL reads this code and stores up to six pairs in the VrOne Feature Code in the entity header. DSFL Out writes the %D record with these values. These values may be set during collection and DSFL Out will translate the Feature Code into a %D record in the DSFL output file. The format for the storage of the attribute records is:

```
D Id Arg  Id Arg  Id Arg  Id Arg  Id Arg   Id Arg
```

Where:

Id - The attribute ID
Arg - The attribute argument

For example: The DSFL attribute records of:

```
%D8901 9905
%D8834 USPEC
```

Would be stored in the VrOne Feature Code as:

```
D 8901 9905 8834 USPEC
```

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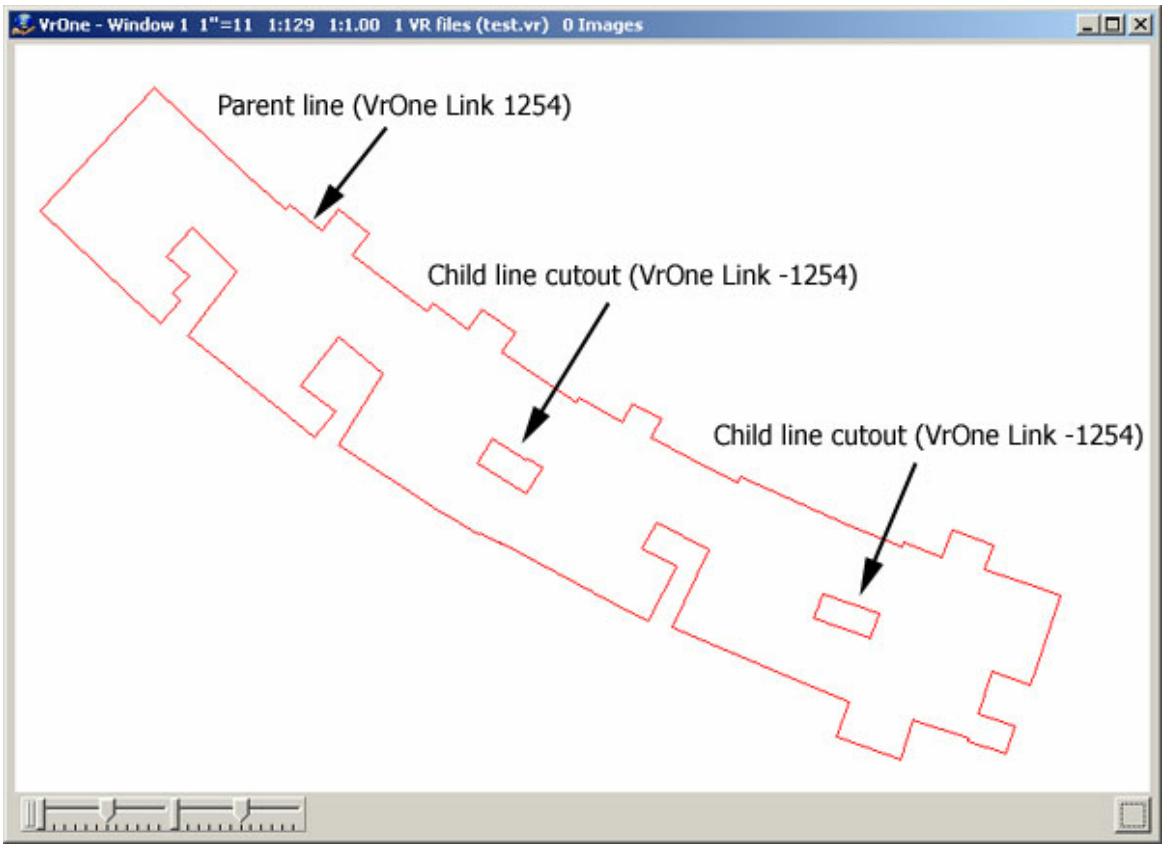
Where the first character (D) indicates the Feature Code contains attributes.

%F4KR Record – Cutouts

DSFL Line and Area entities may follow with cutout lines or areas. These are stored in the Link header field in VrOne. Each cutout is considered a child of a parent, or base line. The parent line is coded with a unique number from 1 to 2,147483,648 and is always positive. Cutouts or children are coded with the same number as the parent but are stored as a negative number. These values may be set during collection and DSFL Out will translate the parent lines and child cutouts into the %F1 and %F4 DSFL records in the DSFL output file.For example the following building may be stored in the VrOne Link header field as:



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Mapping

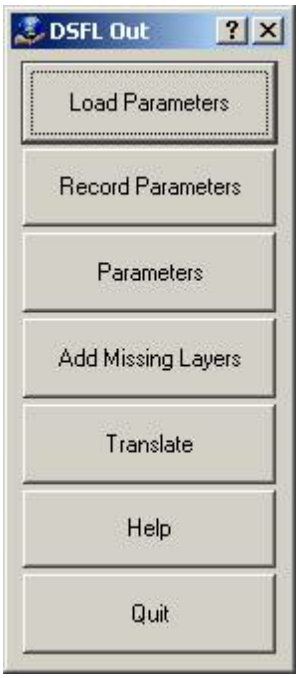
DSFL Out (DsfOut)

Type: Translator

Translates VrOne file(s) to DSFL formatted files.
The DSFL format is widely used in Denmark for the exchange of Geographic Information (GIS) data between computer systems. The user should have some familiarity with the DSFL format before using the translator.
Although the VrOne database is not considered a GIS structured system, it maintains several non-graphic attributes in the entity headers to allow the storage and re-output of GIS type data.

Load Parameters	Record Parameters	Parameters
Add Missing Layers	Translate	DSFL Attributes and the VrOne File

DSFL Out



Load Parameters

Loads previously recorded DSFL Out (.dso) parameter file.

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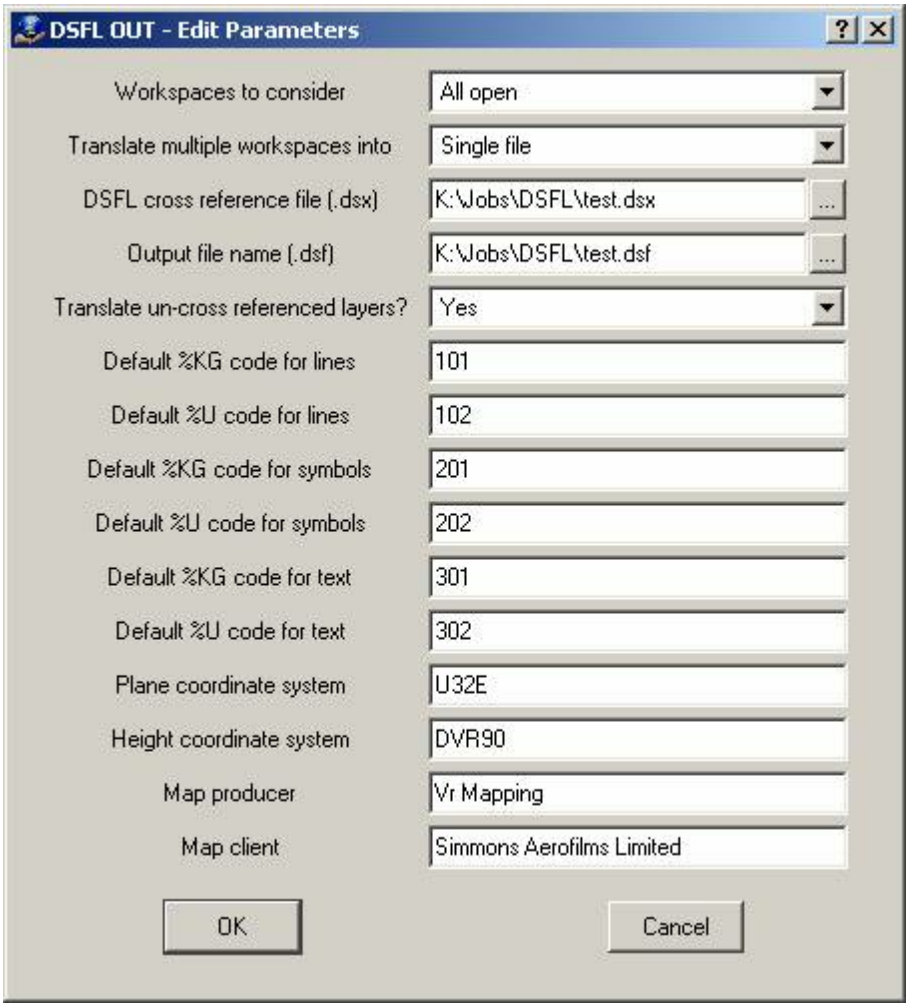
Record Parameters

Records current translation parameters to DSFL Out (.dso) parameter file.

Parameters

Allows editing general translation parameters.



Workspaces to consider

Defines the workspaces to consider for translation. Options are “All open”, in which all the open workspaces are translated, or “Current”, in which only the current Active Workspace is translated.

Translate multiple workspaces into

Multiple VrOne Workspaces may be translated into a single DSFL output file or a DSFL output file for each open workspace. If “Single file” is chosen, an output file may be specified. If “One file per workspace” is specified, each DSFL output file is given the same name as the VrOne file with a .dsf file name extension.

DSFL cross-reference file (.dsx)

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A DSFL Cross-Reference file is used to cross-reference VrOne layer numbers to DSFL %KG and %U codes. This ASCII file must exist before the translation is started. If a VrOne layer is not defined in this file, user-defined default values will be used for the DSFL codes. An example of the format of the DSFL Cross-Reference follows:

```
** LINES **
1, 82, 125, SKILTEPORTAL
1, 17, 17, BUMP
2, 11, 18, KOMMUNEGRÆNSE
3, 101, 520, VEJ BEFÆSTET
3, 102, 521, VEJ UBEFÆSTET
3, 14, 35, CYKELSTI(BY)
3, 16, 40, VEJMIDTE
3, 168, 42, INDKØRSELSVEJMIDTE
** AREA **
1, 19, 46, FÆLLES KOMMUNEGRÆNSE
2, 111, 45, LEVERANCEGRÆNSE
4, 1, 10, BYGNING TAG
4, 31, 12, DRIVHUS
4, 312, 502, FOT-DRIVHUS
4, 52, 13, BYGNING SILO
** SYMBOLS **
1, 1, 21, STOPHANE
1, 2, 136, PLANFIKSPUNKT
1, 3, 138, HØJDEFIKSPUNKT
1, 4, 140, NATURLIGT PASPUNKT
1, 725, 114, SIGNALSTANDER
1, 65, 14, PLAKATSØJLE
1, 94, 15, GADELYSAMATUR
** TEXT **
131, 130, VEJNAVN
132, 131, HUSNUMMER
115, 132, Bygningsnummer
121, 135, STEDNAVN
51012, 137, Planfikspunkt tekst
51013, 139, HØJDEFIKSPUNKT TEKST
**END**
```

Each section begins with two asterisks and the LINES and AREAS sections are considered lines in VrOne. The first two fields are the %KG and %U code; the third field is the VrOne layer number. The fourth field is the description field and is not used. The text area does not carry the same attributes as the lines, area and symbols areas and is not used. The default %KG and %U codes are used to translate VrOne text entities.

Output file name (.dsf)

Defines the DSFL file name to use as the output file name if the “Translate multiple workspaces into” option is set to “Single file".

Translate uncross-referenced layers?

Specifies whether layers that are not defined in the DSFL Cross-Reference file are translated using the default %KG and %U codes. Layers that are turned off will not be translated even if

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this parameter is set to Yes.

Default %KG, default %U codes for lines, symbols and text
Defines values to be used during translation iff a layer is not defined in the DSFL Cross-Reference file and “Translate uncross-referenced layer?” is set to "Yes". VrOne text entities will always use the default values when translating.

Plane coordinate system
Defines the DSFL plane coordinate system. The plane coordinate system should be defined as part of the mapping project. Options include SE4J, S34S, S45B, U32, U33, U32W, U33W and LOK. This parameter will be written to the DSFL file with the %H1 code.

Height coordinate system.
Defines the DSFL height coordinate system. The height coordinate system should be defined as part of the mapping project. This parameter will be written to the DSFL file with the %H2 code.

Map producer
Defines (in text) the producer of the mapping data. This parameter is written to the DSFL file with the %H11 code.

Map client
Defines (in text) the client of the mapping data. This parameter is written to the DSFL file with the %H21 code.

Add Missing Layers

Searches VrOne file(s) and adds missing layers to the DSFL Cross-Reference file. The %KG and %U codes are set to the default codes defined in Parameters. Layers that are turned off will not be added.

Translate

Translates VrOne files into DSFL files.

Help

Displays this page.

Quit

Quits DSFL Out and gives an option to save the current parameters if they have been changed.



DSFL Attributes and the VrOne file

Several DSFL non-graphic attributes are stored in the VrOne entities' headers. These values

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may be set during collection in VrOne or may be translated using DSFL In and will be translated to the DSFL output file with the DSFL Out translator.

%N Record

DSFL In reads this code and stores its value in the VrOne Non-Graphic Pointer. During collection, the Non-Graphic Pointer may be conditioned and DSFL Out will translate this field into a %N record in the DSFL output file.

%D Record

DSFL reads this code and stores up to six pairs in the VrOne Feature Code in the entity header. DSFL Out writes the %D record with these values. These values may be set during collection and DSFL Out will translate the Feature Code into a %D record in the DSFL output file. The format for the storage of the attribute records is:

```
D Id Arg  Id Arg  Id Arg  Id Arg  Id Arg   Id Arg
```

Where:
Id - The attribute ID
Arg - The attribute argument

For example: The DSFL attribute records of:

```
%D8901 9905
%D8834 USPEC
```

Would be stored in the VrOne Feature Code as:

```
D 8901 9905 8834 USPEC
```

Where the first character (D) indicates the Feature Code contains attributes.

%F4KR Record – Cutouts

DSFL Line and Area entities may follow with cutout lines or areas. These are stored in the Link header field in VrOne. Each cutout is considered the child of a parent (base) line. The parent line is coded with a unique number from 1 to 2,147483,648 and is always positive. Cutouts or children are coded with the same number as the parent but are stored as a negative number. These values may be set during collection and DSFL Out will translate the parent lines and child cutouts into the %F1 and %F4 DSFL records in the DSFL output file. For example the following building may stored in the VrOne Link header field as:

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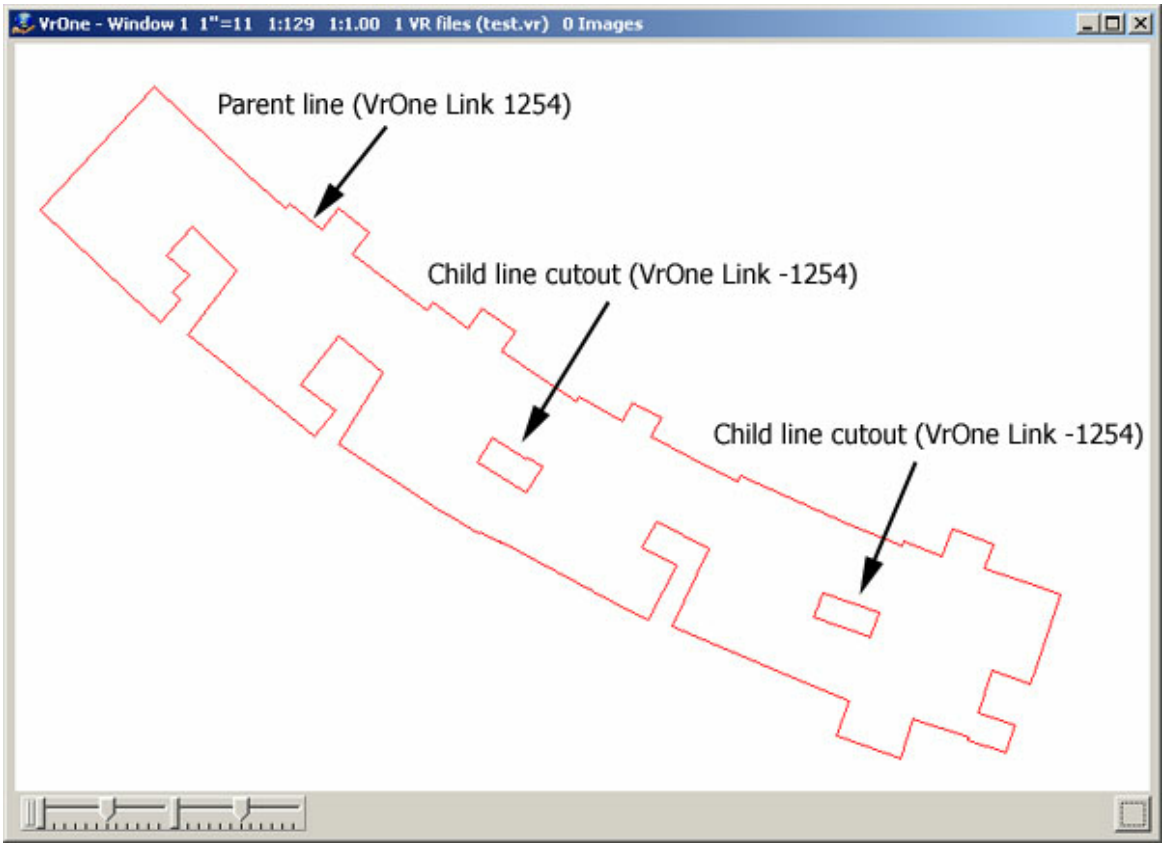

2.1.1.25.6 Dxf In

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

DXF IN (DxfIn)

Type: Translator

Translates DXF (Drawing Exchange Format) files to VrOne files.

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The DXF format is commonly used to translate map data to Autodesk's AutoCAD program. Due to the popularity of the format, it is used by many other CADD and GIS (Geographic Information Systems) systems for the transfer of map vector data. From GIS to civil engineering systems, DXF is considered the de-facto standard for moving vector data. Experience has shown that DXF is well suited to move vector data to the ARC INFO GIS system.

The DXF IN translator is limited to those AutoCAD entities that have a meaningful equivalent in VrOne. The following table describes the AutoCAD entities that are translated into VrOne from a DXF file.

AutoCAD Entity	VrOne Entity
Line	Line
3D Line	Line
Polyline (2D or 3D)	Line
Solid	Line
0 length line	Symbol
Point	Symbol
Block	Symbol
Shape	Symbol
Circle	Line with arc codes
Arc	Line with arc codes
Dimension	Exploded into multiple entities
Text	Text

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Load Parameters	Record Parameters	Reset Parameters
Edit Parameters	Cross-Reference Layers	Cross-Reference Line Types
Cross-Reference Symbols	Scan DXF Files	Translate
Quick Translation		

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Dxf In parameter file name (.dxi)
HELP	Display help	
RUN	Run Dxf In	

DXF In

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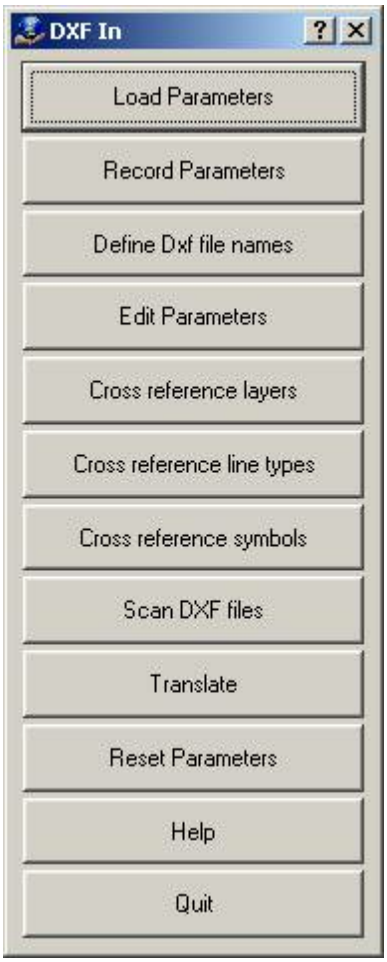

Load Parameters

Loads previously recorded DXF In (.dxi) parameter file.

Record Parameters

Records current translation parameters to a DXF In (.dxi) parameter file.

Reset Parameters

Resets translation parameters to default values. **NOTE:** Current translation parameters will be lost.



Define Dxf file names

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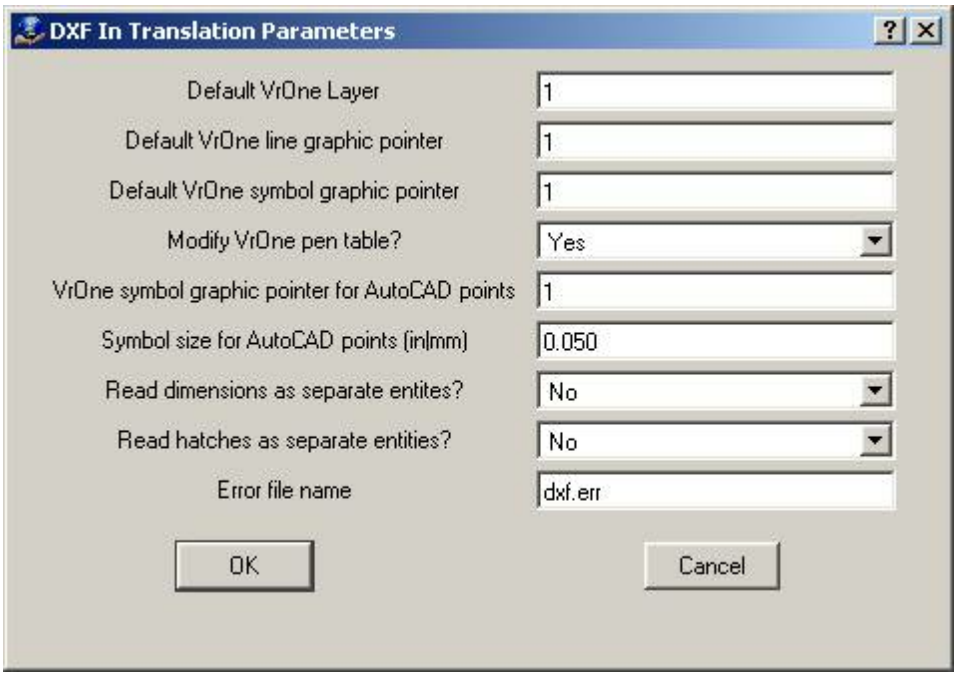
Allows one or more DXF files to be selected for translation.

Edit Parameters

Allows editing general translation parameters.



Default VrOne Layer

Specifies default layer to place entities that are not cross-referenced.

Default VrOne line graphic pointer

Specifies default graphic pointer to use on lines that are not cross-referenced.

Default VrOne symbol graphic pointer

Specifies default graphic pointer to use on symbols that are not cross-referenced.

Modify VrOne pen table?

Specifies whether the VrOne pen table is modified to match the colors defined in the DXF file layer table.

VrOne symbol graphic pointer for AutoCAD points

Specifieshe graphics pointer to use when translating AutoCAD points or AutoCAD 0 length lines to VrOne symbols.

Symbol size for AutoCAD points (in|mm)

Defines in display units symbol size to use when translating AutoCAD points or AutoCAD 0 length lines to VrOne symbols.

Read dimensions as separate entities?

VrOne does not have an equivalent to the AutoCAD dimension entity. Normally, dimension entities are ignored, but if this is set to yes, the individual entities that make up the dimension entity are translated as separate VrOne entities. All standard translation parameters are applied

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to the separate entities.

Read hatches as separate entities?
VrOne does not have an equivalent to the AutoCAD hatch entity. Normally, hatch entities are ignored, but if this is set to yes, the individual entities that make up the hatch entity are translated as separate VrOne entities. All standard translation parameters are applied to the separate entities.

Error file name
Any problems encountered during translation are included in this file.

Cross-reference layers

AutoCAD uses a layer table to defines layer names. Within each layer, a line type and color is defined. VrOne uses layer numbers and has 10,001 predefined layers.

This dialog allows the AutoCAD layer names to be cross-referenced to VrOne layer numbers. Each layer name may be up to 32 characters in length.

While it is possible to name layers in VrOne, the names are only for user reference and VrOne handles all layers by number.

An easy way to define this table is supplied by using the "Scan DXF files" option. This scans a list of DXF file and creates a layer table entry for each layer used. **NOTE:** If layer names have been defined in VrOne, those layer names will be used in the table. If a layer name has not been defined in VrOne, the layer number will be used with the word "Layer" before the number.

Each individual entity in the DXF file may have its color and linetype assigned based on the layer table settings (this is called BYLAYER in AutoCAD) or it may have a specific value set for the color and linetype. If an entity uses BYLAYER for color or linetype, the linetype or color defined in the layer table is used. The resulting linetype is then cross-referenced to the line types table defined in the next section.

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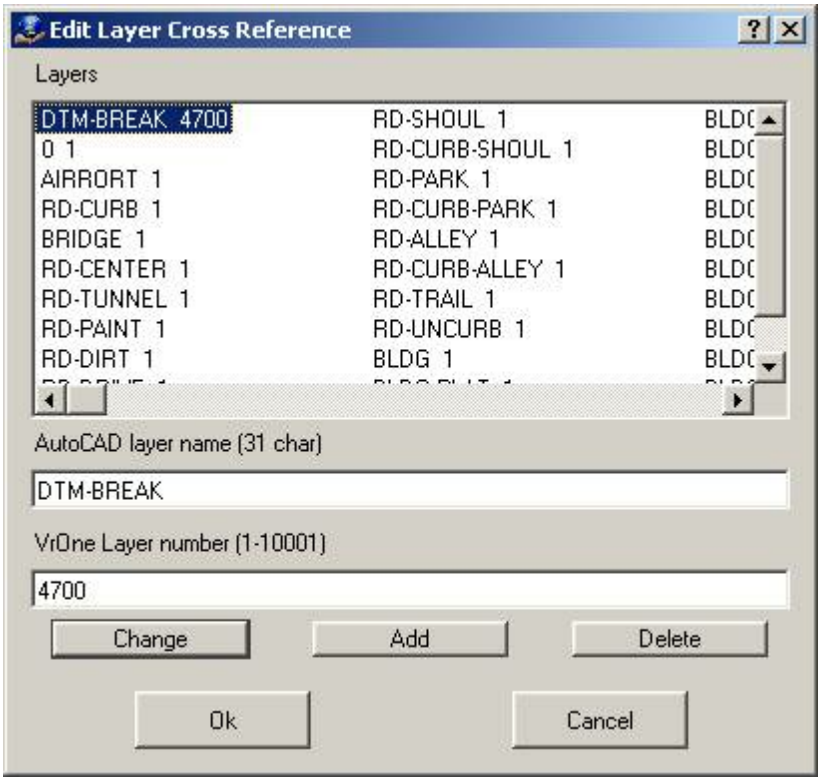

AutoCAD layer name (31 char)
Specifies the input layer name from the DXF file.

VrOne layer number (1-10001)
Specifies the VrOne output layer number.

Cross-reference line types

AutoCAD uses names to define linetypes (line fonts). VrOne uses graphic pointer numbers to define line fonts. Although names are assigned to VrOne line fonts, the graphic pointer number is the primary means for identifying line fonts in VrOne. This table allows the AutoCAD linetype names to be cross-referenced to VrOne line font graphic pointer numbers. See the cross-reference layers section for an explanation of how the layer table in the DXF file relates to this cross-reference table.

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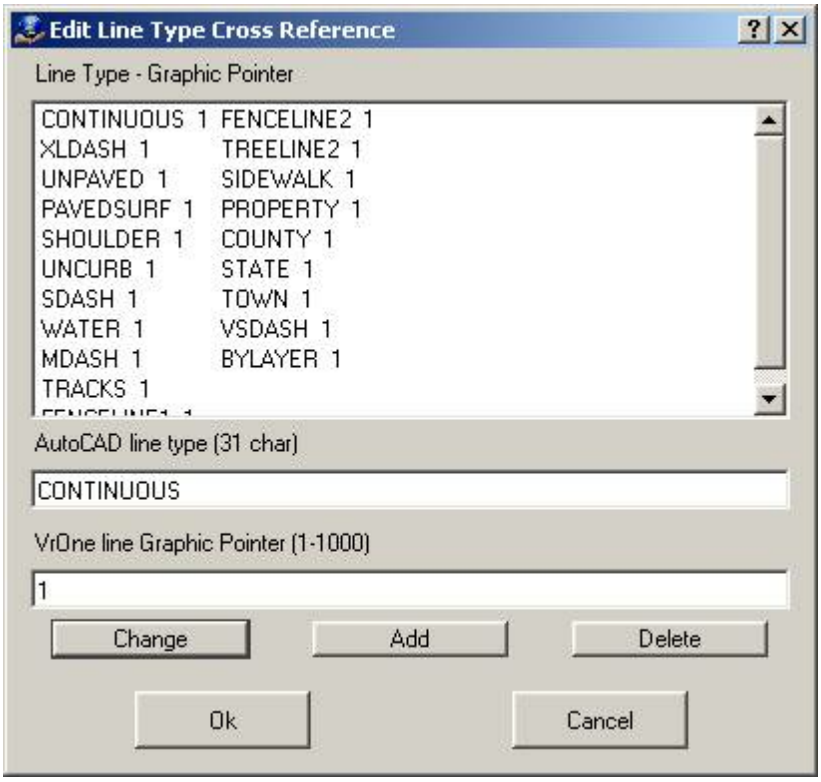

AutoCAD line type (31 char)
Defines the input linetype name from the DXF file.

VrOne line Graphic Pointer (1-10001)
Specifies the VrOne output line font graphic pointer.

Cross-reference symbols

AutoCAD uses names to define blocks (symbols). VrOne uses graphic pointer numbers to define symbols. Although names are assigned to VrOne symbols, the graphic pointer number is the primary method for identifying symbols in VrOne. This table allows the AutoCAD block names to be cross-referenced to VrOne symbol graphic pointer numbers.

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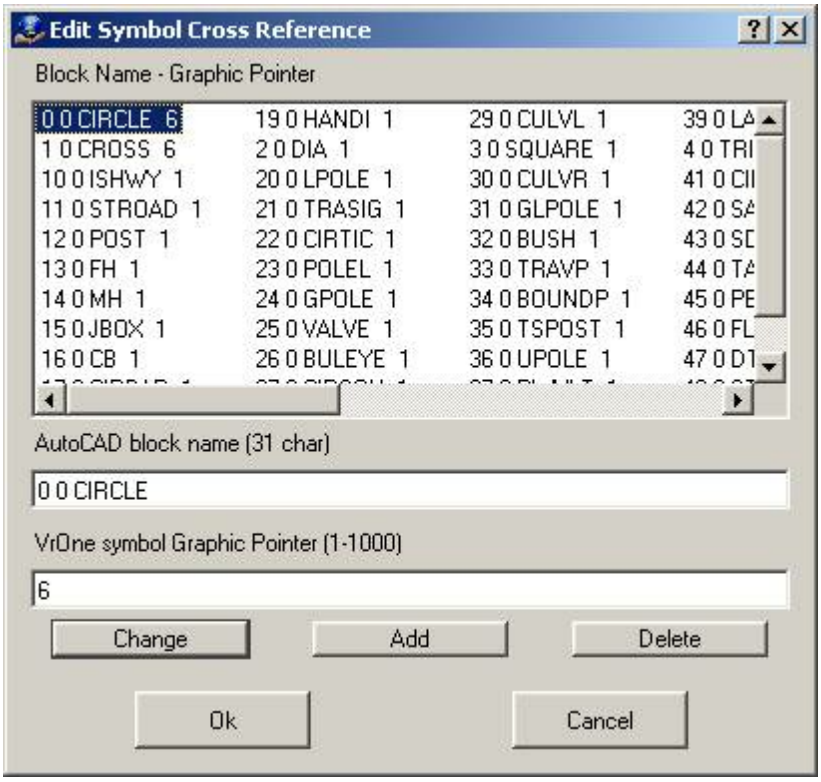
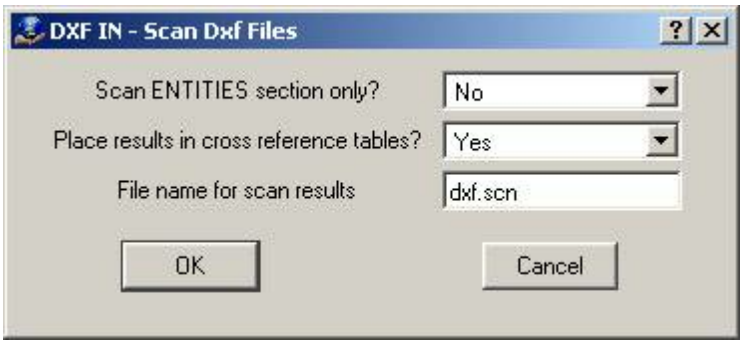


AutoCAD block name (31 char)
Defines the input block name from the DXF file.

VrOne symbol Graphic Pointer (1-10001)
Specifies the VrOne output symbol graphic pointer.

Scan DXF files

Scans one or more DXF files and places entries in the cross-reference tables for all layers, linetypes, and symbols found. This should be used as a starting point for populating the cross-reference tables. Default output values are written that can be edited to match translation needs. The "Define Dxf file names" option must be used before this will run.
The following options are displayed before the DXF files are scanned:



Scan ENTITIES section only
If set to yes, only the ENTITIES section of the DXF is processed. The LAYER and BLOCK

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definition tables are skipped, resulting in the cross-reference table only containing entries from entities that exist in the DXF file. If set to no, then all entries in the LAYER and BLOCK definition tables from the DXF file are placed in the cross-reference tables, even if there are no actual entities in the DXF file that use those layers or block definitions.

Place results in cross-reference tables

If set to no, results will only be written to the scan results file.

File name for scan results

Defines file name to which a summary of the results from scanning the DXF files is written.

Translate

Translates the currently defined DXF files to the current VrOne file.

Help

Starts the browser and displays the current help document.

Quit

Quits Dxf In and gives an option to save the current parameters.



Quick Translation

The following steps allow one to translate DXF files into VrOne in the fewest possible steps. The result is a translation in which all lines are translated as solid, all blocks are translated as graphics pointer 1, and all entities are placed on layer 1.

1. Select "Reset Parameters"
2. Select "Define Dxf file names" and select one or more DXF files.
3. Select "Scan DXF files"
4. Select "Translate"

2.1.1.25.7 Dxf Out

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Mapping

DXF OUT (DxfOut)

Type: Translator

Translates VrOne file(s) to DXF (Drawing Exchange Format).

The DXF format is commonly used to translate map data to Autodesk's AutoCAD program. Due to the popularity of the format, it is used by many other CADD and GIS (Geographic Information Systems) systems for the transfer of map vector data. From GIS to civil engineering systems, DXF is considered the de-facto standard for moving vector data. Experience has shown that DXF is well-suited to move vector data to the ARC INFO GIS system.

The DXF format is not without some problems when dealing with map data. While symbols and text translate very easily, three-dimensional and fonted (patterned) lines do not. These map features require some additional options.

The VrOne DXF Out translator is very flexible and offers many options for translating VrOne map data to AutoCAD.

Each symbol definition in VrOne may be translated to DXF in one of four different ways. It may be translated as a Block, exploded, placed as text, or translated as a DXF point. Symbol names may also be cross-referenced to a client's block library and a scale factor may be applied to adjust the size.

Each VrOne line font may be translated to DXF in one of four different ways. It may be translated to a DXF line style, exploded, use a symbol line, or be translated using DXF bulges.

Because of the many options offered by DXF Out, you should communicate with your client to discuss the options and determine the best translation method to suit their needs. Time should be spent becoming familiar with the options offered and test translations should be done to AutoCAD to view the translation results. Dxf Out can translate map data using very basic translation parameters which produce lines with no line fonting, or advanced translation options which produce a readable and usable map for your client.

This documentation will point out the advantages and disadvantages to many of the translation options.

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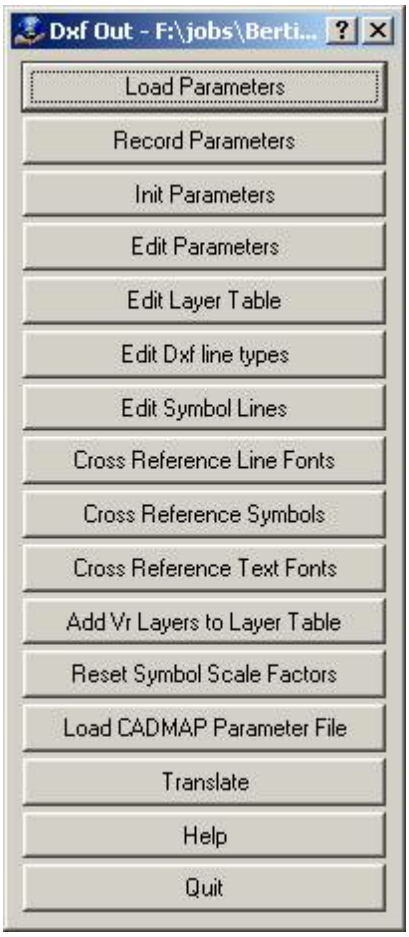
Load Parameters	Record Parameters	Init Parameters
Edit Parameters	Edit Layer Table	Edit Dxf line types
Edit Symbol Lines	Cross-Reference Line fonts	Cross-Reference Symbols
Cross-Reference Text Fonts	Load CADMAP Parameter File	Translate
Quick Translation	Translation Hints	

Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	Dxf Out parameter file name (.dxo)
HELP	Display help	
RUN	Run Dxf Out	

DXF Out



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Load Parameters

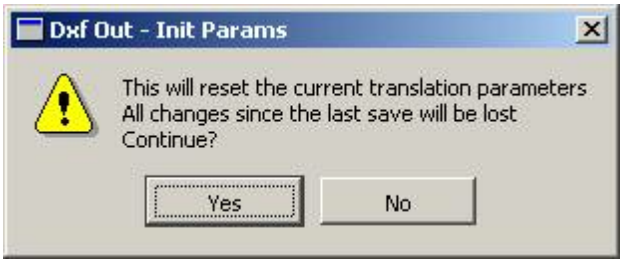
Loads previously recorded DXF Out (.dxo) parameter file.

Record Parameters

Records current translation parameters to a DXF Out (.dxo) parameter file.

Init Parameters

Initializes translation parameters to default values. NOTE: Current translation parameters will be lost.



Edit Parameters

Allows editing general translation parameters.

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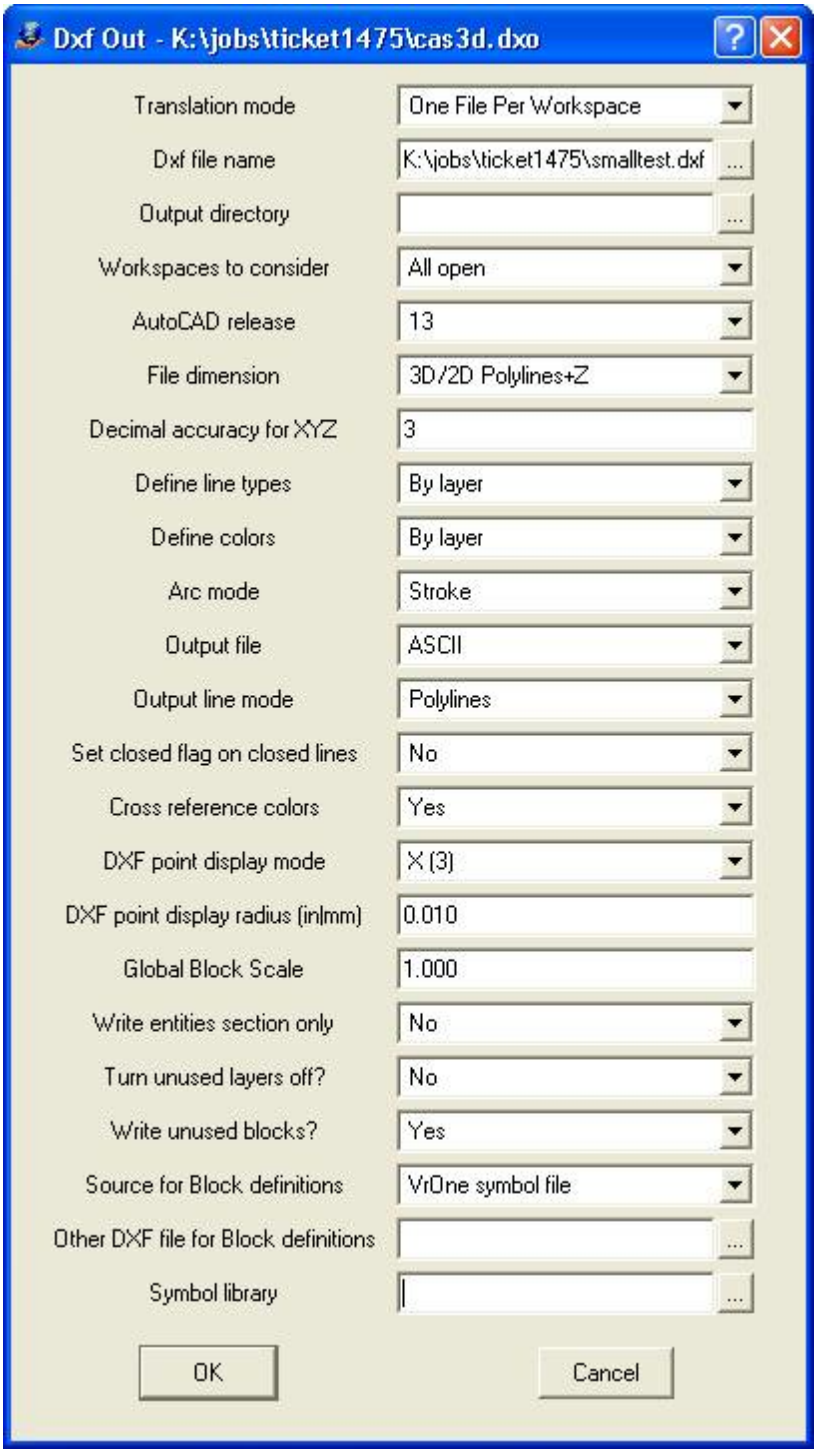

Translation Mode?

Determines how DXF files will be written.

Single File	All entities are written to a single output file. The Dxf file name parameter must be filled in when using this option.
One File Per Workspace	A separate DXF file is created for each open workspace. The

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	DXF filenames are the same as the workspace name with a .dxf extension. The Dxf file name parameter is ignored. The output directory is used to determine where the files are placed.
One File Per Feature Code	A separate DXF file is created for each unique feature code. All entities that have the same feature code are written to the same DXF file with the DXF file name the same as the feature code value. The output directory determines where the files are placed.
One File Per Layer Output Name	A separate DXF file is created for each unique layer output name in the layer cross-reference table. All entities with the same output layer name are written to the same DXF file, with the DXF file name the same as the output layer name. The output directory determines where the files are placed.
One File Per VrOne Layer Name	A separate DXF file is created for each unique layer name in the VrOne layer table. All entities with the same VrOne layer name (not related to the output layer) are written to the same DXF file, with the DXF file name the same as the VrOne layer name. The output directory is used to determine where the files are placed.

Dxf file name
Defines file name to which to write DXF translated data. If this file exists, it is overwritten.

Output directory
Defines output directory to place DXF files if not using Single File translation mode. If left blank, files are placed in the same directory as the VrOne files.

Workspaces to consider
Definse workspaces to use when translating VrOne data to a DXF file. Options are "Current only" or "All open". When "All open" is selected, all open workspaces will be translated into a single DXF file.

AutoCAD release
Defines the AutoCAD release format to use when translating. Options are 9, 10, 11, 12, and 13. Currently, AutoCAD Release 14 and AutoCAD 2000 support files written in Release 13.

File dimension
Determines the method to translate elevations to DXF. It is possible to override this option per layer by using the Layer Table cross-reference dialog. Options are:

2D	2 dimension DXF file.
3D	3 dimension DXF file. Polylines are created as 3d polylines.
3D/2D Polylines+Z	3 dimension DXF file. Polylines are created as 2d polylines with an elevation in the header and elevations on each vertex. NOTE: AutoCAD might change the line to make the line point elevations the same.

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3D/2D Polylines+Thick	3 dimension DXF file. Polylines are created as 2d polylines with an elevation in the header and elevations on each vertex. Elevations are placed as thickness in the polyline header and on each vertex. NOTE: AutoCAD might change the line to make the line point elevations the same.

In some versions of AutoCAD operations such as joining lines are not allowed on 3D lines in which the elevation of the line points were not the same. The last two options are variations on the 3D option.

File accuracy for XYZ

Defines the number of places to the right of the decimal point to display for the coordinate positions written to the DXF file.

Define line types

Specifies how line types will be referenced in the DXF file. Each DXF file has a layer table that defines a layer name, the layer line type and the layer color. Options are:

By layer	If a line type is used, the line type definition is not placed with the entity and the line type definition in the layer table is used. Using this setting makes all lines using line types on a layer use the same line type definition.
By entity	If a line type is used, the line type definition is placed with the entity and the line type definition in the layer table is ignored when drawing the entity. This allows multiple line type definitions to be used within a layer.

Define colors

Defines how colors will be referenced in the DXF file. Each DXF file has a layer table that defines a layer name, the layer line type and the layer color. Options are:

By layer	The color definition is not placed with the entity and the color definition in the layer table is used. Using this setting makes all entities on a layer the same color.
By entity	The color definition is placed with the entity and the color definition in the layer table is ignored when drawing the entity. This allows multiple colors to be used within a layer.

Arc mode

VrOne supports lines that are defined as arcs. This parameter defines the method to translate these arcs. Options are:

Stroke	Individual arc points are placed in the DXF file. *Advantages*: If the file is three-dimension, the Z dimension is represented more accurately. *Disadvantages*: The DXF file is larger.
DXF Arc	The arc is broken out of the VrOne line and translated as a DXF arc. *Advantages*: DXF arcs are created and may be edited by the client. *Disadvantages*: If the file is three- dimensional, the elevation is not

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	represented well along the arc.
DXF Bulge	The arc is broken out of the VrOne line and translated as a DXF bulge. *Advantages*: DXF bulges are created and may be edited by the client. *Disadvantages*: If the file is three-dimensional, the elevation is not represented well along the arc.

Output file

VrOne can write DXF file in ASCII (text) format or DXF binary format. The two formats are the same, though the binary format takes less disk space. If disk space is not an issue on your computer, it is suggested that the ASCII format is used.

Output line mode

Lines may be written as DXF polylines or DXF lines.

Lines	Lines – Each VrOne line is broken into line segments and each line is written as two coordinate positions. This option is very seldom used. Advantages: Useful only if the target systems do not understand DXF polylines. Disadvantages: Requires almost twice the disk space per line.
Polylines	Polylines – DXF polylines are used when ever possible. This option should always be used unless the target system does not understand DXF polylines.

DXF point display mode

It is possible to cross a VrOne symbol to a DXF point during translation. AutoCAD allows only one graphic representation for a point and this parameter defines this representation. Points are often used to translate DTM (Digital Terrain Model) XYZ points to systems that do not understand DXF blocks. Normally, the VrOne X symbol is cross-referenced to a DXF point definition 3, which is shown graphically as an X. There are twenty possible settings for the point display mode but only one is active in a DXF file. If there are no symbols cross-referenced to DXF points in "Cross-Reference Symbols" then this parameter is ignored during translation.

DXF point display radius (in|mm)

It is possible to cross a VrOne symbol to a DXF point during translation. AutoCAD allows only one graphic representation for a point and this parameter defines the display radius for the point. This parameter is entered as inches or millimeters at target scale. Points are often used to translate DTM (Digital Terrain Model) XYZ points to systems that do not understand DXF blocks. Normally the VrOne X symbol is cross-referenced to a DXF point definition 3, which is shown graphically as an X. If there are no symbols cross-referenced to DXF points in "Cross-Reference Symbols" then this parameter is ignored during translation.

Global Block Scale

Defines the scale factor that applies to all symbols that have a cross-reference scale factor of -1.0. This allows a translation to be made where all blocks in the DXF have a uniform scale factor regardless of the symbol sizes in VrOne.

NOTE: The Reset Symbol Scale Factors can be used to quickly set all symbols cross-references to use a scale factor of –1.0.

Write entities Section only

If set to "Yes", only the entities section of the DXF will be written. This eliminates all header

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information such as Layer tables, Linestyle tables, and Block definitions from the DXF files. This can be useful in some versions of AutoCAD where an existing drawing can be used when importing a DXF file. In this situation, all of the existing block definitions and layer table settings in the current AutoCAD drawing remain intact.

Turn unused layers off
Each DXF file has a layer table that defines a layer name, the layer line type, and the layer color. If this parameter is set to "Yes", only layers that are used in the VrOne file(s) are placed in the layer table. Since VrOne allows 10,001 layers, if this parameter is set to no then 10,001 entries will be placed in the DXF layer table.

Write unused blocks
Each DXF file has a block table that defines all of the blocks that will be used in the drawing. If this parameter is set to "No", only blocks that are used in the DXF file(s) will be placed in the block table. If set to Yes, then all blocks defined in the current Symbol file will be written to the block table, regardless of whether they are used or not.

Source for block definitions
Normally, the DXF Out translator reads a VrOne symbol file and creates DXF blocks to represent symbols. There may be times where the client has defined their own block library and wishes you to cross-reference the VrOne symbols to their blocks. Options are:

VrOne symbol file	VrOne symbol definitions are read and DXF blocks are created.
Other DXF file	The blocks from another DXF file are copied to the DXF file being created by this translator.

Notes on using “Other DXF file”:

- The “Cross-Reference Symbols” menu allows the cross-referencing of VrOne symbol names to DXF block names and the application of scale factors when referencing DXF blocks.
- Care must be taken to cross-reference VrOne symbol names to the block names in the DXF file. If a VrOne symbol is used and does not have a matching block name in the DXF file then an “un-referenced block name” error will occur during translation from DXF to AutoCAD.
- Since DXF blocks may be created with a scale it may be necessary to apply a scale factor to VrOne symbols.
- If your client has supplied you with an AutoCAD drawing (.dwg) file, you must convert it to a DXF file in order to copy the blocks. When converting this file to a DXF file, use the earliest release available, which is normally R13.

Other DXF file for Block definitions
Defines the DXF file that contains the block definitions to copy to the current DXF file iff the “Source for block definitions” is set to “Other DXF file”. The […] browse button may be pressed in this field, which allows browsing for the target DXF file.

Symbol library

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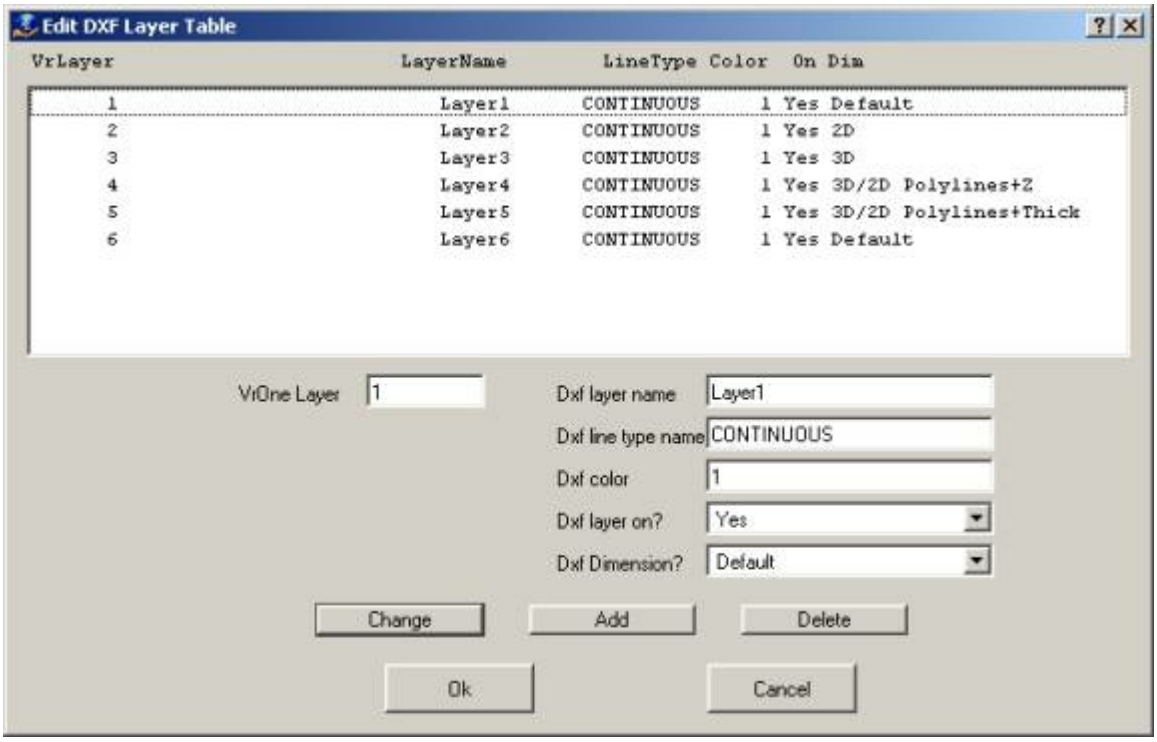
Allows an alternate symbol library to be used during the translation. If this is left blank then the currently attached symbol library will be used. If a VrOne symbol library is specified, the symbol definitions from the specified library are used during the translation.

Edit Layer Table

AutoCAD uses a layer table which defines layer names. Within each layer, a line type, color, and display status (on/off) are stored. The VrOne DXF Out translator creates this table and places it in each DXF file created.

VrOne uses layer numbers and has 10,001 predefined layers. AutoCAD uses layer names. Each layer name may be up to 32 characters in length. It is possible to name layers in VrOne, but the names are only for reference and VrOne references all layers by number.

An easy way to define this table is supplied by using the "Add VrOne Layers to Layer Table" option. This scans the current VrOne file(s) and creates a layer table entry for each layer used. **NOTE:** If layer names have been defined in VrOne, those layer names will be used in the table. If a layer name has not been defined in VrOne then the layer number will be used with the word "Layer" before the number.



The Edit DXF Layer Table dialog box allows editing the DXF layer table. If "Define line types" is set to "By entity" in Edit Parameters then the Line Type definition in this table is ignored and may be left CONTINUOUS. If "Define colors" is set to "By entity" in Edit Parameters, the Color definition in the table is ignored and may be set to 1. All layers should be tuned on. The layer table may also be edited in AutoCAD.

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VrOne Layer
Specifies the VrOne input layer.

Dxf layer name
Specifies the DXF layer name used for entities in the current VrOne Layer.

Dxf line type name
Specifies the DXF line type name used for entities in the current VrOne Layer.

Dxf color
Specifies the DXF color used for entities in the current VrOne Layer.

Dxf layer on

Specifies whether the current VrOne Layer is translated.

Dxf dimension
Determines the method to translate elevations to DXF for the current VrOne layer. Options are:

Default	Uses whatever value is specified in the main parameters dialog.
2D	2 dimension DXF file.
3D	3 dimension DXF file. Polylines are created as 3d polylines.
3D/2D Polylines+Z	3 dimension DXF file. Polylines are created as 2d polylines with an elevation in the header and elevations on each vertex. NOTE: AutoCAD might change the line to make the line point elevations the same.
3D/2D Polylines+Thick	3 dimension DXF file. Polylines are created as 2d polylines with an elevation in the header and elevations on each vertex. Elevations are placed as thickness in the polyline header and on each vertex. NOTE: AutoCAD might change the line to make the line point elevations the same.

In some versions of AutoCAD, operations such as joining lines are not allowed on 3D lines in which the elevation of the line points are not the same. The last two options are variations on the 3D option.

Edit Dxf line types

If any VrOne line fonts are to be cross-referenced to DXF line styles, this dialog may be used to create DXF line styles. By definition, DXF line styles consist of dashes, but are useful when defining VrOne line fonts that are dashed lines. Up to 60 line styles may be defined.
Advantages: DXF lines styles allow the client to edit lines and make the map more readable.
Disadvantages: If line points are closer than the line style distance then the line may be drawn as solid in AutoCAD.

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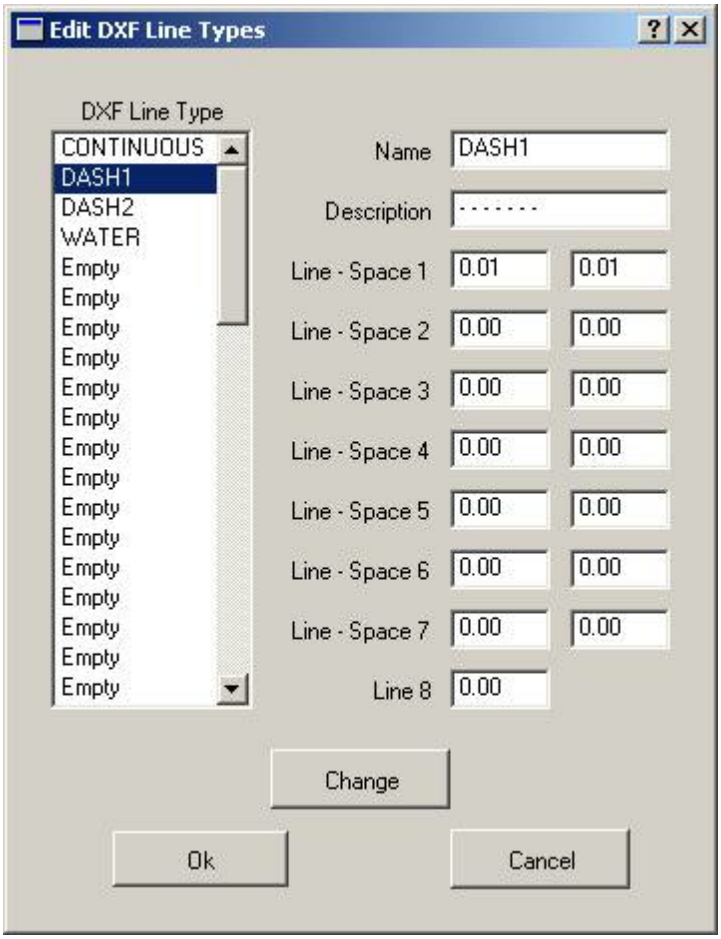

In the above dialog box only the CONTINUOUS line style is defined and represents a solid line. The line styles defined here may be cross-referenced to VrOne line fonts in "Cross-Reference Line Fonts".

Edit Symbol Lines

While not a feature of AutoCAD or VrOne, it is possible to create special line types called symbol lines. A symbol line is a line with DXF blocks placed at user-defined intervals along the line. Symbol lines offer mapping symbolization and give the client editing capability in AutoCAD. After a symbol line has been created, it may be cross-referenced to a VrOne line font in " Cross-Reference Line Fonts".

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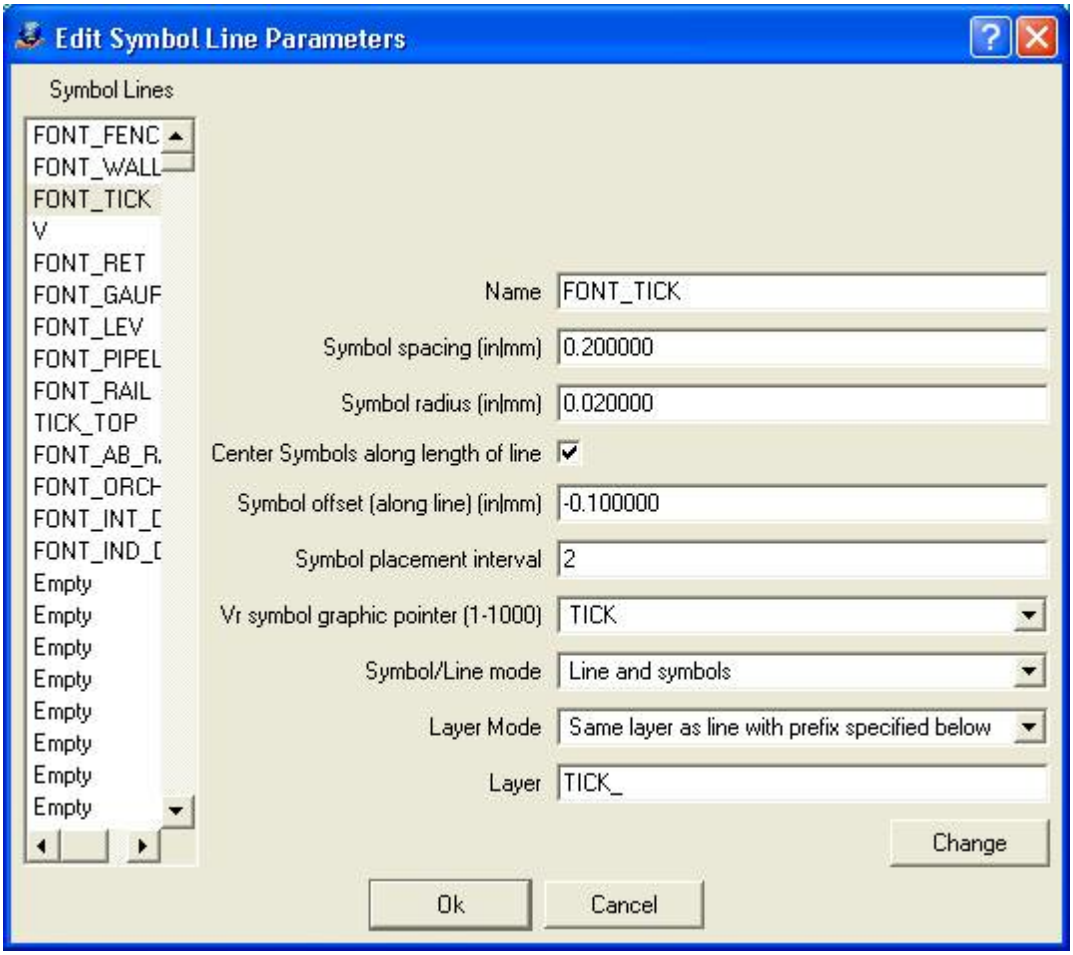

Symbol Lines
Displays the current symbol lines that have been defined. An entry of Empty means the symbol line has not been defined. Clicking an entry will copy the settings to the edit fields where they may be changed.

Name
Defines the name of the symbol line. This name will be available in "Cross-Reference Line Fonts ".

Symbol spacing (in|mm)
Defines in inches or millimeters at target scale the distance to place the symbols along a line.

Symbol radius (in|mm)
Defines in inches or millimeters at target scale the size of the symbols that are placed along the line.

Center Symbols along length of line
Specifies whether the placement of symbols is adjusted so the first and last symbols placed are equal distances from the begin and end of the line. This is useful to line a symbol up on a dashed line type, as AutoCAD displays line types using this method.

Symbol offset (along line) (in|mm)

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Defines in inches or millimeters at target scale the amount which each symbol is offset along the direction of the line. A negative number offsets in the reverse direction of the line.

Symbol placement interval
Defines interval to place symbols. Use 1 to place a symbol at the spacing defined. Use a value of 2 to place a symbol at every other location, and so on. This is useful when using the center option to align symbols to dashed AutoCAD line types. In this case, the Symbol spacing must match the dash-space length of the line type to compute the alignment correctly, but you may not want symbols plotted as frequently as the line type is defined.

Vr symbol graphic pointer (1-1000)
Specifies the VrOne symbol to place along the line.

Symbol/Line mode
Specifies the symbol/line placement mode. Options are:

Off	Do not place symbol/line.
Line and Symbols	Place both the line and the symbols.
Symbols only	Place symbols but not the line.

Layer mode
Determines the layer in which the symbols are placed. Options are:

Same layer as line	The symbols are placed on the same layer as the line to which they belong.
Use symbol line name	The symbols are placed on a layer name that matches the name of the symbol line.
Use layer specified below	The symbols are placed on the layer name entered in the text box below.
Same layer as line with prefix specified below	The symbols are placed on a new layer that combines the prefix entered in the text box with the layer the line is on.
Same layer as line with postfix specified below	The symbols are placed on a new layer that combines the postfix entered in the text box with the layer the line is on.

Layer
Defines the layer name to be used according to the Layer mode setting.

Cross-Reference Line Fonts

Defines the settings for the cross-referencing of VrOne line fonts to DXF. Each VrOne line font may be translated to DXF in one of four different ways. It may be translated to a DXF line style, exploded, use a symbol line, or be translated using DXF bulges.

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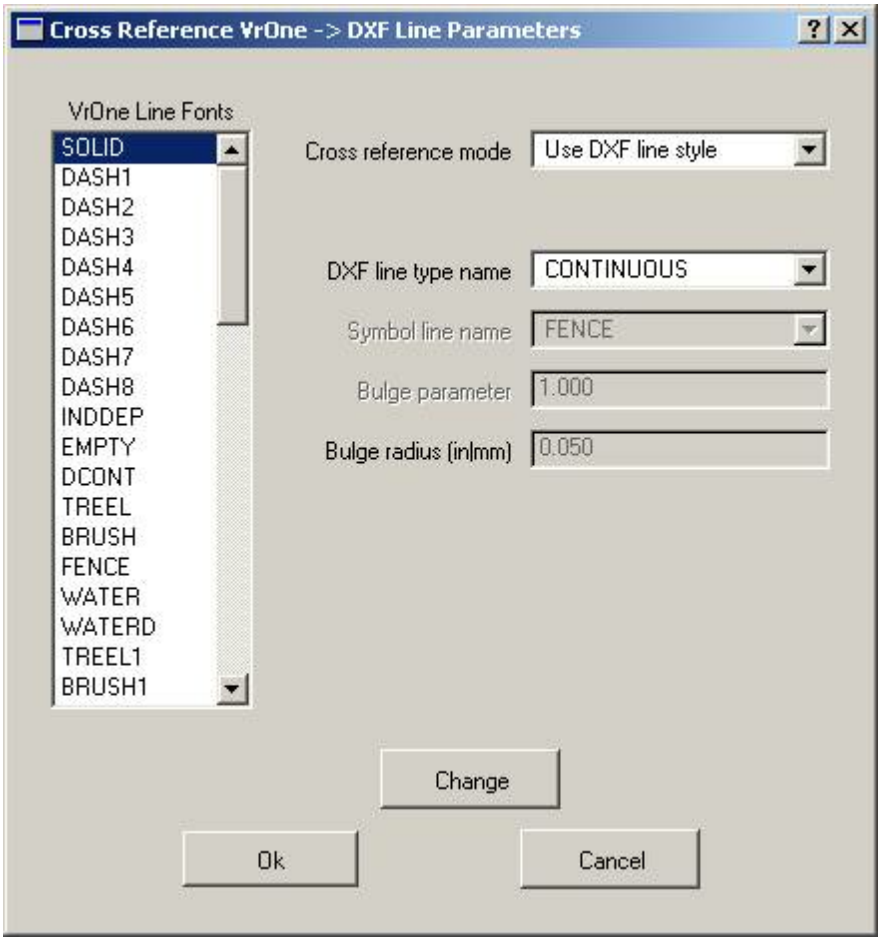

VrOne Line Fonts

Displays the VrOne line font names for the current VrOne symbol file. Clicking an entry will copy the settings to the edit fields where they may be changed.

Cross-reference mode

Defines the cross-reference mode for the currently selected VrOne line font. Options that are not valid for a cross-reference mode will be dimmed. Options are:

Use DXF line style	Use a line style defined in "Edit DXF line types". *Advantages*: Uses standard AutoCAD line type and is editable by the client. *Disadvantages*: Cannot define lines such as fence lines.
Explode line font	Breaks the fonted line into individual line segments. *Advantages*: Graphically, lines appear in AutoCAD the same as they appear in VrOne. *Disadvantages*: Since the lines are broken into segments, the file size is much larger. Due to the line segments it is very difficult for the client to edit the line as a single entity.
Use symbol line	Places a line with symbols. The symbols are placed at user-defined intervals. *Advantages*: Lines are readable as mapping features. *Disadvantages*: It takes many entities to create a line, which makes

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	editing difficult.
Use bulge	Places a line with DXF bulges. *Advantages*: Makes nice tree lines. *Disadvantages*: Has no other use than tree lines. Requires large amount of storage.

DXF line type name

It the "Cross-reference mode" is set to "Use DXF line style", a line style may be selected here. Line styles may be created using "Edit DXF line types".

Symbol line name

If "Cross-reference mode" is set to "Use symbol line", a symbol line may be selected here. Line styles may be created using "Edit symbol lines".

Bulge parameter

If "Cross-reference mode" is set to "Use bulge", the bulge parameter, which defines the degree of arc, is defined here.

Bulge radius (in|mm)

If "Cross-reference mode" is set to "Use bulge", the bulge radius is defined here in inches or millimeters.

Cross-Reference Symbols

Defines the settings for the cross-referencing of VrOne symbols to DXF. Each symbol definition in VrOne may be translated to DXF in one of four different ways. It may be translated as a Block, exploded, placed as text, or translated as a DXF point. Symbol names may also be cross-referenced to a client's block library, where a scale factor may be applied to adjust the size.

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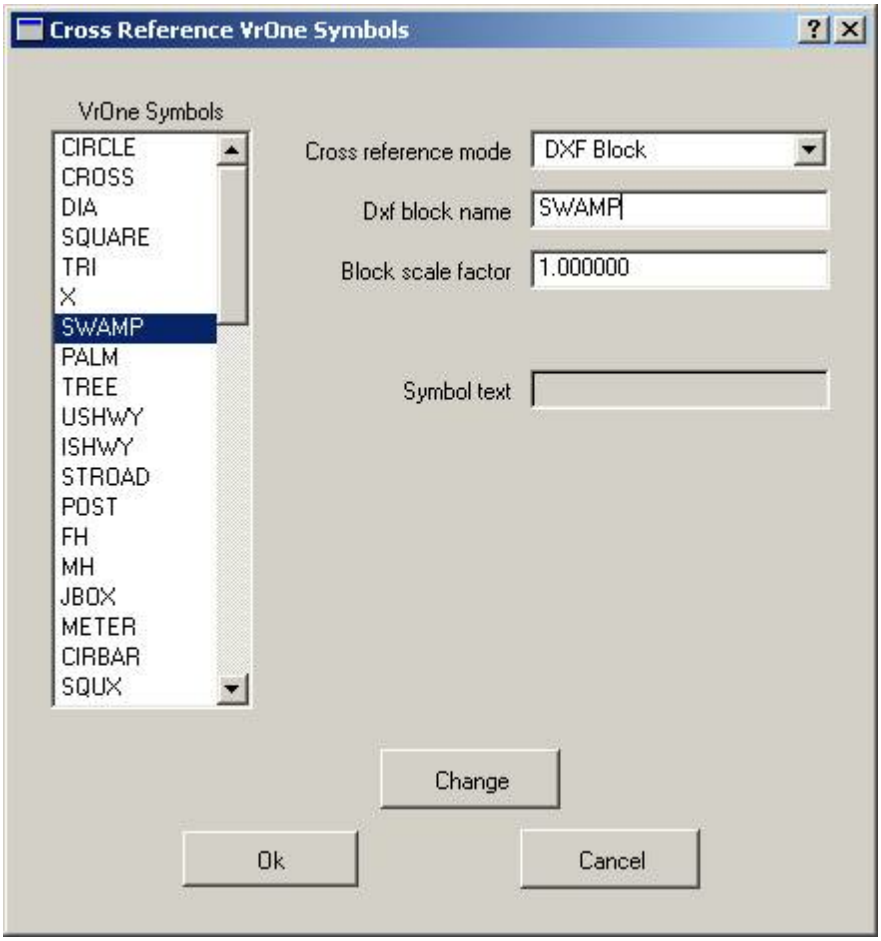

VrOne Symbols

Displays the VrOne symbol names for the current VrOne symbol file. Clicking an entry will copy the settings to the edit fields where they may be changed.

Cross-reference mode

Defines the cross-reference mode for the currently selected VrOne symbol. Options that are not valid for a cross-reference mode will be dimmed. Options are:

DXF Block	Places the symbol as a DXF block. This is the preferred method for translating symbols
Explode VrOne Symbol	Breaks the symbol into individual line segments. *Disadvantages*: Since the symbol is broken into segments, the file size is much larger. Due to the line segments, it is very difficult for the client to edit the symbol as a single entity.
Place text	Places the symbol as a text label. This is normally only used when the target systems does not understand blocks.
DXF point	Places the symbol as a DXF point. (See DXF point display mode)

DXF block name

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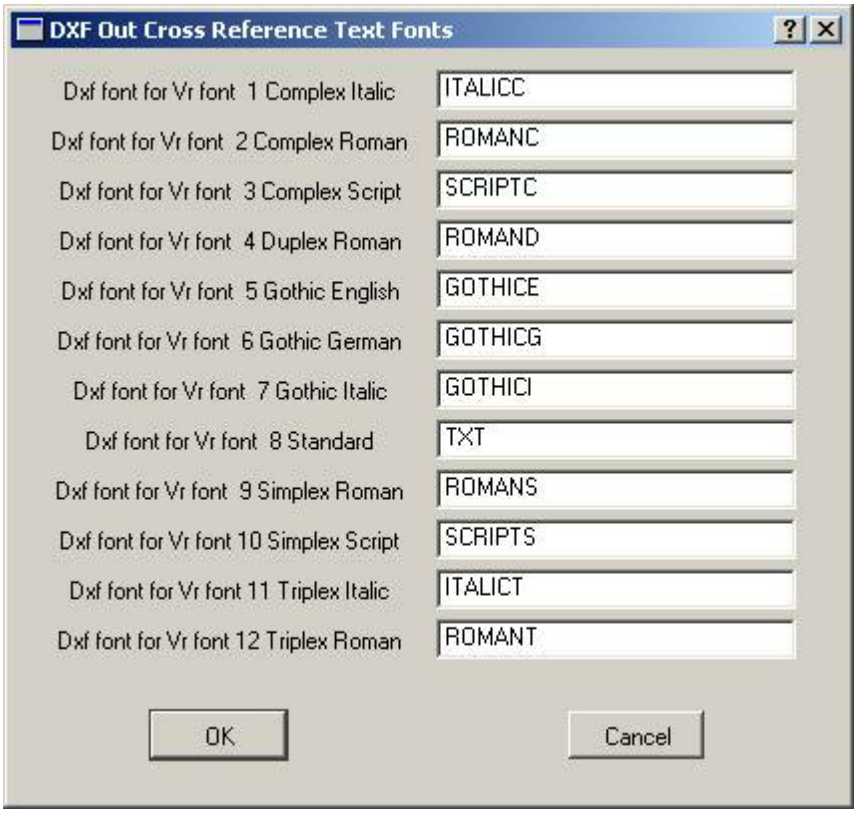
It is possible to rename the VrOne symbol when translating to a DXF block. This is normally used when using a client's block library.

Block scale factor
This scale factor is applied to the block size when translating a VrOne symbol to a DXF block. It is normally used when using a client's block library and scaling is needed to place the block at the same size.

Symbol text
Defines text to be placed instead of a symbol if the "Cross-reference mode" is set to "Place text". The size of the text will be the radius of the symbol.

Cross-Reference Text Fonts

VrOne supports 12 text fonts. These font styles are cross-referenced to match the text font styles in AutoCAD. By default, this cross-reference is set to the best match between VrOne and AutoCAD text font styles and should not need to be modified.



Add Vr Layers to Layer Table

Scans open VrOne file(s) and copies the layers used to the DXF layer table. "Edit Layer Table" may be used to cross-reference VrOne layer numbers to AutoCAD layer names. If layer names have been defined in VrOne, those layer names are used in the table. If a layer name has not been defined in VrOne, the layer number are used with the word "Layer" before the number.

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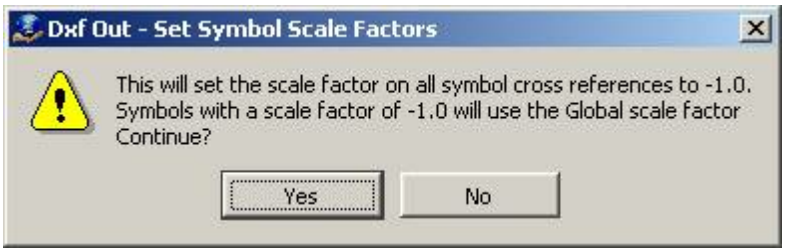
Reset Symbol Scale Factors

Resets all scale factors to –1.0 in the Symbol Cross-Reference table. This is useful if the Global Scale Factor is used to set a uniform scale for all symbols. The following prompt is displayed after pressing this button.



Load CADMAP Parameter File

Loads a CADMAP parameter file (.ACO) and translates it into the current translation parameters.

Translate

Translates the current VrOne file(s) using the current translation parameters into a DXF file.

Help

Starts the browser and displays the current help document.

Quit

Quits Dxf Out and gives an option to save the current parameters.



Quick Translation

The following may be done to translate VrOne file(s) to a DXF file in the fewest possible steps. The result is a translation in which all lines are translated as solid. Symbols are translated as blocks and text labels are translated with the proper text font styles.

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1. Init Parameters
2. Define the “Dxf file name” in “Edit Parameters”
3. Add Vr Layers to Layer Table
4. Translate

Translation Hints

- Speak to your client about the available features to best translate data to their system.
- Learn about the various options for translating symbols and line fonts.
- Test different options by translating files into AutoCAD.

2.1.1.25.8 Grid In

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Grid In (GriIn)

Type: Translator

Translates grid point (GridFloat) formatted files to VrPoints in VrOne files.

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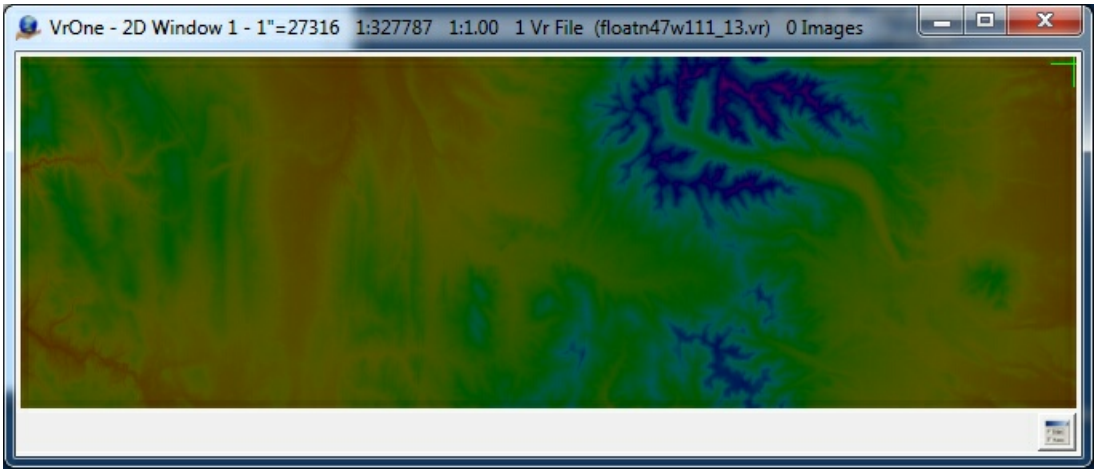

The Grid In translator converts points in from a grid file to the Vr Mapping database as Vr Points. The GridFloat format is supported by this translator in either binary or ASCII formats. More information of the GridFloat format can be found at

http://www.digitalpreservation.gov/formats/fdd/fdd000422.shtml
http://www.digitalpreservation.gov/formats/fdd/fdd000421.shtml

The grid formatted file only stores the point elevations. Grid parameters such as the origin, grid spacing and number of rows and columns are stored as the file header (ASCII format) or in a separate header file (binary format). The grid file header file has a file extension of .hdr and the grid data file has a file extension of .flt.

During translation, the coordinates may be re-projected to a different coordinate system by defining the coordinate system of the "Translation Out Projection" and coordinate system of the VrOne file(s). See Coordinate Projections for more information.

Information on translating Digital Terrain Elevation Data (DTED) files and National Elevation Dataset (NED) files can be found at the end of this document.

The Grid Out (GriOut) translator exports grid point data.

Load Parameters	Record Parameters	Define Input Filenames
Parameters	Translate	Help
Quit		

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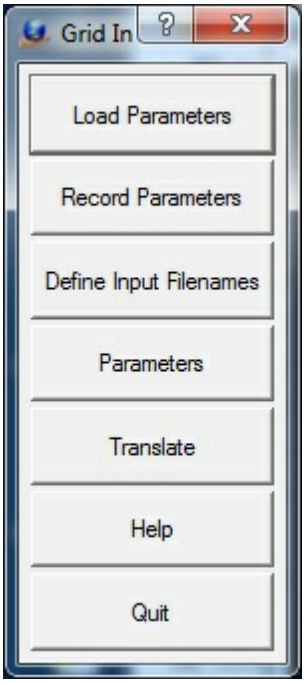
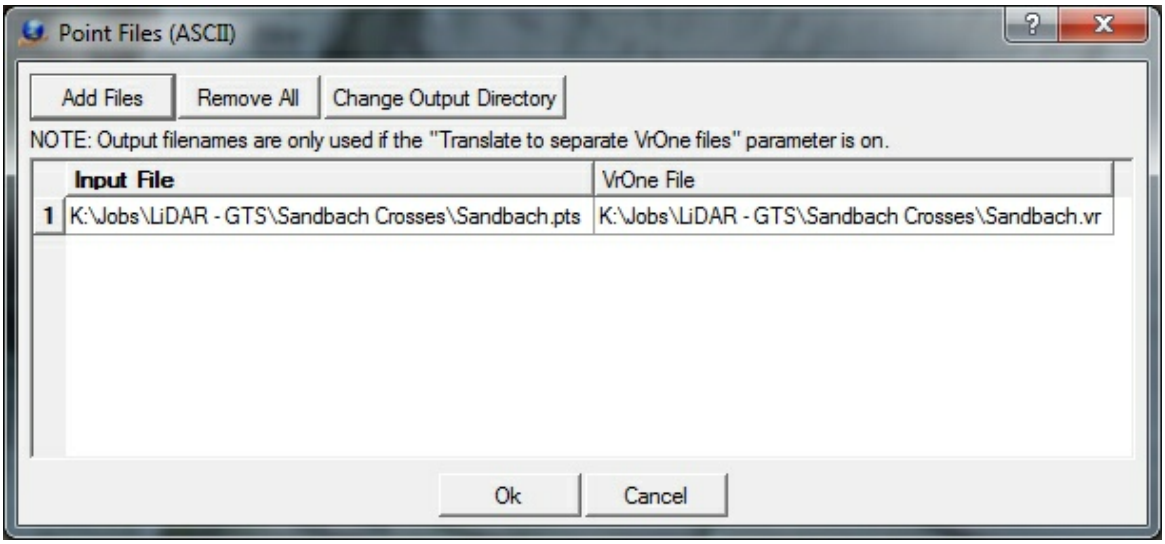


Load Parameters
Loads previously recorded Grid In (.gri) parameter file.

Record Parameters
Records current translation parameters to a Grid In (.gri) parameter file.

Define Input Filenames
Allows Points input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .flt by default, but attempts to read in any file chosen.
The VrOne output filenames are only used if the "Translate to separate VrOne files" option is on.



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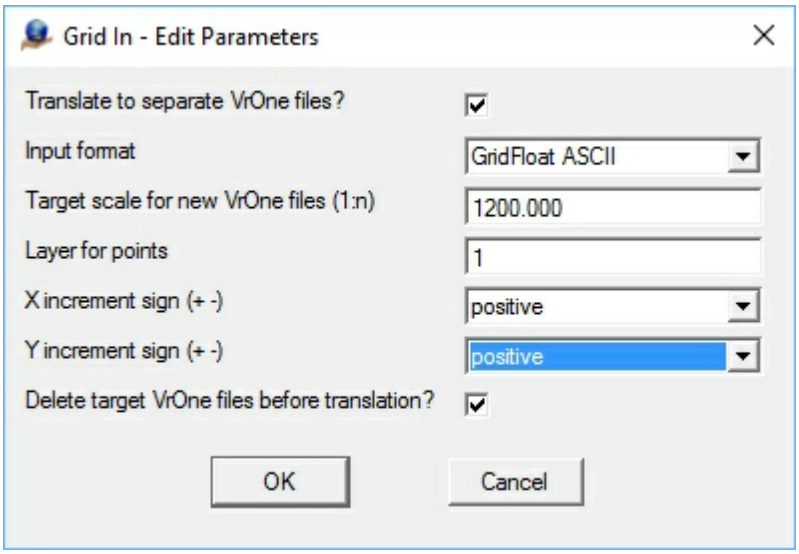
The Define Input Filenames dialog box

- **Add Files -** Displays a standard VrOne file selection dialog. All files selected are added to the list of Input files. Generates a VrOne output filename based on each input filename.
- **Remove All -** Removes all files from the Input file table.
- **Change Output Directory -** Allows changing the output directory (folder). By default, the output directory is the same as the input file directory.

Parameters

Allows the entry and editing of translation parameters.



The Edit Parameters dialog Box

Translate to separate VrOne files?

Determines whether the grid input files are translated to a separate VrOne files. The Input to Output filename cross-reference is set in the "Define Input Filenames" dialog.

Input format

Defines the format of the input files.

- **GridFloat binary** - The input format is binary with each elevation being represented by a four-byte floating point number. When using this format, the header information is saved in a separate ASCII file. This file has the same name as the data file but with a .hdr file extension.
- **GridFloat ASCII** - The input format is ASCII (text). The header information is in the beginning of each data file

Target Scale for new VrOne files (1:n)

Defines target scale to use when creating the new VrOne file if the "Translate to separate VrOne files?" is on and a VrOne file does not exist during translation.

Layer for points

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Specifies layer into which to place translated points.

X increment sign (+-)

Typically the origin X coordinate is to the left and is the smallest X value in the resulting file. Setting this parameter to negative makes the origin X coordinate to the right, making it the largest X value in the resulting file. This, in effect, mirrors the X axis.

Y increment sign (+-)

Typically the origin Y coordinate is to the bottom and is the smallest Y value in the resulting file. Setting this parameter to negative makes the origin Y coordinate to the top, making it the largest Y value in the resulting file. This, in effect, mirrors the Y axis.

Delete target VrOne files before translation?

If this option is checked each target VrOne file will be deleted before translation if it exists. If this option is unchecked and the target VrOne file exists, the new data will be appended to the file. This parameter is considered only if the "Translate to separate VrOne files" option is checked.

Translate

Begins the file translation process. All files that were defined by the “Define input Filenames” option are imported.

Help

Starts the browser and displays the current help document.

Quit

Quits Points In and allows current parameters to be saved if they were altered.

Translating Digital Terrain Elevation Data (DTED) Files

Digital Terrain Elevation Data (DTED) files can be translated by first converting the DTED files to Grid Float ASCII files. Since DTED files are grid files similar to the Grid Float files, the conversion is straightforward. This conversion can be performed by using the Geospatial Data Abstraction Library (GDAL) application gdal_translate which is provided with the installation of Vr Mapping. gdal_translate is run from a Command Prompt window.

Following are the steps to convert a DTED file to a Grid Float ASCII file.

Open a Command Prompt window

Type 'cmd' in the Windows search field from the Start button.

Set an environment variable.

This step needs to be done only after opening the Command Prompt Window

```
> c:\vr\bin\gdal_translate\gdal_translate_setenv
```

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Move to the folder containing the DTED files

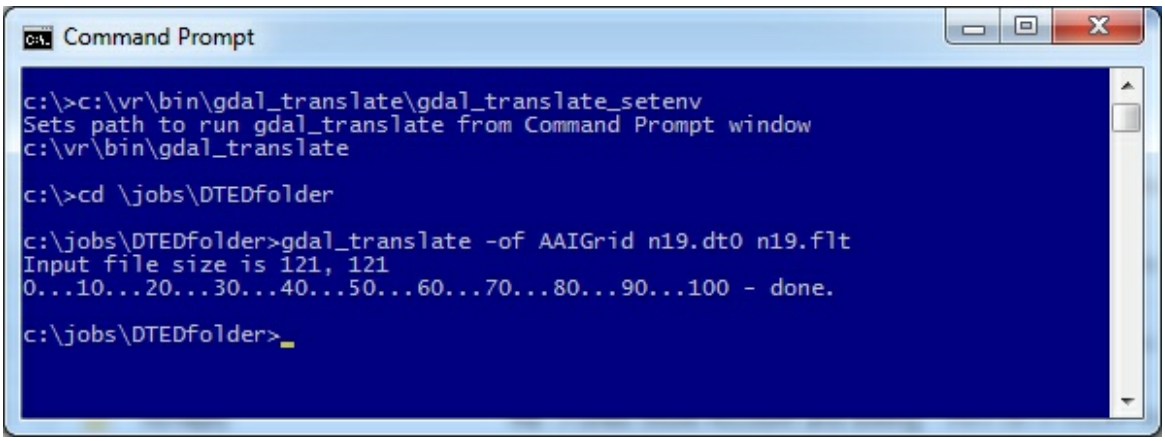
```
> cd \jobs\DTEDfolder
```

(DTEDfolder is used as an example. You folder name will be different)

Translate DTED file to Grid Float ASCII file

```
> gdal_translate -of AAIGrid   DTEDfile.dt0  GridFloat.flt
```

where:
`gdal_translate` - The translation program
`-of AAIGrid` - Specifies the output format
`DTEDfile.dto` - The DTED input file name to be translated. (DTEDfile.dto is used as an example. Your file name will be different)
`GridFloat.flt` - The Grid Float output file name. (GridFloat.flt is used as an example. Your file name will be different)



Example conversion of DTED file n19.dt0 to Grid Float ASCII file n19.flt

Translating National Elevation Dataset (NED) Files

National Elevation Dataset (NED) files are grid formatted files and are similar to Grid Float files. NED files can be in several formats including DEM, DXF, GeoTIFF, ASCII XYZ and Arc ASCII. Most of these formats, such as ASCII XYZ, are supported by one of the Vr Mapping translators. If the NED input format is not supported by Vr Mapping it should be able to be converted to a supported format using the GDAL gdal_translate program.

Grid In (GriIn)
- Added March 2016 - Version 05.07.30
- Revised July 2017 - Version 05.09.00

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2.1.1.25.9 Grid Out

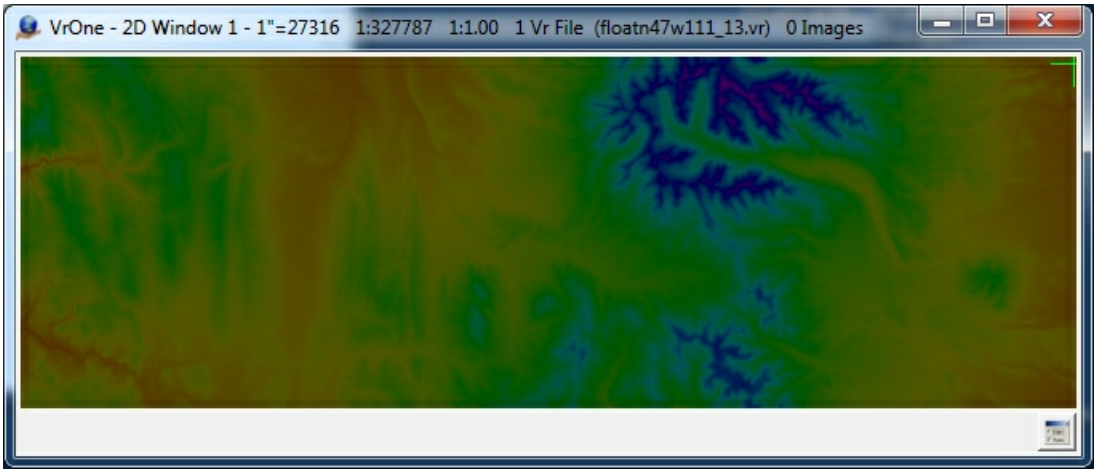
ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Grid Out (GriOut)

Type: Translator

Translates VrPoints in VrOne files to grid point (GridFloat) formatted files.



The Grid Out translator converts points in the Vr Mapping database as Vr Points to grid files. The GridFloat format is supported by this translator in either binary or ASCII formats. More information of the GridFloat format can be found at

http://www.digitalpreservation.gov/formats/fdd/fdd000422.shtml
http://www.digitalpreservation.gov/formats/fdd/fdd000421.shtml

The grid formatted file only stores the point elevations. Grid parameters such as the origin, grid spacing and number of rows and columns are stored as the file header (ASCII format) or in a separate header file (binary format). The grid file header file has a file extension of .hdr and the

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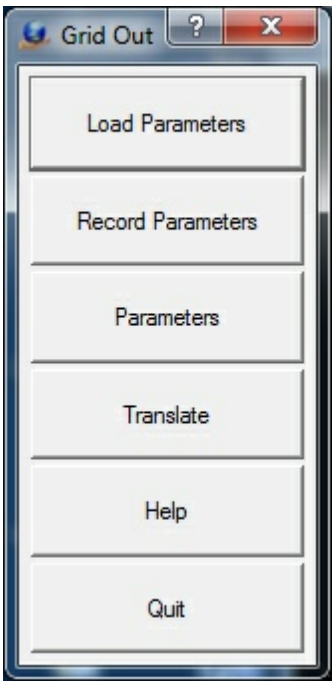
grid data file has a file extension of .flt.

Information on translating to Digital Terrain Elevation Data (DTED) files and National Elevation Dataset (NED) files can be found at the end of this document.

The Grid In (GriIn) translator imports grid point data.

Load Parameters	Record Parameters	Parameters
Translate	Help	Quit



Load Parameters
Loads previously recorded Grid Out (.gro) parameter file.

Record Parameters
Records current translation parameters to a Grid Out (.gro) parameter file.

Parameters
Allows editing general translation parameters.

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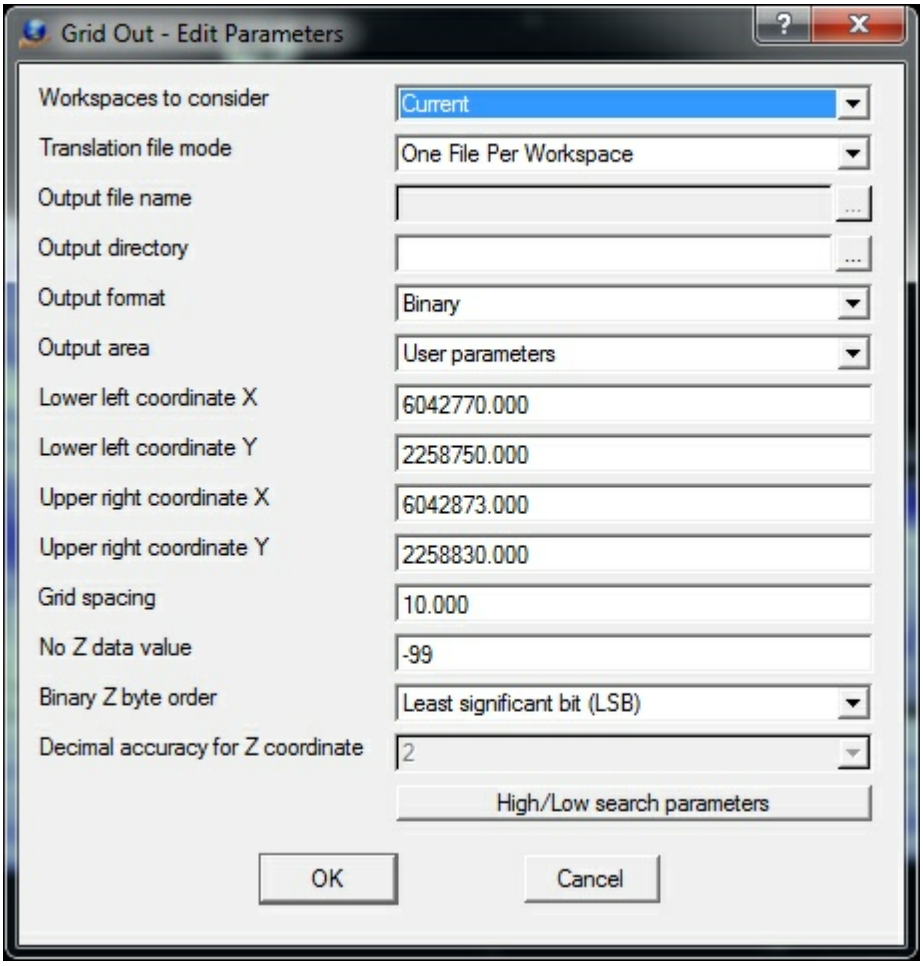

The Edit Parameters dialog Box

Workspaces to consider

Defines the workspaces to consider when running exporting grid files. Options are "Current workspace" or "All open workspaces".

Translation file mode

Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single grid file. The "Output file name" field determines the Points file name.
- **One File Per Workspace** - A grid file is created for each open workspace. The grid filename is the same as the workspace (VrOne) filename with a .flt extension. The "Output directory" field may be used to place the grid files in a different folder than the VrOne file.

Output file name

Defines the output file name when "Translation file mode" is set to "Single File". This name is ignored if "Translation file mode" is set to "One file Per Workspace".

Output directory

Defines output directory if not using "Single File" translation mode. This field may be left blank to place the grid files in same the directory as the VrOne files. This field is ignored if the

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"Translation file mode" is set to "Single File".

Output format
Defines the format of the output files.

- **Binary** - The output format is binary with each elevation being represented by a four-byte floating point number. When using this format, the header information is saved in a separate ASCII file. This file has the same name as the data file but with a .hdr file extension.
- **ASCII** - The input format is ASCII (text). The header information is in the beginning of each data file

Output area
Determines how the output area is defined. Options are "User parameters" or "File boundary". With either option, the bounding coordinates are rounded to an even grid spacing value.

- **User parameters** - The lower left and upper right coordinates are defined by the user and are the following four parameter fields. This is useful when writing a single grid file.
- **File boundary** - The boundary of the VrOne file determines the output area.

Lower left coordinate X
X coordinate position of the lower left corner of the area to cover. (ground)

Lower left coordinate Y
Y coordinate position of the lower left corner of the area to cover. (ground)

Upper right coordinate X
X coordinate position of the upper right corner of the area to cover. (ground)

Upper right coordinate Y
Y coordinate position of the upper right corner of the area to cover. (ground)

Grid spacing
Distance between grid points in the X and Y direction. The grid spacing is the same for the X and Y axis. (ground)

No Z data value
Since the output data file contains only elevations, if an Z value cannot be determined at a XY location this value will be used as a place holder. (default=-9999)

Binary Z byte order
If the output format is binary, this parameter specifies the bit order of the elevations in the file. The options are "Most significant bit (MSB)" and "Least significant bit (LSB)". Windows typically use LSB and UNIX and Linux typically use MSB.

Decimal accuracy for Z coordinate
If the output format is ASCII, this parameter specifies the decimal accuracy of the elevations in the ASCII output file. (default=3)

High/Low search parameters
When draping the XY grid positions onto the points, the High/Low search parameters are used to determine elevations. See High/Low Point Search for more information.

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Translate
Begins the file translation process.

Help
Starts the browser and displays the current help document.

Quit
Quits Grid Out and allows the current parameters to be saved if they were altered.

Translating To Digital Terrain Elevation Data (DTED) Files

Grid Float files can be translated to Digital Terrain Elevation Data (DTED) files. Since DTED files are grid files similar to the Grid Float files, the conversion is straightforward. This conversion can be performed by using the Geospatial Data Abstraction Library (GDAL) application gdal_translate which is provided with the installation of Vr Mapping. gdal_translate is run from a Command Prompt window.

Following are the steps to convert a DTED file to a Grid Float ASCII file.

Open a Command Prompt window
Type 'cmd' in the Windows search field from the Start button.

Set an environment variable.
This step needs to be done only after opening the Command Prompt Window

```
> c:\vr\bin\gdal_translate\gdal_translate_setenv
```

Move to the folder containing the Grid Float files

```
> cd \jobs\DTEDfolder
```

(DTEDfolder is used as an example. You folder name will be different)

Translate Grid Float file to DTED file

```
> gdal_translate -of DTED  GridFloat.flt  DTEDfile.dt0
```

where:
`gdal_translate` - The translation program
`-of DTED` - Specifies the output format
`GridFloat.flt` - The Grid Float output file name. (GridFloat.flt is used as an example. Your file name will be different)

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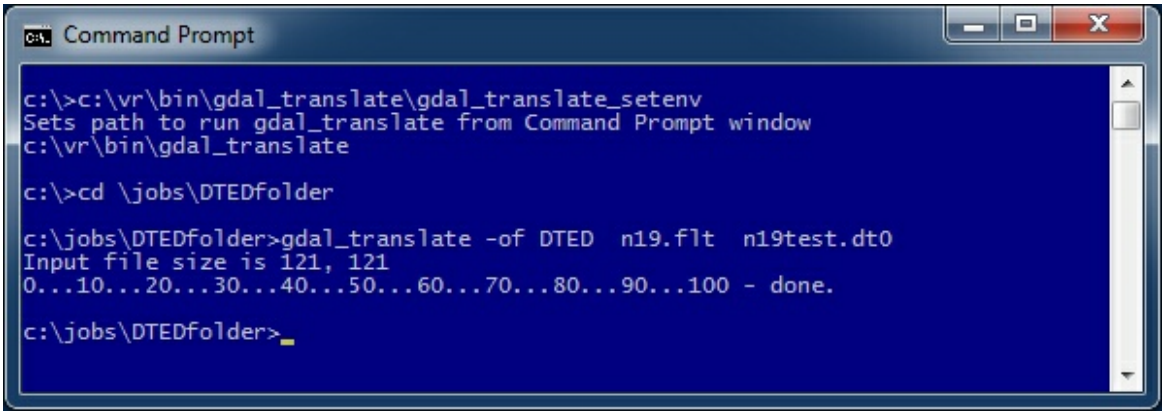
`DTEDfile.dto` - The DTED input file name to be translated. (DTEDfile.dto is used as an example. Your file name will be different)



Example conversion of Grid Float ASCII file n19.flt to DTED file n19test.dt0

Translating to National Elevation Dataset (NED) Files

National Elevation Dataset (NED) files are grid formatted files and are similar to Grid Float files. NED files can be in several formats including DEM, DXF, GeoTIFF, ASCII XYZ and Arc ASCII. Most of these formats, such as ASCII XYZ, are supported by one of the Vr Mapping translators. If the desired NED output format is not supported by Vr Mapping then it should be possible to convert a Grid Float file to the required NED format using the GDAL gdal_translate program.

Grid Out (GriOut) added March 2016 - Version 05.07.30

2.1.1.25.10 KML Out

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

KML Out (KmlOut)

Type: Translator

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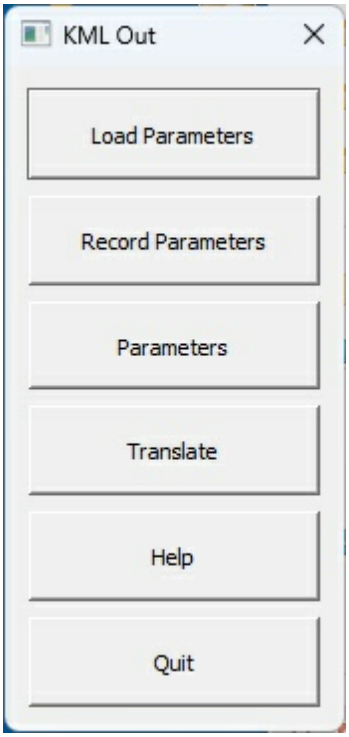
Translates VrOne lines and symbols into a KML (Keyhole Markup Language) file that can be displayed in an Earth browser such as Google Earth.
KML uses a tag-based structure with nested elements and attributes and is based on the XML standard. KML is an international standard maintained by the Open Geospatial Consortium, Inc. (OGC).
The coordinate system for Earth browsers such as Google Earth is WGS (World Geodetic System) 84. This coordinate projection uses longitude and latitude which are in angular units (i.e. -81.057995, 29.196447) that are expressed in decimal degrees. The z (elevation or altitude) coordinate, if used, is expressed in meters (i.e. 10.2654). The EPSG code for WGS 84 is 4326.

Load Parameters	Record Parameters	Parameters	Edit Symbol Parameters
Translate	Help	Quit	Requirements



The KML Out button box.

Load Parameters
Loads previously recorded KML Out (.kmo) parameter file.

Record Parameters
Records current translation parameters to a KML Out (.kmo) parameter file.

Parameters
Allows editing of the translation parameters.

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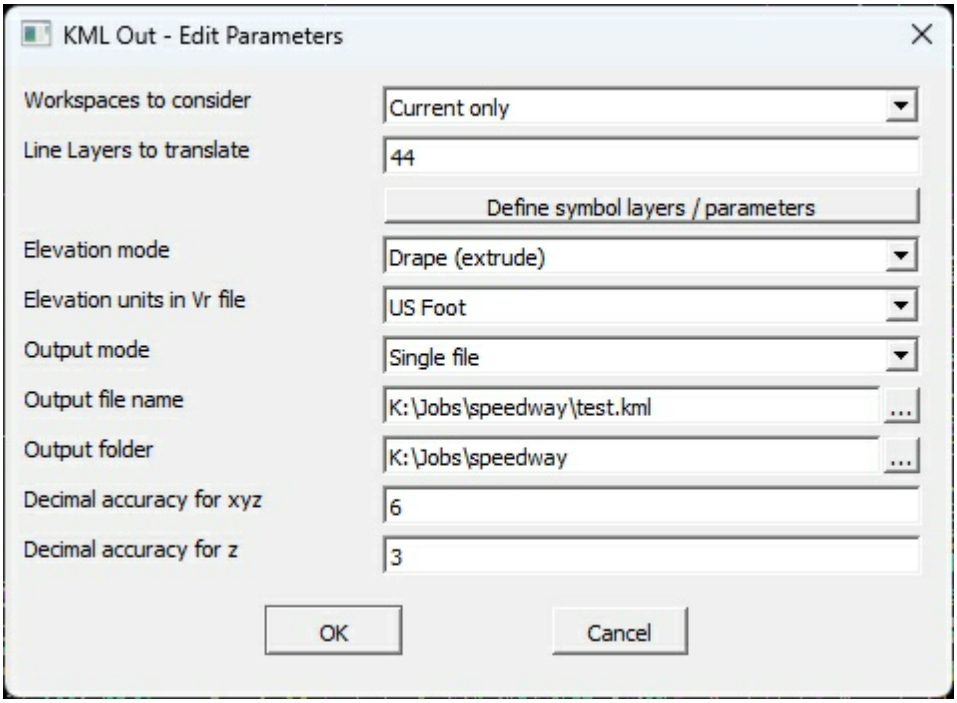

The Edit Parameters dialog box

Workspaces to consider

Defines the workspaces to consider when exporting KML Out files. Options are "Current only" and "All open".

Line Layers to translate

Defines the line layers in the VrOne file(s) to translate. These lines will be translated to the KML file using the approximate color and line weight defined in the VrOne file. A Number Line may be used to define these layers.

Define symbol layers / parameters

This button will display the Edit Symbol Parameters dialog box (see below).

Elevation mode

Defines the mode to use for line point and symbol elevations.

- Drape (extrude) - Drapes the elevations onto the Earth browser's surface. It should be noted that this draping will be influenced by features such as vegetation.
- Use Vr entity elevation - The elevation of each line point and symbol will be used.

Elevation units in Vr file

If the Elevation mode is set to "Use Vr entity elevation" then this parameter will be used to convert from US Survey Foot or International Survey Foot to meters. The Earth browser's elevation units is defined in meters. The options are "US Foot", "International Foot", or "Meters".

Output mode

Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single Survey Points file. The

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"Output file name" field determines the output file name. The "Output directory" field may be used to place the output file in a different folder than the VrOne file.

- **One File Per Workspace** - A Survey Points file is created for each open workspace. The output filename is the same as the workspace (VrOne) filename with a .kml extension. The "Output directory" field may be used to place the output files in a different folder than the VrOne files.

Output file name
Defines the output file name when "Output mode" is set to "Single File". This name is ignored if "Output mode" is set to "One file per workspace". The file extension for a KML file is .kml

Output folder
Defines the folder name to place the output file(s). This field may be left blank to place the output files in same the directory as the VrOne files.

Decimal accuracy for xy
Defines the number of decimal places for the x, y geographic coordinates in the output file(s). The coordinate system for Earth browsers such as Google Earth is WGS (World Geodetic System) 84. This coordinate projection uses longitude and latitude which are in angular units (i.e. -81.057995, 29.196447) that are expressed in decimal degrees.

Decimal accuracy for z
Defines the number of decimal places for the z (elevation or altitude) in the output file(s). The z coordinate is expressed in meters (i.e. 10.2654).

Translate
Begins the file translation process. Upon completion, KML (.kml) file or files will be created. Double clicking on a .kml file in the Windows File Explorer will typically start Google Earth and drive to the location defined in the KML file.

Help
Starts the browser and displays the current help document.

Quit
Quits KML Out and allows current parameters to be saved if they were altered.

Edit Symbol Parameters

When Vr lines are displayed in the Earth browser (Google Earth), the color and weight from Vr are used (Line fonts such as tree lines are not supported). When symbols are displayed there is a single default marker or icon that is used. The Edit Symbol Parameters allow symbols to be grouped by layer with different display parameters. These parameters include an icon definition and scale factor and options for the icon label text. Up to 10 symbol definitions, or passes, are available.

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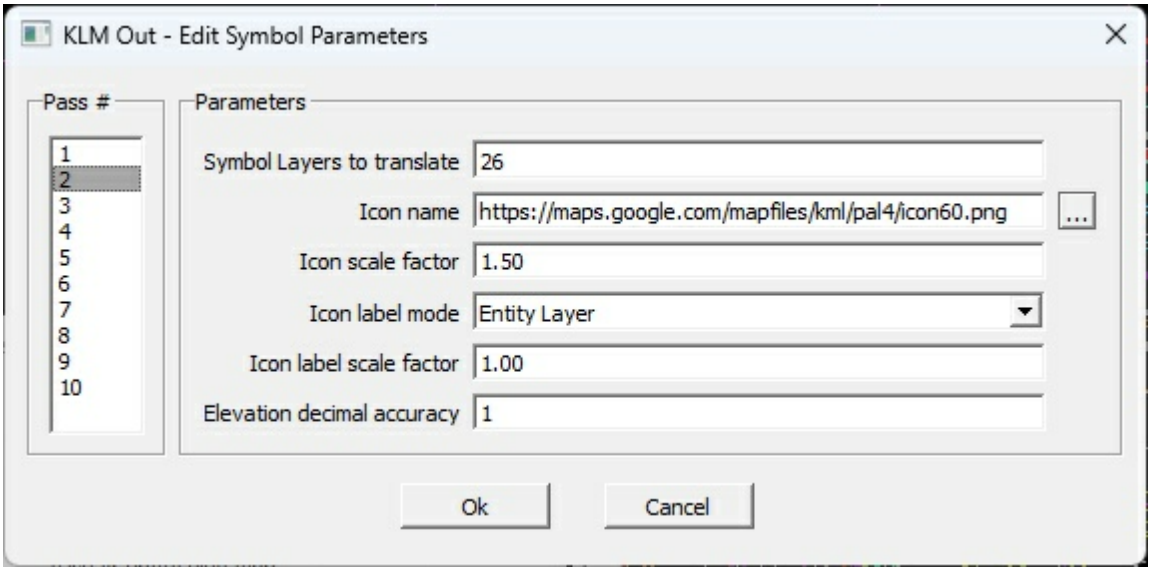

The Edit Symbol Parameters dialog box

Symbol Layers to translate

Defines the symbol layers in the VrOne file(s) to translate for the current pass. A Number Line may be used to define these layers.

Icon name

An icon is used to mark the location of the symbol. This icon (or placemark) is defined using a Portable Network Graphic (.png) file. This file may be located on your local computer or an Internet site such as http://kml4earth.appspot.com/icons.html or Google "icons for google earth" for more icons. If the icon name is not defined or or the defined icon cannot be found, the default icon will be used. The default icon for Google Earth is the yellow pushpin.

Icon scale factor

Scales the icon. A scale factor of 1 displays the icon with no scaling.

Icon label mode

Defines the text label to be used for the icon (symbol).

- **No label** - The icon will not be labeled.
- **Entity elevation** - The Vr symbol entity elevation will be used as the label. This label will be in the same units (i.e. US Survey Foot) as the Vr file. The decimal accuracy may be specified with the "Elevation decimal accuracy" parameter.
- **Entity Layer** - The layer number of the Vr symbol entity will be used as the label.
- **Entity Feature Code** - The Feature Code of the Vr symbol entity will be used as the label if it is defined.

Icon label scale factor

Scales the icon label. A scale factor of 1 displays the icon label with the default size.

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Elevation decimal accuracy
If the "Icon label mode" is set to "Entity elevation", this parameter will define the number of digits to the right of the decimal point that will be displayed.

Requirements

The following are required to use KML Out

- Google Earth or compatible Earth browser must be installed.
- The VrOne file projection must be defined. Since the coordinate system used by Google Earth is WGS 84 and State Plane coordinate systems are common in Vr Mapping, the conversion from State Plane to WGS 84 must be performed by KML Out. The coordinate system for Earth browsers such as Google Earth is WGS (World Geodetic System) 84. This coordinate projection uses longitude and latitude which are in angular units (i.e. -81.057995, 29.196447) that are expressed in decimal degrees. The coordinate projection for a VrOne file can be set in File -> Edit Vr Header -> Coordinate projection. If using a state plane coordinate system, the easiest method to define a projection is to use an EPSG code. The Search button will display a list of supported EPSG projections.

KML Out (KMLOut) added July 2023 - Version 07.01.21

2.1.1.25.11 MicroStation In

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Mst In (MstIn)

Type: Translator
See Also: Mst Out (MstOut)

Translates MST (Microstation Translation Format) files toVrOne files.

Overview

VrOne translates files to and from Microstation using a neutral file. This allows both programs to read and write map data using their internal libraries. This results in a more flexible and accurate

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translation.

When translating from VrOne to Microstation, the MstOut application is used to translate VrOne vector data to an Mst neutral file. The MDL (Microstation Development Language) MstIn program is used in Microstation to read the Mst neutral file and create a design file.



When translating from Microstation to VrOne, the MDL (Microstation Development Language) MstOut program used to translate Microstation vector data to an Mst neutral file. The VrOne application MstIn is used to translate Mst neutral file to the current VrOne file.



The Microstation MstIn and MstOut software must be downloaded from the Cardinal Systems web page and installed in Microstation. Please see "MSTIN and MSTOUT Microstation MDL programs" for more information.

Detailed Description

The MST format was defined by Cardinal Systems to allow accurate translations between VrOne and Microstation. MST files may be read into Microstation using the MstIn MDL program supplied by Cardinal Systems. The MST file format is ASCII based and supports all VrOne entity types and their equivalent Microstation entity types. The MST format is only used to transfer to and from Microstation. If you need to convert to other programs, please look at the DxfIn and DxfOut translators.

While the MST format was designed to make translation from Microstation as accurate as possible, there are some basic differences between Microstation and VrOne entities that present some problems when translating. The following sections will give an overview of how each VrOne entity is translated from Microstation. Detailed descriptions of each entities translation parameters will be given after the overview.

Cells

VrOne Symbols may be translated from Microstation Normal or Shared Cells. VrOne stores all symbols in a symbol library. When a symbol is placed in VrOne, a graphic pointer is stored which indicates what symbol should be displayed. The actual entities that make up the symbol definition are only stored in the symbol library. To translate cells, a cell cross-reference table is used that maps each Microstation Cell name to a VrOne symbol and radius size. By default, the translator will try to match the Microstation Cell name to an existing VrOne symbol name.

Lines

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Microstation Arcs, Lines, Line Strings, Curves, and Complex Chains/Shapes are all translated to the standard VrOne line entity. VrOne represents all lines using a single entity type. Microstation styles are mapped to VrOne line fonts using a cross-reference table. Each Microstation style can be mapped to a different VrOne line font name. Curves are translated as lines with a spline display mode.

Text

Microstation text elements are translated to VrOne text entities. All Microstation text justifications are translated accurately to VrOne. Default font mappings are used to determine the VrOne text font to use (see "Auto Cross-Reference Tables" for details).

Points

Microstation points (0 length lines) are translated to VrOne symbols. A single VrOne symbol will be used to represent all Microstation points.

Because of the many options offered by Mst In, you should communicate with your client to discuss the options and determine the best translation method to suit their needs. Time should be spent familiarizing yourself with the options offered and test translations should be done from Microstation to view the translation results. Mst In can translate map data using very basic translation parameters, or advanced translation options may be used to produce a readable and usable map for your client.

This documentation will point out the advantages and disadvantages to many of the translation options.

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Load Parameters	Record Parameters	Reset Parameters
Edit Parameters	Cross-Reference Levels	Cross-Reference Styles
Cross-Reference Cells	Import MSTOUT Cross-References	Scan Mst files
Translate	Help	Quick Translation
Translation Hints	Auto Cross-Reference Tables	

MST In

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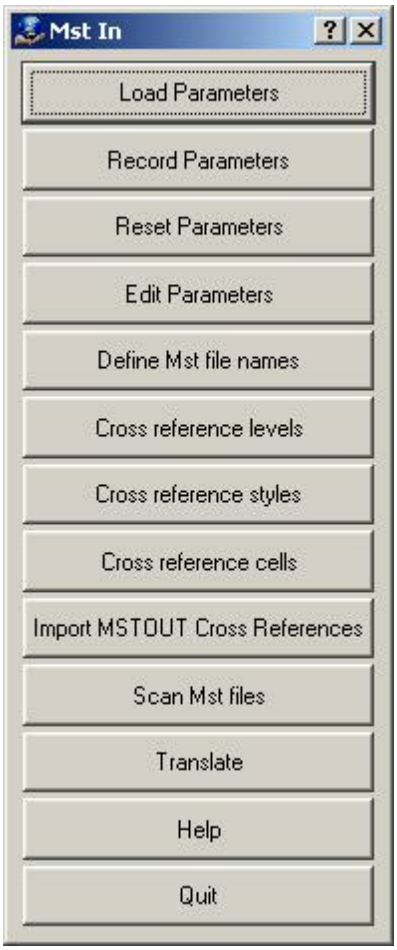


Load Parameters

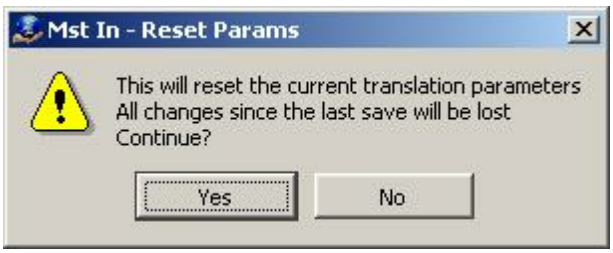
Loads previously recorded MST In (.msi) parameter file.

Record Parameters

Records current translation parameters to a MST In (.msi) parameter file.

Reset Parameters

Initializes translation parameters to default values. **NOTE:** Current translation parameters will be lost.



Edit Parameters

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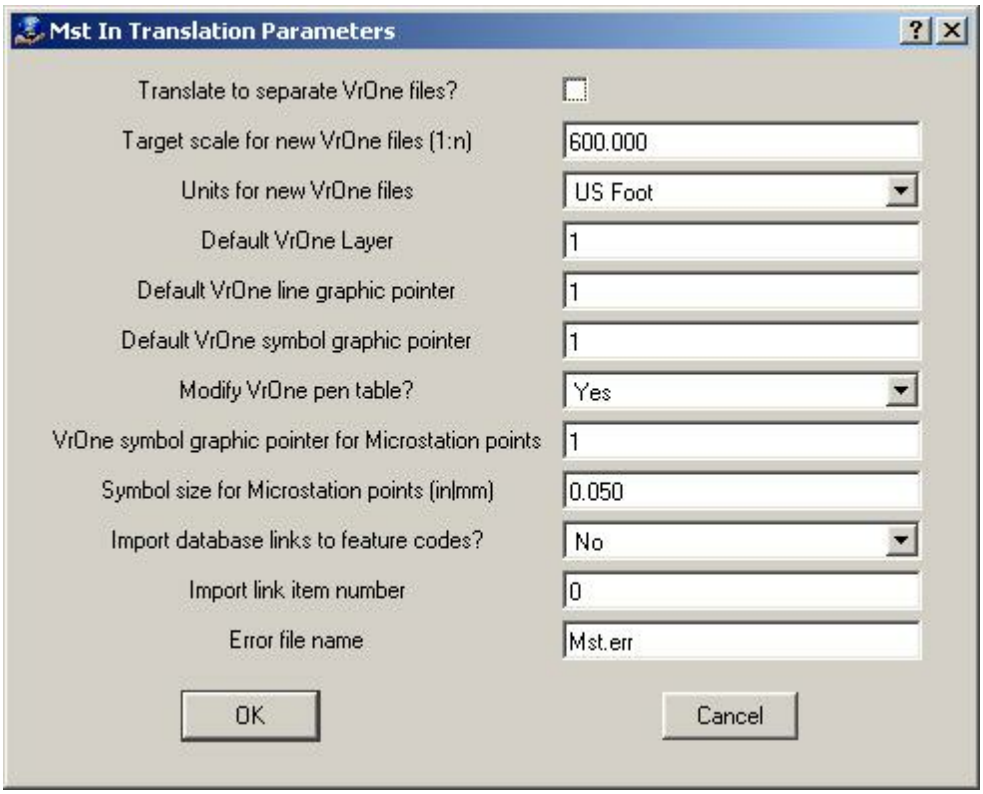
Allows editing general translation parameters.



Translate to separate VrOne files?
If this is checked, each MST file is translated to a separate VrOne file. The name of the VrOne files may be specified using the Define Mst file names dialog. By default, the VrOne filenames are the same as the base names of the MST files. If a VrOne file does not exist, it is created using the Target scale and Units specified below.

Target scale for new VrOne files (1:n)
Target scale to use if new VrOne files are creating when using the Translate to separate VrOne files option.

Units for new VrOne files (1:n)
Units to use if new VrOne files are creating when using the Translate to separate VrOne files option.
This setting is stored in the VrOne file for informational purposes only; it does not change how the translation is performed.

US Foot
Meter
Intl Foot

Default VrOne Layer
Specifies layer in which to place entities whose level is not found in the levels cross-reference table.

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Default VrOne line graphic pointer
Specifies line font graphic pointer to use for lines that have a style not found in the styles cross-reference table.

Default VrOne symbol graphic pointer
Specifies symbol graphic pointer to use for symbols not found in the symbols cross-reference table.

Modify VrOne pen table?
Specifies whether to change the VrOne pen colors in the current pen table to match those active in Microstation when the MST was created.

VrOne symbol graphics pointer for Microstation points
Specifies symbol graphics pointer to use when translating Microstation points to VrOne symbols. Microstation points are 0 length lines.

Symbol size for Microstation points (in|mm)
Defines in inches or millimeters (depending on VrOne file units) size for symbols that are translating from Microstation points.

Import database links to feature codes?
Specifies whether database links found attached to Microstation entities are translated to VrOne feature codes. While Microstation can store multiple link items per entity, only one link can be translated and it must be specified in the field below.

Import link item number
Specifies the item link number to translated if "Import database links to feature codes" is on. The first link item is 0.

Error file name
Defines file name to which, if any errors occur during the translation, the details of the error are written. If left blank, no error file will be created.

Define Mst file names

Allows all MST input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .MST by default, but will attempt to read in any files chosen.
The VrOne output filenames will only be used if the "Translate to separate VrOne files" option is on.

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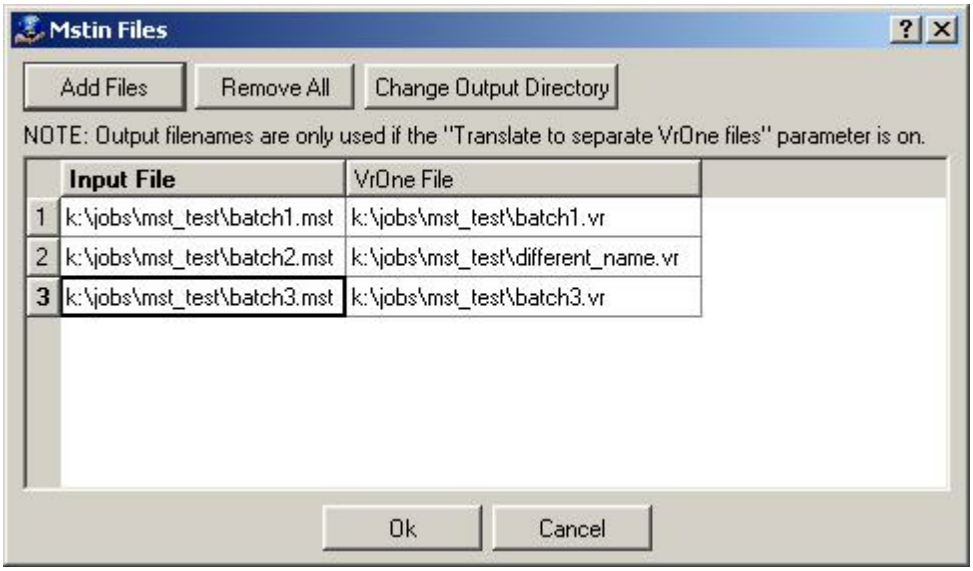

NOTE: The VrOne output filenames may be edited in place by the user.

Cross-Reference Levels

This dialog defines the settings for the cross-referencing Microstation levels to VrOne layers. VrOne layers are numbered from 1-10001, and have optional names assigned. The cross-reference table only refers the the VrOne layer numbers. Each combination of Microstation Level, Color, and Weight may be cross-referenced to a different VrOne layer. For example, entities on Level 1 with color 1 can be translated to VrOne layer 20, while entities on Level 1 with color 2 are translated to VrOne layer 21.

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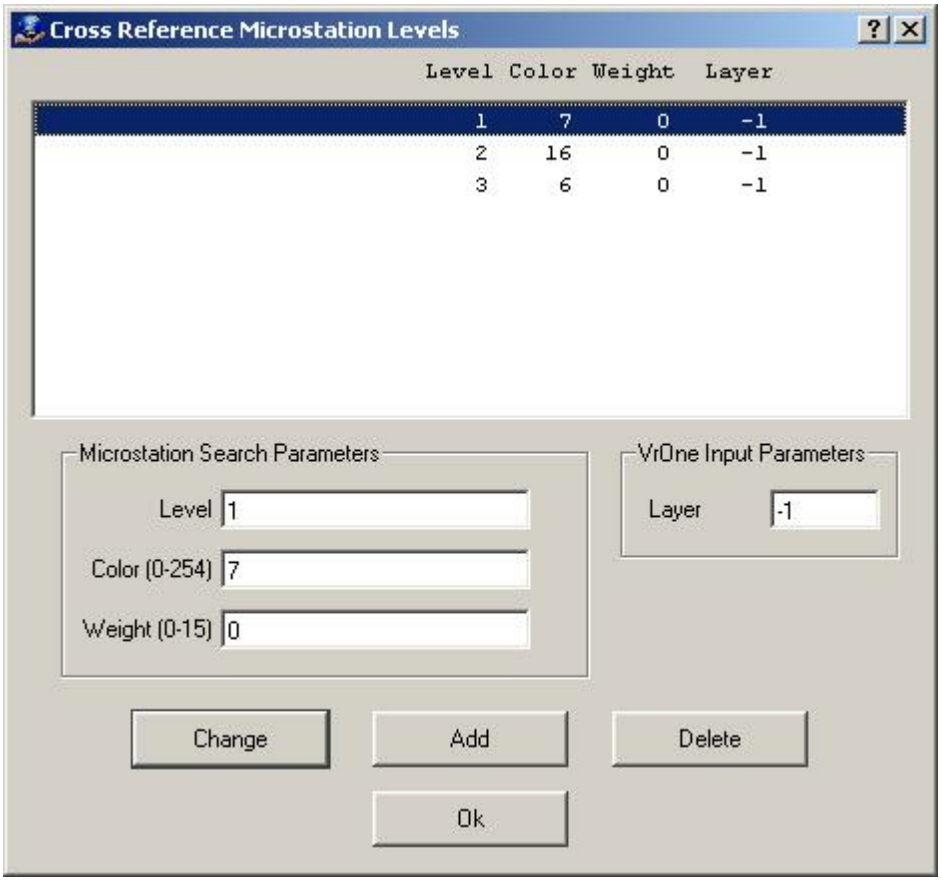

Microstation Search Parameters

Defines the search criteria for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Description
Level	V7 = 1-63. V8 = 64 character name.	Indicates the Microstation level required to match this cross-reference entry.
Color	0-254	Indicates the Microstation color required to match this cross-reference entry.
Weight	0-15	Indicates the Microstation weight required to match this cross-reference entry

VrOne Input Parameters

Defines the VrOne input settings for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard – Description	Description
VrOne Layer	-1, 1-32001	-1 – Translate to the same Vr layer	VrOne layer to

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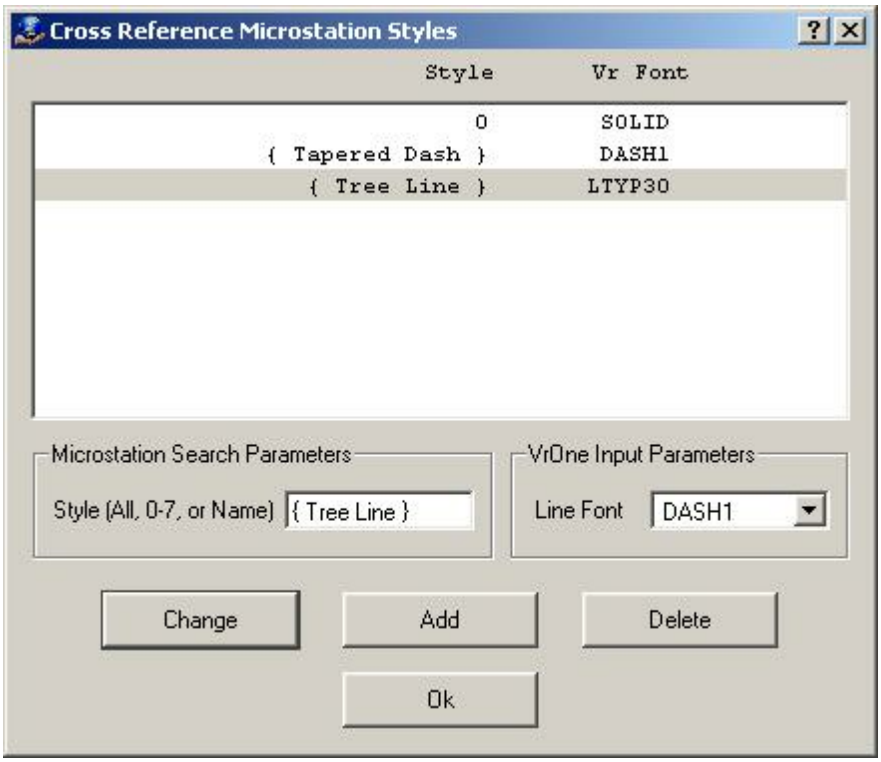
		as the Microstation level number.	place entities that match this cross-reference entry.

Cross-Reference Styles

Defines the settings for the cross-referencing of Microstation Styles to VrOne line fonts. Each Microstation style may be translated to a different VrOne line font. The line fonts are specified by name, so the translation is dependent on having the correct symbol file loaded with matching names in VrOne.



Microstation Search Parameters

Defines the search criteria for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
Style	All, 0-7, Name	All - Indicates that all cells will match this cross-reference.	Specified the Microstation style name required to match this cross-reference entry.

VrOne Input Parameters

This section of the dialog box defines the VrOne input settings for one cross-reference entry. The parameters in this section are defined as follows:

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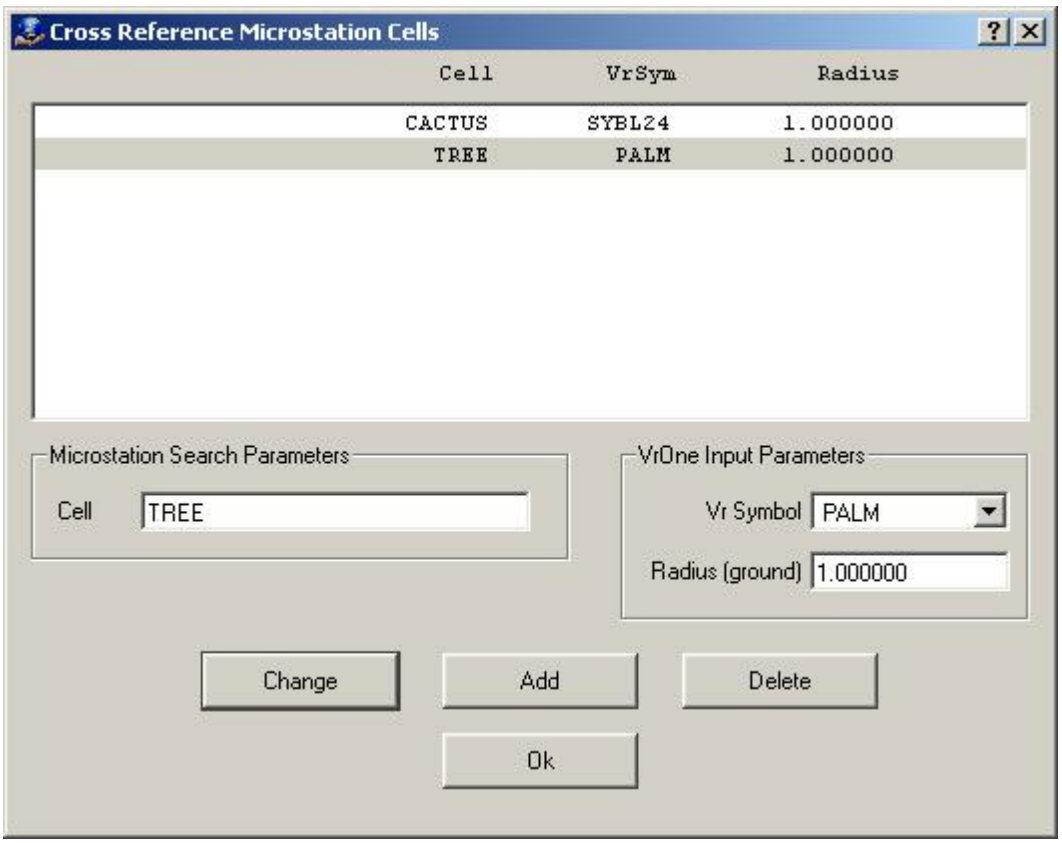
Name	Possible Values	Wildcard - Description	Description
Line Font	Any valid line font name in the current symbol library.	N/A	Specified the line font to assign for this cross-reference entry.

Cross-Reference Cells

Defines the settings for the cross-referencing of Microstation Cells to VrOne symbols. Each Microstation cell may be translated to a different VrOne symbol. The symbols are specified by name, so the translation is dependent on having the correct symbol file loaded with matching names in VrOne.



Microstation Search Parameters

Defines the search criteria for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
Cell	ALL or Any valid Microstation cell	All - Indicates that all cells will match this cross-reference.	Specifies the Microstation cell name required to match this cross-reference

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	name		entry.

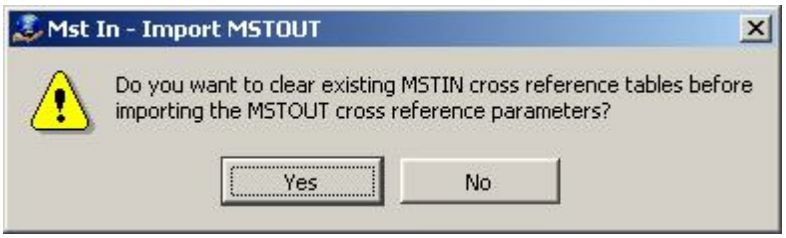
VrOne Input Parameters

Defines the VrOne input settings for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
Vr Symbol	Any VrOne symbol name in the current symbol library.	N/A	Specifies the symbol name to assign for this cross-reference entry.
Radius (ground)	> 0.0	-1 - Indicates that the radius should be the same as the Microstation cell scale.	Specifies the radius in ground units to assign for this cross-reference entry.

Import MSTOUT Cross-References

Imports cross-reference tables from an MSTOUT parameter file. Because the MSTIN and MSTOUT are designed with different style cross-reference tables, this option should only be used as a starting point to creating full translation cross-references. You will be asked to select an existing MSTOUT parameter file, then you will then be given the option to clear all existing cross-reference table before importing the MSTOUT cross-references.



After answering this dialog, the MSTIN parameters will be imported. After an import, you should always check each cross-reference table to verify that the cross-reference items were imported as expected.

Scan Mst files

Scans all Mst files specified in the Define Mst file names dialog and fills in the cross-reference tables for all entities found in the files. This can be a good way to start setting up a translation, as each unique level, style, and cell will automatically have an entry in the cross-reference tables.

Translate

Translates the current Microstation file(s) using the current translation parameters into one or more VrOne files.

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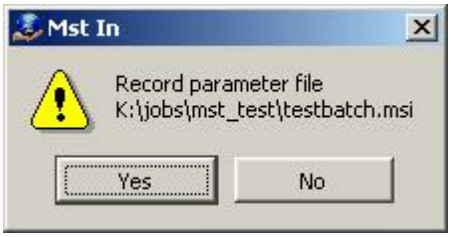
Help

Starts the browser and displays the current help document.

Quit

Quits Mst In and gives an option to save the current parameters.



Quick Translation

The following may be done to get a basic translation of MST file(s) into VrOne in just a few steps. The result is a translation in which entities are translated with layer numbers matching the Microstation levels (unless level names are used), symbols are translated to match the Microstation cell names.

1. Select Reset Parameters
2. Select Define Mst file names and select files to translate.
3. Select Scan Mst files
4. Select Translate

Translation Hints

- Speak to the mapping client about the available features to best translate data to their system.
- Learn about the various options for translating symbols and line fonts.
- First define cross-references using wildcards to cover the broadest range of cases, then add detailed cross-reference entries to handle the exceptions.
- Test different options by translating files into Microstation.

Auto Cross-Reference Tables

This section shows how Text Fonts and Color are translated for some standard Microstation settings.

Microstation Font	VrOne Font
0 (Standard)	STANDARD
2 (Fancy)	CR
23 (Italics)	CI

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Microstation Color	VrOne Pen
0	8
1	1
2	2
3	3
4	4
5	5
6	6

2.1.1.25.12 MicroStation Out

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Mst Out (MstOut)

Type: Translator
See Also: MstIn

Translates VrOne file(s) to MST (MicroStation Translation Format).

Overview

VrOne translates files to and from MicroStation using a neutral file. This allows both programs to read and write map data using their internal libraries. This results in a more flexible and accurate translation.

When translating from VrOne to MicroStation, the MstOut application is used to translate VrOne vector data to an Mst neutral file. The MDL (MicroStation Development Language) MstIn program is used in MicroStation to read the Mst neutral file and create a design file.

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When translating from MicroStation to VrOne, the MDL (MicroStation Development Language) MstOut program used to translate MicroStation vector data to an Mst neutral file. The VrOne application MstIn is used to translate Mst neutral file into the current VrOne file.



The MicroStation MstIn and MstOut software must be downloaded from the Cardinal Systems web page and installed in MicroStation. Please see "MSTIN and MSTOUT MicroStation MDL programs" for more information.

Detailed Description

The MST format was defined by Cardinal Systems to allow accurate translations between VrOne and MicroStation. MST files may be read into MicroStation using the VrIn MDL program supplied by Cardinal Systems. The MST file format is ASCII based, and supports all VrOne entity types and their equivalent MicroStation entity types. The MST format is only used to transfer to and from MicroStation. If you need to convert to other programs, please look at the DxfIn and DxfOut translators.

The MstOut translator was designed to give the user precise control over all translation options. Two main features give MstOut this capability:

1	Entity translation parameters may be defined on a layer-by-layer basis, allowing a great deal of control over the translation process;
2	Translation parameters may be specified with wildcards, allowing default translation parameters for a group of entities, but also more detailed parameters that override the defaults for certain entities. For example, you can specify that all lines on all layers be translated with a weight of 2, but any line on layer 100 be translated with a weight of 1.

While the MST format was designed to make translation to MicroStation as accurate as possible, there are some basic differences between MicroStation and VrOne entities that present some problems when translating. The following sections will give an overview of how each VrOne entity is translated to MicroStation. Detailed descriptions of each entities translation parameters will be given after the overview.

Symbols

Symbols may be translated to MicroStation Normal or Shared Cells. At a global level, you can specify an optional cell library to be attached when translating into MicroStation, if new Cell definitions are created from VrOne symbol definitions, and if Normal or Shared cells are used.

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For any combination of Layer and Symbol Name, you can specify the MicroStation Cell name, level, color, weight, and scale factor, whether the symbol should be exploded into separate entities or placed as a single entity, and if the symbol should be translated to a MicroStation symbol text font character instead of a Cell. For example, all symbols named CIRCLE on Layer 105 can be translated to MicroStation Cells named "CIRC" on Level 5.

Lines

Lines may be translated to MicroStation Arcs, Lines, Line Strings, Curves, and Complex Chains. At a global level, you can specify an optional pattern library to be attached when translating into MicroStation. For any combination of Layer, Line Mode, Line Font, and Line Width, you can specify the MicroStation level, color, weight, style number, custom style name, pattern name, and whether the line (if fonted) should be exploded into separate entities or placed as a single entity. For example, all VrOne splined lines on Layer 250, with a font of "TREEL", and a width of 2 can be translated to MicroStation lines on Level 45, with a custom linestyle of "{ Tree Line }", and a weight of 1.

Text

Text entities are translated to MicroStation text elements. All VrOne text justifications except "Decimal" are translated accurately to MicroStation. Text with Decimal point justification are translated with a MicroStation justification of Center/Bottom and spaces are added to the beginning or end of the text string to allow the decimal point to align approximately with the insertion point. For any combination of Layer and Text Font, you can specify the MicroStation font, level, color, weight, and height. For example, all VrOne text entities with font "CI" (Complex Italic) can be translated to MicroStation text elements with font 2 (Fancy). Default font mappings are used if no specific translation exists for a font (see "Auto Cross-Reference Tables" for details).

Because of the many options offered by Mst Out, you should communicate with your client to discuss the options and determine the best translation method to suit their needs. Time should be spent familiarizing yourself with the options offered and test translations should be done to MicroStation to view the translation results. Mst Out can translate map data using very basic translation parameters, or advanced translation options may be used to produce a readable and usable map for your client.

This documentation will point out the advantages and disadvantages to many of the translation options.

NOTE: References to V8+ mean MicroStation version 8 and above.

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Available Key-ins

Key-in	Description	Range
PARFIL=	Load parameter file	MstOut parameter file name (.mso)

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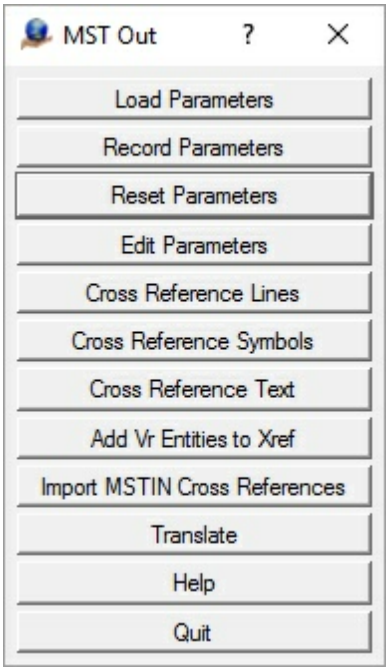
RUN	Run MstOut	

Load Parameters	Record Parameters	Reset Parameters
Edit Parameters	Cross-Reference Lines	Cross-Reference Symbols
Cross-Reference Text	Translate	Quick Translation
Translation Hints	Auto Cross-Reference Tables	

MST Out



Load Parameters
Loads previously recorded MST Out (.mso) parameter file.

Record Parameters
Records current translation parameters to a MST Out (.mso) parameter file.

Reset Parameters
Initializes translation parameters to default values. NOTE: Current translation parameters will be lost.

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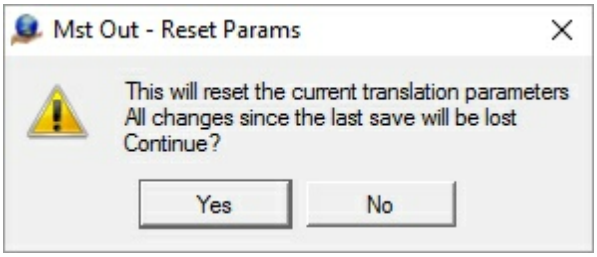
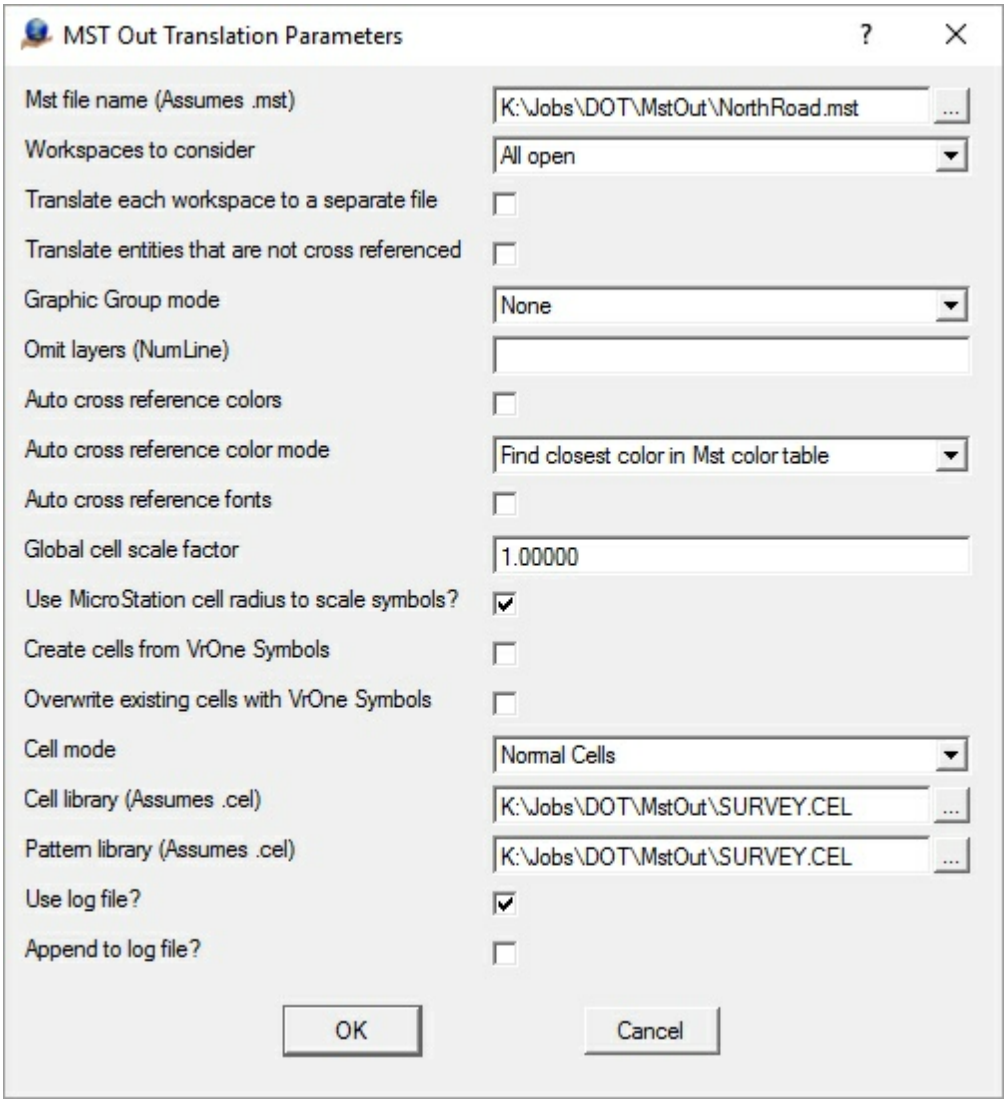


Edit Parameters

Allows editing general translation parameters.



Mst file name

Defines file name to which to write MicroStation translated data. If this file exists, it is overwritten. An .mst extension is added to the filename if no extension is specified.

Workspaces to consider

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Defines workspaces to use when translating VrOne data to MicroStation. Options are "Current only" or "All open". When "All open" is used, all open workspaces are translated into a single MST file.

Translate each workspace to a separate file?
Specifies whether each workspace is translated to a separate .mst file. Each .mst file is given the same name as the workspace.

Translate entities that are not cross-referenced?
Specifies whether all entities are translated, regardless of whether they match any entries in the cross-reference tables. A note is made in the mst.err file for any entities that are translated without having a match in the cross-reference tables.

Omit layers (NumLine)
Allows a set of layers to be omitted from the translation. All entities that reside on these layers are be translated even if the layers are turned on. A Number Line may be used to specify multiple layers.

Auto cross reference colors?
Specifies whether VrOne pen colors are automatically mapped to the appropriate color in MicroStation unless a cross-reference is defined. See "Auto Cross-Reference Color Mode" for details.

Auto cross reference color mode
Determines how colors are determined if auto cross reference colors is checked. The options are "Find closest color in Mst color table" or "Replace colors in Mst color table for exact match".
If "Find closest color in Mst color table" is selected, a search will be done on the current MicroStation color table to determine which RGB color is closest to the VrOne RGB screen color in effect when the MstOut translation was run. RGB color comparisons are done by first converting all RGB values into HSV (Hue, Saturation, Value) values then comparing those converted values. The hue component of the HSV is given the highest priority. Comparing HSV values results in more desirable colors in terms of what the human eye expects to see.
If "Replace colors in Mst color table for exact match" is selected, the first 70 colors in the current MicroStation color table are assigned the exact VrOne RGB screen values that were in effect when the MstOut translation was run. This option will guarantee that the design file display colors exactly match the VrOne display colors.

Auto cross reference fonts?
Specifies whether some VrOne fonts are automatically mapped to appropriate fonts in MicroStation unless a cross-reference is defined that specifies a specific font. See "Auto Cross-Reference Settings" for details.

Global cell scale factor
Defines the scale factor by which cells are multiplied before being written to the .mst file. The scale factor in the cross-reference is always be applied to the symbol radius first.

Use MicroStation cell radius to scale symbols?
When using an existing MicroStation cell library that has cells at different scales this will scale the

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cells to match the VrOne symbol sizes. This parameter is used with the Scale parameter in "Cross Reference Symbols". Symbols that specify a Scale of -1 will match the VrOne symbol size. By default, this parameter should be checked.

Create cells from VrOne Symbols?
Specifies whether new cell definitions are created in MicroStation from the VrOne Symbol definitions. If a cell definition already exists in MicroStation, it is NOT overridden. How the cells are created is controlled by the "Cell mode" parameter.

Cell mode
Specifies method of cell creation. Options are:

- **Normal** - Normal cells are placed in MicroStation. If "Create cells from VrOne Symbols" is on, cells are created in the currently attached cell library for each VrOne Symbol definition and a cell library name should be specified in the "Cell Library" parameter.
- **Shared** - Shared cells will be placed in MicroStation. If "Create cells from VrOne Symbols" is on, a shared cell definition is created in the current design file for each VrOne Symbol definition. Please see the MicroStation documentation for more information about Shared cells.

Notes on using "Shared"
✓Since MicroStation Cells may be created with a scale, it may be necessary to apply a scale factor to VrOne symbols.
✓The "Cross-Reference Symbols" menu allows the cross-referencing of VrOne symbol names to MicroStation Cell names and the application of scale factors.

Cell library (Assumes .cel)
Specifies the cell library to attach in MicroStation when creating or placing Cells. Only applies when "Cell mode" is set to "Normal". This parameter is not always necessary if the MicroStation design file already has a cell library attached and patterning is not being used. If patterning is being used and "Cell mode" is set to "Normal", then this needs to be specified. This is necessary because the VrIn translator must switch back and forth between the Pattern Library and the Cell Library. This does not work if a Cell Library is not specified. A .cel extension is added to the filename; do not include an extension.

Pattern library (Assumes .cel)
Specifies the pattern library to attach in MicroStation when placing patterned lines. This applies to lines that have been cross-referenced using the "Pattern Library" setting. This parameter may not be necessary if the MicroStation design file already has a pattern library attached and "Cell mode" is not set to "Normal". If "Cell mode" is set to "Normal", and patterning is being used, then this parameter needs to be specified. This is necessary because the VrIn translator must switch back and forth between the Pattern Library and the Cell Library. This does not work if a Pattern Library is not specified. A .cel extension is added to the filename; do not include an extension.

Use log file?
Specifies whether the log file is to be written with the same name and location as the current

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parameter file with a postfix of .log.

Append to log file?
Appends log information to the log file if it exists. Set this off to replace the log file each time.

Cross Reference Lines

Defines the settings for the cross-referencing of VrOne lines to MicroStation lines. Lines with any combination of Layer, Mode, Font, and Width may be translated differently or wildcards may be used to apply cross-reference settings to a group of lines. For example, you can have all lines with a width of 5 translate to MicroStation lines with a weight of 2. Alternatively, you can have all lines on Layer 10 with a font name of "TREEL" translate to a MicroStation lines on level 2 with a custom line style of "{ Tree Line}".

For example, the cross-reference parameters displayed on the following dialog box will translate according to these criteria:
By default, all lines will be translated to MicroStation lines with the color 2 assigned. However, if a line is on Layer 102, is splined, and has a font name of "TREEL", then it will be translated to MicroStation level 2 and wibe assigned the custom linestyle name of "{ Tree Line }".

When using custom linestyle names, MicroStation must be able to find the custom linstyle within a .rsc file during the import. This is the standard procedure we recommend in MicroStation to make sure the translator finds the custom linestyle resources. Once this is set, the MSTIN mdl should automatically find and make use of the custom linestyles.

- Go to the Workspace->Configuration dialog.
- Select Symbology on the left. It should then display "Symbology Resources" on the right. A list of existing .rsc files or search paths will be shown on the bottom right.
- Either add the client resource file(s) to one of the existing paths, or use the "Select..." button to add your resource file(s).
- If MicroStation finds multiple resource files containing the same linestyle names, it will use the first one, so be careful that you don't have resource files in the search paths with duplicate linestyle names.

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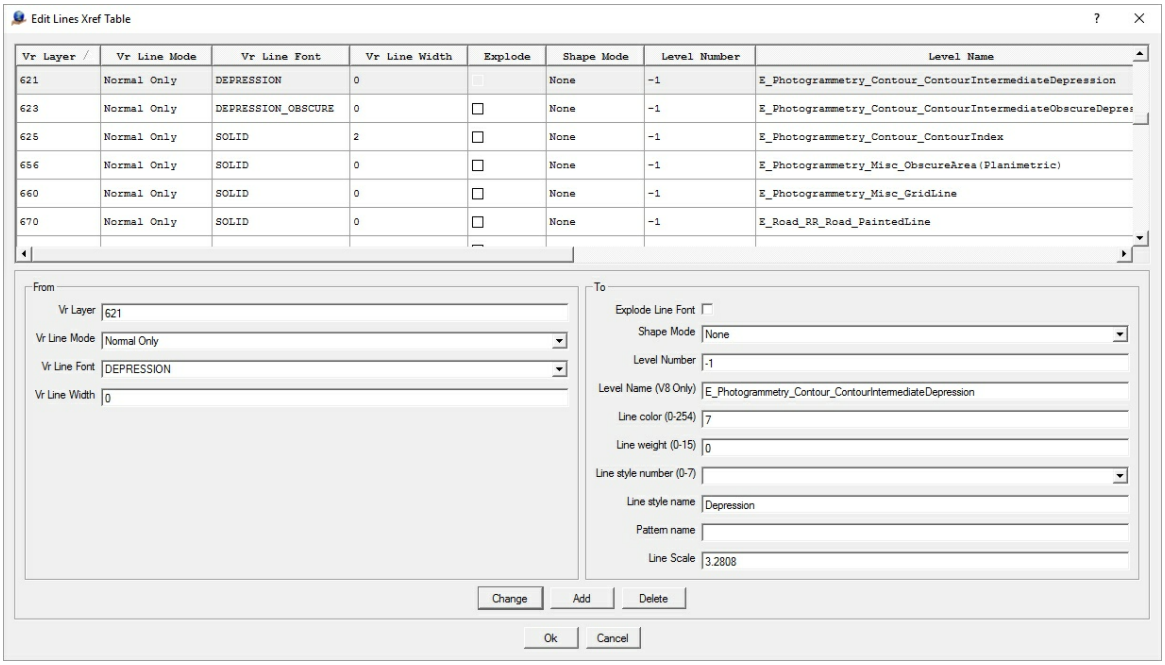

VrOne Search Parameters

Defines the search criteria for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
VrOne layer	-1,1-32001	-1 - Indicates that lines on all layers will match this cross-reference.	
VrOne line mode	All, Normal, Spline	All - Indicates that normal and spline lines will match this cross-reference.	
VrOne line font	All, “Font Name”	All - Indicates that lines with any font name will match this cross-reference.	.
VrOne line width	-1,0-255	-1 - Indicates that lines with any width will match this cross-reference.	

MicroStation Output Parameters

This section of the dialog box defines the output settings for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
Explode	checked,	N/A	If checked, then matching lines are

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line font	unchecked		“exploded” when placed into MicroStation. This means that individual elements are placed to make the line in MicroStation look exactly like the fonted line in VrOne. A copy of the non-exploded line is also placed using the “Patterned” display class. The individual elements are placed using the “Pattern Component” display class. This allows the MicroStation “patterns” view attribute to work correctly with these lines. NOTE: Using custom linestyles is preferred, as this option creates large files with elements that are hard to manipulate.
Shape mode	None, Normal, Complex	N/A	If "None", then MicroStation Shapes are not used. If “Normal”, then VrOne lines that are closed are placed as Shapes in MicroStation. If a line has too many points to be placed as a standard Shape, it is placed as a Complex Shape. If "Complex", then all closed VrOne lines are placed as Complex Shapes even if they have fewer than the maximum allowed line points.
Level number	-1, V7 = 1-63. V8+ = 64 character name.	-1 - Indicates that the level should be the same as the original VrOne layer.	Indicates which MicroStation level number to assign to lines that match this cross-reference.
Level name (V8+)	Level name		Defines the MicroStation level name to use. This parameter is used when translating to V8 or above.
Line color	-1, 0-254	-1 - Indicates that the color should be the same as the original VrOne color.	Indicates which MicroStation color to assign to lines that match this cross-reference.
Line weight	-1, 0-15	-1 - Indicates that the weight should be the same as the original VrOne width. If the VrOne width is greater than 15, then the weight will be 15.	Indicates which MicroStation weight to assign to lines that match this cross-reference.

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Line style number	0-7	N/A	Indicates which MicroStation line style number to assign to lines that match this cross-reference. This is ignored if a line style name or pattern name is entered.
Line style name	64 character name	Same - Indicates that the style name should be the same as the original VrOne font name.	Indicates which MicroStation custom line style name to assign to lines that match this cross-reference. If the custom line style does not exist in MicroStation, then a solid line will be placed.
Pattern name	V7 = 6 character name V8+ = 64 character name	N/A	Indicates which MicroStation pattern to assign to lines that match this cross-reference. If the pattern does not exist in MicroStation, a solid line will be placed. NOTE: A pattern library should be specified in the "Edit Parameters" dialog box if this option is used.
Line scale	-1, Value > 0.0	-1 – Indicates that the line scale should be 1.0	Indicates what scale factor to use for lines that match this cross-reference. NOTE: This only applies if Line Style name or Pattern name is specified.

Cross-Reference Symbols

Defines the settings for the cross-referencing of VrOne symbol to MicroStation cells or symbol fonts characters. Symbols with any combination of Layer and Symbol name may be translated differently or wildcards may be used to apply cross-reference settings to a group of Symbols.

For example, the cross-reference parameters displayed on the following dialog box will translate according to these criteria:
All symbols named "TREE" on all Layers will be translated to MicroStation Cells with the name "TR", with level equal to the VrOne Layer, Color equal to the VrOne Pen Color, and Scale equal to the VrOne Symbol radius.
All symbols named "METER" on all Layers will be translated to MicroStation Cells with the name "MTR", with level equal to 10, Color equal to the VrOne Pen Color, and Scale equal to 10.0
All symbols named "X" on all Layer 501, will be translated to MicroStation Text elements using font library 102, font character "K", with level equal to the VrOne Layer, Color equal to the VrOne Pen Color, and scale (text height) equal to 20.0.

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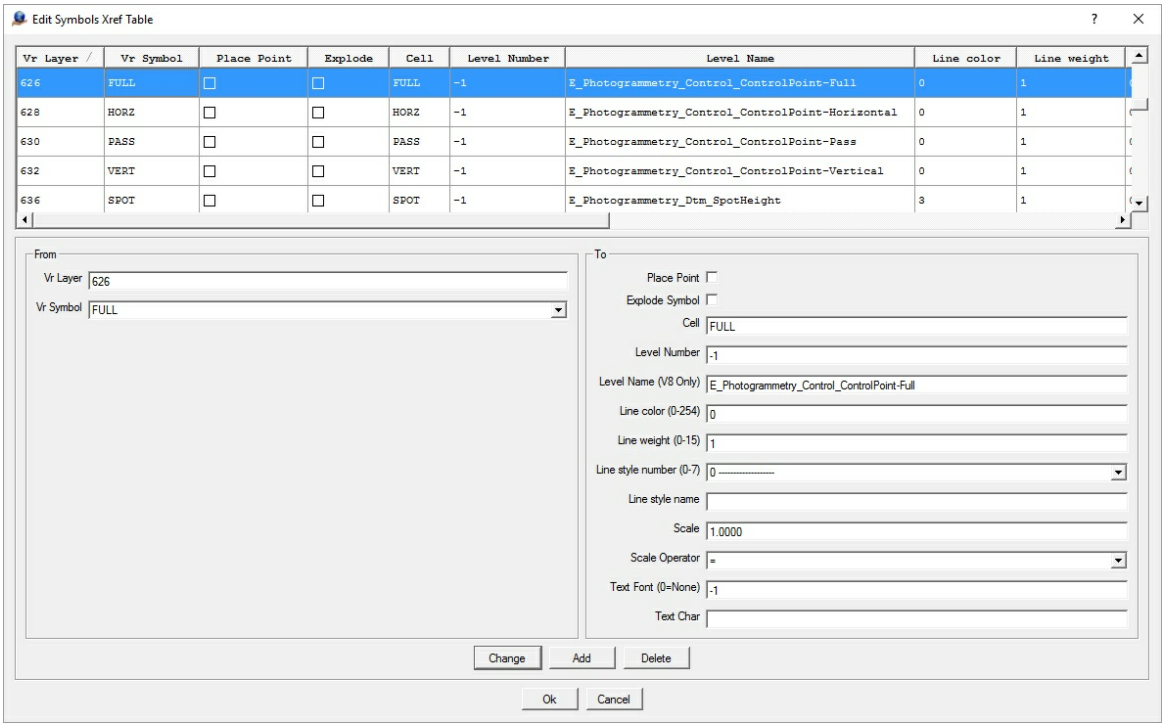

VrOne Search Parameters

This section of the dialog box defines the search criteria for one cross-reference entry. The parameters in this section are defined as follows:

Name	Possible Values	Wildcard - Description	Description
VrOne layer	-1,1-32001	-1 - Indicates that symbols on all layers will match this cross-reference.	
VrOne symbol	Symbol Name	All - Indicates that all symbol names will match this cross-reference	

MicroStation Output Parameters

Defines the output settings for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
Place point	checked, unchecked	N/A	If checked, then a MicroStation "point" (0 length line) is placed at each symbol location. The other parameters are be ignored except for Level, Color, and Weight.
Explode	checked,	N/A	If checked, then matching symbols are

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symbol	unchecked		"exploded" when placed into MicroStation. This means that individual elements are placed to make the symbol in MicroStation look exactly like the symbol in VrOne. NOTE: This option is not recommended as it creates large files with elements that are hard to manipulate.
Cell	V7 = 6 character name V8+ = 64 character name	Blank – If left blank, the VrOne symbol name will be used. If reading into V7, then only the first six characters will be recognized.	This can be any valid MicroStation cell name. If "Create Cells from VrOne Symbols" option is set checked, a cell will be created using this name if it does not already exist in MicroStation.
Level number	-1, V7 = 1-63. V8+ = 64 character name.	-1 - Indicates that the level should be the same as the original VrOne layer. For V7, if the VrOne layers is over 63, then the Level will be set to 63.	Indicates which MicroStation level to assign to cells that match this cross-reference.
Level name (V8+)	Level name		Defines the MicroStation level name to use. This parameter is used then translating to V8 and above.
Line color	-1, -2, 0-254	-1 - Indicates that the color should be the same as the original VrOne color. -2 - If using an existing MicroStation cell library and the cell name exists then the cell library colors will be used.	Indicates which MicroStation color to assign to cells that match this cross-reference.
Line weight	0-15	N/A	Indicates which MicroStation weight to assign to cells that match this cross-reference.
Line style number	0-7	N/A	Indicates which MicroStation line style number to assign to lines that match this cross-reference. This is ignored if a line style

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			name or pattern name is defined.
Line style name	64 character name	Same - Indicates that the style name should be the same as the original VrOne Line Font name.	Indicates which MicroStation custom line style name to assign to lines that match this cross-reference. If the custom line style does not exist in MicroStation, then a solid line will be placed.
Scale	-1, Value > 0.0	-1 – Indicates that the cell scale should be the same as the VrOne symbol radius.	Indicates what scale factor to use for cells that match this cross-reference. NOTE: The "Use MicroStation cell radius to scale symbols" in Edit Parameters must be checked if -1 is used as the cell scale.
Scale operator	=,*,+	N/A	Indicates how to apply the Scale value. If "=", then the cell scale will be set to the Scale value. If "*", then the cell scale will be set to the symbol radius multiplied by the Scale value. If "+", then the cell scale will be set to the symbol radius added to the Scale value.
Text font	1-999	0 – Do not use	Indicates which MicroStation font to use for cells that match this cross-reference. This option is useful if you want to use MicroStation symbol fonts instead of cells. If this parameter is anything other than 0, then a cell will not be placed for each symbol, instead, a single character text element will be placed.
Text char	Single character	N/A	If a Font number is specified, then this is the character that will be used when placing the text element.

Cross-Reference Text

Defines the settings for the cross-referencing of VrOne Text entities to MicroStation text elements. Text with any combination of Layer and Font name may be translated differently or wildcards may be used to apply cross-reference settings to a group of Text entities.

For example, the cross-reference parameters displayed on the following dialog box will translate according to these criteria:
All text on all Layers with a font of "CI" will be translated to MicroStation text with a font of 7, with level equal to the VrOne Layer, Color equal to the VrOne Pen Color, and Height equal to the VrOne Text height.
All text on all Layer 10 with a font of "STANDARD" will be translated to MicroStation text with

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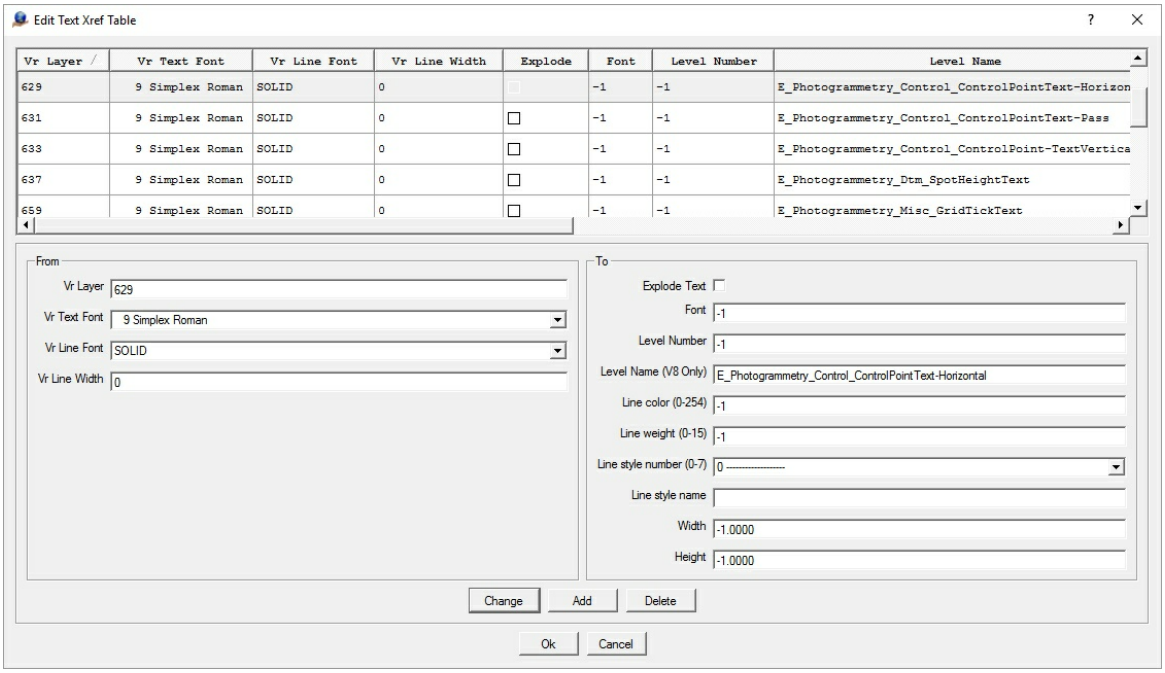
a font of 2, with level equal to the VrOne Layer, Color equal to 20, and Height equal to the VrOne Text height.
All text on all Layer 12 will be translated as exploded entities, with level equal to 50, Color equal to 10, and Height equal to the VrOne Text height.



VrOne Search Parameters

Defines the search criteria for one cross-reference entry. The parameters in this section are as follows:

Name	Possible Values	Wildcard - Description	Description
VrOne layer	-1, 1-32001	-1 - Indicates that lines on all layers will match this cross-reference.	Layer number
VrOne text font	All, “Font Name”	All - Indicates that all font names will match this cross-reference	Defines the Vr Text Font to use
Vr line font	"Font Name"	All - Indicates that all font names will match this cross-reference	Defines the Vr Line Font to use
Vr line width	0-255		Defines the Vr line width to use

MicroStation Output Parameters

Defines the output settings for one cross-reference entry. The parameters in this section are as follows:

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Name	Possible Values	Wildcard - Description	Description
Explode text	checked, unchecked		If checked, then text entities are exploded and translated to MicroStation as line elements.
Font	-1, 0-999	-1 – Indicates that the font number should be 0 or should use the default font mapping setting if "Auto Cross-Reference Fonts" is checked.	Indicates which MicroStation font to assign to texts that match this cross-reference.
Level number	-1, 1-32001	-1 - Indicates that the level should be the same as the original VrOne layer. If the VrOne layers is over 63, then the Level will be 63.	Indicates which MicroStation level to assign to texts that match this cross-reference.
Level name (V8+)	Level name		Defines the MicroStation level name to use. This parameter is used then translating to V8 and above.
Line color	-1, 0-254	-1 - Indicates that the color should be the same as the original VrOne color.	Indicates which MicroStation color to assign to texts that match this cross-reference.
Line weight	0-15	N/A	Indicates which MicroStation weight to assign to texts that match this cross-reference.
Line style number	0-7	N/A	Indicates which MicroStation line style number to assign to lines that match this cross-reference. This is ignored if a line style name is entered.
Line style Name	64 character name	Same - Indicates that the style name should be the same as the original VrOne font name.	Indicates which MicroStation custom line style name to assign to lines that match this cross-reference. If the custom line style does not exist in MicroStation, then a solid line will be placed.
Width	-1, Value > 0.0	-1 – Indicates that	Indicates what width to use for texts that

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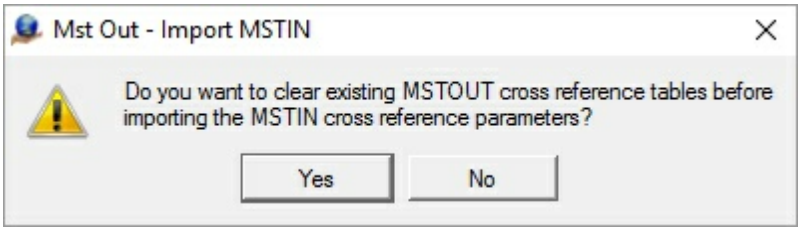
		the width should be the same as the VrOne Text width.	match this cross-reference.
Height	-1, Value > 0.0	-1 – Indicates that the height should be the same as the VrOne Text height.	Indicates what height to use for texts that match this cross-reference.

Add Vr Entities to Xref

Creates entries in the cross-reference tables for all VrOne entities in the currently opened workspaces. A detailed listing of entities added is displayed.

Import MSTIN Cross-References

Imports cross-reference tables from an MSTIN parameter file. Because the MSTIN and MSTOUT are designed with different style cross-reference tables, this option should only be used as a starting point to creating full translation cross-references. You will be asked to select an existing MSTIN parameter file. Then, you will then be given the option to clear all existing cross-reference table before importing the MSTIN cross-references.



After answering this dialog, the MSTIN parameters are imported. After an import, you should always check each cross-reference table to verify that the cross-reference items were imported as expected.

Translate

Translates the current VrOne file(s) using the current translation parameters into a MST file. The MST may then be read into MicroStation using the VrIn MDL program.

Help

Starts the browser and displays the current help document.

Quit

Quits Mst Out and gives an option to save the current parameters.

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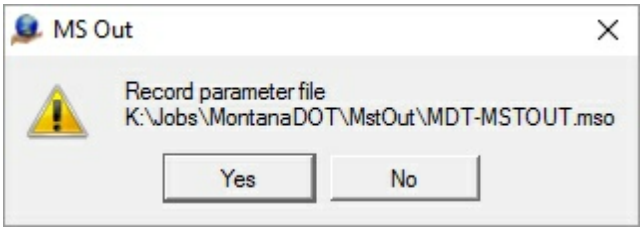

Quick Translation

The following may be done to translate VrOne file(s) to an MST file in the fewest possible steps. The result is a translation in which all lines are translated with custom style names equal to the VrOne font names. Symbols are translated as Normal Cells with cell names equal to the VrOne symbol names.

1. Reset Parameters
2. Define the "Mst file name" in "Edit Parameters"
3. Translate

Translation Hints

- Speak to your client about the available features to best translate data to their system.
- Learn about the various options for translating symbols and line fonts.
- First define cross-references using wildcards to cover the broadest range of cases, then add detailed cross-reference entries to handle the exceptions.
- Test different options by translating files into MicroStation.

Auto Cross-Reference Tables

This section shows how Text Fonts are translated when the "Auto Cross-Reference Fonts" option is set to "Yes".

VrOne Font	MicroStation Font	
CI	23	(Italics)
CR	2	(Fancy)
CS	0	(Standard)
DR	2	(Fancy)
GE	0	(Standard)
GG	0	(Standard)
GI	23	(Italics)
STANDARD	0	(Standard)
SR	0	(Standard)
SS	0	(Standard)
IT	23	(Italics)

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TR	2 (Fancy)

2.1.1.25.13 MicroStation Translators

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

MSTIN and MSTOUT
Microstation MDL Programs

Translators to convert files between VrOne and Microstation.

Overview
Distribution
VrOne to Microstation Translation Steps
Microstation To VrOne Translation Steps
Microstation Cells To VrOne Symbols Translation Steps
Microstation Fonts To VrOne Fonts Steps
Installation
Notes

Overview

This directory contains the MDL programs needed to translate from VrOne to Microstation or vice versa. An intermediate file format named MST was created by Cardinal Systems to assist in translation between the two.

MST files may be read into Microstation using the MSTIN MDL program or created from Microstation using the MSTOUT MDL program. MST files may be read into VrOne using the MstIn command or created from VrOne using the MstOut command.

The MST file format is ASCII based and supports all VrOne entity types and their equivalent Microstation entity types. The MST format is only used to transfer to and from Microstation. If

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you need to convert to other programs, please look at the DxfIn and DxfOut translators.

The MSTIN and MSTOUT MDL programs were made to simply read and write the MST formatted files. There are no translation options to setup inside of Microstation; all options are specified in VrOne using the MstIn and MstOut commands. Please see the VrOne documentation for MstOut and MstIn for detailed information on setting up translations.

Distribution

The MSTOUT and MSTIN MDL programs may be freely distributed as long as they are accompanied by this documentation.

VrOne to Microstation Translation Steps

A typical translation from VrOne to Microstation would involve the following steps:



1. Run VrOne.
2. Issue the MstOut command.
3. Set up all translation parameters using the menus provided in MstOut.
4. Select the "Translate" button, and specify a file to which to export the VrOne data (this file will have an .mst extension)
5. Run Microstation.
6. Load the MSTIN MDL program by typing in "mdl load mstin". (Installation of MDL programs should already have been completed)
7. Select the file that was created in step 4.

Microstation To VrOne Translation Steps

A typical translation from Microstation to VrOne would involve the following steps.



1. Run Microstation.
2. Load the MSTOUT MDL program by typing in "mdl load mstout8i". (Installation of MDL programs should already have been completed)
3. Specify a file to which to export the Microstation data (this file will have an .mst extension).
4. Run VrOne.
5. Issue the MstIn command.
6. Set up all translation parameters using the menus provided in MstIn.
7. Select the "Translate" button then select the file that was created in Step 3.

Microstation Cells To VrOne Symbols Translation Steps

The MSTOUT MDL program, in conjunction with the MstIn VrOne command, may be used to create VrOne symbols from Microstation cells.

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1. Make a backup copy of the current Vr symbol library. The current Vr symbol library can be determined by starting Vr Configuration and going to the Configuration->Vector Graphics dialog. The current symbol library is shown in the "Symbol file name" field. This should be set to "c:\vr\data\default.sym" if it has not been changed yet.
2. Run Microstation.
3. Create a blank .dgn file and attach the cell library to be translated.
4. Load the MSTOUT MDL program by typing in “mdl l mstout8i cells”. (MDL program installation should already have been completed).
5. A dialog box displays, allowing an .mst file to be created. The top of the dialog should show "CELLS" to indicate that cells are being exported.
6. Press "Ok" to perform the translation. Verify that the .mst file was created.
7. In VrOne, run the Microstation In translator (File->Import->Microstation (MstIn)).
8. Select "Define Mst file names" and specify the .mst file created above.
9. In the "Edit Parameters" dialog, make sure "Create VrOne symbols from Microstation Cells" is checked. Optionally set the "Overwrite existing VrOne symbols" to replace existing symbols with the Microstation cells (this only applies to symbols with the same name as the Microstation cell).
10. Select "Cross ref cell definitions" and map each Microstation cell name to a VrOne symbol name and graphic pointer. If an entry is missing in the cross-reference table for a cell, then the Microstation cell name will be used, and the next available empty graphic pointer will be used.
11. Select "Translate". When the translation is complete, use Environment->Manage Symbols (ManSym) to browse through the created symbols. Note that the Target Scale setting of the active VrOne file at the time of the translation will affect how smoothly VrOne approximates that shape of arcs or circles that were part of the Microstation cells. If VrOne/VrTwo is unusually slow when dragging or plotting certain translated symbols, it may be that too many points were used to approximate the arcs. Changing the Target Scale to a lower value using "File->Edit Vr Header (EdiVr)" then re-translating the cells should help.

Microstation Fonts To VrOne Fonts Translation Steps

The MSTOUT MDL program may be used in conjunction with the Create Font VrOne command to create VrOne text fonts from Microstation fonts. The number of fonts available in VrOne has been extended from 12 to 30000. The first 12 fonts are reserved for the standard 12 Vr fonts. New fonts can be imported and assigned to any number above 12. The fonts are defined in a file named \vr\data\vrfonts.txt. The font file are stored in the \vr\data folder with .vrf extensions. Importing fonts from Microstation requires a V7 MDL named fontexpt.ma that can be downloaded from the Cardinal Systems web site.

1. Load fontexpt.ma in Microstation.

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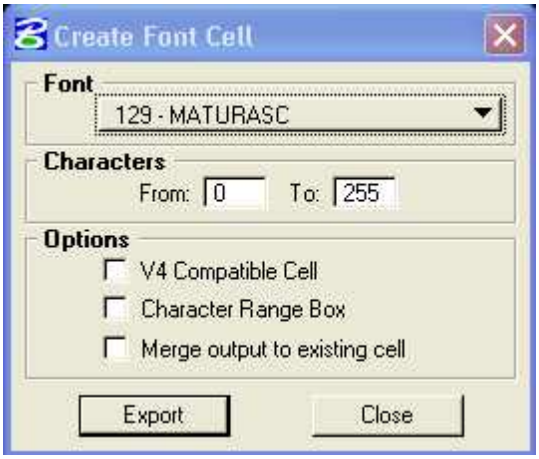
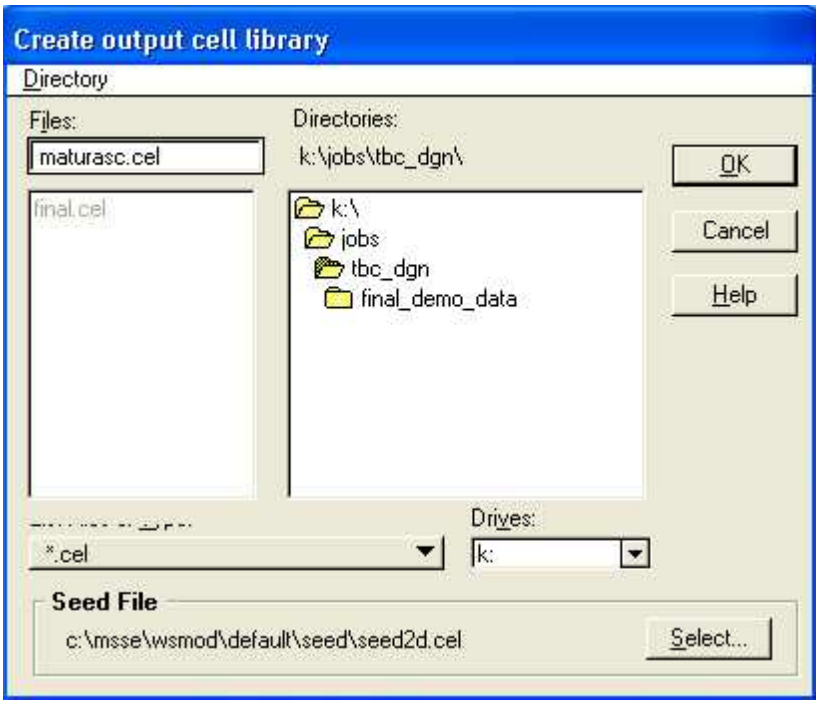


2. Leave all settings to defaults and select the desired font.

3. Select the Export button.

4. Name the output .cel file.



5. The .cel library is created and attached to the current design file.

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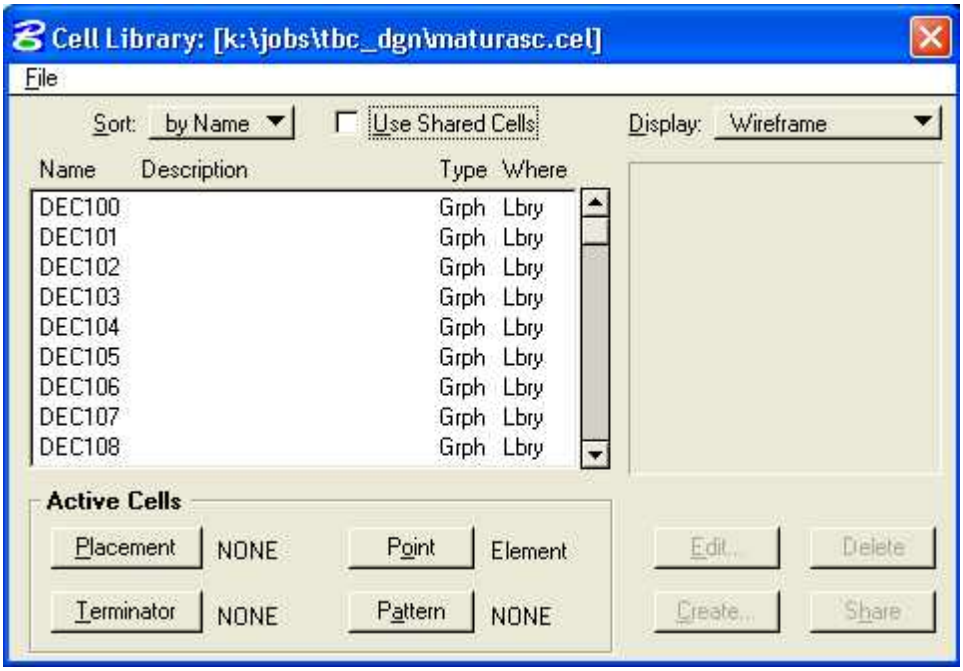
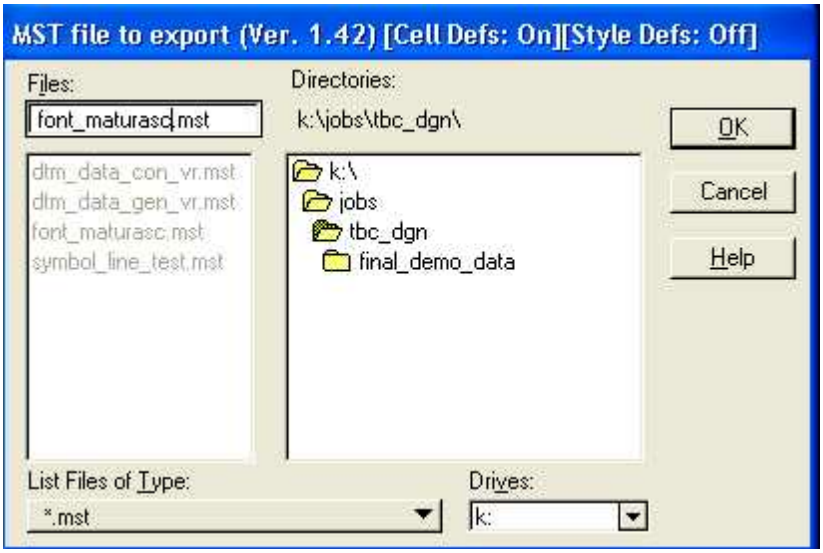


6. Load the MSTOUT mdl with the cells argument: (mdl l mstout8i cells) to create an output .mst file.



7. Inside VrOne, run the CreFon (Create Font) command and fill out information.

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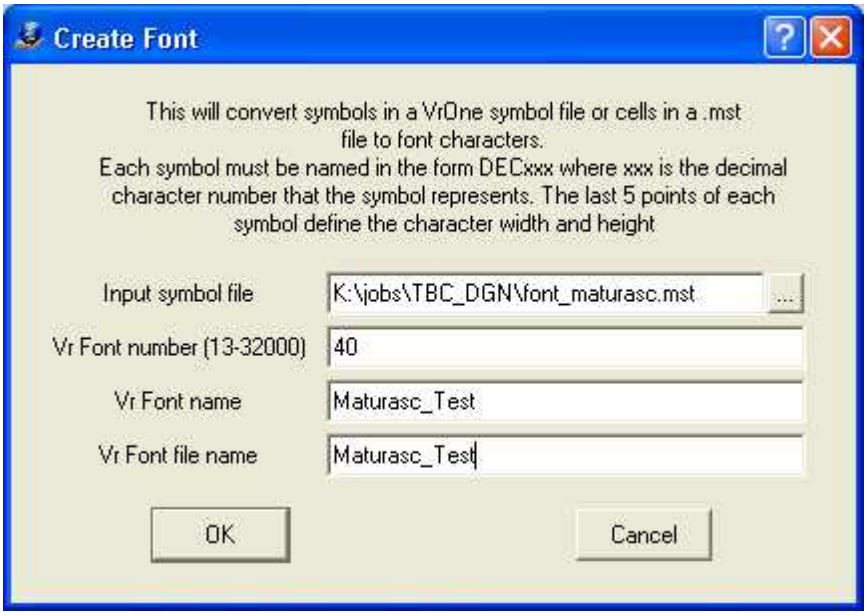
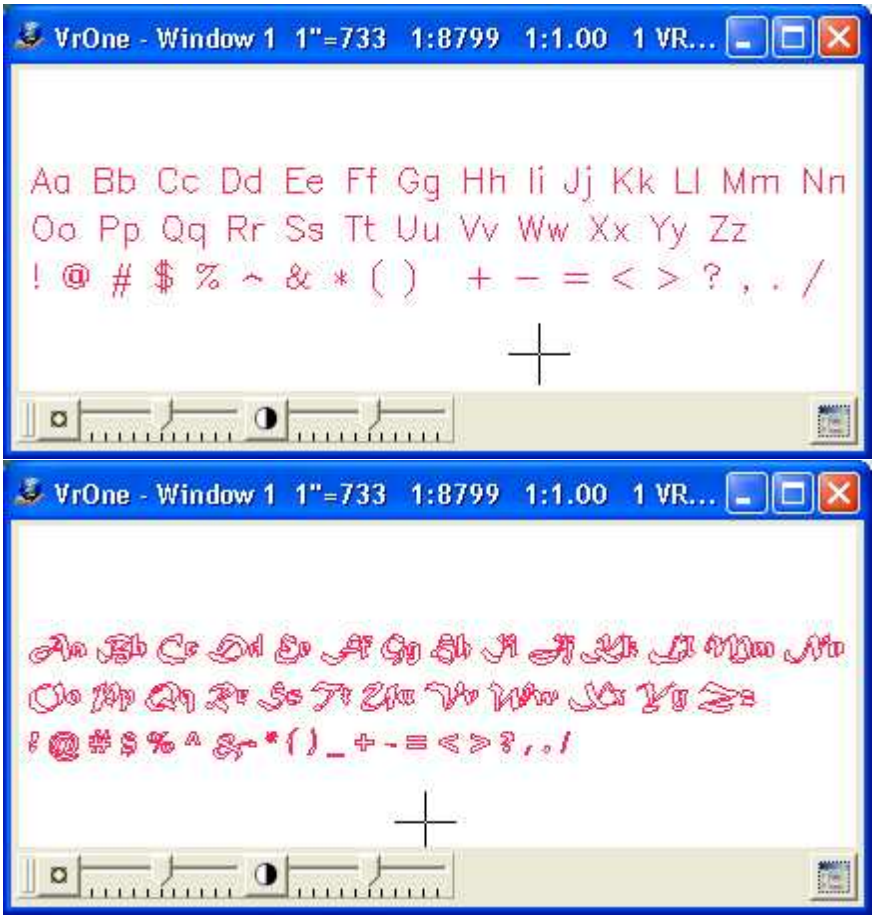


8. Below is an example of text labels in a font before and after importing from .mst file.



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Installation

The files mentioned below are downloaded from www.cardinalsystems.net using the "Download Vr Mapping Software" link under SUPPORT. They are delivered in a .zip file. Once the files are unzipped they must be placed in the mdlapps folder. The .zip files can be found under "Mst Translator Files" on the Vr Mapping Download page.

MicroStation CONNECT (MicroStation 10)

The following files are needed to run the MSTIN application for Microstation CONNECT:

- **mstin10.ms**
- **mstin10.ma**

These files must be placed in a location that MicroStation recognizes for MDL applications. Typically, they are placed in the directory “mdlapps”. The default location is "C:\Program Files\Bentley\MicroStation CONNECT Edition\MicroStation\mdlapps" but this might be different on your configuration.

NOTE:

Currently the Vr (MstOut) to MicroStation (mstin10) is available. (9-Feb-2021)

When importing a MST file using mstin10, the design file (.dgn) must exist and have the same name as the MST (.mst) import file before entering MicroStation graphics.

MicroStation Version 8i (SELECTseries 3/4)

The following files are needed to run the MSTIN and MSTOUT MDL applications for MicroStation Version 8:

- **mstin8i.ma**
- **mstin8i.dll**
- **mstout8i.ma**
- **mstout8i.dll**

These files must be placed in a location that MicroStation recognizes for MDL applications. Typically, they are placed in the directory “mdlapps”. The default location is "C:\Program Files (x86)\Bentley\MicroStation V8i (SELECTseries)\MicroStation\mdlapps" but this might be different on your configuration.

MicroStation Version 8

The following files are needed to run the MSTIN and MSTOUT MDL applications for MicroStation Version 8:

- **mstin8.ma**
- **mstin8.dll**
- **mstout8.ma**
- **mstout8.dll**

These files must be placed in a location that MicroStation recognizes for MDL applications. Typically, they are placed in the directory “mdlapps”. The default location is "C:\Program Files (x86)\Bentley\Program\MicroStation\mdlapps" but this might be different on your configuration.

Earlier Versions of MicroStation

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The following files are needed to run the MSTIN and MSTOUT MDL applications for earlier MicroStation versions:

- **mstin.ma**
- **mstin.dll**
- **mstout.ma**
- **mstout.dll**

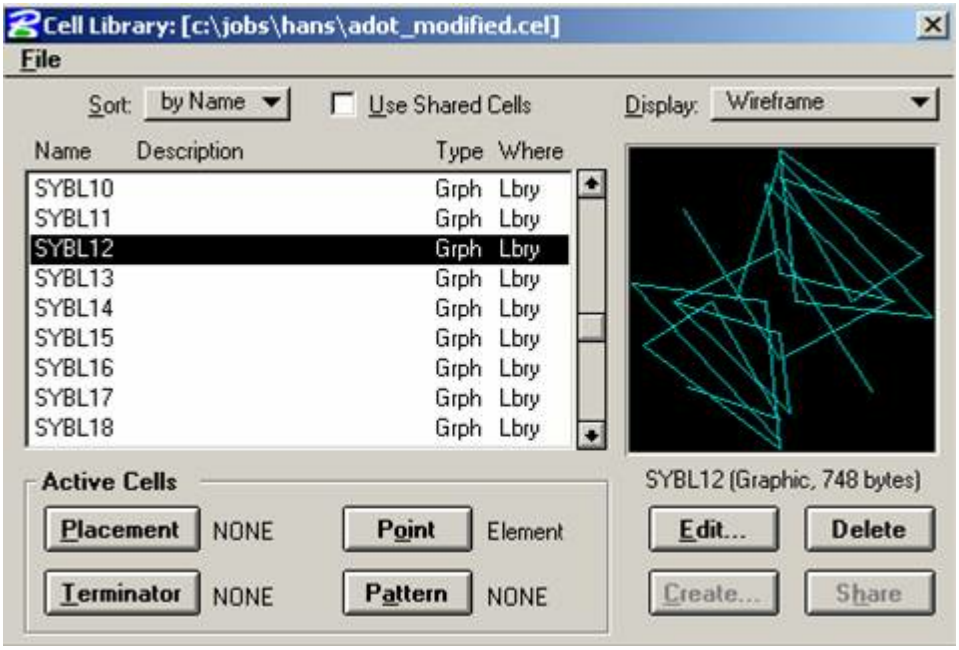
These files must be placed in a location that Microstation recognizes for MDL applications. Typically, they are placed in the directory “mdlapps”. The default location is "C:\WIN32APP\USTATION\MDLAPPS" but this might be different on your configuration.

To run the MSTOUT mdl, you may type in "mdl l mstout8i" (Version 8i (SELECTseries 3/4)) or “mdl l mstout8” (Version 8) or “mdl l mstout” (earlier versions), or choose Utilities->Mdl Applications from the pull-down menus, find the MSTOUT8I (Version 8i (SELECTseries 3/4)) or MSTOUT8 (Version 8) or MSTOUT (earlier versions) application, and press the “Load” button.

To run the MSTIN mdl, you may type in “mdl l mstin8i” or “mdl l mstin8” or “mdl l mstin”, or choose Utilities->Mdl Applications from the pull-down menus, find the MSTIN or MSTIN8 application, and press the “Load” button.

Notes

If your cells look like the graphics shown below, you are using a 3D cell library and translating into a 2D design file.



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Vr Mapping

Shape In (ShpIn)

Type: Translator

Translates ArcView Shapefiles to VrOne files.

The Shapefile format is used by ArcView GIS software sold by Esri corporation. At the time of writing, a free Shapefile viewer named ArcExplorer is available for download at the Esri web site .

This description of the shapefile format is taken from Esri documentation:

"A shapefile stores non-topological geometry and attribute information for the spatial features in a data set. The geometry for a feature is stored as a shape comprising a set of vector coordinates. Because shapefiles do not have the processing overhead of a topological data structure, they have advantages over other data sources such as faster drawing speed and edit ability. Shapefiles handle single features that overlap or that are noncontiguous. They also typically require less disk space and are easier to read and write. Shapefiles can support point, line, and area features. Area features are represented as closed loop, double-digitized polygons. Attributes are held in a dBASE® format file. Each attribute record has a one-to-one relationship with the associated shape record."

A shapefile consists of one main file, one index file, and one dBASE table file. All file names adhere to the 8.3 naming convention. The main file, the index file, and the dBASE file have the same prefix. The prefix consists of an alphanumeric character (a–Z, 0–9) followed by up to seven characters (a–Z, 0–9, _, -). The suffix for the main file is .shp. The suffix for the index file is .shx. The suffix for the dBASE table is .dbf.
NOTE: The 8 character limit on filenames has been removed. ShpIn supports the longer filenames.

Example:

Main file:	counties.shp
Index file:	counties.shx

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dBASE table:	counties.dbf

Shapefiles may only contain one feature per file. Multiple shape files may be translated into a single VrOne file or they may be split out into separate VrOne files. The following shape file types are supported: 2D Polyline, 3D Polyline, 2D Polygon, 3D polygon, 2D Point, and 3D Point.

Fields associated with Shape File entities may be cross-referenced with VrOne entity attributes.

NOTE: Only entities in layers contained in the Layer Cross-Reference table will be considered for translation.

Load Parameters	Record Parameters	Init Parameters
Edit Parameters	Edit Feature Names	Cross-Reference Layers
Cross-Reference Line Fonts	Cross-Reference Symbols	Cross-Reference Symbols
ScanShapeFiles		

Shape Out

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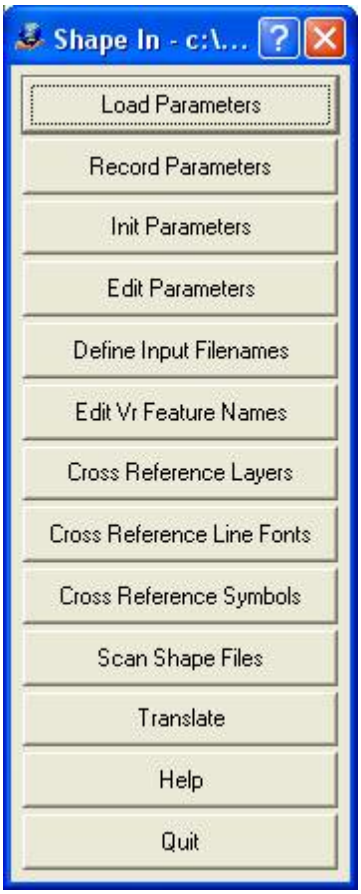


Load Parameters

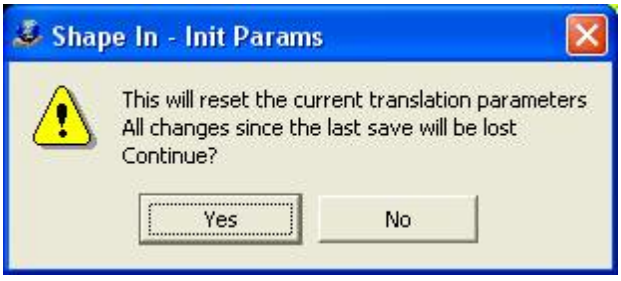
Loads a previously recorded Shape In (.shi) parameter file.

Record Parameters

Records current translation parameters to a Shape In (.shi) parameter file.

Init Parameters

Initializes translation parameters to default values. **NOTE:** Current translation parameters will be lost.



Edit Parameters

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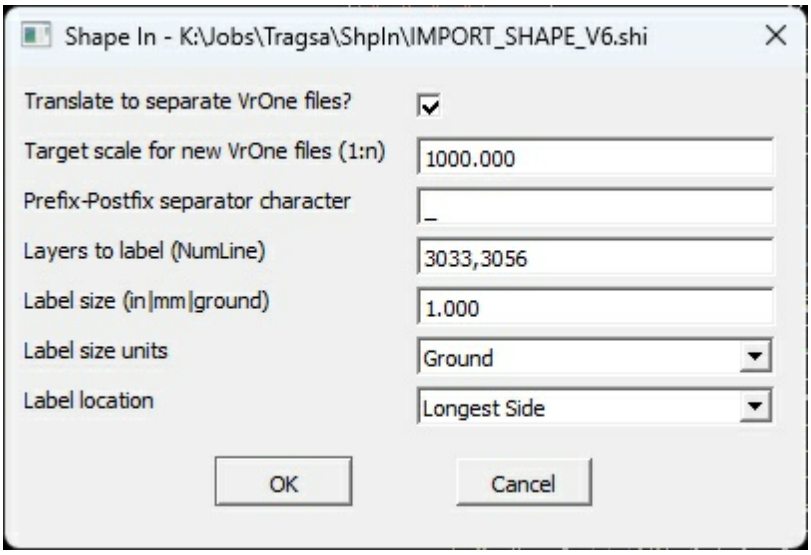
Allows editing general translation parameters.



Translate to separate VrOne files?
Specifies whether to write shape files to separate VrOne files based on the settings in the Filenames cross-reference settings. If off, then all shapefiles will be translated into the currently open VrOne file.

Target scale for new VrOne files (1:n)
Defines target scale to use when creating the new VrOne file if "Translate to separate VrOne file?" is on and a VrOne file does not exist during translation.

Prefix-Postfix separator character
Defines character to use to parse out the base shapefile names from shape file prefixes. This is used when cross-referencing shape files to VrOne files. The output VrOne file names are determined by the base shapefile name. For example, if two shapefiles named job1_pt.shp and job1_ln.shp were added to the input filenames table and the separator character was set to "_", they would both translated into a VrOne file named job1.vr. Without the separator character specified (or with a different character specified), they would be translated to two separate files: job1_pt.vr and job1_ln.vr.

Layers to label (NumLine)
Lines can be labeled with the value that is defined by the 'Text Label' Attribute Name in the Feature Name Table.

Label size (in|mm|ground)
The size of the text labels. The size units are defined in 'Label size units' below.

Label size units
The units for the size of the text labels defined in 'Label size' above, can be inches, millimeters, or ground units. If the size is defined as inches or millimeters, the size of the text is computed in ground units based on the Vr file Target Scale. The options for this parameter are Inches, Millimeters, or Ground.

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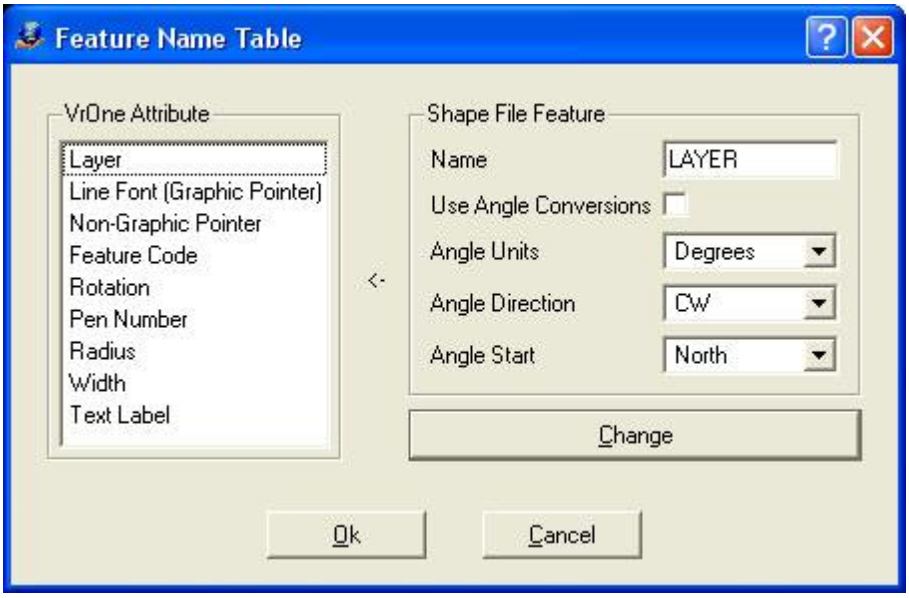
Label location
Defines the location of the text label in relation to the line. Text labels can be placed in the middle of the line considering multiple vertices or may be placed at the center of the longest line segment. Options include Middle of or Longest Size.

Edit Vr Feature Names
Allows editing feature name fields that correspond to VrOne entity attributes. Layer, Graphic Pointer (Line Font/Symbol Name), Non-Graphic Pointer, Feature Code, Rotation, Pen Number, Radius, and Width attributes may be mapped from feature attributes in the shapefile database. For instance, if there is a shapefile attribute field named Layer that contains layer numbers, it can be cross-referenced with the Layer attribute for each VrOne entity.



VrOne Attribute
Displays the VrOne attributes that can be cross-referenced with shapefile feature fields. Clicking an entry copies the settings to the Shape File Feature fields, where they may be changed. Always press the "Change" button after completing any edits.

Name
Defines the name of the shapefile database field used for the selected VrOne attribute. Any name longer than 10 characters is truncated.

Use Angle Conversions
If this is on and the field type is Float, the attribute will be treated as a rotation angle and converted according to the Angle settings below. This allows rotation values stored in the Shapefile to be translated to Vrone rotation angles correctly. You may need to experiment with the angle conversion settings to get the correct settings to match the rotation of symbols in VrOne.

Angle Units
Specifies input units when converting attributes to angles. Options are degrees and radians. Only

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used if "Use Angle Conversions" is on.

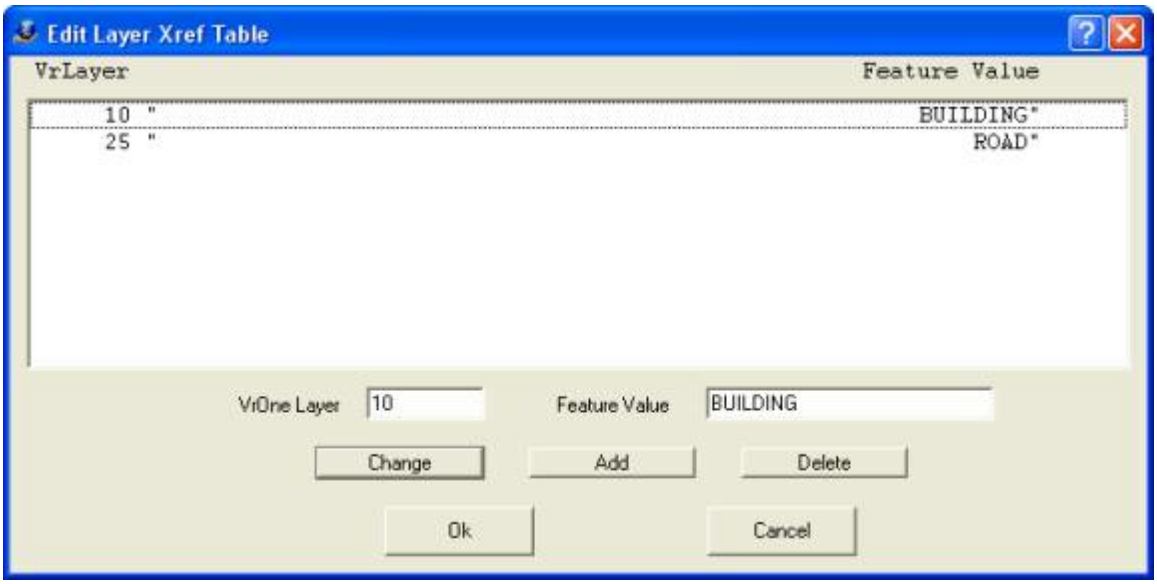
Angle Direction
Defines the input angle direction when converting attributes to angles. This can be CW (clockwise) or CCW (counterclockwise). Only used if "Use Angle Conversions" is on.

Angle Start
Specifies the input angle starting direction. This can be North, East, South, or West. Only used if "Use Angle Conversions" is on.

Cross-Reference Layers

Defines the settings for the cross-referencing of shapefile values to VrOne layer numbers. The attribute field name for Layers is defined in the Edit Feature Names dialog.

The Scan Shape Files button provides an easy way to define this table. This scans the currently selected Shape files and creates a layer cross-reference entry for each layer used.
NOTE: A cross-reference for the VrOne Layer attribute must first be defined in the Vr Feature names cross-reference.



VrOne Layer
Specifies the VrOne output layer.

Feature Value
Specifies the shapefile feature. Should be taken from the Layer feature field in the shapefile database.

Cross-Reference Line Fonts

Defines settings for cross-referencing VrOne line fonts with the line font attribute values in the shapefile database. The attribute field name for Line Fonts (also known as Graphic Pointer) is defined in the Edit Feature Names dialog.

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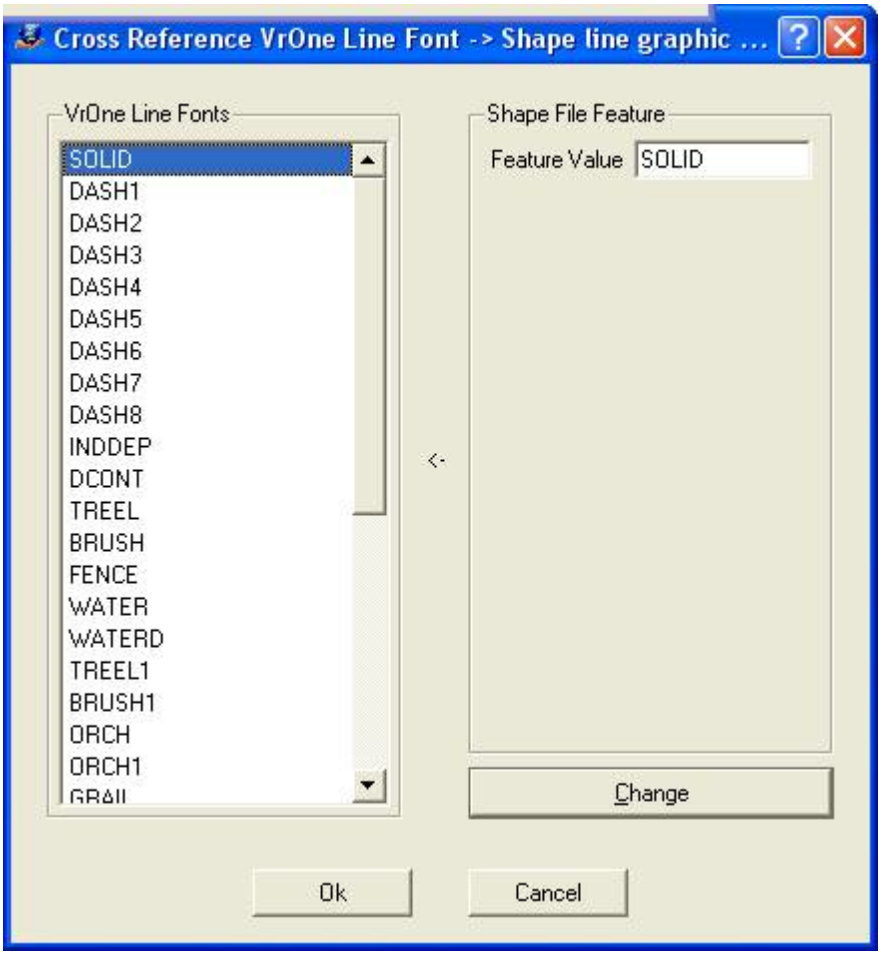

VrOne Line Fonts

Displays the VrOne line font names for the current VrOne symbol file. Clicking an entry copies the settings to the Shape File Feature fields, where they may be changed.

Feature Value

Defines the value to be placed in the line font graphics pointer attribute field for each occurrence of this line font.

Cross-Reference Symbols

Defines the settings for cross-referencing VrOne symbol fonts with attribute values in the shapefile database. The attribute field name for Symbol Fonts is defined in the Edit Feature Names dialog.

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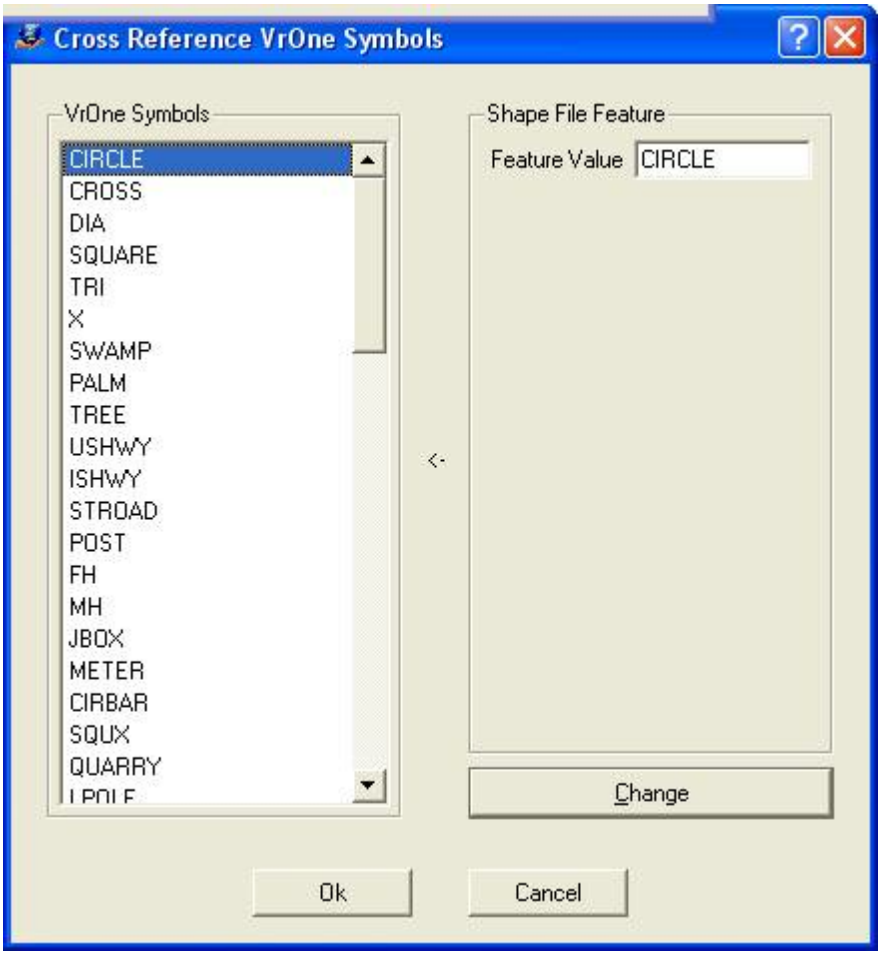

VrOne Symbols

Displays the VrOne line font names for the current VrOne symbol file. Clicking an entry will copy the settings to the Shape File Feature fields where they may be changed.

Feature Value

Defines the value to be placed in the symbol graphics pointer attribute field for each occurrence of this symbol.

Scan Shape Files

Scans all shape files listed in "Define Input Filenames" and copies the layers used to the layer cross-reference table. "Cross-Reference Layers" may be used to cross-reference shapefile attribute values to VrOne layer numbers.

Translate

Begins the translation process.

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Vr Mapping

Shape Out (ShpOut)

Type: Translator

Translates VrOne file(s) to ArcView Shapefile format.

The Shapefile format is used by ArcView GIS software sold by Esri corporation. At the time of writing, a free Shapefile viewer named ArcExplorer is available for download at the Esri web site .

This description of the shapefile format is taken from Esri documentation:

"A shapefile stores non-topological geometry and attribute information for the spatial features in a data set. The geometry for a feature is stored as a shape comprising a set of vector coordinates. Because shapefiles do not have the processing overhead of a topological data structure, they have advantages over other data sources such as faster drawing speed and edit ability. Shapefiles handle single features that overlap or that are noncontiguous. They also typically require less disk space and are easier to read and write. Shapefiles can support point, line, and area features. Area features are represented as closed loop, double-digitized polygons. Attributes are held in a dBASE® format file. Each attribute record has a one-to-one relationship with the associated shape record."

A shapefile consists of one main file, one index file, and one dBASE table file. All file names adhere to the 8.3 naming convention. The main file, the index file, and the dBASE file have the same prefix. The prefix consists of an alphanumeric character (a–Z, 0–9) followed by up to seven characters (a–Z, 0–9, _, -). The suffix for the main file is .shp. The suffix for the index file is .shx. The suffix for the dBASE table is .dbf.
NOTE: The 8 character limit on filenames has been removed. ShpIn supports the longer filenames.

Example:

Main file:	counties.shp
Index file:	counties.shx

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dBASE table:	counties.dbf

Shapefiles may only contain one feature per file. This means that points and lines must be translated into separate files. This also means that the file containing lines will either have all polylines or all polygons (closed areas), but not both. You can create up to four separate file types during one translation. Each file may have its postfix, contents, and dimension (2D or 3D) defined. Each VrOne layer can be translated into a separate set of theme files if needed. VrOne symbols are translated into the Point shapefile. VrOne lines are translated into the PolyLine and Polygon shapefile. VrOne text entities may be translated into a PolyLine file and represented as 2 point lines.

Example:

INPUT PARAMETERS

Shape base file name:	bnd5533
Points postfix:	pt
Polylines postfix:	ln
Text lines postfix:	tx

OUTPUT FILES
bnd5533pt.shp
bnd5533pt.shx
bnd5533pt.dbf
bnd5533ln.shp
bnd5533ln.shx
bnd5533ln.dbf
bnd5533tx.shp
bnd5533tx.shx
bnd5533tx.dbf

The attributes assigned to entities in the shapefile may be customized using the cross-reference tables. The translator will try to assign default values so a quick translation can be accomplished without editing the cross-reference tables.

The user may define the field names and types used to hold entity attributes in the shapefile. The fields are taken from the following VrOne attributes: Layer, Graphic Pointer (Line Font/Symbol Name), Non-Graphic Pointer, and Feature Code.

Layer numbers, line font names, and symbol names from VrOne may be cross-referenced with attribute names in the shapefile.

NOTE: Only entities on layers contained in the Layer Cross-Reference table are considered for translation.

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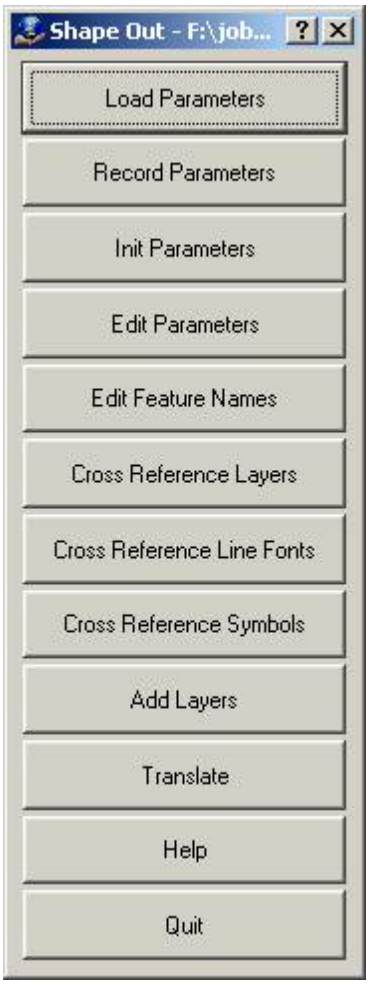
Load Parameters	Record Parameters	Init Parameters
Edit Parameters	Edit Feature Names	Cross-Reference Layers
Cross-Reference Line Fonts	Cross-Reference Symbols	Cross-Reference Symbols
Add Layers	Quick Translation	

Shape Out



Load Parameters

Loads a previously recorded Shape Out (.sho) parameter file.

Record Parameters

Records current translation parameters to a Shape Out (.sho) parameter file.

Init Parameters

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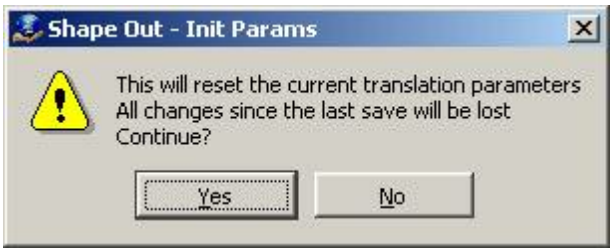
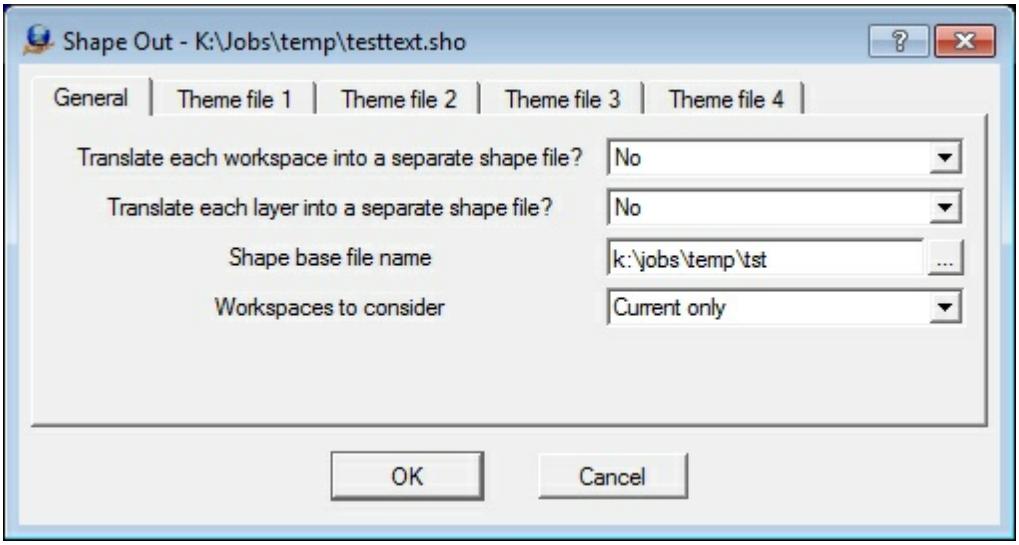
Initializes translation parameters to default values. **NOTE:** Current translation parameters will be lost.



Edit Parameters

Allows editing general translation parameters.



General Tab

Translate each workspace into a separate shape file?

Specifies whether to write a separate shapefile for each open workspace. The shapefile filename prefixes are the same as the workspace filename. The theme postfixes are still be appended to each filename.

Translate each layer into a separate shape file?

Specifies whether to write a separate shapefile for each layer containing data. The shapefile filename prefixes are the same as the layer name. The theme postfixes will still be appended to each filename.

Shape base file name

Defines the base shapefile name to which to write translated data. The main shapefile, shapefile index, and shapefile dBASE files use this name with extensions of .shp, .shx, and .dbf, respectively. If any of the shape files exist, they are overwritten.

Workspaces to consider

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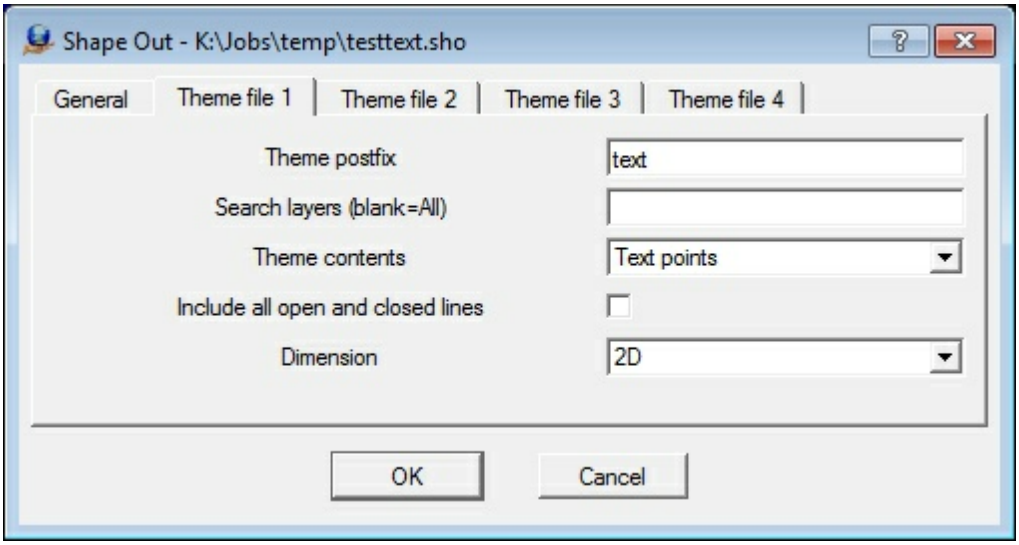
Defines the workspaces to use when translating VrOne data to a shapefile. Options are “Current only” or “All open”.

Theme file 1-4 tabs



Theme postfix

Defines postfix to add to the Shape base file name when creating the shape file for this theme.

Search layers

Determines what layers are used for this theme. Should be entered as a number line. If left blank, all layers are considered.

Theme contents

Defines how lines are translated to the shapefile.

None	This theme is not used.
Points	This theme contains points. VrOne symbols are written to this file.
PolyLine	This theme contains polylines. By default, only open lines are written to this file. **NOTE:** The “Include all open and closed lines” option overrides this.
Polygon	This theme contains polygons. By default, only closed lines will be written to this file. **NOTE:** The “Include all open and closed lines” option overrides this. In that case, open lines in VrOne have a segment added connecting their last and first points in the shapefile.
Text Lines	This theme contains two-point polylines representing text entities. Each VrOne text entity is translated as a two-point line passing horizontally through the center of the text label.
Text Points	This theme contains single points representing text entities. Each VrOne text entity is translated as a point.

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Include all open and closed lines
Determines if all lines are written or only those that match the content type if the theme contains polylines or polygons. For example, if the theme content is PolyLine, by default only open lines are written. If this box is checked, all closed lines are also written to the polylines file. On the other hand, if the content is polygons, by default only closed lines are written. If this box is checked, all open lines are also written to the polygons file.

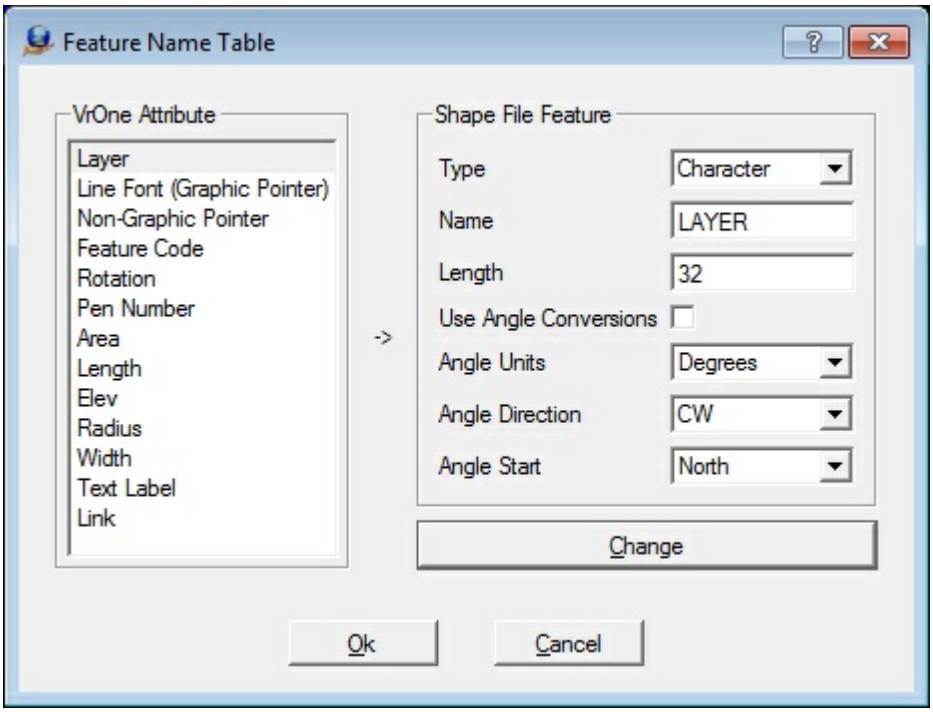
Dimension
Determines the dimension to use for this theme. Options are:

2D	2-dimension shape point file.
3D	3-dimension shape point file.

NOTE: The free ArcExplorer shapefile viewer does not display elevations when viewing 3D files.

Edit Vr Feature Names

Allows editing feature name fields that correspond to VrOne entity attributes. Layer, Graphic Pointer (Line Font/Symbol Name), Non-Graphic Pointer, and Feature code attributes may all be mapped to feature attributes in the shapefile database. For instance, if the VrOne Layer attribute were mapped to a shapefile feature named "LAYER", the shapefile database would contain a LAYER field for each entity. This field would be filled with the value specified in the Layer cross-reference.



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VrOne Attribute
Displays the VrOne attributes that can be cross-referenced with shapefile feature fields. Clicking an entry copies the settings to the Shape File Feature fields, where they may be changed. Always press the "Change" button after completing any edits.

Type
Defines the type of shapefile database field used for the selected VrOne attribute. Options are Numeric or Character.

Name
Defines the name of the shapefile database field used for the selected VrOne attribute. Any name longer than 10 characters is truncated.

Length
Defines the maximum length of the field. A maximum value of 19 is allowed for numeric fields, and 255 for character fields. Do not specify a larger length than needed, as this affects the size of the .dbf output file.

Use Angle Conversions
If this is on and the field type is Float, then the attribute will be treated as a rotation angle and converted according to the Angle settings below. If your viewer supports the display of symbols with rotations, then you may need to experiment with the angle conversion settings to get the correct settings to match the rotation of symbols in VrOne.

Angle Units
Defines the output units when converting attributes to angles. This can be Degrees or Radians. Only used if "Use Angle Conversions" is on.

Angle Direction
Defines the output angle direction when converting attributes to angles. This can be CW (clockwise) or CCW (counterclockwise). Only used if "Use Angle Conversions" is on.

Angle Start
Defines the output angle starting direction. This can be North, East, South, or West. Only used if "Use Angle Conversions" is on.

Cross-Reference Layers

Defines the settings for cross-referencing VrOne layer numbers with attribute values in the shapefile database. The attribute field name for Layers is defined in the Edit Feature Names dialog.

The "Add Layers" option provides an easy way to define this table. This scans the current VrOne file(s) and creates a layer cross-reference entry for each layer used.
NOTE: If layer names have been defined in VrOne, they are used in the table. If a layer name has not been defined in VrOne, the layer number is used instead (with the word "Layer" before the number).

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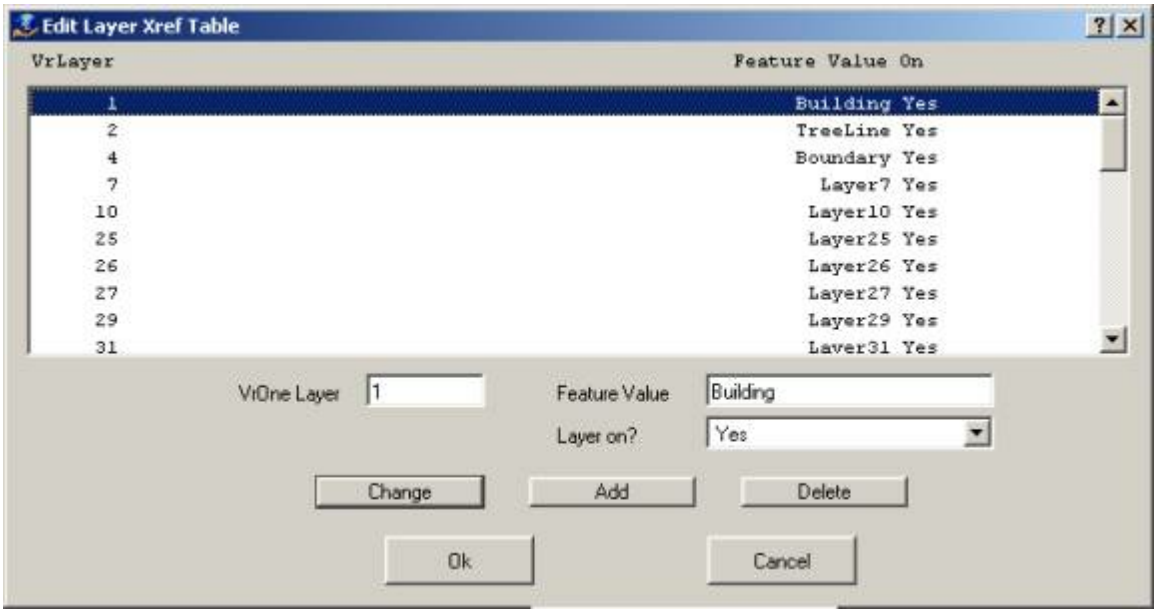

VrOne Layer
Specifies the VrOne input layer.

Feature Value
Defines value to put in the Layer feature field of the shapefile database.

Layer on
Specifies whether the current VrOne Layer is to be translated.

Cross-Reference Line Fonts

Defines the settings for cross-referencing VrOne line fonts with attribute values in the shapefile database. The attribute field name for Line Fonts (also known as Graphic Pointer) is defined in the Edit Feature Names dialog.

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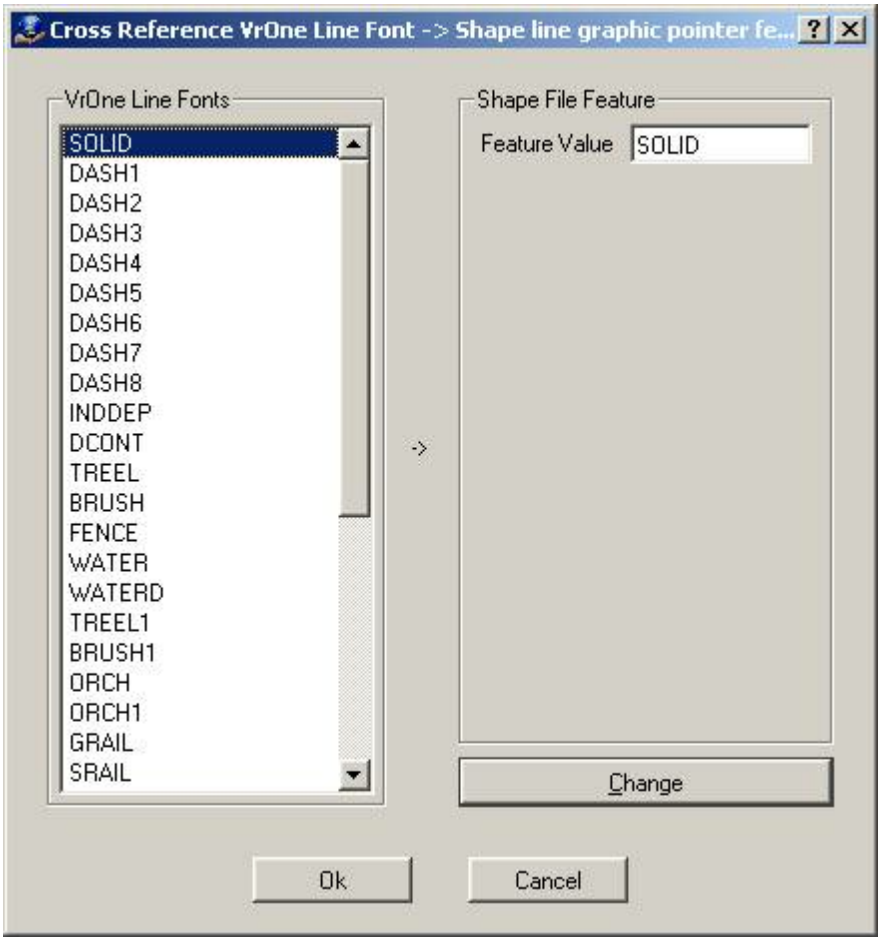

VrOne Line Fonts

Displays VrOne line font names for the current VrOne symbol file. Clicking an entry copies its settings to the Shape File Feature fields, where they may be changed.

Feature Value

Defines the value to place in the line font graphic pointer attribute field for each occurrence of this line font.

Cross-Reference Symbols

Defines the settings for cross-referencing VrOne symbols with attribute values in the shapefile database. The attribute field name for symbols is defined in the Edit Feature Names dialog.

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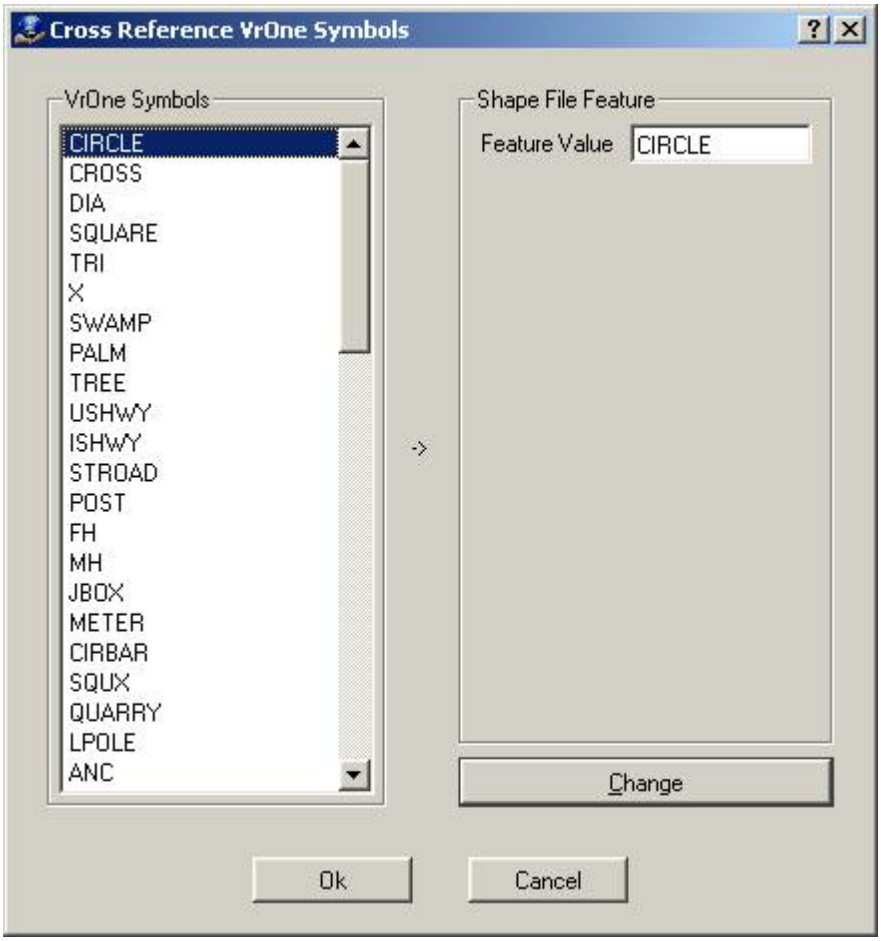

VrOne Symbols

Displays the VrOne line font names for the current VrOne symbol file. Clicking an entry will copy the settings to the Shape File Feature fields where they may be changed.

Feature Value

Defines the value to place in the symbol graphics pointer attribute field for each occurrence of this symbol.

Add Layers

Scans open VrOne file(s) and copies the layers used to the layer cross-reference table. "Cross-Reference Layers" may be used to cross-reference VrOne layer numbers to shapefile attribute values. If layer names have been defined in VrOne, those layer names are used in the table. If a layer name has not been defined in VrOne, the layer number will be used instead (with the word "Layer" before the number).

Quick Translation

The following may be done to translate VrOne file(s) to a DXF file in the fewest possible steps. The result is a translation with all lines translated as solid, symbols translated as blocks, and text labels translated with the proper text font styles.

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1. Init Parameters.
2. Define the “Shape base file name” and the "Theme Postfix" setting for points and lines in “Edit Parameters”.
3. Add Layers to Layer Cross-Reference Table.
4. Translate.

2.1.1.25.16 Survey Points Out

Vr Mapping

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Survey Points Out (SurOut)

Type: Translator

Translates VrOne lines and symbols into Survey Points Format.
The Survey Points Format consists of lines and points in comma delimited ASCII file.

Load Parameters	Record Parameters	Parameters
Translate	Help	Quit

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The Survey Points Out button box.

Load Parameters

Loads previously recorded Survey Points Out (.spo) parameter file.

Record Parameters

Records current translation parameters to a Survey Points Out (.spo) parameter file.

Parameters

Allows editing of the translation parameters.

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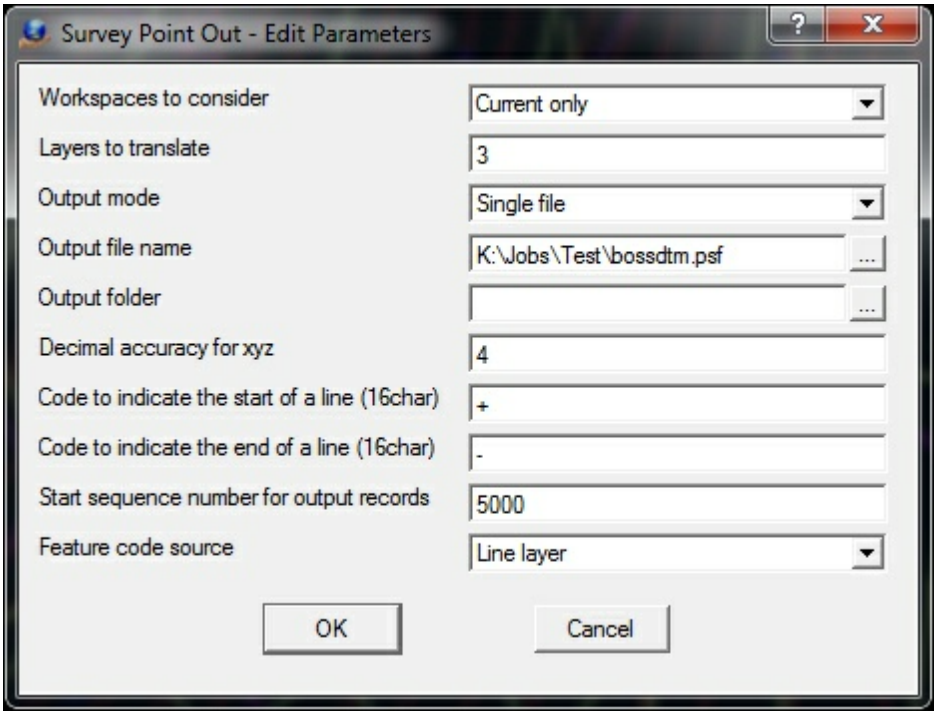

The Edit Parameters dialog box

Workspaces to consider

Defines the workspaces to consider when exporting Survey Points files. Options are "Current only" and "All open".

Layers to consider

Defines the layers in the VrOne file(s) to translate. A Number Line may be used to define these layers.

Output mode

Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single Survey Points file. The "Output file name" field determines the output file name. The "Output directory" field may be used to place the output file in a different folder than the VrOne file.
- **One File Per Workspace** - A Survey Points file is created for each open workspace. The output filename is the same as the workspace (VrOne) filename with an .spf extension. The "Output directory" field may be used to place the output files in a different folder than the VrOne files.

Output file name

Defines the output file name when "Output mode" is set to "Single File". This name is ignored if "Output mode" is set to "One file per workspace".

Output folder

Defines the folder name to place the output file(s). This field may be left blank to place the output files in same the directory as the VrOne files.

Decimal accuracy for xyz

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Defines the number of decimal places for the x, y and z coordinates in the output file(s).

Code to indicate the start of a line (16char)
The start of a line in the output files is defined by this code. The default code is '+'.

Code to indicate the end of a line (16char)
The end of a line in the output files is defined by this code. The default code is '-'.

Start sequence number for output records
Each point or record in the output files much contain a unique number. This parameter defines the start sequence number for the output records. If multiple files are being translated, the number will be sequenced between output files.

Feature code source
The cross referencing between VrOne Layers and Survey Points Format Feature Code is accomplished by using the Vr Function Keys. One of two methods may be used when searching for a point's Feature Code.

- **Line layer** - When the translator needs a Feature Code, the Function Keys are searched for the VrOne layer. When the layer number is found, the Function Key name is used as the Survey Points Feature Code. The Function Key Description is also used as the Survey Points Description or Comment.
- **Line point's M flag** - The layer number in the line point's M Flag is used to search Function Keys. The Function Key's Feature Code is used as the survey point feature code. The setting of the layer number in a Vr Line point's M Flag is done by another application such as the batch application Drape.

Translate
Begins the file translation process.

Help
Starts the browser and displays the current help document.

Quit
Quits Survey Points Out and allows current parameters to be saved if they were altered.

Survey Points Format

The Survey Points Format consists of lines and points in comma delimited ASCII file. Each record has a unique sequence number, a coordinate position, a feature code, a control code and an optional description.

Following is an example of the Survey Points Format:

```
5000,553318.7073,1857992.2046,623.8169,BL+/CL
5001,553327.2930,1857901.5110,624.9915,BL
5002,553336.4310,1857813.4315,625.2355,BL
5003,553342.8827,1857744.9807,624.0503,BL-
5004,553498.2773,1857906.8409,621.6160,FN
```

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```
5005,553436.2169,1857979.3360,645.5678,XLP2
5006,553500.5725,1857929.4577,637.6788,XLP2
5007,553504.7982,1857886.2872,640.6937,XLP2
5008,553511.2007,1857834.5915,643.5109,XLP2
5009,553400.0948,1857886.2190,630.4220,BC
```

Field	Example	Description
1	5000	Sequence number
2	553318.7073	X coordinate
3	1857992.2046	Y coordinate
4	623.8169	Z coordinate
5	BL	Feature code
6	+	Control code (see below)
7	/CL	Description or comment

Feature Codes

The cross referencing between VrOne Layers and Survey Points Format Feature Code is accomplished by using the Vr Function Keys. One of two methods may be used when searching for a point's Feature Code.

- **Feature Code Source - Line layer** - When the translator needs a Feature Code, the Function Keys are searched for the VrOne layer. When the layer number is found, the Function Key name is used as the Survey Points Feature Code. The Function Key Description is also used as the Survey Points Description or Comment.
- **Feature Code Source - Line point's M flag** - The layer number in the line point's M Flag is used to search Function Keys. The Function Key's Feature Code is used as the survey point feature code. The setting of the layer number in a Vr Line point's M Flag is done by another application such as the batch application Drape.

Control Codes

Currently the only control codes that are used are the + (plus) character to indicate the beginning of a line and the - (minus) character to indicate the end of a line.

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Mapping

LAS In (LasIn)

Type: Translator

Translates LAS (LiDAR Archive Standard) files to VrOne files.

The LAS file format is a public file format for interchanging LiDAR data between computer systems. This binary file format consists of point coordinate data along with up to 16 attributes per point. The LAS In and LAS Out translators maintain these attributes in the Vr Mapping database. The translation of LAS data to and from the Vr Mapping database requires very few parameters. The LAS translators are based on the LAS Specification Version 1.2 and the LAS Specification Version 1.4. The support of version 1.4 was added in Vr Mapping version 05.09.00. Please see LAS Version 1.2 and LAS Version 1.4 Support for more information. Support for the import of compressed LAS (LAZ) files was added in Vr Mapping Version 06.00.06.

LiDAR points are stored as Vr Points and maintain LAS defined point attributes.

Load Parameters	Record Parameters	Define Input Filenames
Parameters	Translate	Scan Files
Help	Quit	LAS 1.2 and LAS 1.4

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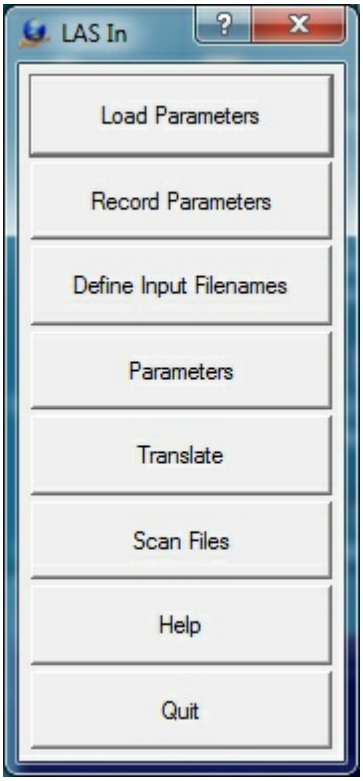

Load Parameters

Loads previously recorded LAS In (.lap) parameter file.

Record Parameters

Records current translation parameters to a LAS In (.lap) parameter file.

Define Input Filenames

Allows all LAS input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .las and .laz by default, but attempts to read in any file chosen. The type of file, uncompressed (.las) or compressed (.laz) is determined by the file name extension (.las or .laz).
The VrOne output filenames are only used if the "Translate to separate VrOne files" option is on.

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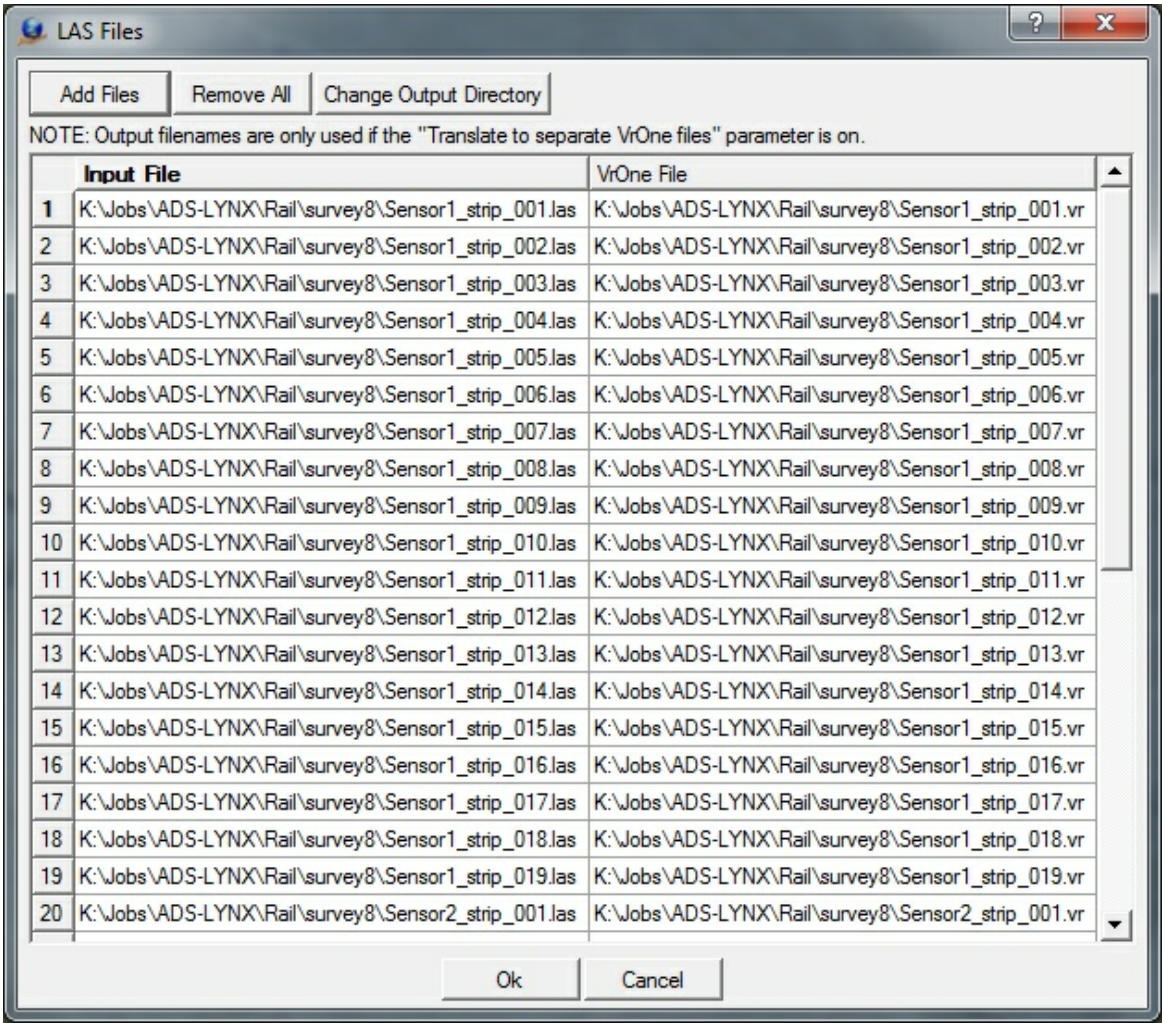

The Define Input Filenames dialog box

Add Files

Displays a standard VrOne file selection dialog. All files selected are added to the list of Input files. A VrOne output filename is generated based on each input filename.

Remove All

Removes all files from the Input file table.

Change Output Directory

Allows changing the output directory (folder). By default, the output directory is the same as the input file directory.

Parameters

Allows editing general translation parameters.

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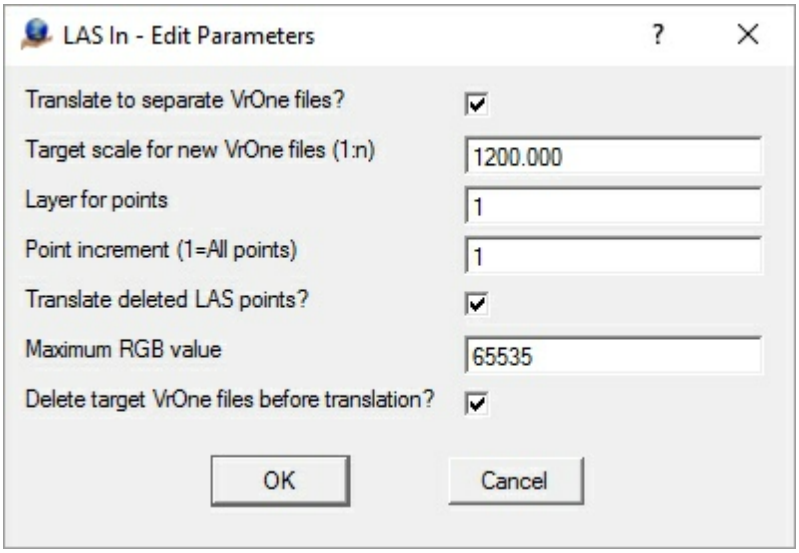

The Edit Parameters dialog Box

Translate to separate VrOne files?

Determines whether to translate each LAS input file to a separate VrOne file. The Input to Output filename cross-reference is set in the "Define Input Filenames" dialog.

Target scale for new VrOne files (1:n)

Defines target scale to use when creating the new VrOne file if the "Translate to separate VrOne files?" is on and a VrOne file does not exist during translation.

Layer for points

Specifies layer into which to place translated points.

Translate deleted LAS points?

One of the attributes stored with each LiDAR points is a delete flag, which allows points in the database to be marked as deleted. If this parameter is selected, deleted points are translated. Deleted points that are translated retain their delete flag in the Vr Mapping database.

Maximum RGB value

Defines the maximum RGB values that are expected in the LAS file. The Vr Point structure defines the RGB range as 0-255. If the Maximum RGB value is greater than 255, incoming RGB files are scaled to the range of 0-255.

Delete target VrOne files before translation?

If this option is checked each target VrOne file will be deleted before translation if it exists. If this option is unchecked and the target VrOne file exists, the new data will be appended to the file. This parameter is considered only if the "Translate to separate VrOne files" option is checked.

Scan Files

Scans the currently defined LAS files and displays various information including coordinate, intensity and RGB ranges.

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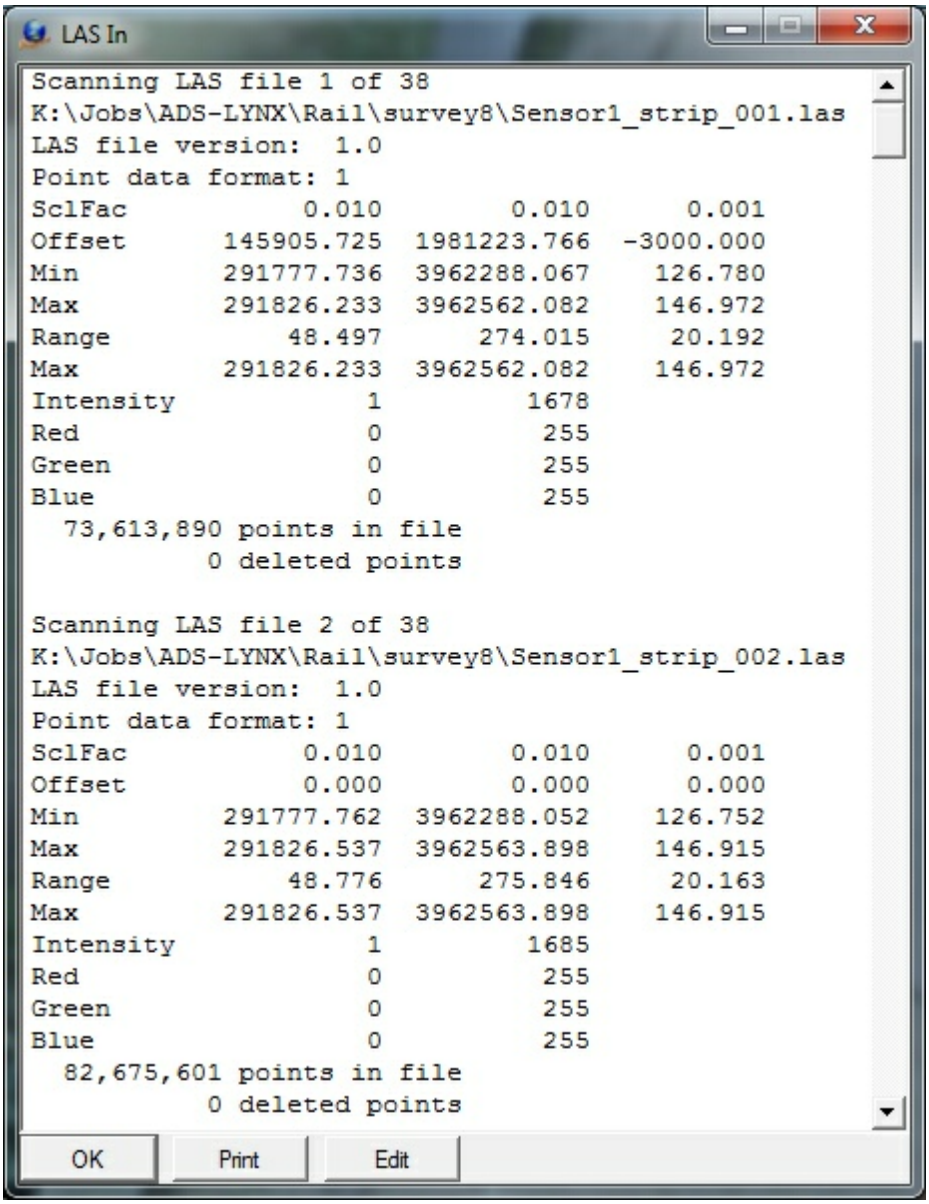

The Scan Files information box

Translate

Begins the file translation process. All files defined by the “Define input Filenames” option are imported.

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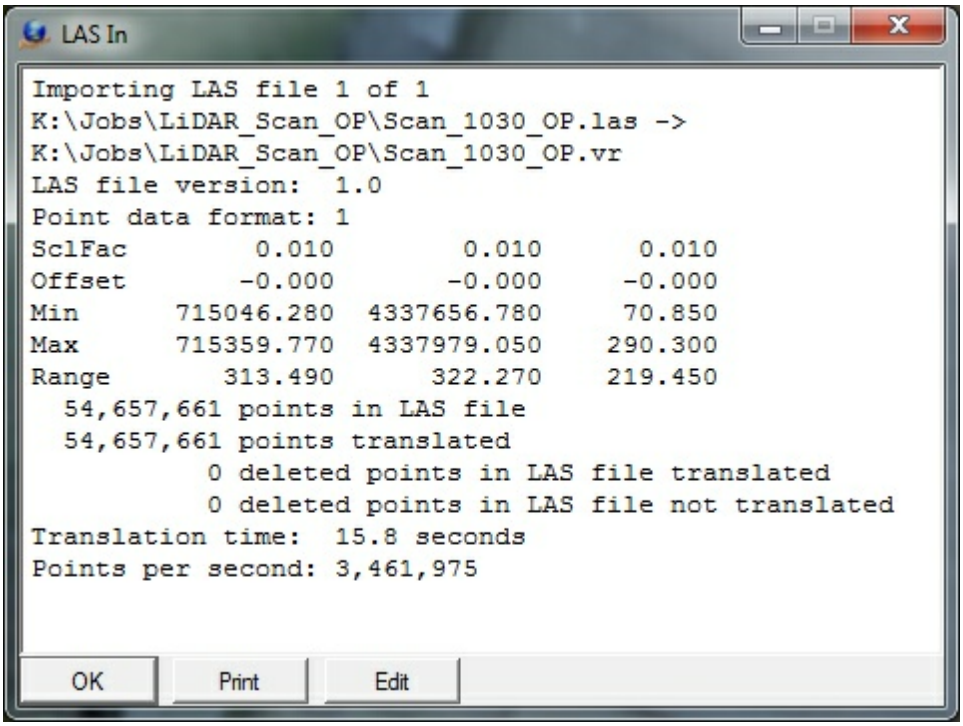

The Translation information box

Help

Starts the browser and displays the current help document.

Quit

Quits LAS In and allows current parameters to be saved if they were altered.

LAS Version 1.2 and LAS Version 1.4 Support

LAS 1.2 and LAS 1.4

For more information on the supported LAS formats please see:

LAS Specification Version 1.2
LAS Specification Version 1.4

Overview of Changes in 1.4

Following is an overview of the changes from LAS 1.2 to LAS 1.4. This list does not include all the differences. Please see the LAS format specifications for more details.

- The number of returns per LiDAR pulse and the return number has been extended from 5 to 15.
- The sensor number is now included in version 1.4 and has a range from 0 to 3.
- The overlap flag has been added.
- The number of point classifications has been extended from 32 to 256.

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- The Near Infrared Channel (NIR) field has been added.
- The scan angle is now defined with a range of -30,000 to 30,000 with a resolution of 0.006 degrees.

Supported Point Data Records

LAS 1.4 supports waveform data, however the Vr Mapping LAS translators does not support this data so the LAS Point Data Record formats 4, 5, 9 and 10 are not supported. LAS 1.4 consists of 11 Point Data Record formats. Formats 0-3 are legacy formats from version 1.2 which are still supported and formats 6-8 are defined in the 1.4 specification. For more details on each of the supported point formats, please see the LAS format specifications in the LAS documentation listed above. Following are the record formats supported by Vr Mapping.

- **Format 0** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID
- **Format 1** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time
- **Format 2** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Red, Green, Blue
- **Format 3** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time, Red, Green, Blue
- **Format 6** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number, GPS Time
- **Format 7** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue
- **Format 8** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue, Near Infrared Channel (NIR)

Additions and Modifications to the LAS Specification

- Vr Mapping contains a layer number for each point (1-32001)
- Vr Mapping contains a flight number for each point (0-255)
- Vr Mapping contains a display flag for each point (0-1)

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- The red, green, and blue values in LAS point data record formats 2, 3, 7, and 8 are defined with a range of 0-65535 (6 bytes). Vr Mapping scales these values to 0-255 (3 bytes)
- LAS version 1.4 waveform data is not supported so LAS Point Data Record formats 4, 5, 9 and 10 are not supported.
- LAS version 1.4 specifies the maximum number of points in an LAS file to be up to18 quintillion (18,446,744,073,709,551,615). Currently, Vr Mapping supports the LAS 1.2 specification which allows point counts up to 4 billion (4,294,967,295).

Updated: May 2019

2.1.1.25.18 LAS Out

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Vr Mapping

LAS Out (LasOut)

Type: Translator

Translates Vr Points to the LAS (LiDAR Archive Standard) format.

The LAS file format is a public file format for interchanging LiDAR data between computer systems. This binary file format consists of point coordinate data along with up to 16 attributes per point. The LAS In and LAS Out translators maintain these attributes in the Vr Mapping database. The translation of LAS data to and from the Vr Mapping database requires very few parameters. The LAS translators are based on the LAS Specification Version 1.2 and the LAS Specification Version 1.4. The support of version 1.4 was added in Vr Mapping version 05.09.00. Please see LAS Version 1.2 and LAS Version 1.4 Support for more information. Support for the output of compressed LAS (LAZ) files was added in Vr Mapping Version 06.00.06.

LiDAR points are stored as Vr Points and maintain LAS defined point attributes.

Load Parameters	Record Parameters	Edit Header
Parameters	Translate	Help

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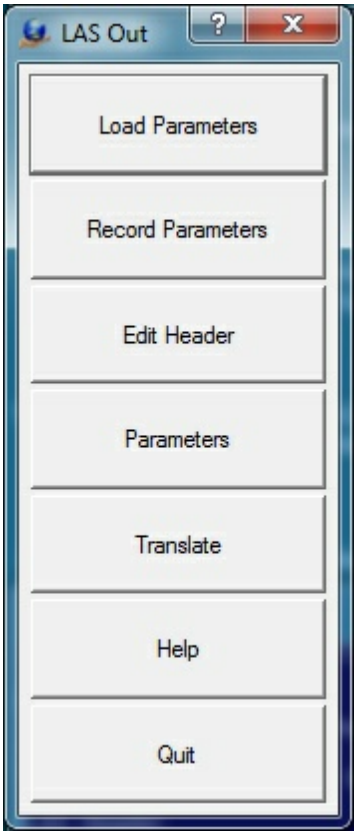
Quit	LAS 1.2 and LAS 1.4	



Load Parameters
Loads previously recorded Las Out (.lao) parameter file.

Record Parameters
Records current translation parameters to a Las Out (.lao) parameter file.

Edit Header
Edits the LAS file header used when creating LAS or LAZ files.

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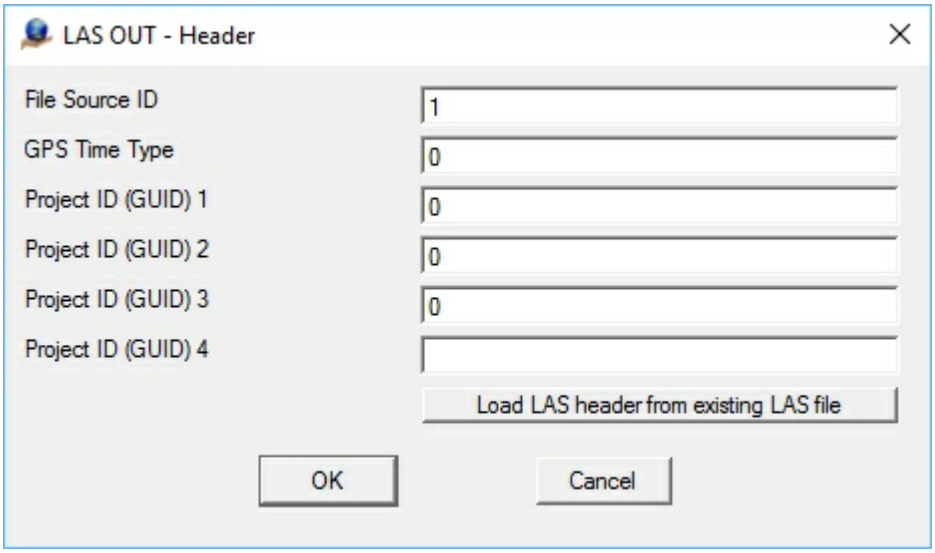

The Define LAS Header dialog box

File Source ID

This field should be set to a value between 1 and 65,535 inclusive (Flight Line Number if this file was derived from an original flight line). 0 means an ID has not been assigned. In that case, processing software is free to assign any valid number. Note that this scheme allows a LiDAR project to contain up to 65,535 unique sources. A source can be an original flight line or the result of merge and/or extract operations.

GPS Time Type

Specifies the meaning of GPS Time in the Point Records. 0 indicates that GPS time in the point record fields is GPS Week Time (the same as previous versions of LAS). 1 indicates that GPS Time is standard GPS Time (satellite GPS Time) minus 1 x 109. The offset moves the time back to near zero to improve floating point resolution.

Project ID (GUID)

Project ID (GUID data): The four fields that comprise a complete Globally Unique Identifier (GUID) are now reserved for use as a Project Identifier (Project ID). The field remains optional. The time of assignment of the Project ID is at the discretion of processing software. The Project ID should be the same for all files that are associated with a unique project. By assigning a Project ID and using a File Source ID (defined above) every file within a project and every point within a file can be uniquely identified, globally.

Parameters

Allows editing general translation parameters.

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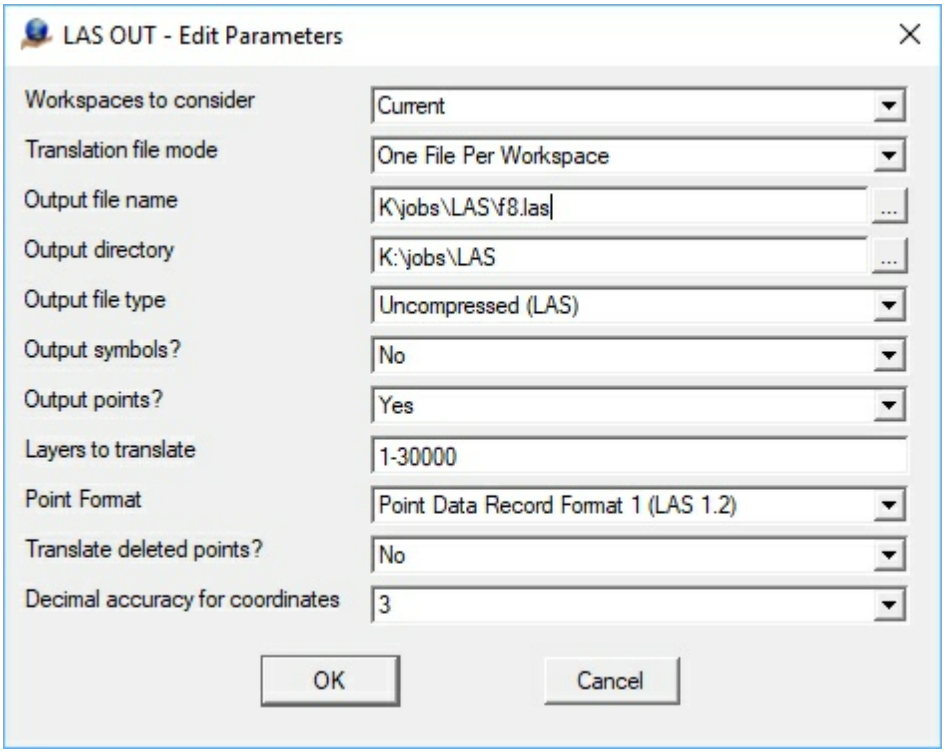

The Edit Parameters dialog box

Workspaces to consider

Defines the workspaces to consider when running exporting LAS files. Options are "Current workspace" and "All open workspaces".

Translation file mode

Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single LAS file. The "Output file name" field determines the LAS file name.
- **One File Per Workspace** - An LAS file is created for each open workspace. The LAS filename is the same as the workspace (VrOne) filename with an .las or .laz extension. The "Output directory" field may be used to place the LAS files in a different folder than the VrOne file.

Output file name

Defines the output file name when "Translation file mode" is set to "Single File". This name is ignored if "Translation file mode" is set to "One file Per Workspace".

Output directory

Defines the output directory if not using "Single File" translation mode. This field may be left blank to place the output files in same the directory as the VrOne files. This field is ignored if the "Translation file mode" is set to "Single File".

Output file type

The files output from LAS Out may be uncompressed (.las) or compressed (.laz). When the "Translation file mode" is set to "One File Per Workspace", the output files will have a .las or .laz

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file extension depending on this parameter.

Output Symbols
Determines whether to output Symbols. The LAS Out translator typically exports Vr Points only. Symbols do not carry LiDAR attributes like Vr Points; default values are assigned to these attributes for each symbol.

Output Points
Determines whether to export Vr Points. This parameter is normally set to "Yes".

Point Format
The point data format ID corresponds to the Point Data Record format type. LAS 1.2 defines types 0, 1, 2, and 3. LAS 1.4 defines types 6, 7, and 8. Following are the attributes included in each format as defined by the LAS Specification 1.2 and LAS Specification 1.4.

- **Format 0** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID
- **Format 1** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time
- **Format 2** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Red, Green, Blue
- **Format 3** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time, Red, Green, Blue
- **Format 6** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number, GPS Time
- **Format 7** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue
- **Format 8** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue, Near Infrared Channel (NIR)

See the Vr Point format for more information on these fields and any differences between the Vr Point format and the LAS specification.

Layers to translate
Defines the layers to translate to LAS. If a layer is specified, it is translated even if it is turned off in VrOne/VrTwo.

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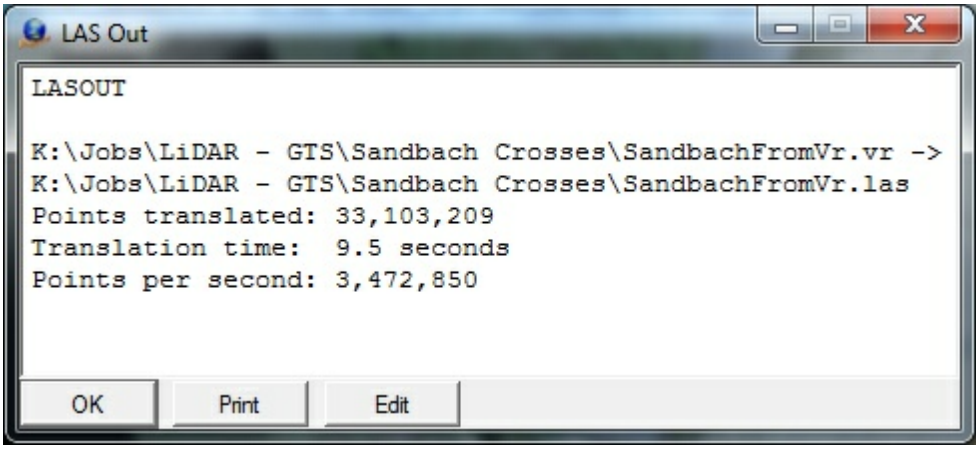
Translate deleted points
One of the attributes stored with each Vr Point is a delete flag, which allows points in the database to be marked as deleted. If this parameter is selected, deleted points will be translated. Translated deleted points retain their delete flag in the LAS output file.

Decimal Accuracy for coordinates
Defines the decimal accuracy for the coordinates. When point coordinates are stored in a LAS file, a scale factor and offset are applied. If the decimal accuracy is too high, it is reduced automatically.

Translate
Begins the file translation process.



The Translation information box

Help
Starts the browser and displays the current help document.

Quit
Quits LAS Out and allows current parameters to be saved if they were altered.

LAS Version 1.2 and LAS Version 1.4 Support

LAS 1.2 and LAS 1.4
For more information on the supported LAS formats please see:

LAS Specification Version 1.2
LAS Specification Version 1.4

Overview of Changes in 1.4
Following is an overview of the changes from LAS 1.2 to LAS 1.4. This list does not include all the differences. Please see the LAS format specifications for more details.

- The number of returns per LiDAR pulse and the return number has been extended from 5 to 15.

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- The sensor number is now included in version 1.4 and has a range from 0 to 3.
- The overlap flag has been added.
- The number of point classifications has been extended from 32 to 256.
- The Near Infrared Channel (NIR) field has been added.
- The scan angle is now defined with a range of -30,000 to 30,000 with a resolution of 0.006 degrees.

Supported Point Data Records

LAS 1.4 supports waveform data, however the Vr Mapping LAS translators does not support this data so the LAS Point Data Record formats 4, 5, 9 and 10 are not supported. LAS 1.4 consists of 11 Point Data Record formats. Formats 0-3 are legacy formats from version 1.2 which are still supported and formats 6-8 are defined in the 1.4 specification. For more details on each of the supported point formats, please see the LAS format specifications in the LAS documentation listed above. Following are the record formats supported by Vr Mapping.

- **Format 0** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID
- **Format 1** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time
- **Format 2** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Red, Green, Blue
- **Format 3** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time, Red, Green, Blue
- **Format 6** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number, GPS Time
- **Format 7** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue
- **Format 8** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue, Near Infrared Channel (NIR)

Additions and Modifications to the LAS Specification

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- Vr Mapping contains a layer number for each point (1-32001)
- Vr Mapping contains a flight number for each point (0-255)
- Vr Mapping contains a display flag for each point (0-1)
- The red, green, and blue values in LAS point data record formats 2, 3, 7, and 8 are defined with a range of 0-65535 (6 bytes). Vr Mapping scales these values to 0-255 (3 bytes)
- LAS version 1.4 waveform data is not supported so LAS Point Data Record formats 4, 5, 9 and 10 are not supported.
- LAS version 1.4 specifies the maximum number of points in an LAS file to be up to18 quintillion (18,446,744,073,709,551,615). Currently, Vr Mapping supports the LAS 1.2 specification which allows point counts up to 4 billion (4,294,967,295).

Updated: May 2019

2.1.1.25.19 Points In

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Points In (PoiIn)

Type: Translator

Translates LiDAR point lists to VrOne files.

The Points In translator converts LiDAR data contained in an ASCII file to the Vr Mapping database as Vr Points. Convertible data fields are X, Y, Z, Intensity, Red, Green, and Blue. A Vr Point may contain up to16 attributes. The LAS format also contains up to 16 attributes per point and so, if possible, should be used instead of the Points In translator. Since the Points format is ASCII, the Points In and Points Out translators are significantly slower than the LAS In and LAS Out translators.

The ASCII In translator may be used to import XYZ coordinates into Vr Mapping but it does not support point attributes.

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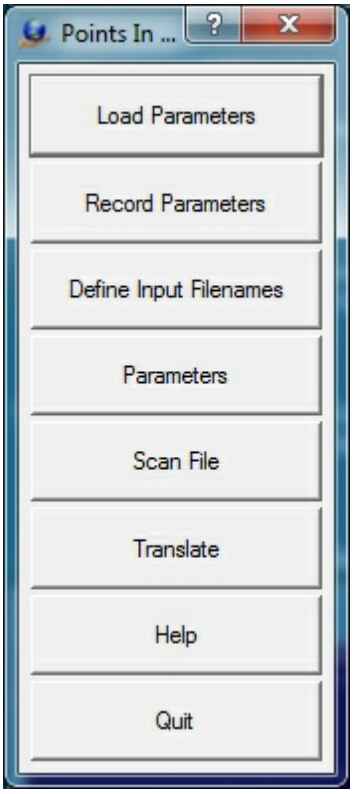
Load Parameters	Record Parameters	Define Input Filenames
Parameters	Scan File	Translate
Help	Quit	



Load Parameters

Loads previously recorded Points In (.poi) parameter file.

Record Parameters

Records current translation parameters to a Points In (.poi) parameter file.

Define Input Filenames

Allows Points input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .pts by default, but attempts to read in any file chosen.
The VrOne output filenames are only used if the "Translate to separate VrOne files" option is on.

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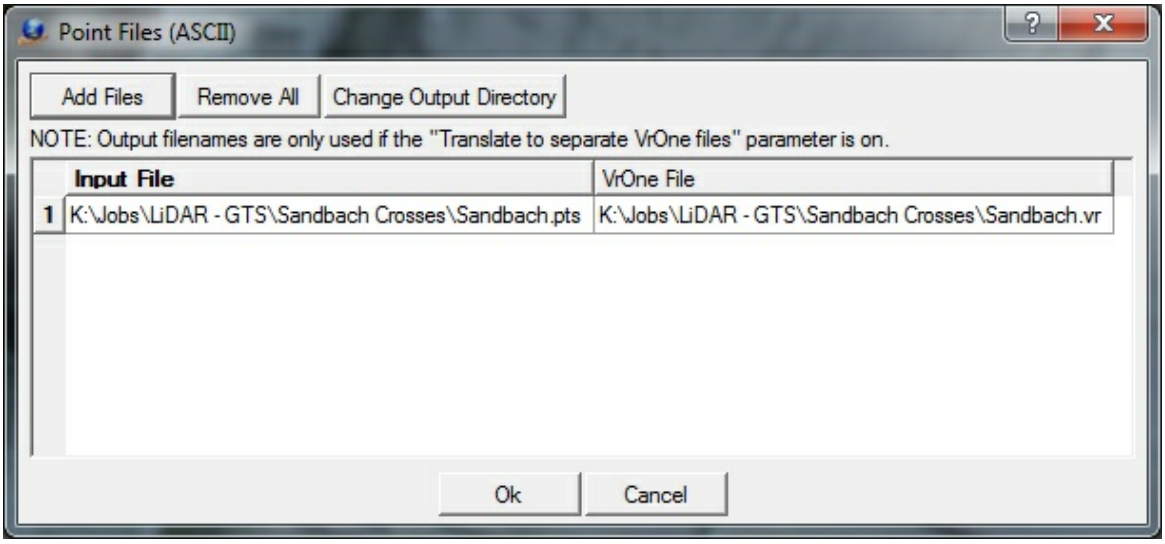


The Define Input Filenames dialog box

Add Files

Displays a standard VrOne file selection dialog. All files selected are added to the list of Input files. Generates a VrOne output filename based on each input filename.

Remove All

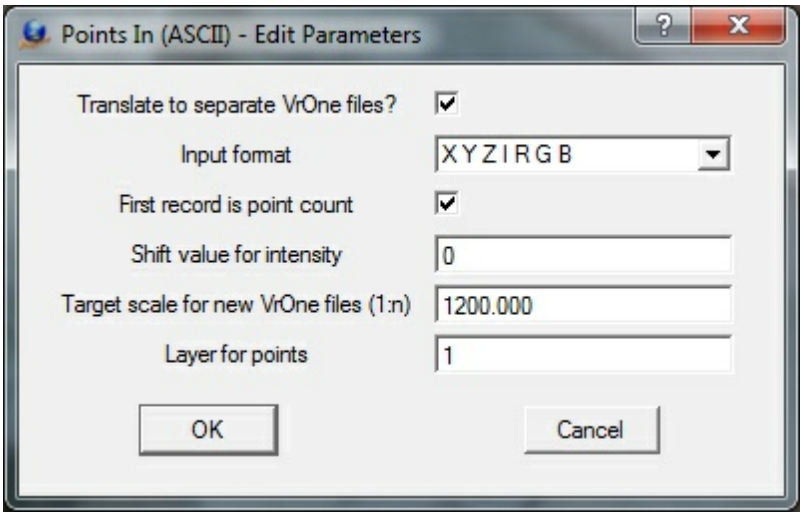
Removes all files from the Input file table.

Change Output Directory

Allows changing the output directory (folder). By default, the output directory is the same as the input file directory.

Parameters

Allows editing general translation parameters.



The Edit Parameters dialog Box

Translate to separate VrOne files?

Determines whether the Points input file is translated to a separate VrOne file. The Input to

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Output filename cross-reference is set in the "Define Input Filenames" dialog.

Input format

Defines the format of the input files and the fields to be translated.

- **X Y Z I R G B** - X, Y, Z, Intensity, Red, Green, Blue.
- **X Y Z I** - X, Y, Z, Intensity.
- **X Y Z R G B** - X, Y, Z, Red, Green, Blue.
- **X Y Z** - X, Y, Z.

The range for the intensity field is 0-32767. An intensity shift value may be set in cases when there are negative intensity values. RGB values may range from 0 to 255.

First record is point count

Determines whether the number of points should be the first record of each input file.

Shift value for intensity

Defines the value to add to all incoming intensity values. It may be used in the case of negative intensity values. Valid range for intensity in the Vr Point format is 0-32767.

Target Scale fo new VrOne files (1:n)

Defines target scale to use when creating the new VrOne file if the "Translate to separate VrOne files?" is on and a VrOne file does not exist during translation.

Layer for points

Specifies layer into which to place translated points.

Scan File

Scans a single Points file and displays the first 100 lines. This may be used to determine the input format of the Points files.

Translate

Begins the file translation process. All files that were defined by the “Define input Filenames” option are imported.

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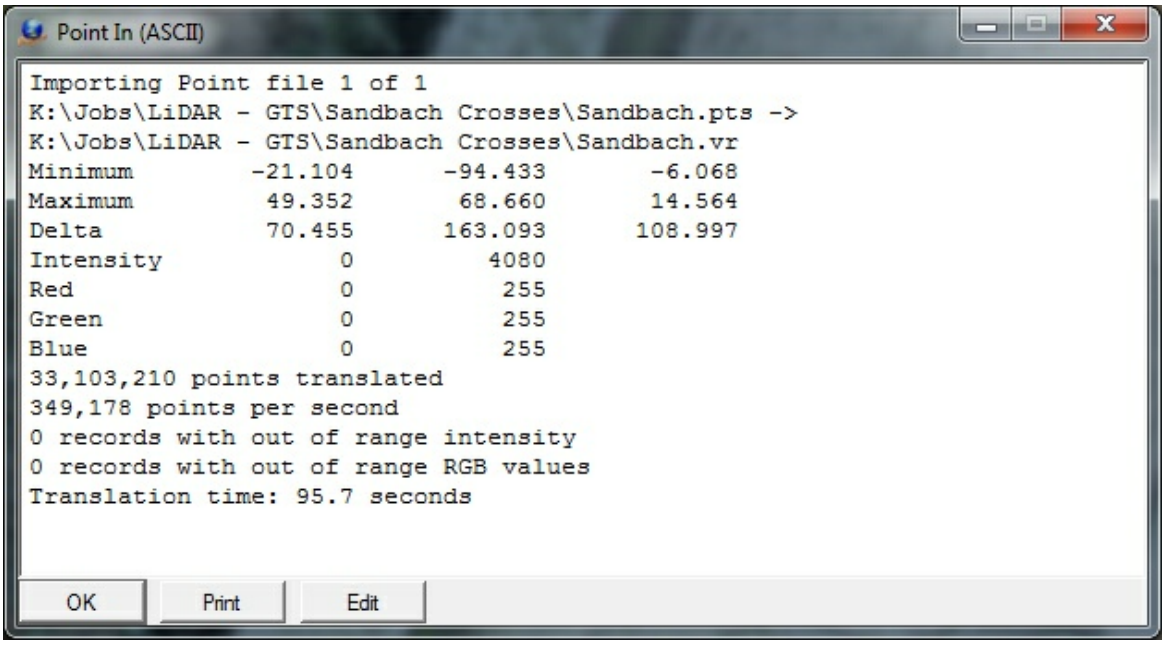

The Translation information box

Help

Starts the browser and displays the current help document.

Quit

Quits Points In and allows current parameters to be saved if they were altered.

2.1.1.25.20 Points Out

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Points Out (PoiOut)

Type: Translator

Translates Vr Points to the LiDAR point lists in ASCII format.

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The Points Out translator converts Vr Points to ASCII formatted LiDAR point lists. Each record consists of XYZ coordinates and optionally selected point attributes which include intensity, RGB, layer, classification, return number, keypoint flag and(or) GPS time. A Vr Point may contain up to 16 attributes. The LAS format also contains up to 16 attributes per point and so, if possible, should be used instead of the Points In translator. Since the Points format is ASCII, the Points In and Points Out translators are significantly slower than the LAS In and LAS Out translators.

Load Parameters	Record Parameters	Parameters
Translate	Help	Quit



Load Parameters

Loads previously recorded Points Out (.poo) parameter file.

Record Parameters

Records current translation parameters to a Points Out (.poo) parameter file.

See the Vr Point format for more information on these fields and any differences between the Vr Point format and the LAS specification.

Parameters

Allows editing general translation parameters.

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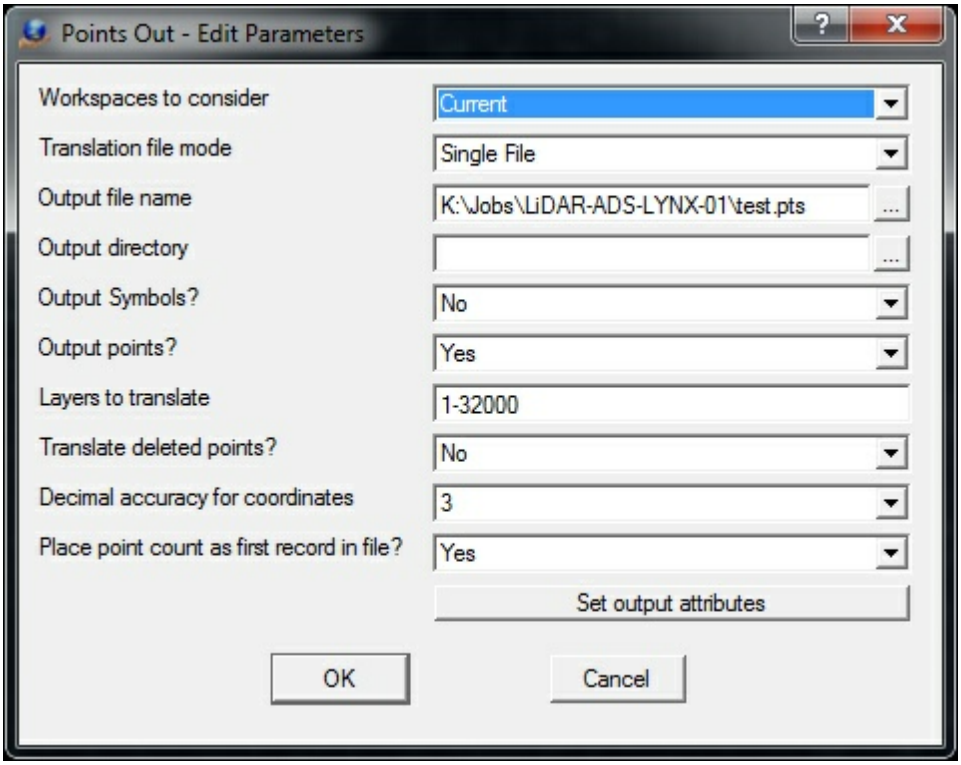

The Edit Parameters dialog Box

Workspaces to consider

Defines the workspaces to consider when running exporting LAS files. Options are "Current workspace" or "All open workspaces".

Translation file mode

Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single Points file. The "Output file name" field determines the Points file name.
- **One File Per Workspace** - An Points file is created for each open workspace. The Points filename is the same as the workspace (VrOne) filename with a .pts extension. The "Output directory" field may be used to place the Points files in a different folder than the VrOne file.

Output file name

Defines the output file name when "Translation file mode" is set to "Single File". This name is ignored if "Translation file mode" is set to "One file Per Workspace".

Output directory

Defines output directory if not using "Single File" translation mode. This field may be left blank to place the Points files in same the directory as the VrOne files. This field is ignored if the "Translation file mode" is set to "Single File".

Output Symbols

Determines whether to output Symbols. The Points Out translator typically exports Vr Points only. Symbols do not carry LiDAR attributes like Vr Points; default values are assigned to these attributes for each symbol.

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Output Points
Determines whether to export Vr Points. This parameter is normally set to "Yes".

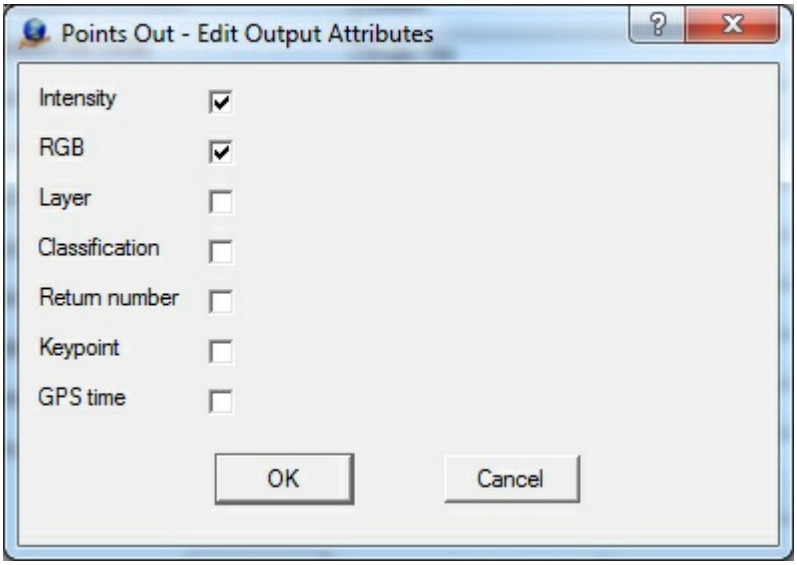
Layers to translate
Defines the layers to translate to Points files. If a layer is specified, it is translated even if it is turned off in VrOne/VrTwo.

Translate deleted points
One of the attributes stored with each Vr Point is a delete flag, which allows points in the database to be marked as deleted. If this parameter is selected, deleted points are translated. Translated deleted points retain their delete flag in the Points Output file.

Decimal Accuracy for coordinates
Defines the decimal accuracy for the coordinates in the Points files.

Place point count as the first record in file?
Determines whether then the first record of each Points file should contain the number of points in the file.

Set output attributes
Pressing this button will display the following dialog which allows the specification of point attributes to output with each point.



Edit Parameters - The Output Attributes dialog

Translate

Begins the file translation process.

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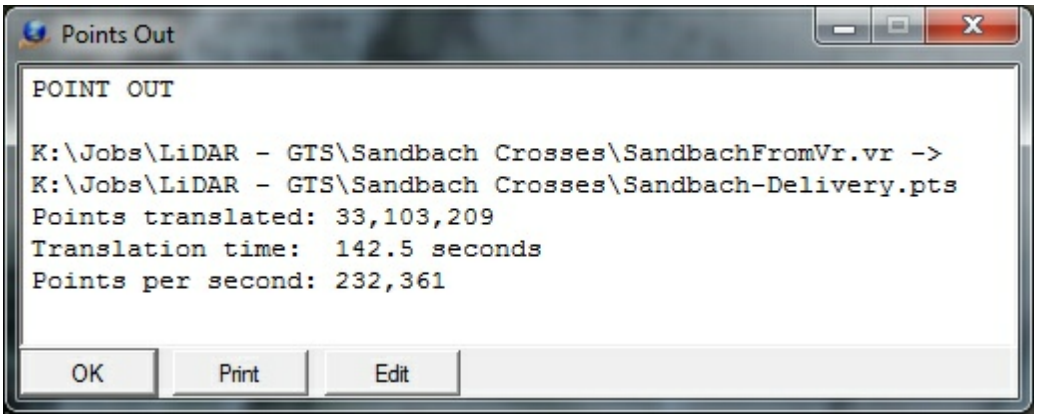

The Translation information box

Help

Starts the browser and displays the current help document.

Quit

Quits Points Out and allows the current parameters to be saved if they were altered.

2.1.1.25.21 XML In

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

XML In (XmlIn)

Type: Translator

Translates LandXML schema based surface XML files into Vr Mapping's VrOne data files

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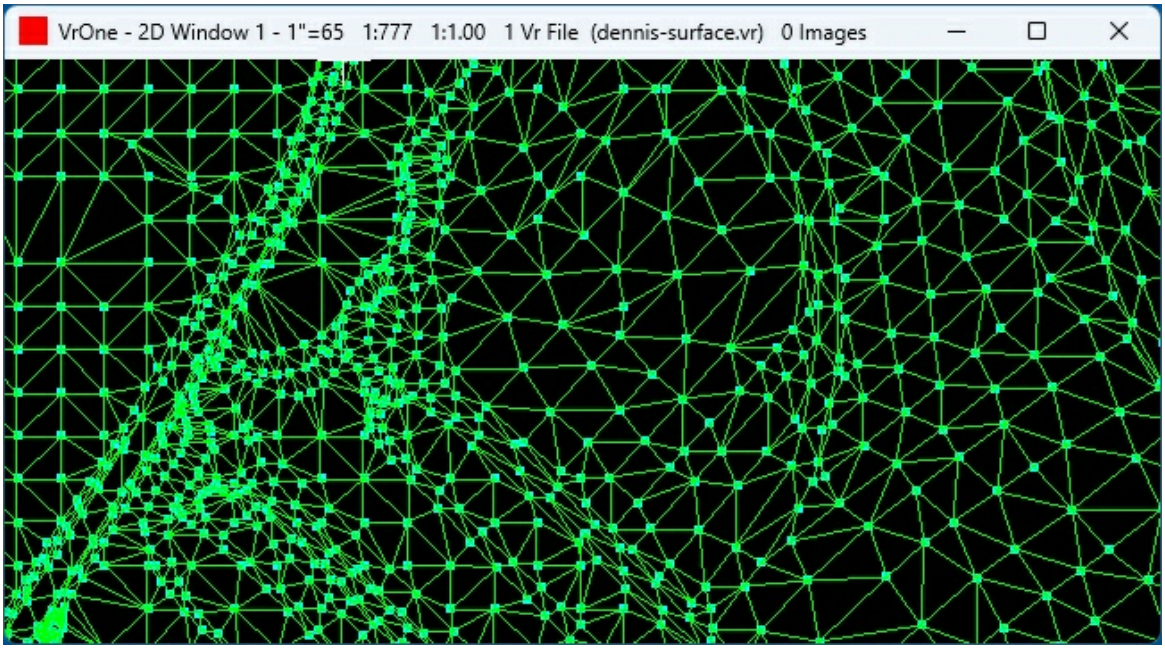

The XML In translator converts surface data, which typically includes features such as break and boundary lines, points, and triangle lines (faces) in from a XML file or files to the Vr Mapping's VrOne file or files. This translator uses the LandXML's schema but does not support all the elements that are available in that schema.

Load Parameters	Record Parameters	Define Input Filenames
Parameters	Translate	Help
Quit		

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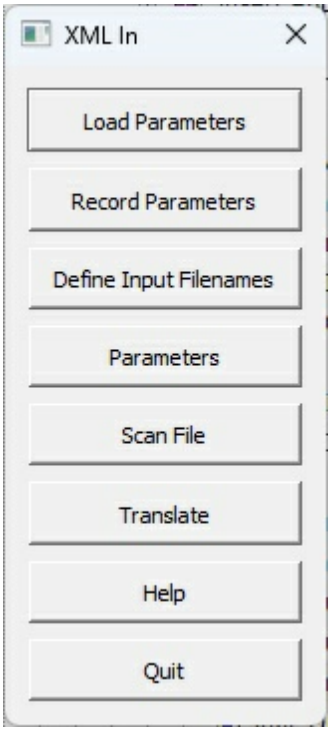

Load Parameters
Loads previously recorded XML In (.xmi) parameter file.

Record Parameters
Records current translation parameters to a XML In (.xmi) parameter file.

Define Input Filenames
Allows XML input files to be selected. Also allows a VrOne output file to be defined for each input file. Looks for files with an extension of .xml by default, but attempts to read in any file chosen.
The VrOne output filenames are only used if the "Translate to separate VrOne files" option is on.

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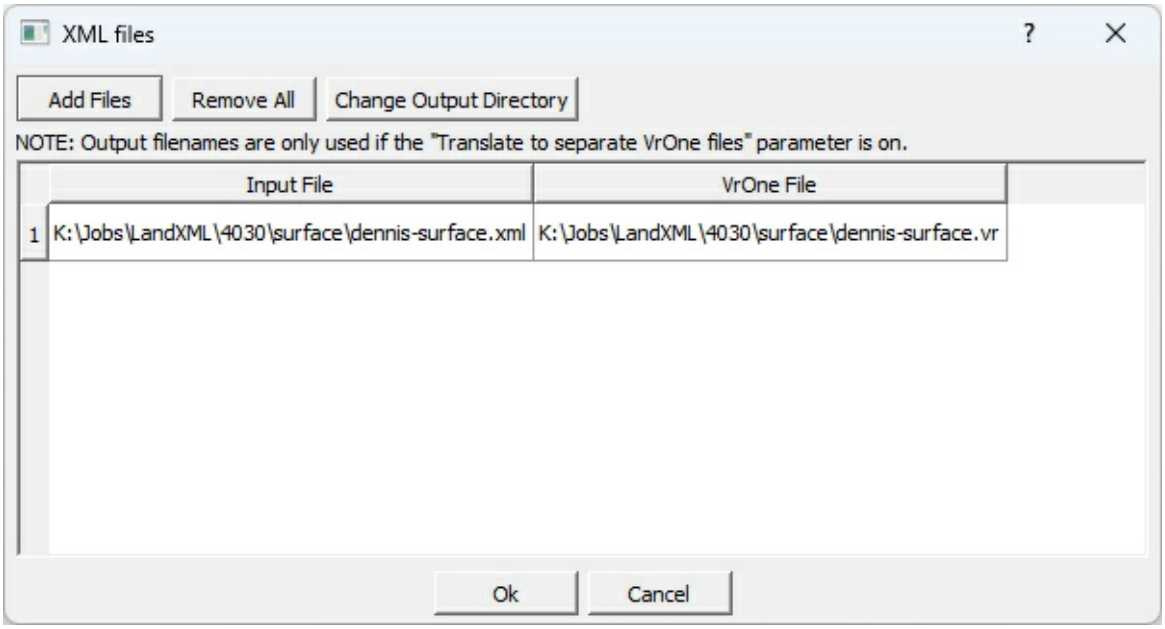
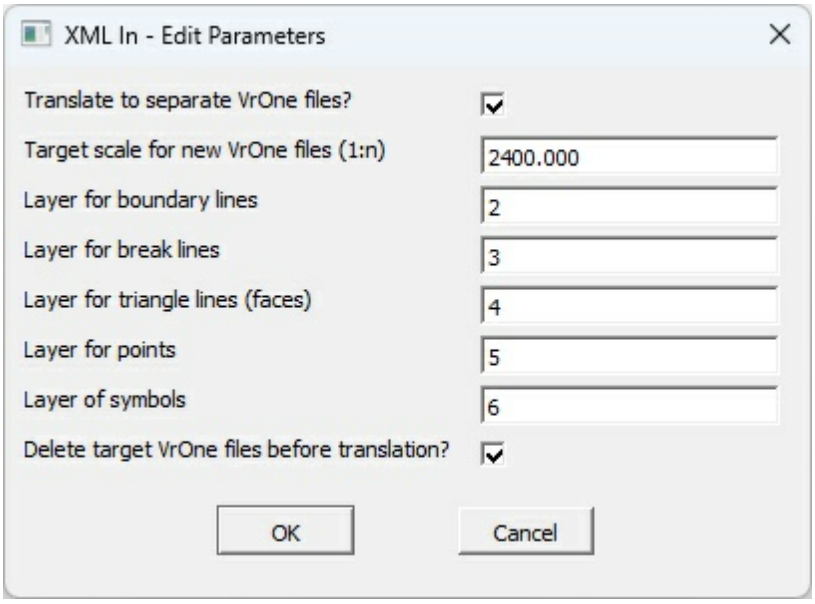


The Define Input Filenames dialog box

- **Add Files -** Displays a standard VrOne file selection dialog. All files selected are added to the list of Input files. Generates a VrOne output filename based on each input filename.
- **Remove All -** Removes all files from the Input file table.
- **Change Output Directory -** Allows changing the output directory (folder). By default, the output directory is the same as the input file directory.

Parameters

Allows the entry and editing of translation parameters.



The Edit Parameters dialog Box

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Translate to separate VrOne files?
Determines whether the XML input files are translated to a separate VrOne files. The Input to Output filename cross-reference is set in the "Define Input Filenames" dialog.

Target Scale for new VrOne files (1:n)
Defines target scale to use when creating the new VrOne file if the "Translate to separate VrOne files?" is on and a VrOne file does not exist during translation.

Layer for boundary lines
Specifies layer into which to place boundary lines. The boundary lines are defined with the Boundary element in the XML file(s). If this field is set to zero then boundary lines will not be translated.

Layer for break lines
Specifies layer into which to place break lines. The break lines are defined with the Breakline element in the XML file(s). If this field is set to zero then break lines will not be translated.

Layer for triangle lines (faces)
Specifies layer into which to place break lines. The triangle lines are defined with the Faces element that is preceded with the Pnts element in the XML file(s). If this field is set to zero then triangle lines (faces) will not be translated.

Layer for points
Specifies layer into which to place translated points. If this layer is specified, the coordinate positions in the Pnts element will be saved as VrPoints, which is the data type typically used to store LiDAR and/or point cloud data. If this field is set to zero then points will not be translated as VrPoints.

Layer for symbols
Specifies layer into which to place translated symbols. If this layer is specified, the coordinate positions in the CgPoints element will be saved as symbols. NOTE: If this field is set to zero then points will not be translated as VrPoints.

Delete target VrOne files before translation?
If this option is checked each target VrOne file will be deleted before translation if it exists. If this option is unchecked and the target VrOne file exists, the new data will be appended to the file. This parameter is considered only if the "Translate to separate VrOne files" option is checked.

Translate
Begins the file translation process. All files that were defined by the “Define input Filenames” option are imported.

Help
Starts the browser and displays the current help document.

Quit
Quits XML In and allows current parameters to be saved if they were altered.

XML In (GriIn)
- Added December 2023 - Version 07.01.22

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2.1.1.25.22 XML Out

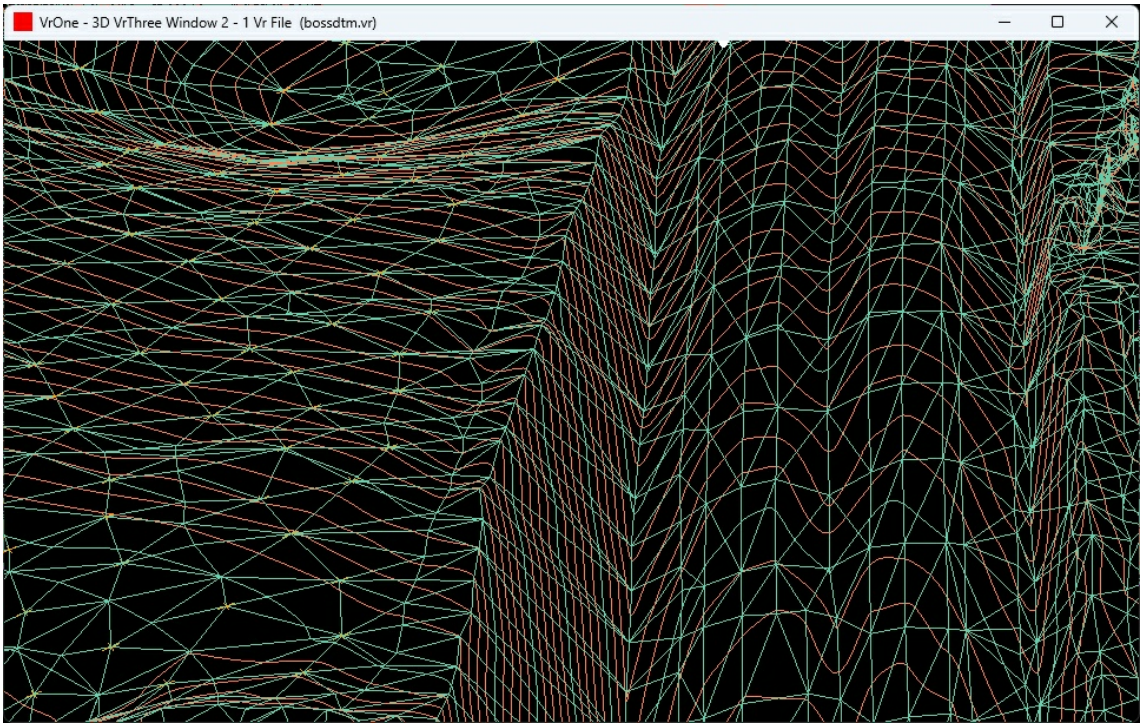
ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

XML Out (XmlOut)

Type: Translator

Translates VrOne lines and symbols into a XML (Extensible Markup Language) file and is based on the LandXML schema



DTM Surface

The LandXML schema is usually used to represent surface data (ground or topography of

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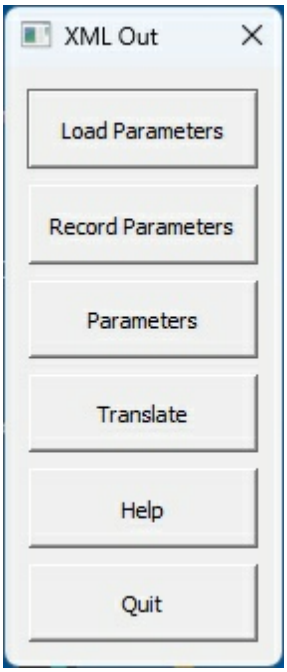
terrain). XML Out includes the translation of Vr Symbols and Vr Points (LiDAR). Both of these entity types are translated using the coordinate position and no other attributes are translated. The LandXML schema is not designed for storing and displaying point cloud data or individual point coordinates. Even though LiDAR coordinate positions can be translated, it is recommended that LAS Out is used to translate LiDAR data. The LAS format is specifically designed for efficiently representing point cloud data.

Load Parameters	Record Parameters	Parameters
Translate	Help	Quit



The XML Out button box.

Load Parameters

Loads previously recorded XML Out (.xmo) parameter file.

Record Parameters

Records current translation parameters to a XML Out (.xmo) parameter file.

Parameters

Allows editing of the translation parameters.

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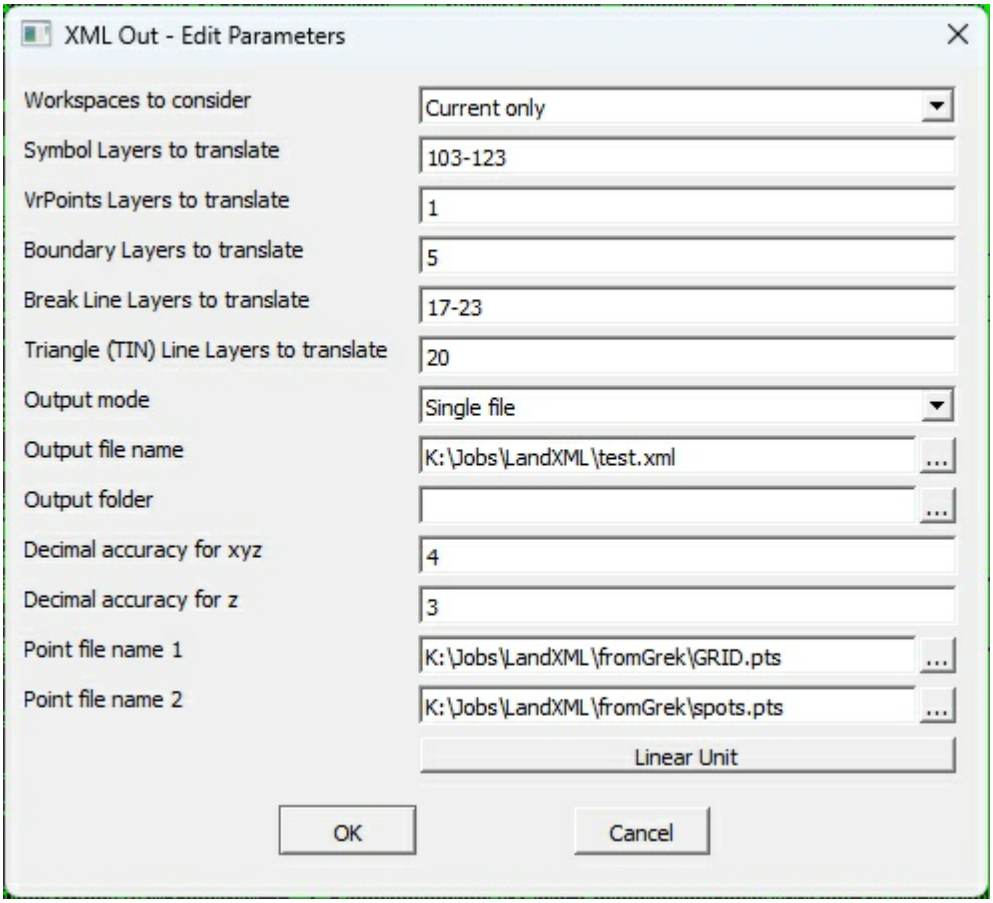

The Edit Parameters dialog box

Workspaces to consider

Defines the workspaces to consider when exporting XML Out files. Options are "Current only" and "All open".

Symbol Layers to translate

Defines the symbol layers in the VrOne file(s) to translate. A Number Line may be used to define these layers. Symbols are defined using the LandXML CgPoints element with the "Symbols" attribute. If this field is empty, symbols will not be translated.

VrPoints Layers to translate

Defines the VrPoints layers in the VrOne file(s) to translate. A Number Line may be used to define these layers. VrPoints are defined using the LandXML CgPoints element with the "VrPoints" attribute. If this field is empty, VrPoints will not be translated.

Boundary Layers to translate

Defines the layers containing boundary lines in the VrOne file(s) to translate. A Number Line may be used to define these layers. Boundary lines are defined using the LandXML Boundary element. If this field is empty, boundary lines will not be translated.

Triangle (TIN) Line Layers to translate

Defines the layers containing triangle lines that define a surface in the VrOne file(s) to translate. A Number Line may be used to define these layers. The three coordinate positions of each

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triangle is used to create a LandXML surface using the Pnts and Faces elements. A DTM surface must be created in VrOne using SetDtm and RunDtm with the Legs Layer defined. The Legs Layer should be used as the Triangle Line Layer. If this field is empty, triangle lines will not be translated.

Break Line Layers to translate
Defines the layers containing break lines in the VrOne file(s) to translate. A Number Line may be used to define these layers. If this field is empty, break lines will not be translated.

Output mode
Determines handling of output files during translation.

- **Single File** - All open workspaces are translated into a single XML file. The "Output file name" field determines the output file name. The "Output directory" field may be used to place the output file in a different folder than the VrOne file.
- **One File Per Workspace** - A XML file is created for each open workspace. The output filename is the same as the workspace (VrOne) filename with a .xml extension. The "Output directory" field may be used to place the output files in a different folder than the VrOne files.

Output file name
Defines the output file name when "Output mode" is set to "Single File". This name is ignored if "Output mode" is set to "One file per workspace". The file extension for a XML file is ..xml

Output folder
Defines the folder name to place the output file(s). This field may be left blank to place the output files in same the directory as the VrOne files.

Decimal accuracy for xy
Defines the number of decimal places for the x, y coordinates in the output file(s).

Decimal accuracy for z
Defines the number of decimal places for the z coordinates (elevation or altitude) in the output file(s).

Point file name 1
File name for an existing ASCII point file. The format of this file is determined by the software translating the XML file(s).

Point file name 2
File name for an existing ASCII point file. The format of this file is determined by the software translating the XML file(s).

Linear Unit

Allows for the definition of the Linear Unit (linearUnit=) attribute in the Units Element in the output file.

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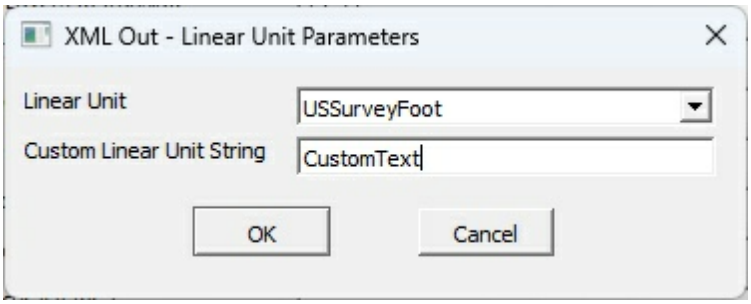

Linear Unit Attribute Dialog

- **Linear Unit** - Defines the Linear Unit. Options include Foot, USSurveyFoot, Inch, Mile, Millimeter, Centimeter, Meter, Kilometer, and Custom. If Custom is selected then the string defined in the Custom Linear Unit String parameter is used.
- **Custom Linear Unit String** - If the Linear Unit is set to Custom them this text string will be used as the Linear Unit.

Translate

Begins the file translation process. Upon completion, XML (.xml) file or files will be created.

Help

Starts the browser and displays the current help document.

Quit

Quits XML Out and allows current parameters to be saved if they were altered.

XML Out (XMLOut) added June 2023 - Version 07.01.20
Added Linear Units definition - January 2025 - Version 07.01.24

2.1.1.26 Version

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Vr Mapping

Version

Name	Key-in	Description
Global Help	Ghelp	Displays this page.
Local Help	Help	Displays information about the currently running application.

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Release Notes	RelNot	Displays the release notes.
Help Index	HelInd	Displays the help main page (List of Commands).
About	Abo	Displays information about VrOne, including version.

2.1.1.27 Videomap

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Vr Mapping

Videomap

The Ziess Vidomap system is a CRT based system for the display of vector superimposition on stereo models. This system is an option to the Zeiss Planicomp series of analytical stereo plotters.

Name	Key-in	Description
Replot	VidRep VmRep	Replots vectors from workspace 1 to Videomap.
Test	VidTes VmTes	Tests Videomap by drawing a cross at graphics origin.
Videomap On	VmOn	Turns Videomap on.
Videomap Off	VmOff	Turns Videomap off.

NOTE: Videomap must be configured in the Vr Configuration program (VrCfig) for Videomap commands to be recognized.

2.1.2 Python Programming

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Vr

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Mapping

Python Programming



Overview
Why Python?
Prerequisites
Getting Started
VrOne/Python Classes
Examples
Warning

Overview

Python is an object-oriented scripting language. Its design mixes software engineering features of traditional languages with the usability of scripting languages. Python scripts can be written that interface with VrOne through VrOne/Python classes. The VrOne/Python classes allow full access to the VrOne database and interactive mapping features. Python is a great way to extend the capabilities of the existing VrOne collection applications. For example, a Python script could be written to place symbols on the ends of a line each time the line is saved. (See the example AddPosts.py)

Why Python?

It's easy to learn

Python is a full-featured programming language and you should have prior programming experience, but compared to other programming languages, the core Python language is amazingly easy to learn. The new Python programmer should expect to be coding significant Python programs in a matter of days. If you know C, C++, Pascal, BASIC, FORTRAN or Java you will be writing Python in minutes.

It's powerful

From a features perspective, Python is something of a hybrid. Its tool set places it between

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traditional scripting languages such as Tcl, Scheme, and Perl, and systems languages such as C, C++, and Java. Python provides all the simplicity and ease of use of a scripting language as well as the more advanced programming tools typically found in systems development languages.

It's easy to use

For many, Python's combination of rapid turnaround and language simplicity makes programming more fun than work. To run a Python program, you simply type it and run it. There are no intermediate compile and link steps. As with other interpreted languages, Python executes immediately, which makes for both an interactive programming experience and rapid turnaround after program changes.

It's object-oriented

Python is an object-oriented language, from the ground up. Its class model supports advanced notions such as polymorphism, operator overloading, and multiple inheritance. Yet, iin the context of Python's dynamic typing, object-oriented programming (OOP) is remarkably easy to apply. In fact, if you don't understand these terms, you'll find they are much easier to learn with Python than with just about any other OOP language available. In most cases, the new programmer will find that task oriented object-oriented programming is clearer and easier to implement than older procedural programming methods. If you are a new programmer and unfamiliar with OOP, look at the examples to see how clear they are before going back to school.

It's free

Although VrOne comes with all the necessary software to run Python scripts within VrOne, the entire system can be downloaded from the Internet for free.

Prerequisites

The VrOne/Python programmer should have some prior programming experience with Python or other languages such as C, C++, Pascal, BASIC or Java. This is not an absolute requirement, but the Python programmer should be ready to learn about variables, looping, conditional branching and other basic programming concepts. There are several good programming books on Python available at local bookstores such as Barnes and Noble or online at such sites as www.amazon.com.

Since VrOne/Python gives full read/write access to the VrOne database, you should understand the VrOne database and data structures.

Although the Python interpreter is embedded in VrOne and no other software is required to run Python scripts, it is recommended that the user download the Python development. Python is freely available for download from www.python.org. Versions are available for UNIX, Windows, Macintosh, and Java. In addition, this site includes links to documentation, how-to guides, and a wide assortment of extension modules.

Getting Started

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VrOne/Python scripts are written using any text editor and stored in the \vr\python directory. Scripts may be stored in other directories and those directories may be entered as a File Path in the Vr Configuration program. Python scripts are started in VrOne by entering the word Python, Pyt or Py and the script name. For example `Py AddPosts`. If "Require PY command to run Python scripts" is turned off, you can simply type the name of the Python script to run it (assuming there is not a built-in command, function key, or macro of the same name).

It is also possible to pass arguments to the Python scripts from the command window. Any items added to the command line while Python Scripts are running will show up in the VrArgs global list variable. Arguments must be separated by spaces. If an argument contains spaces it must be surrounded by quotes. For example, to run a python script named "drawcircle" that takes arguments for the center point and radius you would type "py drawcircle "10.0 10.0 20.0" 150.0". In this case the VrArgs variable will contain two elements, and if printing the VrArgs variable will display the following: ['10.0 10.0 20.0', '150.0'].

When VrOne starts, a Command Prompt window starts with it. This Command Prompt window displays output from a Python script. Any errors which occur during the execution of a script it is displayed in this window. During development, it is recommended that this window be left partially visible so any output can be seen.

Python scripts may be started from the following areas:

- **Key-ins** – Python scripts may be started anytime from a VrOne key-in.
- **Function Keys** – Python scripts add to the power and flexibility of Function Keys. The most common use is in the OnEnd command. This allows modification of an entity each time it is saved. Please see the AddPosts example.
- **Macros** – Python scripts may be embedded in VrOne macros.

VrOne/Python Classes

Python classes have been developed to facilitate the interfacing and communication between a Python script and VrOne. These classes are:

PyVrWs	Manages VrOne file (workspace) queries and some file operations.
PyVrLine	Holds and manipulates VrOne line data including loading lines from a file.
PyVrSym	Holds and manipulates VrOne symbol data including loading symbols from a file.
PyVrText	Holds and manipulates VrOne text label data including loading text labels from a file.
PyVrPunt	Holds and manipulates VrOne point data.
PyVrGeom	Coordinate geometry routines
PyVrGui	Graphical user interface and miscellaneous system routines

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PyVrDtm	DTM routines
PyVrDtmMgr	DTM Surface Management routines
PyVrGr	Graphics routines for drawing directly to graphics windows, and querying cursor state.
PyVrLayer	Layer management routines
PyVrCfg	Allows various VrOne configuration parameters to be viewed and changed.
PyVrMenuKeys	Displays standard menu keys dialog.
VrPromBox	Creates a dialog box with programmable entry fields (prompts) to allow entry of parameters.
PyVrApp	Provides a way to write true event-driven python scripts that have the look and feel of a standard VrOne application.
PyVrImgMgr	Image management routines.

Examples

The following examples offer a starting point for VrOne/Python programming. These examples are delivered with each version of VrOne. If you modify and use one of these examples it must be renamed or moved to another directory so it will not be overwritten during the installation of a new VrOne release. The examples are found in the vr\Python directory. NOTE: Tab stops for the example Python (.py) files are set to three.

Program Name	Demonstrates	Description
AddCircle.py	PyVrSym, PyVrLine	Loads the last symbol and draws a star type line around the symbol.
AddPosts.py	PyVrLine, PyVrSym	Loads the last line and adds symbols to line ends.
ChangeLines.py	PyVrWs, PyVrLine	Loads all the lines in current workspace, changes the layers and graphic pointers and re-records them.
ChangeSymbols.py	PyVrWs, PyVrSym	Loads all the symbols in the current workspace, changes the layers and graphic pointers and re-records them.
ChangeText.py	PyVrWs, PyVrText	Loads all the text in the current workspace and changes the text label to the elevation of the entity.
FindLayer12.py	PyVrWs	Counts lines, symbols and text in layer 12 in all open workspaces.
IdLine.py	PyVrLine	Locks onto lines and changes their layer graphic pointer to 5 and their width to 3. The lines will not be resaved, so a replot (Rep) will return the screen to its original state.

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IdSym.py	PyVrSym	Locks onto symbols, changes its graphic pointer, adds 20 degrees to their rotation, makes them four times their original size, and redisplays them. The symbols will not be resaved, so a replot (Rep) will return the screen to its original state.
IdText.py	PyVrText	Locks onto text entities, change their text labels to their elevation. The text entities will not be resaved, so a replot (Rep) will return the screen to its original state.
WriteAscii.py	PyVrLine, PyVrSym, PyVrText	Reads all lines, symbols and text in workspace 0 and writes them to a text file.
TextIn.py	PyVrText, PyVrGui	Allows user to import an ASCII text file as VrOne text labels. Displays open file dialog and prompts for coordinate point.
DtmTest.py	PyVrLine, PyVrDtm, PyVrSym	Tests various features of the PyVrDtm class.
TestVrWs	PyVrWs	Tests various capabilities of the PyVrWs class.
TestVrGr	PyVrGr	Tests various capabilities of the PyVrGr class.
TestImgMgr	PyVrImgMgr	Tests various capabilities of the PyVrImgMgr class.

Warning

Like any powerful programming language, Python has the ability to modify and damage data. VrOne/Python programming allows modification of the VrOne database and programming errors made by you could damage VrOne files. During development you should back up any VrOne files that will be open during Python program execution!

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If you disagree with the above warning and disclaimer, please do not use Python programming in VrOne.

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2.1.2.1 PyVrApp

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Vr Mapping

Application Class Reference (PyVrApp)

Vr Application Class More...

Members

- SetDigCB (Function)
- SetKeyCB (Function)
- SetCmdCB (Function)
- SetReplotCB (Function)
- Close ()
- KeepRunning ()
- StopRunning ()

Description

The Python Vr Application class provides a way to write true event-driven Python scripts that have the look and feel of a standard VrOne application. When you create a Python VrApp class, a new application is added to the application stack just like any built-in application such as Insert Line. The user can be presented with a menu keys dialog box that looks like the ones used by standard VrOne applications. You can also respond to user command entries such as "lay=10". Using event-driven designs, Python scripts can become very interactive applications. While applications created with Python are treated similarly to built-in VrOne applications, only one Python application can be run at a time. Standard VrOne apps and one Python application can be mixed on the stack. See the testvrapp.py script to see an example of a simple application that demonstrates the capabilities of the VrApp class.

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Member Function Documentation

SetDigCB (Function)

Sets callback function for digitizer events. Allows the Python script to respond when the cursor is moved or keys are pressed.

Function	Python function to handle digitizer events. This is a function that you must create in your Python script. The function should have the following format: 'def MyAppDigCB (x, y, z, key):'

SetKeyCB (Function)

Sets callback function for menu key events. Allows the Python script to respond when the user presses a menu key.

Function	Python function to handle digitizer events. This is a function that you must create in your Python script. The function should have the following format: 'def MyAppKeyCB (key):'

SetCmdCB (Function)

Sets callback function for command events. Allows the Python script to respond when the user keys in commands.

Function	Python function to handle command events. This is a function that you must create in your Python script. The function should have the following format: 'def MyAppCmdCB (cmdStrg):'

SetReplotCB (Function)

Sets callback function for replot events. Allows the Python script to respond when a graphics window is replotted. This is useful if the script is displaying temporary information that needs to be refreshed when the graphics windows are replotted.

Function	Python function to handle replot events. This is a function that you must create in your Python script. The function should have the following format: 'def MyAppReplotCB (WinNum):'

Close ()

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Closes the current application. This should always be called before calling the StopRunning method.

KeepRunning ()

This must be called at the end of Python script to keep the script running. A call to StopRunning must be made from one of the callback functions to allow the script to exit.

StopRunning ()

Stops the current script from running. The Close method should always be called before StopRunning.

2.1.2.2 PyVrCfg

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Vr Mapping

Configuration Class Reference (PyVrCfg)

VrOne/Python Configuration Class More...

Members

- Load (FileName)
- Rec ()
- GetVrVersion ()
- SetUseDefaultDir (UseDefaultDir)
- UseDefaultDir ()
- SetDefaultDir (ProgNum, DefaultDir)
- GetDefaultDir (ProgNum, Override)
- GetSymFileName ()

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- SetSymFileName (FileName)
- GetCharSetDir ()
- GetColorTableScreen ()
- GetColorTablePlot ()
- GetColorTableOverride ()
- GetLayerNameFile ()
- GetPenTable ()
- SetPenTable (FileName)
- GetUsePenTable ()
- GetBackgroundColor ()
- GetSeaRad ()
- GetSeaDim ()
- GetSplineChord ()
- GetBSplineIncr ()
- GetStrokeDist ()
- GetStrokeMode ()
- GetFillDist ()
- GetMinTextSize ()
- GetMinSymSize ()
- GetMbrOffset ()
- SetDspLines (DspLines)
- GetDspLines ()
- SetDspSplines (DspSplines)
- GetDspSplines ()
- SetDspLfonts (DspLfonts)
- GetDspLfonts ()
- SetDspConstr (DspConstr)
- GetDspConstr ()
- SetDspLinePoints (DspLinePoints)
- GetDspLinePoints ()
- SetDspLineElevs (DspLineElevs)
- GetDspLineElevs ()
- SetDspSymbols (DspSymbols)
- GetDspSymbols ()
- SetDspText (DspText)
- GetDspText ()
- SetDsplLines (DsplLines)

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- GetDsplLines ()
- SetDsplSymbols (DsplSymbols)
- GetDsplSymbols ()
- SetDsplText (DsplText)
- GetDsplText ()
- SetMbrOffset (Offset)
- SetColorTableOverride (ColorTableName)
- SetSplineChord (SplineChord)
- SetBSplineIncr (BSplineIncr)
- SetCursorType (CursorType)
- GetCursorType ()
- SetCursorSize (CursorSize)
- GetCursorSize ()
- SetCursorColor (CursorColor)
- GetCursorColor ()
- SetCursorMaskSize (CursorSize)
- GetCursorMaskSize ()
- SetCursorMaskShape (CursorShape)
- GetCursorMaskShape ()
- SetCursorTrackPlane (TrackPlane)
- GetCursorTrackPlane ()
- GetImgPyraDir ()
- GetImgPyraDrive ()
- TogImgEdges ()
- SetImgEdges (ImgEdges)
- GetImgEdges ()
- TogImgNames ()
- SetImgNames (ImgNames)
- GetImgNames ()
- SetImgDrawMode (DrawMode)
- GetImgDrawMode ()
- GetWinShift ()
- SetWinShift (WinShift)
- SetBufXyXyzInput (BufMode)
- GetBufXyXyzInput ()
- SetWinSync (WinSync)
- GetWinSync ()

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- SetGridStus (GridStus)
- GetGridStus ()
- SetGridRes (GridRes)
- GetGridRes ()
- SetGridType (GridType)
- GetGridType ()
- SuspendGrid ()
- ResumeGrid ()
- SetCursConstStus (CursConstStus)
- GetCursConstStus ()
- TogCursConstStus ()
- GetXyDigId ()
- SetXyDigId (XyDigId)
- GetXyDigDelay ()
- GetXyDigMode ()
- GetXyzDigId ()
- SetXyzDigId (XyzDigId)
- GetXyzDigDelay ()
- SetVrTwoWake (WakeMode)
- GetVrTwoWake ()
- SetVrTwoEdgeDist (EdgeDist)
- GetVrTwoEdgeDist ()
- SetHwId (HwId)
- GetHwId ()
- SetHwSfX (HwSfX)
- GetHwSfX ()
- SetHwSfY (HwSfY)
- GetHwSfY ()
- SetHwSfZ (HwSfZ)
- GetHwSfZ ()
- SetHwLocZ (HwLocZ)
- GetHwLocZ ()
- SetMouseTwSf (Sf)
- GetMouseTwSf ()
- SetMouseKeyX (RawKey, KeyX)
- GetMouseKeyX (RawKey)
- SetZSource (ZSource)

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- GetZSource ()
- SetActiveZ (ActiveZ)
- GetActiveZ ()
- IncActiveZ (DeltaZ)
- GetForceZ ()
- SetForceZ (ForceZ)
- GetContInt ()
- SetContInt (ContInt)
- GetSnapZToActiveZ ()
- SetSnapZToActiveZ (SnapZToActiveZ)
- SetPlotFormat (PlotFormat)
- GetPlotFormat ()
- GetPlotIface ()
- GetPlotBrightContrast ()
- SetPlotBrightContrast (Bright, Contrast)
- GetVrPathDir (DirNum)
- SetVrPathDir (DirNum, DirName)
- GetActiveDig ()
- GetOpenLastVr ()
- GetOpenLastImg ()
- GetPromptUnits ()
- GetMaxApps ()
- SetMwDecAccur (DecAccur)
- GetMwDecAccur ()
- GetMmPerInch ()
- GetMetersToFeet ()
- GetBrowser ()
- GetFkeyFileName ()
- GetMbCmdFileName ()
- GetKpCmdFileName ()
- GetMacroFileName ()
- SetBeepStus (BeepStus)
- GetBeepStus ()
- GetBeep (ButtonNum)
- SetBeep (ButtonNum, BeepStatus)
- SetBeep2 (BeepStatus)
- GetBeepSound (ButtonNum)

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- SetBeepSound (ButtonNum, BeepSound)
- SetBeepNormal (BeepSound)
- GetBeepNormal ()
- SetBeepAlert (BeepSound)
- GetBeepAlert ()
- SetBeepPlotStart (BeepSound)
- GetBeepPlotStart ()
- SetBeepPlotDone (BeepSound)
- GetBeepPlotDone ()
- SetNumLockControl (State)
- GetNumLockControl ()

Description

The Configuration class allows various VrOne configuration parameters to be viewed and changed.

```
Example:

from pycfg import *

Cfg = VrCfg ()

(VrVersion) = Cfg.GetVrVersion ()
```

Member Function Documentation

Load (FileName)

Loads configuration from disk.

FileName	Configuration file name. (0=Use default)	
returns	(ret)	
	ret	returns 0 = OK 1 = File did not exist and was created. -1 = Could not open file.

Rec ()

Records the current configuration.

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returns	(ret)	
	ret	0=Success, 1=Failed

GetVrVersion ()

Returns the VrOne version string.

returns	(VrVersion)	
	VrVersion	VrOne version string

SetUseDefaultDir (UseDefaultDir)

Sets whether or not VrOne uses default directories.

UseDefaultDir	0=Don't use default directories, 1=Use default directories

UseDefaultDir ()

Returns status of default directory usage.

returns	(ret)	
	ret	0=Not using default directories, 1=Using default directories

SetDefaultDir (ProgNum, DefaultDir)

Sets the default directory for a program

ProgNum	Program number
DefaultDir	Default directory

GetDefaultDir (ProgNum, Override)

Returns the default directory for a program. If UseDefaultDir is FALSE then NULL is returned

ProgNum	Program number (see vrcfg.h)	
Override	TRUE - Always return default directory FALSE - If UseDefaultDir is FALSE then NULL is returned	
returns	(ret)	
	ret	Default directory

GetSymFileName ()

Gets the current symbol filename.

returns	(ret)	
	ret	Current symbol filename.

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SetSymFileName (FileName)

Sets the current symbol filename. The specified symbol file is loaded.

FileName	Name of symbol file to load.

GetCharSetDir ()

Returns the directory that the character set files are in.

returns	(ret)	
	ret	Directory of character set files.

GetColorTableScreen ()

Returns the color table for screen filename.

returns	(ret)	
	ret	Color table for screen filename.

GetColorTablePlot ()

Returns the color table for plotting filename.

returns	(ret)	
	ret	Color table for plotting filename.

GetColorTableOverride ()

Returns the color table override filename.

returns	(ret)	
	ret	color table override filename.

GetLayerNameFile ()

Returns name of file containing layer names.

returns	(ret)	
	ret	Name of file containing layer names.

GetPenTable ()

Returns the pen table filename.

returns	(ret)

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	ret	Pen table filename.

SetPenTable (FileName)

Sets the pen table filename.

FileName	Pen table filename.

GetUsePenTable ()

Gets status of pen table usage.

returns	(ret)	
	ret	0=Pen table not being used, 1=Pen table being used.

GetBackgroundColor ()

Returns current background color.

returns	(ret)	
	ret	Background color (1-255)

GetSeaRad ()

Returns current search radius.

returns	(ret)	
	ret	Current search radius.

GetSeaDim ()

Returns current search dimension.

returns	(ret)	
	ret	Current search dimension.

GetSplineChord ()

Returns the spline chord length in in. or mm.

GetBSplineIncr ()

Returns the B-Spline increment

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GetStrokeDist ()

Returns the stroke distance for wide lines.

GetStrokeMode ()

Returns the stroke mode for wide line.

GetFillDist ()

Returns the fill distance for wide lines.

GetMinTextSize ()

Returns the minimum text size for plotting.

GetMinSymSize ()

Returns the minimum symbol size for plotting.

GetMbrOffset ()

Returns the default MBR offset

SetDspLines (DspLines)

Sets the display line status.

DspLines	0=Don't display lines, 1=Display lines

GetDspLines ()

Gets the display line status.

returns	(ret)	
	ret	0=Don't display lines, 1=Display lines

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SetDspSplines (DspSplines)

Sets the display splined line status.

DspSplines	0=Don't display splined lines, 1=Display splined lines

GetDspSplines ()

Gets the display splined line status.

returns	(ret)	
	ret	0=Don't display splined lines, 1=Display splined lines

SetDspLfonts (DspLfonts)

Sets the display line fonts status.

DspLfonts	0=Don't display line fonts, 1=Display line fonts

GetDspLfonts ()

Gets the display line fonts status.

returns	(ret)	
	ret	0=Don't display line fonts, 1=Display line fonts

SetDspConstr (DspConstr)

Sets the display construction lines status.

DspConstr	0=Don't display construction line, 1=Display construction lines

GetDspConstr ()

Gets the display construction lines status.

returns	(ret)	
	ret	0=Don't display construction line, 1=Display construction lines

SetDspLinePoints (DspLinePoints)

Sets the display line points flag.

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DspLinePoints	0=Don't display line points, 1=Display line points

GetDspLinePoints ()

Gets the display line points flag.

returns	(ret)	
	ret	0=Don't display line points, 1=Display line points

SetDspLineElevs (DspLineElevs)

Sets the display line elevations flag.

DspLineElevs	0=Don't display line elevations, 1=Display line elevations

GetDspLineElevs ()

Gets the display line points flag.

returns	(ret)	
	ret	0=Don't display line elevations, 1=Display line elevations

SetDspSymbols (DspSymbols)

Sets the display symbols flag.

DspSymbols	0=Don't display symbols, 1=Display symbols

GetDspSymbols ()

Gets the display symbols flag.

returns	(ret)	
	ret	0=Don't display symbols, 1=Display symbols

SetDspText (DspText)

Sets the display text flag.

DspText	0=Don't display text, 1=Display text

GetDspText ()

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Gets the display text flag.

returns	(ret)	
	ret	0=Don't display text, 1=Display text

SetDspILines (DspILines)

Sets the display interactive lines flag.

DspILines	0=Don't display interactive lines, 1=Display interactive lines

GetDspILines ()

Gets the display interactive lines flag.

returns	(ret)	
	ret	0=Don't display interactive lines, 1=Display interactive lines

SetDspISymbols (DspISymbols)

Sets the display interactive symbols flag.

DspISymbols	0=Don't display interactive symbols, 1=Display interactive symbols

GetDspISymbols ()

Gets the display interactive symbols flag.

returns	(ret)	
	ret	0=Don't display interactive symbols, 1=Display interactive symbols

SetDspIText (DspIText)

Sets the display interactive text flag.

DspIText	0=Don't display interactive text, 1=Display interactive text

GetDspIText ()

Gets the display interactive text flag.

returns	(ret)

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	ret	0=Don't display interactive text, 1=Display interactive text

SetMbrOffset (Offset)

Sets the entity MBR offset used when searching.

Offset	MBR offset.

SetColorTableOverride (ColorTableName)

Sets the color table override filename.

ColorTableName	Color table override filename

SetSplineChord (SplineChord)

Sets the spline chord length.

SplineChord	Spline chord length (in|mm) It is expected that the parameter is in the proper units (inches or millimeter).

SetBSplineIncr (BSplineIncr)

Sets the B spline increment. Sets the number of points that will be added between current points.

BSplineIncr	

SetCursorType (CursorType)

Sets the cursor type.

CursorType	0=Cross 1=Dot

GetCursorType ()

Returns the cursor type.

returns	(ret)	
	ret	0=Cross 1=Dot

SetCursorSize (CursorSize)

Sets the cursor size.

CursorSize	Cursor size in pixels

GetCursorSize ()

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Returns the cursor size in pixels.

returns	(ret)	
	ret	Cursor size in pixels

SetCursorColor (CursorColor)

Sets the cursor color.

CursorColor	0=White 1=Black 2=Red 3=Green 4=Blue 5=Yellow

GetCursorColor ()

Gets the cursor color.

returns	(ret)	
	ret	0=White 1=Black 2=Red 3=Green 4=Blue 5=Yellow

SetCursorMaskSize (CursorSize)

Sets the cursor mask size.

CursorSize	Cursor mask size in pixels

GetCursorMaskSize ()

Gets the cursor mask size.

returns	(ret)	
	ret	Cursor mask size in pixels

SetCursorMaskShape (CursorShape)

Sets the cursor mask shape.

CursorShape	0=Square,1=Circle

GetCursorMaskShape ()

Gets the cursor mask shape.

returns	(ret)	
	ret	0=Square,1=Circle

SetCursorTrackPlane (TrackPlane)

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Sets the cursor track plane for VrTwo.

TrackPlane	0=VIEW_PLANE 1=GROUND_PLANE

GetCursorTrackPlane ()

Gets the cursor track plane for VrTwo.

returns	(ret)	
	ret	0=VIEW_PLANE 1=GROUND_PLANE

GetImgPyraDir ()

Returns the image pyramid directory.

GetImgPyraDrive ()

Returns the image pyramid drive.

TogImgEdges ()

Toggles the display of image edges/names (Mono view only).

SetImgEdges (ImgEdges)

Sets the image edge display flag.

ImgEdges	0=Don't display image edges, 1=Display image edges

GetImgEdges ()

Gets the image edge display flag.

returns	(ret)	
	ret	0=Don't display image edges, 1=Display image edges

TogImgNames ()

Toggles the display of image edges/names (mono view only).

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SetImgNames (ImgNames)

Sets the image edge display flag.

ImgNames	0=Don't display image names, 1=Display image names

GetImgNames ()

Gets the image edge display flag.

returns	(ret)	
	ret	0=Don't display image names, 1=Display image names

SetImgDrawMode (DrawMode)

Sets image draw mode.

DrawMode	1=Draw, 3=Xor, 4=Or

GetImgDrawMode ()

Gets image draw mode.

returns	(ret)	
	ret	1=Draw, 3=Xor, 4=Or

GetWinShift ()

Gets Window shift flag.

returns	(ret)	
	ret	0=Window shifting off, 1=Window shifting on

SetWinShift (WinShift)

Sets Window shift flag.

WinShift	0=Window shifting off, 1=Window shifting on

SetBufXyXyzInput (BufMode)

Sets input buffering flag.

BufMode	0=Off, 1=On

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GetBufXyXyzInput ()

Gets input buffering flag.

returns	(ret)	
	ret	0=Off, 1=On

SetWinSync (WinSync)

Sets window synchronization flag.

WinSync	0=Off, 1=On

GetWinSync ()

Gets window synchronization flag.

returns	(ret)	
	ret	0=Off, 1=On

SetGridStus (GridStus)

Sets grid display flag.

GridStus	0=Off, 1=On

GetGridStus ()

Gets grid display flag.

returns	(ret)	
	ret	0=Off, 1=On

SetGridRes (GridRes)

Sets grid resolution.

GridRes	

GetGridRes ()

Gets grid resolution.

SetGridType (GridType)

Sets grid type.

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GridType	0=Points, 1=Lines

GetGridType ()

Gets grid type.

returns	(ret)	
	ret	0=Points, 1=Lines

SuspendGrid ()

Suspends grid display point snapping.

ResumeGrid ()

Resumes grid display point snapping.

SetCursConstStus (CursConstStus)

Sets cursor constraint mode flag.

CursConstStus	0=Off, 1=On

GetCursConstStus ()

Gets cursor constraint mode flag.

returns	(ret)	
	ret	0=Off, 1=On

TogCursConstStus ()

Toggles cursor constraint flag.

GetXyDigId ()

Gets the XY Digitizer ID.

SetXyDigId (XyDigId)

Sets the XY Digitizer ID.

XyDigId	

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GetXyDigDelay ()

Gets XY Digitizer delay.

GetXyDigMode ()

Gets XY Digitizer mode.

GetXyzDigId ()

Gets the XYZ Digitizer ID.

SetXyzDigId (XyzDigId)

Sets the XYZ Digitizer ID.

XyzDigId	

GetXyzDigDelay ()

Gets the XYZ digitizer delay amount.

SetVrTwoWake (WakeMode)

Sets VrTwo wake mode.

WakeMode	0=Static, 1=Roaming

GetVrTwoWake ()

Gets VrTwo wake mode.

returns	(ret)	
	ret	0=Static, 1=Roaming

SetVrTwoEdgeDist (EdgeDist)

Sets VrTwo edge distance.

EdgeDist	

GetVrTwoEdgeDist ()

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Gets VrTwo edge distance.

SetHwId (HwId)

Sets handwheel ID.

HwId	

GetHwId ()

Gets handwheel ID.

SetHwSfX (HwSfX)

Sets handweel X scale factor.

HwSfX	

GetHwSfX ()

Gets handweel X scale factor.

SetHwSfY (HwSfY)

Sets handweel Y scale factor.

HwSfY	

GetHwSfY ()

Gets handweel Y scale factor.

SetHwSfZ (HwSfZ)

Set handweel Z scale factor.

HwSfZ	

GetHwSfZ ()

Gets handweel Z scale factor.

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SetHwLocZ (HwLocZ)

Sets handweel Z location.

HwLocZ	0=Normal, 1=Z on right handwheel, 2=Z on left handwheel

GetHwLocZ ()

Gets handweel Z location.

returns	(ret)	
	ret	0=Normal, 1=Z on right handwheel, 2=Z on left handwheel

SetMouseTwSf (Sf)

Sets the Mouse thumbwheel Scale Factor.

Sf	Scale factor (1=none)

GetMouseTwSf ()

Returns the Mouse thumbwheel Scale Factor.

SetMouseKeyX (RawKey, KeyX)

Sets a mouse key cross-reference.

RawKey	Raw key value (1-16)
KeyX	Key cross-reference value

GetMouseKeyX (RawKey)

Gets the cross-reference value for a mouse key.

RawKey	Mouse raw device (1-16)	
returns	(ret)	
	ret	Cross-referenced key value

SetZSource (ZSource)

Sets Z source.

ZSource	0=Instrument or Active Z, 1=Dtm Z if active,

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	2=Force Z

GetZSource ()

Gets Z source.

returns	(ret)	
	ret	0=Instrument or Active Z, 1=Dtm Z if active, 2=Force Z

SetActiveZ (ActiveZ)

Sets active Z.

ActiveZ	

GetActiveZ ()

Gets active Z.

IncActiveZ (DeltaZ)

Increments active Z.

DeltaZ	Increment amount.

GetForceZ ()

Gets force Z flag.

returns	(ret)	
	ret	0=On, 1=Off

SetForceZ (ForceZ)

Sets force Z flag.

ForceZ	0=On, 1=Off

GetContInt ()

Gets contour interval.

SetContInt (ContInt)

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Sets contour interval.

ContInt	

GetSnapZToActiveZ ()

Gets snap z to active z flag.

returns	(ret)	
	ret	0=On, 1=Off

SetSnapZToActiveZ (SnapZToActiveZ)

Sets snap z to active z flag.

SnapZToActiveZ	0=On, 1=Off

SetPlotFormat (PlotFormat)

Sets the plot format.

PlotFormat	0=HPGL 1=HPGL2 2=HPGL2/RTL 3=POSTSCRIPT

GetPlotFormat ()

Sets the plot format.

returns	(ret)	
	ret	0=HPGL 1=HPGL2 2=HPGL2/RTL 3=POSTSCRIPT

GetPlotIface ()

Gets plot interface.

returns	(ret)	
	ret	0=TO_FILE 1=TO_RS232

GetPlotBrightContrast ()

Gets the plotter brightness and contrast adjustments.

returns	(Bright, Contrast)	
	Bright	Brightness adjustment 0-100 (50=none)
	Contrast	Contrast adjustment 0-100 (50=none)

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SetPlotBrightContrast (Bright, Contrast)

Sets the plotter brightness and contrast adjustments.

Bright	Brightness adjustment 0-100 (50=none)
Contrast	Contrast adjustment 0-100 (50=none)

GetVrPathDir (DirNum)

Returns a Vr path directory name.

DirNum	Directory number (0-9)	
returns	(DirName)	
	DirName	Return directory name (128 char)

SetVrPathDir (DirNum, DirName)

Sets a Vr path directory name.

DirNum	Directory number (0-9)
DirName	Return directory name (128 char)

GetActiveDig ()

Gets digitizer used when starting VrOne.

returns	(ret)	
	ret	0 = XY, 1 - XYZ, 2 - Mouse

GetOpenLastVr ()

Gets Open last VR files flag.

returns	(ret)	
	ret	0=No 1=Yes

GetOpenLastImg ()

Gets Open last Image files flag.

returns	(ret)	
	ret	0=No 1=Yes

GetPromptUnits ()

Gets prompt units.

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returns	(ret)	
	ret	0=Inches 1=Millimeters

GetMaxApps ()

Gets the maximum number of VrOne applications.

SetMwDecAccur (DecAccur)

Sets main window decimal accuracy.

DecAccur	Decimal accuracy for coords in main window.

GetMwDecAccur ()

Gets main window decimal accuracy.

GetMmPerInch ()

Gets the number of millimeters per inch.

returns	(ret)	
	ret	Number of mm per inch i.e. 25.4

GetMetersToFeet ()

Gets the meters to feet conversion factor.

GetBrowser ()

Gets the browser program file name.

GetFkeyFileName ()

Gets the function key file name.

GetMbCmdFileName ()

Gets the XYZ digitizer menu board command file name.

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GetKpCmdFileName ()

Gets the keypad menu board command file name.

GetMacroFileName ()

Gets current macro filename.

SetBeepStus (BeepStus)

Sets beep flag.

BeepStus	0=On, 1=Off

GetBeepStus ()

Gets beep flag.

returns	(ret)	
	ret	0=On, 1=Off

GetBeep (ButtonNum)

Gets the button status for a single button.

ButtonNum	Button number 0-11 (10=* 11=#)

SetBeep (ButtonNum, BeepStatus)

Sets the button status for a single button.

ButtonNum	Button number 0-11 (10=* 11=#)
BeepStatus	0=Off 1=On

SetBeep2 (BeepStatus)

Sets the button status for all buttons.

BeepStatus	0=Off 1=On

GetBeepSound (ButtonNum)

Gets the sound file name for a beep.

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ButtonNum	ButtonNum 0-11 (10=* 11=#)	
returns	(BeepSound)	
	BeepSound	Sound file name (128 char, Normally .wav)

SetBeepSound (ButtonNum, BeepSound)

Sets the sound file name for a beep.

ButtonNum	ButtonNum 0-11 (10=* 11=#)
BeepSound	Sound file name (128 char, Normally .wav)

SetBeepNormal (BeepSound)

Sets the normal beep sound.

BeepSound	Sound file name (128 char, Normally .wav)

GetBeepNormal ()

Gets the normal beep sound.

returns	(ret)	
	ret	Sound file name (128 char, Normally .wav)

SetBeepAlert (BeepSound)

Sets the normal beep sound.

BeepSound	Sound file name (128 char, Normally .wav)

GetBeepAlert ()

Gets the normal beep sound.

returns	(ret)	
	ret	Sound file name (128 char, Normally .wav)

SetBeepPlotStart (BeepSound)

Sets the sound of the beep when replot is started.

BeepSound	Sound file name (128 char, Normally .wav)

GetBeepPlotStart ()

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Gets the sound of the beep when replot is started.

returns	(ret)	
	ret	Sound file name (128 char, Normally .wav)

SetBeepPlotDone (BeepSound)

Sets the sound of the beep when replot is done.

BeepSound	Sound file name (128 char, Normally .wav)

GetBeepPlotDone ()

Gets the sound of the beep when replot is done.

returns	(ret)	
	ret	Sound file name (128 char, Normally .wav)

SetNumLockControl (State)

Sets num lock control flag.

State	0=On, 1=Off

GetNumLockControl ()

Gets num lock control flag.

returns	(ret)	
	ret	0=On, 1=Off

2.1.2.3 PyVrDtm

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

DTM Class Reference (PyVrDtm)

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VrOne/Python DTM routines More...

Members

- PyVrDtm (UseVrDtm,CgNum)
- Reset ()
- ResetMinMax (MinX, MinY, MinZ, MaxX, MaxY, MaxZ)
- AddPoint (x, y, z)
- SetAreaToModel (AreaToModel)
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- FindTriangles (x, y)
- FindTrianglesFromEdge (ex1, ey1, ex2, ey2)
- GetTriangle (TriNum)
- GetTriangleInfo (TriNum)

Description

The PythonVrOne DTM Class contains routines for creating and working with DTM models. This includes DTM processing, contour generation, and elevation querying.

IMPORTANT USAGE NOTE: There are two main ways to use the DTM class:

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1. Getting a reference to the main VrOne DTM object. This is done by creating a PyVrDtm object with a parameter of "True" and an optional surface number. This method allows the DTM data to be shared with the current VrOne session. Any DTMs created with this method will be active in VrOne for things such as cursor tracking.
2. Creating a new DTM object separate from the VrOne DTM object. This is done by creating a PyVrDtm object with a parameter of "False". This allows a DTM to be created that is completely separate from the active DTM in VrOne. VrOne has no knowledge of DTMs created using this method. Cursor tracking will not follow a DTM created with this method.

See the dtmtest.py and testslope.py scripts for sample code that use the PyVrDtm class.

Member Function Documentation

PyVrDtm (UseVrDtm, CgNum)

Returns a DTM object. This object is either a newly created DTM object or a reference to the VrOne DTM object depending on what value is passed in for UseVrDtm.

UseVrDtm	True = Return reference to existing VrOne DTM object. False = Return new DTM object.	
CgNum	Optional. Surface number to use. 0-7, or –1 to use active surface.	
returns	(Object)	
	Object	PyVrDtm oject.

Reset ()

Resets DTM parameters so a new Process command can be called. Always call this command or ResetMinMax before calling Process. This method does not need to be called if using the ProcessWs method.

ResetMinMax (MinX, MinY, MinZ, MaxX, MaxY, MaxZ)

Resets DTM parameters so points can be manually added to the DTM. This should always be called before points are added using AddPoint. All points added using AddPoint must fall within these bounds. If you are not adding points manually with AddPoint, Reset can be used instead.

MinX	Min x of box bounding extents of points to be added to DTM.
MinY	Min y of box bounding extents of points to be added to DTM.
MinZ	Min z of box bounding extents of points to be

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	added to DTM.
MaxX	Max x of box bounding extents of points to be added to DTM.
MaxY	Max y of box bounding extents of points to be added to DTM.
MaxZ	Max z of box bounding extents of points to be added to DTM.

AddPoint (x, y, z)

Manually adds a point to the DTM model. ResetMinMax() must be called before adding the first point. The Process method must be used after manually adding points or the points will be ignored.

x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.

SetAreaToModel (AreaToModel)

Sets workspace area to model.

AreaToModel	0=Entire workspace, 1=Window area only

SetVerbose (Verbose)

Sets verbose mode.

Verbose	0=Verbose mode off, 1=Verbose mode on

SetWsToConsid (WsToConsid)

Sets workspace to consider.

WsToConsid	0=All Workspaces, 1= Current Workspace

Process ()

Processes the DTM TIN only. Does not place triangles or contours into the current VrOne file. This processes points and breaklines according to the current DTM parameters. To only process manually added points, call SetPointsLayer and SetBreaksLayer with empty strings before beginning processing.

ProcessWs ()

Processes the complete DTM. Ignores any manually added points and places triangles, contours, boundary line, and depressions into the current VrOne file according to the current

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DTM parameters. This command is equivalent to using the RunDtm command in VrOne.

GetElev (x, y)

Returns elevation of point within the DTM.

x	Floating point X coordinate of point where elevation should be computed.	
y	Floating point Y coordinate of point where elevation should be computed.	
returns	(z)	
	z	Return elevation.

SetFreeFlag (FreeFlag)

Determines whether DTM remains in memory after processing. This must be "True" for cursor tracking. Default value ("True" or "False") depends on currently loaded DTM parameters.

FreeFlag	True = Keep DTM in memory. False = Remove DTM from memory.

IsDtmValid ()

Returns status of DTM.

returns	(ret)	
	ret	True = DTM is valid, False = DTM is not valid.

SetPointsLayer (Layer)

Sets layer for DTM Points.

Layer	String value representing layers to use when searching for DTM points. This may be a number line.

SetBreaksLayer (Layer)

Sets layer for DTM Breaks.

Layer	String value representing layers to use when searching for DTM breaklines. This may be a number line.

GetMinZ ()

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Returns minimum Z value of DTM.

returns	(ret)	
	ret	Floating point value of minimum Z coordinate in DTM.

GetMaxZ ()

Returns maximum Z value of DTM.

returns	(ret)	
	ret	Floating point value of maximum Z coordinate in DTM.

GetBoundary ()

Returns points along DTM boundary.

returns	(ret)	
	ret	List of tuples containing points that make up DTM boundary. Each tuple contains X,Y,Z floating point coordinate.

Example

```
Bndry = Cg.GetBoundary()
for coord in Bndry:
     x, y, z = coord
```

IsPointInside (x, y)

Returns status of point in relation to DTM boundary.

x	X coordinate of point to check.	
y	Y coordinate of point to check.	
returns	(ret)	
	ret	True = Point is inside DTM boundary. False = Point is outside DTM boundary.

GetContour (Elev)

Returns points for all contours at a given elevation.

Elev	Elevation of contour to return.	
returns	(ret)	
	ret	List of tuples containing points

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		that make up all contours at this elevation. Each tuple contains "code,x,y,z", where x,y,z is the floating point coordinate of the point location and code is an integer (0 when a new contour should be started).

Example

```
def SaveContour(Contour, Layer):
     Line = PyVrLine ()
     Line.SetLayer (Layer)

     # Go through contour points
     for coord in Contour:

          code, x, y, z = coord

          # New contour starting if code is 0
          if (code == 0 and Line.GetNumXyz() > 0):
               Line.Rec (Ws.Aws())
               Line.Reset()

               Line.AddPoint (x, y, z)

     # Make sure last contour is saved
     if (Line.GetNumXyz() > 0):
          Line.Rec (Ws.Aws())
          Line.Reset()

ContElev = 125.0
Contour = Cg.GetContour (ContElev)
if (len(Contour) > 1):
     SaveContour (Contour, 2)
```

GetFirstContour ()

Used with GetNextContour to walk through all contours at a specified interval.

returns	(Stat, Elev, Contours)	
	Stat	0=More contours to follow, -1=No more contours available
	Elev	Elevation of current contour.
	Contours	List of tuples containing points that make up all contours at this elevation. Each tuple contains "code,x,y,z", where x,y,z is the

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		floating point coordinate of the point location and code is an integer (0 when a new contour should be started).

Example	`Stat, Elev, Contour = Cg.GetFirstContour (2) # Get contours with 2' interval`
	`SaveContour (Contour, int(Elev))`
	`while (Stat == 0):`
	`  Stat, Elev, Contour = Cg.GetNextContour ()`
	`  SaveContour (Contour, int(Elev))`

GetNextContour ()

Used with GetFirstContour to walk through all contours at a specified interval.

returns	(Stat, Elev, Contours)	
	Stat	0=More contours to follow, -1=No more contours available
	Elev	Elevation of current contour.
	Contours	List of tuples containing points that make up all contours at this elevation. Each tuple contains "code,x,y,z", where x,y,z is the floating point coordinate of the point location and code is an integer (0 when a new contour should be started).

Example	# Walk through all triangles (Tri, x1, y1, z1, x2, y2, z2, x3, y3, z3) = Dtm.GetFirstTriangle () while (Tri): (Tri, x1, y1, z1, x2, y2, z2, x3, y3, z3) = Dtm.GetNextTriangle ()

GetFirstTriangle ()

Used with GetNextTriangle to walk through all triangles.

returns	(TriNum, x1, y1, z1, x2, y2, z2, x3, y3, z3)	
	TriNum	Triangle number. If 0, no triangle was found.
	x1	X Coordinate location of triangle vertex 1.
	y1	Y Coordinate location of triangle vertex 1.

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	z1	Z Coordinate location of triangle vertex 1.
	x2	X Coordinate location of triangle vertex 2.
	y2	Y Coordinate location of triangle vertex 2.
	z2	Z Coordinate location of triangle vertex 2.
	x3	X Coordinate location of triangle vertex 3.
	y3	Y Coordinate location of triangle vertex 3.
	z3	Z Coordinate location of triangle vertex 3.

GetNextTriangle ()

Used with GetFirstTriangle to walk through all triangles.

returns	(TriNum, x1, y1, z1, x2, y2, z2, x3, y3, z3)	
	TriNum	Triangle number. If 0, no triangle was found.
	x1	X Coordinate location of triangle vertex 1.
	y1	Y Coordinate location of triangle vertex 1.
	z1	Z Coordinate location of triangle vertex 1.
	x2	X Coordinate location of triangle vertex 2.
	y2	Y Coordinate location of triangle vertex 2.
	z2	Z Coordinate location of triangle vertex 2.
	x3	X Coordinate location of triangle vertex 3.
	y3	Y Coordinate location of triangle vertex 3.
	z3	Z Coordinate location of triangle vertex 3.

FindTriangles (x, y)

Finds triangles that share point x,y. If x,y is inside a triangle, only 1 triangle is returned. If x,y is

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on edge, 1 (if boundary triangle) or 2 triangles will be returned. If x,y is on a vertex, multiple triangles may be returned.

x	X coordinate of search point.	
y	Y coordinate of search point	
returns	(Triangles)	
	Triangles	List of triangles found.

Example

```
(Triangles) = Dtm.FindTriangles (x, y)

print "Found %d triangles." % len(Triangles)

for Triangle in Triangles:

     (Slope, Aspect, Cx, Cy) = Dtm.GetTriangleInfo
(Triangle)
```

FindTrianglesFromEdge (ex1, ey1, ex2, ey2)

Finds triangles that share the edge between points ex1, ey1 and ex2, ey2. Returns 1 triangle if edge is on boundary or 2 triangles if edge is inside TIN.

ex1	X coordinate of point 1.	
ey1	Y coordinate of point 1.	
ex2	X coordinate of point 2.	
ey2	Y coordinate of point 2.	
returns	(Triangles)	
	Triangles	List of triangles found.

Example

```
(Triangles) = Dtm.FindTrianglesFromEdge (x1, y1, x2,
y2)

print "Found %d triangles." % len(Triangles)

for Triangle in Triangles:

     (Slope, Aspect, Cx, Cy) = Dtm.GetTriangleInfo
(Triangle)
```

GetTriangle (TriNum)

Gets vertex coordinates for a single triangle.

TriNum	Triangle number.
returns	(x1, y1, z1, x2, y2, z2, x3, y3, z3)

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	x1	X coordinate of vertex 1.
	y1	Y coordinate of vertex 1.
	z1	Z coordinate of vertex 1.
	x2	X coordinate of vertex 2.
	y2	Y coordinate of vertex 2.
	z2	Z coordinate of vertex 2.
	x3	X coordinate of vertex 3.
	y3	Y coordinate of vertex 3.
	z3	Z coordinate of vertex 3.

GetTriangleInfo (TriNum)

Gets additional triangle information.

TriNum	Triangle number.	
returns	(Slope, Aspect, cx, cy)	
	Slope	Slope of triangle (0.0 to 1.0)
	Aspect	Direction of slope in radians where 0.0=north.
	cx	Barycenter x coordinate.
	cy	Barycenter y coordinate.

2.1.2.4 PyVrDtmMgr

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Vr Mapping

DTM Manger Class Reference (PyVrDtmMgr)

DTM Manager Class More...

Members

- SetAcg (Acg, FileName)
- Acg ()

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- GetMaxCg ()
- GetCg (CgNum)

Description

VrOne can have up to 8 DTM surfaces defined. The Python Vr DTM Manager class allows each of the defined DTM surfaces (up to the maximum 8 supported by VrOne) to be managed. A surface can be set as the active surface. Any of the 8 surfaces can be returned as a PyVrDtm object, which can then be used to perform any of the standard DTM operations.

Example:

```
DtmMgr = PyVrDtmMgr ()

Dtm = DtmMgr.GetCg (2)

Dtm.Reset()
Dtm.Process()

print "MinZ = %.2f" % Dtm.GetMinZ ()
print "MaxZ = %.2f" % Dtm.GetMaxZ ()
```

Member Function Documentation

SetAcg (Acg)

Sets the current active DTM surface (Contour Generation surface)

Acg	Surface number with index from 0 to GetMaxCg()-1.

Acg ()

Returns	Currently active DTM surface number (Index from 0 to GetMaxCg()-1).

GetMaxCg ()

Returns	Maximum number of surfaces. Always returns 8 in the current release.

GetCg (CgNum)

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CgNum	Surface number with index from 0 to GetMaxCg()-1.
Returns	PyVrDtm object.

2.1.2.5 PyVrGeom

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Vr Mapping

Geometry Class Reference (PyVrGeom)

Helper coordinate geometry routines More...

Members

- AziConv (Angle)
- AziNorth (x1, y1, x2, y2)
- AziSouth (x1, y1, x2, y2)
- AziEast (x1, y1, x2, y2)
- DeltaAng (Azi1, Azi2)
- Dist (x1, y1, x2, y2)
- ZenithAng (x1, y1, z1, x2, y2, z2)
- IsShorter (x1, y1, x2, y2, x3, y3, x4, y4)
- SlopeDist (x1, y1, z1, x2, y2, z2)
- Wind (MinX, MinY, MaxX, MaxY, TestX, TestY)
- InterY2D (X1, Y1, X2, Y2, X3,)
- InterX2D (Y3, X1, Y1, X2, Y2,)
- InterXY (x1, y1, z1, x2, y2, z2, z3)
- InterElev (x1, y1, z1, x2, y2, z2, x3, y3)
- InterZ3 (x1, y1, z1, x2, y2, z2, x3, y3, z3, x, y)

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- RotPoint (BaseX, BaseY, x, y, Rot)
- OfsInt (LineX1, LineY1, LineX2, LineY2, PointX, PointY)
- PntToLine1 (LineX1, LineY1, LineX2, LineY2, PointX, PointY)
- PntToLine2 (LineX1, LineY1, LineZ1, LineX2, LineY2, LineZ2, PointX, PointY, PointZ)
- PntToLine3d (LineX1, LineY1, LineZ1, LineX2, LineY2, LineZ2, xp, yp, zp)
- CanLinesCross (MinX1, MinY1, MaxX1, MaxY1, MinX2, MinY2, MaxX2, MaxY2)
- IsPointOnLine (LineX1, LineY1, LineX2, LineY2, PointX, PointY)
- IsLineOnLine (x1, y1, x2, y2, x3, y3, x4, y4)
- OfsLine (Offset, OrgX1, OrgY1, OrgX2, OrgY2)
- DoLinesIntersect (Line1X1, Line1Y1, Line1X2, Line1Y2, Line2X1, Line2Y1, Line2X2, Line2Y2)
- CanLineCrossMbr (x1, y1, x2, y2, MinX, MinY, MaxX, MaxY)
- LineLineInt (Line1X1, Line1Y1, Line1X2, Line1Y2, Line2X1, Line2Y1, Line2X2, Line2Y2)
- BearBearInt (x1, y1, Azi1, x2, y2, Azi2)
- DistDistInt (x1, y1, dist1, x2, y2, dist2)
- BearDistInt (x1, y1, Azi1, x2, y2, Dist2)
- Circ3Pt (x1, y1, x2, y2, x3, y3)
- AngleIncr (Radius, Scale)
- AngleB (x1, y1, xc, yc, x2, y2)
- AngleDeflect (x1, y1, x2, y2, x3, y3)
- AziToBear (Azi)
- BearToAzi (Bear, Quad)
- FmtAzi (Azi, Accur, Direction)
- ParseDms (Dms)
- FmtBear (Bearing, Quadrant, Accur, FmtOpt)
- DoesMbrOverlap (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)
- GetOverlapArea (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)
- GetOverlapAreaD (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)

Description

The Python VrOne Geometry Class contains useful coordinate geometry routines. Calls to this class use the same coordinate geometry routines used by VrOne. This class is provided to reduce user development time by using time-tested VrOne C++ routines. Unless otherwise

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specified, routines expect double precision numbers.

Member Function Documentation

AziConv (Angle)

Converts an angle between clockwise from North and counterclockwise from East.

Angle	

AziNorth (x1, y1, x2, y2)

Computes North Azimuth from 2 coordinate positions.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
returns	(ret)	
	ret	Azimuth clockwise from North in radians.

AziSouth (x1, y1, x2, y2)

Computes South Azimuth from 2 coordinate positions.

x1	X coordinate of point 1.
y1	Y coordinate of point 1.
x2	X coordinate of point 2.
y2	Y coordinate of point 2.
returns	(ret)
	ret

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AziEast (x1, y1, x2, y2)

Computes East Azimuth from 2 coordinate positions. This angle is normally used for text rotations.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
returns	(ret)	
	ret	Azimuth counterclockwise from East in radians.

DeltaAng (Azi1, Azi2)

Returns the delta angle between two azimuths. Always returns the acute angle.

Azi1	Azimuth 1 to compare (in radians)	
Azi2	Azimuth 2 to compare (in radians)	
returns	(ret)	
	ret	Delta angle. Example (in degrees): Azi1 = 350 Azi2 = 10 returns 20

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Dist (x1, y1, x2, y2)

Computes the 2D distance between two points.

x1	X coordinate of point 1.
y1	Y coordinate of point 1.
x2	X coordinate of point 2.
y2	Y coordinate of point 2.
returns	(ret)
	ret

ZenithAng (x1, y1, z1, x2, y2, z2)

Computes zenith angle from two 3D points.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
z1	Z coordinate of point 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
z2	Z coordinate of point 2.	
returns	(ret)	
	ret	Zenith angle (radians)

IsShorter (x1, y1, x2, y2, x3, y3, x4, y4)

Determines if line1 is shorter than line2.

x1	X coordinate of line 1 point 1.
y1	Y coordinate of line 1 point 1.
x2	X coordinate of line 1 point 2.
y2	Y coordinate of line 1 point 2.
x3	X coordinate of line 2 point 1.
y3	Y coordinate of line 2 point 1.
x4	X coordinate of line 2 point 2.
y4	Y coordinate of line 2 point 2.
returns	(ret)

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	ret	0=Line1 is shorter than Line2, 1=Line1 is longer than or equal to Line2

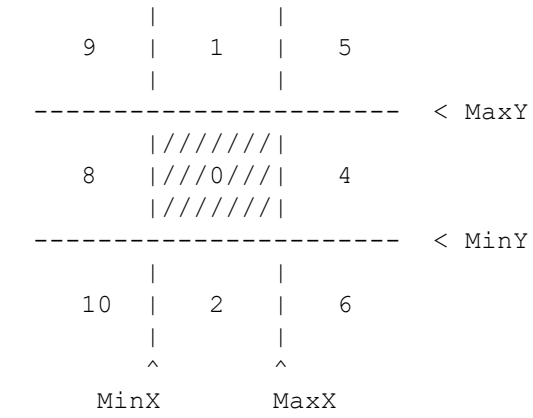
SlopeDist (x1, y1, z1, x2, y2, z2)

Computes slope distance between two 3D points.

x1	X coordinate of point 1.
y1	Y coordinate of point 1.
z1	Z coordinate of point 1.
x2	X coordinate of point 2.
y2	Y coordinate of point 2.
z2	Z coordinate of point 2.
returns	(ret)
	ret

Wind (MinX, MinY, MaxX, MaxY, TestX, TestY)

Returns the relationship of a point within a window.



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MinX	Minimum X coordinate for bounding window.
MinY	Minimum Y coordinate for bounding window.
MaxX	Maximum X coordinate for bounding window.
MaxY	Maximum Y coordinate for bounding window.
TestX	X coordinate of test point.
TestY	Y coordinate of test point.

InterY2D (X1, Y1, X2, Y2, X3,)

Interpolates the unknown Y of three points.

X1	X coordinate of point 1.	
Y1	Y coordinate of point 1.	
X2	X coordinate of point 2.	
Y2	Y coordinate of point 2.	
X3	X coordinate of point 3.	
returns	(UnknownY)	
	UnknownY	

InterX2D (Y3, X1, Y1, X2, Y2,)

Interpolates the unknown X of three points.

Y3	Y coordinate of point 3.	
X1	X coordinate of point 1.	
Y1	Y coordinate of point 1.	
X2	X coordinate of point 1.	
Y2	Y coordinate of point 2.	
returns	(UnknownX)	
	UnknownX	

InterXY (x1, y1, z1, x2, y2, z2, z3)

Interpolates the XY position along a line based on the elevation

x1	X coordinate of point 1.
y1	Y coordinate of point 1.
z1	Z coordinate of point 1.
x2	X coordinate of point 2.
y2	Y coordinate of point 2.
z2	Z coordinate of point 2.
z3	Known elevation
returns	(x3, y3)
	x3

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	y3

InterElev (x1, y1, z1, x2, y2, z2, x3, y3)

Interpolates the unknown elevation of three points.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
z1	Z coordinate of point 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
z2	Z coordinate of point 2.	
x3	X coordinate of point 3.	
y3	Y coordinate of point 3.	
returns	(z3)	
	z3	Unknown elevation of third point. If there is no distance between points one and two then Z3 returns with the elevation of Z1.

InterZ3 (x1, y1, z1, x2, y2, z2, x3, y3, z3, x, y)

Interpolates a Z from a 3D surface defined by a triangle.

x1	X coordinate of point 1 on triangle.
y1	Y coordinate of point 1 on triangle.
z1	Z coordinate of point 1 on triangle.
x2	X coordinate of point 2 on triangle.
y2	Y coordinate of point 2 on triangle.
z2	Z coordinate of point 2 on triangle.

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x3	X coordinate of point 3 on triangle.	
y3	Y coordinate of point 3 on triangle.	
z3	Z coordinate of point 3 on triangle.	
x	X coordinate of point to interpolate Z.	
y	Y coordinate of point to interpolate Z.	
returns	(z)	
	z	Return elevation.

RotPoint (BaseX, BaseY, x, y, Rot)

Rotates a point about a base point.

BaseX	X coordinate of base point.	
BaseY	Y coordinate of base point.	
x	X coordinate of point to be rotated.	
y	X coordinate of point to be rotated.	
Rot	Rotation angle clockwise (in radians).	
returns	(x, y)	
	x	Return point x.
	y	Return point y.

OfsInt (LineX1, LineY1, LineX2, LineY2, PointX, PointY)

Computes the offset and distance from a point to a line.

LineX1	X coordinate of point 1 of the line.	
LineY1	Y coordinate of point 1 of the line.	
LineX2	X coordinate of point 2 of the line.	
LineY2	Y coordinate of point 2 of the line.	
PointX	X coordinate of point.	
PointY	Y coordinate of point	
returns	(Offset, Distance)	
	Offset	Resulting offset with the following conditions: Positive - Point is to the right of the line. Negative - Point is to the left of the line.
	Distance	Resulting distance from point to line.

PntToLine1 (LineX1, LineY1, LineX2, LineY2, PointX, PointY)

Snaps a point to a line 2D.

LineX1	X coordinate of point 1 of the line.

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LineY1	Y coordinate of point 1 of the line.	
LineX2	X coordinate of point 2 of the line.	
LineY2	Y coordinate of point 2 of the line.	
PointX	X coordinate of point to snap.	
PointY	Y coordinate of point to snap.	
returns	(ret, xr, yr, Dist)	
	ret	0=Point falls between line endpoints 1=Point falls below the line * x----------> 2=Point falls above the line x---------> *
	xr	Point x snapped to line.
	yr	Point y snapped to line.
	Dist	Return distance (optional) with the following conditions: Positive - Point is to the right of the line. Negative - Point is to the left of the line.

PntToLine2 (LineX1, LineY1, LineZ1, LineX2, LineY2, LineZ2, PointX, PointY, PointZ)

Snaps a point to a line 2D but interpolates a Z.

LineX1	X coordinate of point 1 of the line.	
LineY1	Y coordinate of point 1 of the line.	
LineZ1	Z coordinate of point 1 of the line.	
LineX2	X coordinate of point 2 of the line.	
LineY2	Y coordinate of point 2 of the line.	
LineZ2	Z coordinate of point 2 of the line.	
PointX	X coordinate of point to snap.	
PointY	Y coordinate of point to snap.	
PointZ	Z coordinate of point to snap.	
returns	(ret, xr, yr, zr, Dist)	
	ret	0=Point falls between line endpoints 1=Point falls below the line * x----------> 2=Point falls above the line x---------> *
	xr	Point x snapped to line.
	yr	Point y snapped to line.
	zr	Interpolated z on line.
	Dist	Return distance (optional) with the following conditions: Positive - Point is to the right of the line. Negative - Point is to the left of the line.

PntToLine3d (LineX1, LineY1, LineZ1, LineX2, LineY2, LineZ2, xp, yp, zp)

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Snaps a 3D point to a 3D line using doubles. This is a true 3D computation.

LineX1	X coordinate of point 1 of the line.	
LineY1	Y coordinate of point 1 of the line.	
LineZ1	Z coordinate of point 1 of the line.	
LineX2	X coordinate of point 2 of the line.	
LineY2	Y coordinate of point 2 of the line.	
LineZ2	Z coordinate of point 2 of the line.	
xp	X coordinate of point to snap.	
yp	Y coordinate of point to snap.	
zp	Z coordinate of point to snap to line.	
returns	(ret, xr, yr, zr, Dist)	
	ret	0=Point falls between line endpoints. 1=Point falls below the line. * x---------> 2=Point falls above the line. x---------> *
	xr	Point x snapped to line.
	yr	Point y snapped to line.
	zr	Point z snapped to line (interpolated).
	Dist	Return distance from xp,yp,zp to line intersection (optional).

CanLinesCross (MinX1, MinY1, MaxX1, MaxY1, MinX2, MinY2, MaxX2, MaxY2)

Determines if it is possible for two lines to cross by checking their MBRs (minimum bounding rectangles).

MinX1	Minimum X coordinate of MBR 1.	
MinY1	Minimum Y coordinate of MBR 1.	
MaxX1	Maximum X coordinate of MBR 1.	
MaxY1	Maximum Y coordinate of MBR 1.	
MinX2	Minimum X coordinate of MBR 2.	
MinY2	Minimum Y coordinate of MBR 2.	
MaxX2	Maximum X coordinate of MBR 2.	
MaxY2	Maximum Y coordinate of MBR 2.	
returns	(ret)	
	ret	TRUE= Lines could cross. FALSE= Lines do not cross.

IsPointOnLine (LineX1, LineY1, LineX2, LineY2, PointX, PointY)

Determines if a point lies on a line.

LineX1	X coordinate of point 1 of the line.
LineY1	Y coordinate of point 1 of the line.
LineX2	X coordinate of point 2 of the line.

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LineY2	Y coordinate of point 2 of the line.	
PointX	X coordinate of test point.	
PointY	Y coordinate of test point.	
returns	(ret)	
	ret	0= Point is not on line. 1= Point is on line and not between line endpoints. 2= Point is on line between line endpoints. 3= Point is the same as one of the endpoints.

IsLineOnLine (x1, y1, x2, y2, x3, y3, x4, y4)

Determines if line2 lies on line1.

I.e.

```
      x3y3              x4y4
  *-----*=-=-=-=-=-=-=-=*-----*          = TRUE
 x1y1                          x2y2
            x3y3                x4y4
  *-------------*=-=-=-=-=-=-=-=*         = TRUE
 x1y1                           x2y2
            x3y3                x4y4
  *-------------*=-=-=-=-=-=-*====*        = FALSE
 x1y1                       x2y2
            x3y3              x4y4
             *==================*
  *--------------------------------*       = FALSE
 x1y1                               x2y2
```

x1	X coordinate of point one of line 1.	
y1	Y coordinate of point one of line 1.	
x2	X coordinate of point two of line 1.	
y2	Y coordinate of point two of line 1.	
x3	X coordinate of point one of line 2.	
y3	Y coordinate of point one of line 2.	
x4	X coordinate of point two of line 2.	
y4	Y coordinate of point two of line 2.	
returns	(ret)	
	ret	0 - Lines do not lie on top of each other. 1 - Lines lie on top of each other.

OfsLine (Offset, OrgX1, OrgY1, OrgX2, OrgY2)

Offsets a two point line.

Offset	Distance to offset new line from original.

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	Negative= Offset to left. Positive= Offset to right.	
OrgX1	X coordinate of point 1 of original line to be offset.	
OrgY1	Y coordinate of point 1 of original line to be offset.	
OrgX2	X coordinate of point 2 of original line to be offset.	
OrgY2	Y coordinate of point 2 of original line to be offset.	
returns	(NewX1, NewY1, NewX2, NewY2)	
	NewX1	X coordinate of point 1 of new line.
	NewY1	Y coordinate of point 1 of new line.
	NewX2	X coordinate of point 2 of new line.
	NewY2	Y coordinate of point 2 of new line.

DoLinesIntersect (Line1X1, Line1Y1, Line1X2, Line1Y2, Line2X1, Line2Y1, Line2X2, Line2Y2)

Determines if lines intersect. Use LineLineInt to determine point of intersection.

Line1X1	X coordinate of point 1 of line 1.	
Line1Y1	Y coordinate of point 1 of line 1.	
Line1X2	X coordinate of point 2 of line 1.	
Line1Y2	Y coordinate of point 2 of line 1.	
Line2X1	X coordinate of point 1 of line 2.	
Line2Y1	Y coordinate of point 1 of line 2.	
Line2X2	X coordinate of point 2 of line 2.	
Line2Y2	Y coordinate of point 2 of line 2.	
returns	(ret)	
	ret	TRUE=Lines intersect. FALSE=Lines don't intersect.

CanLineCrossMbr (x1, y1, x2, y2, MinX, MinY, MaxX, MaxY)

Determines if a line segment can possibly cross an MBR area. Integer based.

x1	X coordinate of point 1 on line segment.
y1	Y coordinate of point 1 on line segment.
x2	X coordinate of point 1 on line segment.
y2	Y coordinate of point 1 on line segment.
MinX	Minimum X coordinate of MBR.
MinY	Minimum Y coordinate of MBR.
MaxX	Maximum X coordinate of MBR.
MaxY	Maximum Y coordinate of MBR.

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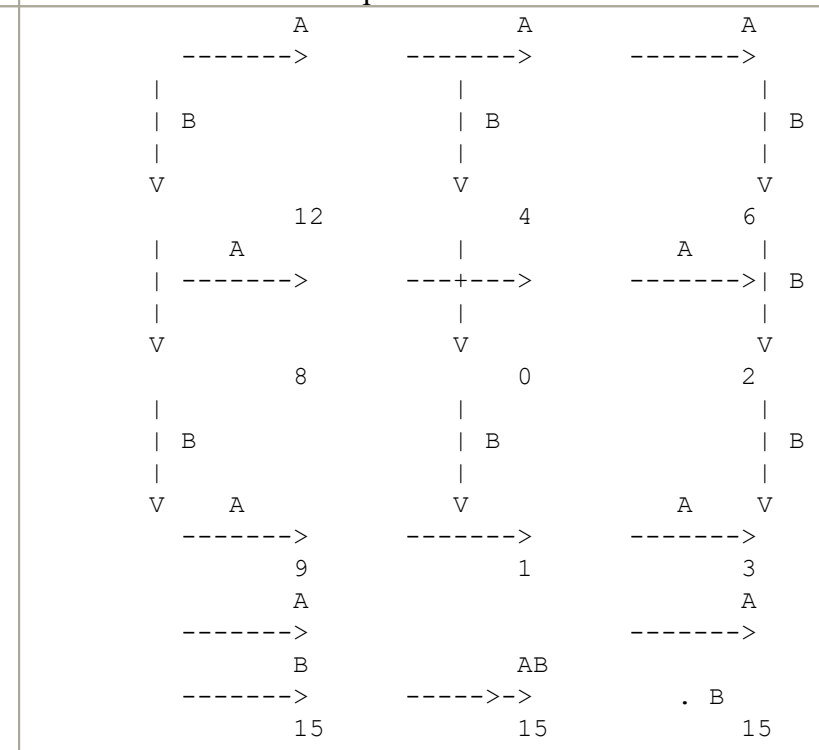
LineLineInt (Line1X1, Line1Y1, Line1X2, Line1Y2, Line2X1, Line2Y1, Line2X2, Line2Y2)

Determines if lines intersect.

Line1X1	X coordinate of point 1 on Line 1.	
Line1Y1	Y coordinate of point 1 on Line 1.	
Line1X2	X coordinate of point 2 on Line 1.	
Line1Y2	Y coordinate of point 2 on Line 1.	
Line2X1	X coordinate of point 1 on Line 2.	
Line2Y1	Y coordinate of point 1 on Line 2.	
Line2X2	X coordinate of point 2 on Line 2.	
Line2Y2	Y coordinate of point 2 on Line 2.	
returns	(IntX, IntY, IntFlag)	
	IntX	X coordinate of intersection point of line1 and line2.
	IntY	Y coordinate of intersection point of line1 and line2.
	IntFlag	

BearBearInt (x1, y1, Azi1, x2, y2, Azi2)

Computes bearing-bearing intersection.

x1	X coordinate of point 1.
y1	Y coordinate of point 1.

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Azi1	Azimuth from point 1 in radians from North.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
Azi2	Azimuth from point 2 in radians from North.	
returns	(IntX, IntY, Stus)	
	IntX	Intersection point x.
	IntY	Intersection point y.
	Stus	Status: 0=Intersection computed. 1= Lines are parallel and no solution computed. 2= Point 1 and point 2 are the same.

DistDistInt (x1, y1, dist1, x2, y2, dist2)

Computes distance-distance intersection.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
dist1	Distance 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
dist2	Distance 2.	
returns	(ret, IntX, IntY)	
	ret	0= Intersection computed. 1= Could not compute intersection. Points 1 and 2 are probably too far apart. Computes the solution clockwise direction from point 1 to point 2. To compute the other solution, call to routine with the points and distances reversed.
	IntX	X coordinate of intersection point.
	IntY	Y coordinate of intersection point.

BearDistInt (x1, y1, Azi1, x2, y2, Dist2)

Computes bearing-distance intersection. To compute the other solution call with reversed azimuth.

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x1	X coordinate of starting point of line.	
y1	Y coordinate of starting point of line	
Azi1	Azimuth of line (Decimal radians from North).	
x2	X coordinate of point to test distance intersection.	
y2	Y coordinate of point to test distance intersection.	
Dist2	Distance from (x2, y2)	
returns	(ret, IntX, IntY)	
	ret	0= Computation successful. 1= no intersection possible.
	IntX	Intersection point X (if possible).
	IntY	Intersection point Y (if possible).

Circ3Pt (x1, y1, x2, y2, x3, y3)

Computes the center of a circle defined by 3 points along edge.

x1	X coordinate of point 1 on arc.	
y1	Y coordinate of point 1 on arc.	
x2	X coordinate of point 2 on arc.	
y2	Y coordinate of point 2 on arc.	
x3	X coordinate of point 3 on arc.	
y3	Y coordinate of point 3 on arc.	
returns	(ret, CenX, CenY, Rad)	
	ret	0= Computation successful -1=Error, do not use results.
	CenX	Return center point of circle X.
	CenY	Return center point of circle Y.
	Rad	Return radius.

AngleIncr (Radius, Scale)

Returns the angle increment for drawing a smooth circular arc.

Radius	Radius of circle or arc in user units.	
Scale	Draw scale in ratio form (1:n). To decrease (increase the number of points on make 24000x larger. $\sqrt{\frac{\text{radius} * \text{sqrt}(2) * 24000}{\text{SCALE}}}$	
returns	(ret)	
	ret	Angle increment for drawing a smooth circular arc.

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AngleB (x1, y1, xc, yc, x2, y2)

Computes angle B of a triangle from three coordinate positions.

x1	X coordinate of point 1 on arc.	
y1	Y coordinate of point 1 on arc.	
xc	X coordinate of center point at angle B.	
yc	Y coordinate of center point at angle B.	
x2	X coordinate of point 2 on arc.	
y2	Y coordinate of point 2 on arc.	
returns	(ret)	
	ret	Angle n radians (0-PI).

AngleDeflect (x1, y1, x2, y2, x3, y3)

Computes the deflection angle from three coordinate positions.

x1	X coordinate of point 1.	
y1	Y coordinate of point 1.	
x2	X coordinate of point 2.	
y2	Y coordinate of point 2.	
x3	X coordinate of point 3.	
y3	Y coordinate of point 3.	
returns	(ret)	
	ret	Angle n radians (0-PI).

AziToBear (Azi)

Converts an azimuth to a bearing and quadrant code.

Azi	Azimuth to convert (in decimal radians from the North)
	`if azi is not in the range of 0-pi radians (0-360 degrees) it will be forced into range.`
	`NOTE : Conversion of angles from h.ms degrees <-> decimal radians.`
	`azi := dec_deg(azi) / conv;  hms degrees -> dec radians`
	`azi := hms (azi*conv);  dec radians -> hms degrees`	

returns	(Bear, Quadrant)	
	Bear	Return bearing (decimal radians)
	Quadrant	Return quadrant code (1-4). If azi is not in the range of 0-pi radians (0-360 degrees) it will be forced into range.

BearToAzi (Bear, Quad)

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Converts a bearing to an azimuth.

Bear	Bearing in decimal radians.	
Quad	Quadrant code (1-4).	
returns	(Azi)	
	Azi	Return azimuth in decimal radians from the north. If quad is out of range of 1-4 or if bear is out of range 0-1.5707963271 radians (0-90 degrees), azi returns 0.0.

FmtAzi (Azi, Accur, Direction)

Formats an azimuth for display in the form ddd mm ss.s

Azi	Azimuth to be formatted (radians from the North)	
Accur	Number of decimal places for seconds	
Direction	0 = Return azimuth from North. 1 = Return azimuth from South.	
returns	(AziStrg)	
	AziStrg	Return string

ParseDms (Dms)

Parses angle expressed in "degrees minutes seconds".

Dms	Angle in the form of ddd.mmsec	
returns	(Deg, Min, Sec)	
	Deg	Return degress
	Min	Return minutes
	Sec	Return seconds

FmtBear (Bearing, Quadrant, Accur, FmtOpt)

Formats a bearing in the form of q hh-mm-ss.tt q

Bearing	Bearing in decimal radians.
Quadrant	Quadrant code (1-4).
Accur	Decimal accuracy of seconds.

FmtOpt	`Bearing format option.`
	`  0 - N dd-mm-ss E`
	`  1 - N dd\mm'ss"E`
	`If Bearing is out of the range of 0-pi/2 radi`
	`then ? **-**-** ? is returned.`
	`If quad is out of the range of 1-4 then and B`
	`? nn-nn-nn ? is returned.`

returns	(BearStrg)

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	BearStrg	Return bearing string.

DoesMbrOverlap (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)

Determines if there is overlap between a source and destination rectangle. Integer based.

DstStartX	Minimum X of destination rectangle.	
DstStartY	Minimum Y of destination rectangle.	
DstEndX	Maximum X of destination rectangle.	
DstEndY	Maximum Y of destination rectangle.	
SrcStartX	Minimum X of source rectangle.	
SrcStartY	Minimum Y of source rectangle.	
SrcEndX	Maximum X of source rectangle.	
SrcEndY	Maximum Y of source rectangle.	
returns	(ret)	
	ret	1 = Areas overlap. 0 = Areas don't overlap.

GetOverlapArea (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)

Finds the overlap area of the source rectangle to the destination rectangle. Integer based.

DstStartX	Minimum X of destination rectangle.	
DstStartY	Minimum Y of destination rectangle.	
DstEndX	Maximum X of destination rectangle.	
DstEndY	Maximum Y of destination rectangle.	
SrcStartX	Minimum X of source rectangle.	
SrcStartY	Minimum Y of source rectangle.	
SrcEndX	Maximum X of source rectangle.	
SrcEndY	Maximum Y of source rectangle.	
returns	(ret, DstOverStartX, DstOverStartY, SrcOverStartX, SrcOverStartY, OverWdt, OverHgt)	
	ret	0 = Areas overlap. -1 = Areas don't overlap.
	DstOverStartX	X coordinate of start of overlap area in destination rectangle.
	DstOverStartY	Y coordinate of start of overlap area in destination rectangle.
	SrcOverStartX	X coordinate of start of overlap area in source rectangle.
	SrcOverStartY	Y coordinate of start of overlap area in source rectangle.
	OverWdt	Width of overlap area.

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	OverHgt	Height of overlap area.

GetOverlapAreaD (DstStartX, DstStartY, DstEndX, DstEndY, SrcStartX, SrcStartY, SrcEndX, SrcEndY)

Finds the overlap area of the source rectangle to the destination rectangle. Double based.

DstStartX	Minimum X of destination rectangle.	
DstStartY	Minimum Y of destination rectangle.	
DstEndX	Maximum X of destination rectangle.	
DstEndY	Maximum Y of destination rectangle.	
SrcStartX	Minimum X of source rectangle.	
SrcStartY	Minimum Y of source rectangle.	
SrcEndX	Maximum Y of source rectangle.	
SrcEndY	Maximum Y of source rectangle.	
returns	(ret, DstOverStartX, DstOverStartY, SrcOverStartX, SrcOverStartY, OverWdt, OverHgt, OverlayMode)	
	ret	0 = Areas overlap -1 = Areas don't overlap
	DstOverStartX	X coordinate of start of overlap area in destination rectangle.
	DstOverStartY	Y coordinate of start of overlap area in destination rectangle.
	SrcOverStartX	X coordinate of start of overlap area in source rectangle.
	SrcOverStartY	Y coordinate of start of overlap area in source rectangle.
	OverWdt	Width of overlap area.
	OverHgt	Height of overlap area.
	OverlayMode	Optional. Returns primary side that is overlapped. LEFT=0 RIGHT=1 TOP=2 BOTTOM=3

2.1.2.6 PyVrGr

Vr

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Mapping

Graphics Class Reference (PyVrGr)

VrOne/Python Graphics class which manages VrOne window graphics operations More…

Members

Window management

- GetWinCorner (Corner, WinNum)
- GetWinSize ()
- SetWinOrg (OrgX, OrgY, OrgZ)
- GetWinOrg ()
- SetWinRot (RotX, RotY, RotZ)
- GetWinRot ()
- SetWinScale (Scale)
- GetWinScale ()
- SetActiveWin (Win)
- GetActiveWin ()

Drawing management

- Replot ()
- GetColor (PenNum, WinNum)
- PenNum (PenNum, WinNum)
- SetDashed (LineLen, SpaceLen, UseInches, WinNum)
- LineWidth (LineWidth, WinNum)
- LineWidthD (LineWidth, WinNum)
- DrawMode (DrawMode, WinNum)
- Plot (x, y, z, Pen, WinNum)
- Plot1 (x, y, z, Pen, WinNum)
- Flush (WinNum)
- SetFlushMode (FlushMode, WinNum)
- DrawMarker (x, y, z, Type, Radius, WinNum)

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- PlotMarker (x, y, z, Type, ScaleFac, WinNum)
- EraseMarker ()
- SetRband (x, y, z, Pen, WinNum)
- SetRbandLast (WinNum)
- HideRband (WinNum)
- EraseRband (WinNum)
- GetRbandState ()

Cursor management

- GetCursor ()

Description

VrOne can open up to 8 graphics windows at one time. Each window can display vector graphics from the currently open workspaces at different locations, scales, and rotations. The Graphics class allows the user to draw graphics directly to any window or all windows at once. Several drawing modes, as well as calls for rubber-banding lines, are supported. This class also allows the window parameters such as Origin and Scale to be changed and queried, and the current cursor state to be queried.

NOTE: The windows numbers range from 0 to 7.

The following example centers the currently active window at coordinate 15.0, 15.0, 0.0, and then draws a large X at the center of the screen.

```
Gr = PyVrGr ()

Gr.SetWinOrg (15.0, 15.0, 0.0)

Gr.PenNum (1)
Gr.DrawMode (MODE_DRAW)
Gr.Plot (10.0, 10.0, 0.0, PEN_UP)
Gr.Plot (20.0, 20.0, 0.0, PEN_DOWN)
Gr.Plot (10.0, 20.0, 0.0, PEN_UP)
Gr.Plot (20.0, 10.0, 0.0, PEN_DOWN)
```

Member Function Documentation

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Replot ()

Replots the graphics windows.

WinNum	Window number (-1=All,Default=-1)

GetWinCorner (Corner, Win)

Returns the origin of the active graphics window.

Corner	Corner to get (0=Lower Left, 1=Lower Right, 2=Upper Right, 3=Upper Left)
WinNum	Window number (0=First window)
Returns	CorX, CorY, CorZ = Corner of graphics window (ground)

GetWinSize ()

Returns the size of the active graphics window.

Returns	Width. Height = Width and height of active window (ground)

SetWinOrg (OrgX, OrgY, OrgZ)

Sets the origin of the active graphics window.

OrgX, OrgY, OrgZ	Origin of graphics window (ground)
Returns	void

Example	Gr.SetWinOrg (15.0, 15.0, 0.0)

GetWinOrg ()

Returns the origin of the active graphics window.

Returns	OrgX, OrgY, OrgZ = Origin of graphics window (ground).

Example	(OrgX, OrgY, OrgZ) = Gr.GetWinOrg ()

SetWinRot (RotX, RotY, RotZ)

Sets the rotation of the active graphics window.

RotX, RotY, RotZ	Rotation of graphics window (radians)
Returns	void

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Example	Gr.SetWinRot (0.0, 0.0, PI/4.0) # Set z rotation to 45 degrees

GetWinRot ()

Returns the rotation of the active graphics window.

Returns	RotX, RotY, RotZ	
	RotX, RotY, RotZ	Return rotation of graphics window (radians).

Example	(RotX, RotY, RotZ) = Ws.GetWinRot ()

SetWinScale (Scale)

Sets the scale of the active graphics window.

Scale	Scale (1"=).
Returns	void

Example	Gr.SetWinScale (50.0)

GetWinScale ()

Returns the scale of the active graphics window.

Returns	Scale = Return window scale (1"=)

Example	(Scale) = Gr.GetWinScale ()

SetActiveWin (Win)

Sets the active window class to which to communicate parameters.

ActiveWin	Active window to set.
Returns	void

Example	Gr.SetActiveWin (0)

GetActiveWin ()

Returns the active window class to which parameters are communicated.

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Returns	ActiveWin - Number of active window

Example	ActiveWin = Gr.GetActiveWin ()

GetColor (PenNum, WinNum)

Returns the RGB color values of the specified pen.
PenNum -> WinNum ->

PenNum	Pen Number.	
WinNum	Window number.	
Returns	Red, Green, Blue.	
	Red	Red color component (0-255).
	Green	Green color component (0-255).
	Blue	Blue color component (0-255).

Example	(red, green, blue) = Gr. GetColor (1, 0)

PenNum (PenNum, WinNum)

Sets the current pen number.

PenNum	Pen Number
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.PenNum (2)

SetDashed (LineLen, SpaceLen, UseInches, WinNum)

Makes current line font represent a dashed line.
NOTE: This only works with the Plot1 command.

LineLen	Length of line (ground or inches).
SpaceLen	Length of space (ground or inches).
UseInches	1=Lengths are in inches. 0=Lengths are in ground units.
WinNum	Window number (-1=All)
Returns	void

Example	Gr.SetDashed (0.2, 0.1, 1)

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LineWidth (LineWidth, WinNum)

Sets the current line if the hardware device is capable.

Width	Line width in pixels (integer).
WinNum	Window number (-1=All, Default=-1).
Returns	void

Example	Gr.LineWidth (2)

LineWidthD (LineWidth, WinNum)

Sets the current line if the hardware device is capable.

Width	Line width in ground units (floating point number).
WinNum	Window number (-1=All, Default=-1).
Returns	void

Example	Gr.LineWidth (2)

DrawMode (DrawMode, WinNum)

Sets the current draw mode.

DrawMode	1 = Draw - MODE_DRAW 2 = Erase - MODE_ERASE 3 = Exclusive - MODE_XOR 4 = Or - MODE_OR
WinNum	Window number (-1=All, Default=-1).
Returns	void

Example	Gr.DrawMode (MODE_DRAW)

Plot (x, y, z, Pen, WinNum)

Plots a line.

x, y, z	Coordinates.
Pen	Pen command. 1=up PEN_UP 2=down PEN_DOWN 4=end PEN_END (optional) (default=0)
WinNum	Window number (-1=All, Default=-1)

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Returns	void

Example	# Draw a line segment Gr.Plot (10.0, 25.54, 5.6, 1) Gr.Plot (60.76, 312.32, 7.8, 2)

Plot1 (x, y, z, Pen, WinNum)

Plots a line with fonting (works with SetDashed method).

x, y, z	Coordinate to plot
Pen	Pen command. 1=up PEN_UP 2=down PEN_DOWN 4=end PEN_END (optional) (default=0)
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	# Draw a line segment Gr.Plot (10.0, 25.54, 5.6, 1) Gr.Plot (60.76, 312.32, 7.8, 2)

Flush (WinNum)

Flushes graphics buffer.

WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.Flush ()

SetFlushMode (FlushMode, WinNum)

Sets flush mode.

FlushMode	0 - Ignore all flushes until FlushMode is set to 1. This is normally used for a screen replot. 1 - Process all flushes.
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.SetFlushMode (1)

DrawMarker (x, y, z, Type, Radius, WinNum)

Draws a marker with the current draw mode and color.

x, y, z	Ground position coordinates to plot marker

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Type	Type of marker (MARK_CROSS|MARK_SQUARE | MARK_X | MARK_CIR| MARK_TRI|MARK_CIRX||MARK_CIRCROSS (default=MARK_CROSS)
Radius	Radius in ground units (-1 =Plot scaled to view, default=-1)
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.DrawMarker (100.23, 106.34, MARK_X, 1.0)

PlotMarker (x, y, z, Type, ScaleFac, WinNum)

Plots tentative marker.

x, y, z	Ground position to plot marker
Type	Type of marker (MARK_CROSS|MARK_SQUARE | MARK_X | MARK_CIR) (default=MARK_CROSS)
ScaleFac	Scale Factor 1.0 = 1/10 inch (default=1.0)
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.PlotMarker (100.23, 106.34, MARK_CROSS, 2.0)

EraseMarker ()

Erases tentative marker at its last location.
NOTE: PlotMarker MUST have been called first.

Returns	void

Example	Gr.EraseMarker ()

SetRband (x, y, z, Pen, WinNum)

Draws rubber-banded line segment.

x, y, z	Current point
Pen	Pen command 1=Start point, 2=End point
WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.SetRband (10.0, 10.0, 0.0, 1)
	while (reading_input):
	  # Insert code to read from input device into curx, cury, curz
	  Gr.SetRband (curx, cury, curz, 2)

SetRbandLast (WinNum)

Draws rubber-banded line segment at it's last position.

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WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.SetRbandLast ()

HideRband (WinNum)

Hides the current rubber-banded line segment if visible.

WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.HideRband ()

EraseRband (WinNum)

Erases rubber-banded line segment at it's last position.

WinNum	Window number (-1=All, Default=-1)
Returns	void

Example	Gr.EraseRband ()

GetRbandState ()

Returns the rubber band state of the active window.

Returns	0=Rubber band is not visible 1=Rubber band is visible

Example	State = Gr.GetRbandState ()

GetCursor ()

Returns the current cursor state.

Returns	x, y, z, key	
	x, y, z	Current cursor position (ground)
	key	Current key being pressed (-1 = None)

Example	(x, y, z, key) = Gr.GetCursor ()

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2.1.2.7 PyVrGui

Vr Mapping

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Gui Class Reference (PyVrGui)

VrOne/Python graphical user interface and miscellaneous system routines More...

Members

- DspMsg (LabelStrg)
- DspMsg0 (LabelStrg)
- DspState (FieldNum, Strg)
- DspShortMsg (Num, LabelStrg)
- SetTitle (TitleStrg)
- ShowCoord (x, y, z)
- ShowZ (z)
- ClearCoord ()
- OpenFileNameDialog (Title, DefaultDir, Ext)
- SaveFileNameDialog (Title, DefaultDir, Ext)
- GetDirectoryName (Title, DefaultDir, ParamName)
- MsgBox (MessageStrg, Title)
- AlertBox (MessageStrg, Title)
- ConfirmBox (MessageStrg, Title)
- YesNoBox (MessageStrg, Title)
- YesNoCancelBox (MessageStrg, Title)
- TryAgainBox (MessageStrg, Title)
- CustomBox (MessageStrg, But0, But1, But2, Title)
- InputDialog (Prompt, Title)
- PushKeyin (Strg)
- GetCoord (Title)
- Beep (SoundFile, UseDefault)
- ProgInit (Desc, TotalSteps)
- ProgSet (Progress)
- ProgReset ()

Description

The Python VrOne GUI Class contains graphical user interface routines.

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Member Function Documentation

DspMsg (LabelStrg)

Places text into the message area of the main window. This is the bottom longest line.

LabelStrg	Text to place in message area.

DspMsg0 (LabelStrg)

Places text into message area 0 of the main window. This is the top longest line. This area is normally filled by fields but may be written as a single line with this routine.

LabelStrg	Text to place in message area.

DspState (FieldNum, Strg)

Places text into a field of the state message area.

FieldNum	Field number (0-5)
Strg	Text to place in field (up to 39 char)

DspShortMsg (Num, LabelStrg)

Places text into the main window label area.

Num	Label area (0-1)
LabelStrg	Text to place in label area.

SetTitle (TitleStrg)

Sets the title sent in the main window's window title bar.

TitleStrg	Title to set.

ShowCoord (x, y, z)

Shows coordinates in main window.

x	X Coordinate to show.
y	Y Coordinate to show.
z	Z Coordinate to show.

ShowZ (z)

Shows elevation in main window.

z	Elevation to show.

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ClearCoord ()

Clears the coordinate display area.

OpenFileNameDialog (Title, DefaultDir, Ext)

Displays an open file dialog and returns the name of the file selected by the user.

Title for dialog box.	
Initial path to display or leave blank to display the current working path	
Allows you to limit the types of files displayed (Example: “*.txt” would only show files that have a .txt extension)	
Return file name.	
(filename)	
filename	File name selected by user

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Example	Gui = PyVrGui()
	(FileName) = Gui.OpenFileNameDialog ("Text File Input", "", ""*.txt”)
	if (FileName):
	InFile = open (FileName, "r") # Read data from file
	InFile.close()

SaveFileNameDialog (Title, DefaultDir, Ext)

Displays a save file dialog and returns the name of the file selected or entered by the user.

Title for dialog box.	
Initial path to display. Leave blank to display the current working path.	
Allows you to limit the types of files displayed (Example: “*.txt” would only show files that have a .txt extension).	
(filename)	
filename	File name selected or entered by user.

Example	Gui = PyVrGui()
	(FileName) = Gui.SaveFileNameDialog ("Enter file name", "", "*.txt")
	if (FileName):
	OutFile = open (FileName, "w") # Write data to file
	OutFile.close()

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GetDirectoryName (Title, DefaultDir, ParamName)

Displays a directory selection dialog and returns the name of the directory selected.

Title	Title for dialog box.	
DefaultDir	Initial path to display or leave blank to display the current working path.	
ParamName	Optional parameter filename so the last location can be remembered.	
returns	(ret, filename)	
	ret	0=Ok pressed, -1=Cancel pressed
	filename	Name of directory

MsgBox (MessageStrg, Title)

Displays a message in a modal dialog box with an OK button.

MessageStrg	Message to display.
Title	Title for window border.

AlertBox (MessageStrg, Title)

Displays a message in a modal dialog box with an OK and Cancel button.

MessageStrg	Message to display.	
Title		
returns	(ret)	
	ret	0= "OK" pressed -1= "Cancel" pressed

ConfirmBox (MessageStrg, Title)

Displays a message in a modal dialog box with an OK and Cancel button.

MessageStrg	Message to display	
Title	Title for window border	
returns	(ret)	
	ret	0= "OK" pressed -1= "Cancel" pressed

YesNoBox (MessageStrg, Title)

Displays a message in a modal dialog box with an Yes and No buttons.

MessageStrg	Message to display.	
Title	Title for window border.	
returns	(ret)	
	ret	0 = "No" pressed

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		1 = "Yes" pressed

YesNoCancelBox (MessageStrg, Title)

Displays a message in a modal dialog box with Yes, No, and Cancel buttons.

MessageStrg	Message to display	
Title	Title for window border	
returns	(ret)	
	ret	1= "Yes" pressed 0= "No" pressed -1= "Cancel" pressed

TryAgainBox (MessageStrg, Title)

Displays a message in a modal dialog box with an Try Again button.

MessageStrg	Message to display.
Title	Title for window border.

CustomBox (MessageStrg, But0, But1, But2, Title)

Displays a message in a modal dialog box with up to 3 buttons

MessageStrg	Message to display.	
But0	Button title 0 (NULL = disabled).	
But1	Button title 1 (NULL = disabled).	
But2	Button title 2 (NULL = disabled).	
Title	Title for window border.	
returns	(ret)	
	ret	Button number pressed (0-2 | -1=Escape or Close box pressed).

InputDialog (Prompt, Title)

Displays a dialog that allows the user to enter a text string.

Prompt	Displayed prompt.	
Title	Title for window border.	
returns	(status, ret)	
	status	0=User cancelled selection. 1=Value entered.
	ret	String entered by user. Blank if user didn't enter a string.

Example	`(Status, InputStrg) = InputDialog ("Input Test", "Enter string")`

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PushKeyin (Strg)

Pushes a string into the VrOne Main Window key-in field and presses return. Emulates a user typing a command or argument then pressing return. All VrOne key-ins are available to this function.

Strg	String to push

Example	`PushKeyin ("SnaOn, SnaInt, InsLin")`

GetCoord (Title)

Allows the user to select a location on the VrOne graphics window and returns the coordinate selected.

Title	Title to display in VrOne message area.	
returns	(status, x, y, z)	
	status	0=User selected point. 1=User cancelled selection.
	x, y, z	Coordinate selected by user (double precision).

Example	`(stat, x, y, z) = GetCoord ("Select Coordinate")`
	`if (stat == 0):`
	`  print ("Selected coordinate %.2f,%.2f,%.2f" % (x,y,z))`

Beep (SoundFile, UseDefault)

Beeps if beeping is enabled.

SoundFile	Sound file to play. Normally a .wav file
UseDefault	If a null string is sent for the sound file, play the default sound (default=TRUE)

ProgInit (Desc, TotalSteps)

Initiates the progress bar.

Desc	Text description of task.
TotalSteps	Total steps. May be any integer number.

ProgSet (Progress)

Updates the progress bar.

Progress	Progress count.
returns	(ret)

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	ret	Current progress percent or -1 if progress was not updated.

ProgReset ()

Resets the progress bar.

2.1.2.8 PyVrImgMgr

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Vr Mapping

Image Manager Class Reference (PyVrImgMgr)

VrOne/Python image management routines More...

Members

- Open (FileName, MakePyra, ReadWorld)
- IsOpen (FileName)
- CloseByIdx (ImgNum)
- CloseByName (FileName)
- CloseAll ()
- GetIndexColorMap (ImgNum)
- GetColor (ImgNum, Idx)
- IsIndexed (ImgNum)
- GetImgCount ()
- GetImgDepth (ImgNum)
- GetImgSizeInt (ImgNum, PixIncr)
- GetImgSizeFloat (ImgNum, PixIncr)
- Clamp (ImgNum, PixIncr, StartX, StartY, Wdt, Hgt)
- GetImgPixelSize (ImgNum)

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- GetImgFileName (ImgNum)
- GetImgNum (FileName)
- GetImgOffset (ImgNum)
- GroundToImage (ImgNum, gx, gy)
- ImageToGround (ImgNum, ix, iy)
- GetImgCorner (ImgNum, Corner)
- GetImgCenter (ImgNum)
- GetImgWin (ImgNum, StartX, StartY, SizeX, SizeY, PixIncr)
- SetWorld (ImgNum, ScaleX, ScaleY, RotX, RotY, UpLeftX, UpLeftY, FileName, WriteFile, Centered)
- GetWorld (ImgNum, ReadFile)
- GetRotation (ImgNum)
- ShiftWorld (ImgNum, ShiftX, ShiftY, WriteFile)
- GetBrightContrast (ImgNum)
- SetBrightContrast (ImgNum, Bright, Contrast)
- AddColorMap (ImgNum, ColorMap, Type)
- RemoveColorMap (ImgNum, Type)
- SetColorMap (ImgNum, ColorMap)
- ColorMapOff (ImgNum)
- ColorMapOn (ImgNum)
- ClearColorMap (ImgNum)
- IsColorMapOn (ImgNum)
- IsColorMapSet (ImgNum)
- SetViewFlags (ImgNum)
- GetViewFlags (ImgNum)
- SetViewFlag (ImgNum, Win, Viewable)
- GetViewFlag (ImgNum, Win)
- GetPhotoInterp (ImgNum)
- GetType (ImgNum)
- MoveImg (ImgNum, MoveTo)
- MoveImgTop (ImgNum)
- MoveImgBottom (ImgNum)
- MoveImgUp (ImgNum)
- MoveImgDown (ImgNum)
- ImgSetDisplayOffsetMode (ImgNum, Mode)

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Description

Allows management of images in VrOne. Images can be opened and closed. Information about currently open images can be queried. Settings for images, such as brightness, color maps, and location, can be changed. Provides methods for converting between ground and image coordinates and for reading image data.

Member Function Documentation

Open (FileName, MakePyra, ReadWorld)

Allocates an image object and opens an image.

FileName	Image file name.	
MakePyra	Make image pyramids? 0=No, 1=Yes(default)	
ReadWorld	Read world file? 0=No, 1=Yes(default)	
returns	(ret)	
	ret	Image sequence number (0-MaxImgs-1) -1 Could not open file.

IsOpen (FileName)

Checks if an image is open.

FileName	Image name to check.	
returns	(ret)	
	ret	0=Image not open. 1=Image is open.

CloseByIdx (ImgNum)

Closes an image using index number.

ImgNum	Image to close.

CloseByName (FileName)

Closes an image using image name.

FileName	File name used to open the image.

CloseAll ()

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Closes all open images.

GetIndexColorMap (ImgNum)

Gets index color map for a simgle image This is the internal colormap for index-based images.

ImgNum	Image index number.	
returns	(ret)	
	ret	List of 255 RGB color values.

GetColor (ImgNum, Idx)

Gets RGB color for a single index value.

ImgNum	Image index number.	
Idx	Color index (0-255)	
returns	(Red, Green, Blue)	
	Red	0-255.
	Green	0-255.
	Blue	0-255.

IsIndexed (ImgNum)

Returns whether an image index is color-based.

ImgNum	Image index number to check.
returns	0=No 1= Yes

GetImgCount ()

Returns the number of images currently open.

returns	(ret)	
	ret	Number of images currently open.

GetImgDepth (ImgNum)

Returns the image bit depth for the image specified.

ImgNum	Image index number. Returns 0 if the image number is out of range.	
returns	(ret)	
	ret	Image bit depth (8, 16, 24).

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GetImgSizeInt (ImgNum, PixIncr=1)

Returns the image width and height for the image specified.

ImgNum	Image index number.	
PixIncr	Pixel increment for which to retrieve size. 1,2,4,8,16,32,64.	
returns	(ret, Width, Height)	
	ret	0 = OK -1 = Image index number out of range
	Width	Image width.
	Height	Image height

GetImgSizeFloat (ImgNum, PixIncr=1)

Returns the image width and height for the image specified.

ImgNum	Image index number.	
PixIncr	Pixel increment for which to retrieve size. 1,2,4,8,16,32,64	
returns	(ret, Width, Height)	
	ret	0 = OK -1 = Image index number out of range
	Width	
	Height	

Clamp (ImgNum, PixIncr, StartX, StartY, Wdt, Hgt)

Clamps values to image size at a given pixel increment.

ImgNum	Image index number.	
PixIncr	Pixel increment. 1,2,4,8,16,32,64.	
StartX	Minimum X of window to clamp.	
StartY	Minimum Y of window to clamp.	
Wdt	Width of window to clamp.	
Hgt	Height of window to clamp.	
returns	(ret, StartX, StartY, Wdt, Hgt)	
	ret	0=Invalid image index number. 1=Clamped.
	StartX	New start X.
	StartY	New start Y.
	Wdt	New width of window.
	Hgt	New height of window.

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GetImgPixelSize (ImgNum)

Returns the image pixel size.

ImgNum	Image index number.	
returns	(ret)	
	ret	Return pixel size. (ground)

GetImgFileName (ImgNum)

Returns the image filename of the image specified.

ImgNum	Image index number.	
returns	(ret, FileName)	
	ret	0 = OK. -1 = Image index number out of range.
	FileName	Image file name.

GetImgNum (FileName)

Returns image index number based on file name.

FileName	Image file name.	
returns	(ret, ImgNum)	
	ret	0 = OK. -1 = Filename not found.
	ImgNum	Return image index number.

GetImgOffset (ImgNum)

Returns the current image offset (if origin has been changed).

ImgNum	Image index number. Returns 0.0, 0.0 if the image number is out of range.	
returns	(OfsX, OfsY)	
	OfsX	Offset X (ground).
	OfsY	Offset Y (ground).

GroundToImage (ImgNum, gx, gy)

Converts ground coordinate to image coordinate.

ImgNum	Image index number.
gx	Input ground coordinate X.
gy	Input ground coordinate Y.

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returns	(ix, iy)	
	ix	Output image coordinate X.
	iy	Output image coordinate Y.

ImageToGround (ImgNum, ix, iy)

Converts ground coordinate to image coordinate.

ImgNum	Image index number.	
ix	Input image coordinate X.	
iy	Input image coordinate Y.	
returns	(gx, gy)	
	gx	Output ground coordinate X.
	gy	Output ground coordinate Y.

GetImgCorner (ImgNum, Corner)

ImgNum	Image index number.	
Corner	Corner to get: 1 = Lower left. 2 = Lower right. 3 = Upper right. 4 = Upper left.	
returns	(ret, x, y)	
	x	Corner X coordinate
	y	Corner Y coordinate

GetImgCenter (ImgNum, x, y)

Returns the image center coordinate in ground units.

ImgNum	Image index number.	
returns	(ret, x, y)	
	ret	0 = OK. -1 = Image index number out of range.
	x	Corner X coordinate.
	y	Corner Y coordinate.

GetImgWin (ImgNum, StartX, StartY, SizeX, SizeY, PixIncr)

Reads a window of image data.

ImgNum	Image index number.
StartX	Minimum X (column) of window.
StartY	Minimum Y (row) of window.
SizeX	Width (columns) of window.

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SizeY	Height (rows) of window.	
PixIncr	Pixel increment used for downsampling (2 = read every other pixel)	
returns	(ret, ImageMemory)	
	ret	0 = OK. -1 = Image index number out of range
	ImageMemory	List of pixel rows and values. List is in [rows][cols] format. Each item in rows is 1 or 3 item list of pixel values.

SetWorld (ImgNum, ScaleX, ScaleY, RotX, RotY, UpLeftX, UpLeftY, WriteFile)

Sets the world file transformation parameters and, optionally, writes the file.

ImgNum	Image index number.	
ScaleX	X direction pixel size (ground).	
ScaleY	Y direction pixel size (ground, sign is reversed and sent as positive).	
RotX	X rotation.	
RotY	Y rotation.	
UpLeftX	Upper left X coordinate (ground).	
UpLeftY	Upper left Y coordinate (ground).	
FileName	File name to write (File name or 0=No file name)	
WriteFile	0=Don't write file 1=Write file.	
Centered	Is coordinate of the upper left pixel centered? (0=No 1=Yes) (Vr Mapping is No)	
returns	(ret)	
	ret	0 = OK. -1 = Image index number out of range

GetWorld (ImgNum)

Gets the current world file transformation parameters.

ImgNum	Image index number.	
returns	(ret, ScaleX, ScaleY, RotX, RotY, UpLeftX, UpLeftY)	
	ret	0 = OK. -1 = ImgNum invalid
	ScaleX	X direction pixel size (ground).
	ScaleY	Y direction pixel size (ground).
	RotX	X rotation.

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	RotY	Y rotation.
	UpLeftX	Upper left X coordinate (ground).
	UpLeftY	Upper left Y coordinate (ground).

GetRotation (ImgNum)

Gets the current world file rotation.

ImgNum	Image index number.	
returns	(ret)	
	ret	World file rotation

ShiftWorld (ImgNum, ShiftX, ShiftY, WriteFile)

Shifts the world file transformation parameters and, optionally, writes file.

ImgNum	Image index number.	
ShiftX	X direction shift value (ground).	
ShiftY	Y direction shift value (ground).	
WriteFile	0=Don't write file. 1=Write file.	
returns	(ret)	
	ret	0 = OK. -1 = Image index number out of range.

GetBrightContrast (ImgNum)

Gets current brightness and contrast of image.

ImgNum	Image index number to get.	
returns	(ret, Bright, Contrast)	
	ret	0 = OK . -1 = Image index number out of range.
	Bright	Brightness index 0-100 (50=None).
	Contrast	Contrast index 0-100 (50=None).

SetBrightContrast (ImgNum, Bright, Contrast)

Sets image brightness and contrast.

Bright	Brightness index 0-100 (50=None, -1= No Change)

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Contrast	Contrast index 0-100 (50=None, -1= No Change)	
ImgNum	Image index number to adjust (defaults to -1= All)	
returns	(ret)	
	ret	0 = OK -1 = Image index number out of range

AddColorMap (ImgNum, ColorMap, Type)

Sets color map to apply whenever pixels are read from the image.

ImgNum	Image index number this applies to or -1 for all images.
ColorMap	3x256 list of values for colormap.
Type	Color map type. User-defined value. Should start at 1000 or greater to avoid conflict with Vr types. For each type added, there can only be one colormap. If a colormap with the same type already exists, it will be replaced.

RemoveColorMap (ImgNum, Type)

Add color map to be applied whenever pixels are read from the image.

ImgNum	Image index number this applies to or -1 for all images.
Type	Color map type.

SetColorMap (ImgNum, ColorMap)

Sets default color map to be applied whenever pixels are read from the image.

ImgNum	Image index number this applies to or -1 for all images.	
ColorMap	3x256 list of values for colormap.	

ColorMapOff (ImgNum)

Turn color mapping off for an image. If a color map was set it will still remain with the image, it will just not be active.

ImgNum	Image index number this applies to or -1 for all images.

ColorMapOn (ImgNum)

Turns color mapping on for an image. This is useful if ImgColorMapOff has been called and you

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want to make the color map active again.

ImgNum	Image index number this applies to or -1 for all images.

ClearColorMap (ImgNum)

Clears the color map data that has been previously set and turns color mapping off for image.

ImgNum	Image index number this applies to or -1 for all images

IsColorMapOn (ImgNum)

Returns status of color mapping.

ImgNum	Image index number this applies to or -1 for all images.	
returns	(ret)	
	ret	TRUE = Color mapping is active. FALSE = Color mapping is not active (although it may be set).

IsColorMapSet (ImgNum)

Returns whether color map has been set or not.

ImgNum	Image index number this applies to or -1 for all image.	
returns	(ret)	
	ret	TRUE = Color map has been set (but not necessarily active). FALSE = Color map has not been set.

SetViewFlags (ImgNum)

Sets view flag for one window.

ImgNum	Image to set view flag.	
returns	(ViewFlags)	
	ViewFlags	List of flags, one for each window. Each entry is 0 or 1 indicating if image is viewable or not in a particular window.

GetViewFlags (ImgNum)

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Gets images view flags for all windows.

ImgNum	Image index number.	
returns	(ret)	
	ret	List of flags, one for each window. Each entry is 0 or 1 indicating if image is viewable or not in a particular window.

SetViewFlag (ImgNum, Win, Viewable)

Sets view flag for one window.

ImgNum	Image index number.
Win	Window number 0 to MAX_WINS
Viewable	0=Image not viewable. 1=Image viewable.

GetViewFlag (ImgNum, Win)

Gets the opacity for an image.

ImgNum	Image index number.	
Win	Window number 0 to MAX_WINS.	
returns	(ret)	
	ret	0=Image not viewable. 1=Image viewable.

GetPhotoInterp (ImgNum)

Gets the photometric interpretation for the image.

ImgNum	Image index number.	
returns	(ret)	
	ret	Photometric Interpretation: 0 = PHOTOMETRIC_M 1 = PHOTOMETRIC_M 2 = PHOTOMETRIC_R 3 = PHOTOMETRIC_P 5 = PHOTOMETRIC_SI 6 = PHOTOMETRIC_Y 8 = PHOTOMETRIC_C 9 = PHOTOMETRIC_IC 10 = PHOTOMETRIC_I 32844 = PHOTOMETRIC_ 32845 = PHOTOMETRIC

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GetType (ImgNum)

Gets the image type.

ImgNum	Image index number.	
returns	(ret)	
	ret	Image Type: 0 = Unknown. 1 = Tiff Scanline. 2 = Tiff Strip. 3 = Tiff Tiled. 4 = Jpeg. 5 = Mr Sid. 6 = Jpeg 2000. 7 = Ecw.

MoveImg (ImgNum, MoveTo)

Moves image to specific place in display order.

ImgNum	Image index number.	
MoveTo	0...ImgCount-1	
returns	(ret)	
	ret	Location to which image moved.

MoveImgTop (ImgNum)

Moves image to top of viewing order (displayed last).

ImgNum	Image index number.

MoveImgBottom (ImgNum)

Moves image to bottom of viewing order (displayed first).

ImgNum	Image index number.

MoveImgUp (ImgNum)

Moves image up in viewing order (displayed later).

ImgNum	Image index number.

MoveImgDown (ImgNum)

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Moves image down in viewing order (displayed earlier).

ImgNum	Image index number.

SetDisplayOffsetMode (ImgNum, Mode)

Sets image display mode.

ImgNum	Image index number.
Mode	0= Display at original location. 1= Display at offset location.

2.1.2.9 PyVrLayer

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Vr Mapping

Layer Class Reference (PyVrLayer)

VrOne/Python Layer Class More...

Members

- Stat (Layer)
- Cond (Layer, OnOff)
- CondNumLine (LayerStrg, OnOff)
- AllOn ()
- AllOff ()
- LoadNames (FileName)
- RecNames (FileName)
- GetNameCount ()
- ResetNameCount ()
- AddName (Layer, Name, Prop, Desc)

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- GetName (Layer)
- GetNameByIdx (Index)
- Print ()

Description

Allows layer settings to be viewed and changed, and contains methods for dealing with layer names.

```
Example:

from pylayer import *

Layer = VrLayer ()


(VrVersion) = Cfg.GetVrVersion ()
```

Member Function Documentation

Stat (Layer)

Returns status of layer sent.

Layer	Layer number.	
returns	(ret)	
	ret	0 - Layer is off. 1 - Layer is on.

Cond (Layer, OnOff)

Conditions a single layer.

Layer	Layer number.
OnOff	0 - Turn layer off. 1 - Turn layer on. 2 - Turn this layer off. Turn all others on. 3 - Turn this layer on. Turn all others off.

CondNumLine (LayerStrg, OnOff)

Conditions a group of layers based on a number line.

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LayerStrg	Layer number line.
OnOff	0 - Turn layers off. 1 - Turn layers on. 2 - Turn these layers off. Turn all others on. 3 - Turn these layers on. Turn all others off.

AllOn ()

Turns all layers on.

AllOff ()

Turns all layers off.

LoadNames (FileName)

Loads layer names from disk.

FileName	Layer name file name.

RecNames (FileName)

Loads layer names from disk.

FileName	Layer name file name.

GetNameCount ()

Returns the current number of layer names used.

ResetNameCount ()

Returns the current number of layer names used.

AddName (Layer, Name, Prop, Desc)

Adds a layer name. A call to RecNames is required after a layer name or names are added to record or re-record the layer name file.

Layer	Layer number (1-MAXLAYERS).
Name	Layer name to set (32 char).
Prop	Layer property (32 char).
Desc	Layer description (64 char).

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GetName (Layer)

Gets a layer name.

Layer	Layer number (1-MAXLAYERS).	
returns	(Name, Prop, Desc).	
	Name	Return layer name (32 char).
	Prop	Return layer property (32 char).
	Desc	Return layer description (64 char).

GetNameByIdx (Index)

Gets a layer number and name by index.

Index	Index 0-GetNameCount()-1.	
returns	(Layer, Name, Prop, Desc).	
	Layer	Return layer number (1-MAXLAYERS).
	Name	Return layer name (32 char).
	Prop	Return layer property (32 char).
	Desc	Return layer description (64 char).

Print ()

Prints current layer table

2.1.2.10 PyVrLine

Vr Mapping

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Layer Class Reference (PyVrLine)

Holds and manipulates VrOne line data More…

Members

Initialization

- Init ()
- Reset ()

File Operations

- Load (WsNum, LineNum, DispFlag=-1)
- LoadLast ()
- Rec (WsNum, DispFlag=-1)
- ReRec (DispFlag=-1)
- Del ()
- Id (WsNum=-1)
- GetIdPoint ()
- Copy (TargetLine)

Set Line Attributes

- SetLayer (Layer)
- SetMode (Mode)
- SetGpoint (Gpoint)
- SetPenNum (PenNum)
- SetNpoint (Npoint)
- SetLink (Link)
- SetFc (Fc)
- SetConstr (Constr)
- SetWidth (Width)
- SetOrient (Orient)
- SetSide1 (Side)
- SetSide2 (Side)
- SetPointFlags (PntNum, p=-1, a=-1, c=-1, f=-1, m=-1)

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- GetFkeyParams (FkeyName)

Get Line Attributes

- GetWsNum ()
- GetLineNum()
- GetNumXyz ()
- GetLayer ()
- GetMode ()
- GetGpoint ()
- GetPenNum ()
- GetNpoint ()
- GetLink ()
- GetFc ()
- GetConstr ()
- GetWidth ()
- GetOrient ()
- GetSide1 ()
- GetSide2 ()
- GetPointFlags (PntNum)

Coordinate Input Output

- AddPoint (x, y, z. p=0, a=0, c=0, f=0, m=0)
- InsPoint (PntNum, x, y, z, p=0, a=0, c=0, f=0, m=0)
- ChgPoint (PntNum, x, y, z=0.0, p=0, a=0, c=0, f=0, m=0)
- GetPoint (PntNum)
- Backup ()
- DelPoint (PntNum)
- DelPoints (Begin, End, Mode)
- ShowPoints ()

Geometry

- Reverse ()
- Offset (OfsDist)
- Move (Dx, Dy, Dz)
- Scale (PivotX, PivotY, SclFac)
- Rotate (PivotX, PivotY, RotAng)
- MirrorX (PntNum)

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- MirrorY (PntNum)
- Length (Mode)
- Area ()
- Direction ()
- ZRange ()
- Mbr ()
- Azimuth ()
- ClosestEnd (x, y)
- IsClosed ()
- CloseDist ()
- Close (CloseMode)
- ClosePoint (x, y)
- SnapPoint (SnapX, SnapY)
- SnapPointAdd (SnapX, SnapY, SnapZ, p=0, a=0, c=0, f=0, m=0)
- AddPointDist (Dist, StoreCmd)
- IsPointInside (x, y)

Graphics

- Plot ()
- Erase ()

Description

The VrOne/Python Line class defines VrOne line data. A line consists of a header and a list of xyz points. An existing line class may be loaded from disk. Header information may be defined by a Python script or may be inherited from a VrOne Function Key. The user of this class should understand the VrOne Data Structure.

Example:

```
# Loads all the lines in current workspace, change the layers
# and graphic pointers and re-records them.
# Filename: ChangeLines.py
# WARNING: Changes data but is undoable

Ws    = PyVrWs()    # VrOne workspace manager object
Line  = PyVrLine()  # VrOne line object
WsNum = Ws.Aws()    # Current workspace

Ws.UndoBegin (WsNum, "ChangeLines")             # Begin undo

for LineNum in range (0, Ws.GetLineCount (WsNum)):
```

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```
      Line.Load (WsNum, LineNum)                # Load line
      Line.Erase()                              # Erase it from graphics
      Line.SetLayer (23)                        # Change the layer
      Line.SetGpoint (15)                       # Change the graphic
pointer
      Line.ReRec()                              # Re-record it
      Line.Plot()                               # Re-plot it

Ws.UndoEnd (WsNum)                              # End undo
```

Member Function Documentation

Init ()

Initializes a line by setting its header data to default values and setting its coordinate data to no points. This is useful when reusing a line class.

Reset ()

Resets a line by setting its coordinate data to no points. The line header is not modified. This is useful when reusing a line class.

Load (WsNum, LineNum)

Loads a line from disk.

Workspace number (0-255).
Line number.
Line number loaded. -1 = workspace or line number out of range.

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LoadLast ()

Loads the last saved line. If a Python script is run as a Function Key's OnEnd command it is possible for the script to further process the line that was just saved. See the AddPosts.py example.

0 = OK. -1 = No last line.

Rec (WsNum, DispFlag=-1)

Records a line at the end of a workspace.

WsNum	Workspace number to record (0-255).
DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display.
returns	Line number. -1 = Workspace number out of range.

ReRec (DispFlag=-1)

Re-records a previously loaded line by marking the original location as deleted and placing the line at the end of the workspace.

DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display.
returns	0 = OK. 1 = Could not record line.

Del ()

Deletes a line by marking its layer number as a negative number on disk. Pack Vr removes deleted entities from a workspace

returns	0 = OK. 1 = Could not delete line. Line was never loaded.

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Id (WsNum=-1)

Allows interactive line selection. Returns a line number that may be used to load the line from disk.

WsNum	Workspace number to search (0-255).
returns	Line number. -1 = Line not selected.

Example:

```
# Select (Id) a line and print it
Ws      = PyVrWs()              # VrOne workspace manager
Line    = PyVrLine()            # VrOne line object

if (Line.Id() != -1):           # Did we get a line?
   # Print the points on the line
   for i in range (0, Line.GetNumXyz()):
      (x, y, z) = Line.GetPoint (i)
      print ("%d %.3f %.3f %.3f" % (i, x, y, z))
```

GetIdPoint ()

Returns the line point that was identified during the last Line.Id(). A Line.Id() must be called before GetIdPoint().

returns	Line point number. -1 = No point available.

Example:

```
# Select (Id) a line and print the line point number that was locked
onto.
Ws      = PyVrWs()              # VrOne workspace manager
Line    = PyVrLine()            # VrOne line object

if (Line.Id() != -1):           # Did we get a line?
   print "The line point we locked onto was", Line.GetIdPoint()
```

Copy (TargetLine)

Copies the current line to the target line.

TargetLine	Line to which to copy the current line.

Example:

```
# Copy line
Ws      = PyVrWs()              # VrOne workspace manager
Line    = PyVrLine()            # VrOne line object
TarLine = PyVrLine()            # Line to copy to

if (Line.Id() != -1):           # Did we get a line?
   print TarLine.GetLayer()     # Print the current layer of TarLine
```

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```
Line.Copy (TarLine)          # Copy the identified line to TarLine
print TarLine.GetLayer()     # Print new layer of TarLine
```

SetLayer (Layer)

Sets the layer of the line.

Layer	Layer number (1-10001).

SetMode (Mode)

Sets the mode of the line. Mode 1 is a line and mode 2 is splined line.

Mode	Line mode (1-2).

SetGpoint (Gpoint)

Sets the graphic pointer of the line. The graphic pointer determines the graphic representation of a line such as a fence or a tree line.

Gpoint	Line graphic pointer (1-1000).

SetPenNum (PenNum)

Sets the pen number of a line, which determines the color to use. NOTE: If a Pen Table is active, this command has no effect.

PenNum	Pen number (1-256).

SetNpoint (Npoint)

Sets the line's non-graphic pointer.

Npoint	Non-graphic pointer (-2,147,483,648 to 2,147,483,648).

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SetLink (Link)

Sets the link of the line.

Link	Line link (-2,147,483,648 to 2,147,483,648).

SetFc (Fc)

Sets the Feature Code of the line.

Fc	Feature code (up to 48 characters).

SetConstr (Constr)

Sets the Construction display of the line. The display of lines that have their construction flags set to 1 may be turned off.

Constr	Construction flag.

Constr Construction flag (0-1)
Example `Line.SetConstr (0)`

SetWidth (Width)

Sets the width of the line. A line width defines the number of lines that will be drawn to the left and right of the centerline. The distance between these lines may be defined in Vr Configuration.

Width	Line width (0-255).

SetOrient (Orient)

Sets the orientation of the line if used by VrMosaic.

Orient	Line orientation. -1 =

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	Auto. 0 = Horizontal. 1 = Vertical.

SetSide1 (Side)

If used by VrMosaic, sets the image side of the first image.

Side	-1 = Auto 0 = Bottom or Left 1 = Top or Right

SetSide2 (Side)

If used by VrMosaic, sets the image side of the second image.

Side	-1 = Auto 0 = Bottom or Left 1 = Top or Right

SetPointFlags (PntNum, p=-1, a=-1, c=-1, f=-1, m=-1)

Sets the point flags to a line coordinate. If the point number is out of range then nothing is done. See the VrOne Data Structure for information on the p (Pen command), a (Arc flag), c (Code), f (Flags), and m (Mosaic width) parameters.

PntNum	Point number. (0 - Line.getNumXyz()-1)
p, a, c, f, m	Flags. If a parameter is passed as 01, the original number is not changed.

GetFkeyParams (FkeyName)

Fills the line header data from a previously defined VrOne function key. If the function key requested does not exist, the line header is filled with default parameters.

FkeyName	Function key name.
returns	0 = OK. -1 = Function key does not exist.

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GetWsNum ()

Returns the workspace number from which a loaded line was retrieved.

returns	Workspace number (0-255. -1 = Line was never loaded from disk).

Example

```
# Select (Id) a line and print its workspace and line number
Ws      = PyVrWs()              # VrOne workspace manager
Line    = PyVrLine()            # VrOne line object

if (Line.Id() != -1):           # Did we get a line?
   print "Workspace  ", Line.GetWsNum()
   print "Line number", Line.GetLineNum()
```

GetLineNum ()

Returns the line number of a loaded line.

returns	Line number (0-?. -1 = Line was never loaded from disk).

Example

```
# Select (Id) a line and print its workspace and line number
Ws      = PyVrWs()              # VrOne workspace manager
Line    = PyVrLine()            # VrOne line object

if (Line.Id() != -1):           # Did we get a line?
   print "Workspace  ", Line.GetWsNum()
   print "Line number", Line.GetLineNum()
```

GetNumXyz ()

Returns the number of points on the line.

returns	Number of points on line 0 - 2,147,483,648, memory permitting.

GetLayer ()

Returns the line's layer.

returns	Layer number (1-10,001). A negative return layer represents a deleted entity.

GetMode ()

Returns the mode of the line.

returns	Line mode . 1 = Line. 2 = Splined line.

GetGpoint ()

Returns the line's graphic pointer. The graphic pointer determines the graphic representation of a

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line such as a fence or a tree line.

returns	Line graphic pointer (1-1000).

GetPenNum ()

Returns the pen number of the line. The pen number determines the color to use when drawing a line.

returns	Line pen number (1-256).

GetNpoint ()

Returns the non-graphic pointer of the line.

returns	Line non-graphic pointer (-2,147,483,648 to 2,147,483,648).

GetLink ()

Returns the link of the line.

returns	Line link (-2,147,483,648 to 2,147,483,648).

GetFc ()

Returns the feature code of the line

returns	Line feature code (up to 48 characters).

GetConstr ()

Returns the construction flag of the line. Lines with construction flags set to 1 may have their displays turned off.

returns	Line construction flag (0-1).

GetWidth ()

Returns the width of the line. A line width defines the number of lines that will be drawn to the left and right of the centerline. The distance between these lines may be defined in Vr Configuration.

returns	Line width (0-255).

GetOrient ()

If used by VrMosaic, returns line orientation.

returns	Line orientation. -1 = Auto. 0 = Horizontal. 1 = Vertical.

GetSide1 ()

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If used by VrMosaic, returns the image side of the first image.

returns	Line orientation. -1 = Auto. 0 = Bottom or left. 1 = Top or right.

GetSide2 ()

If used by VrMosaic, returns the image side of the second image.

returns	Line orientation. -1 = Auto. 0 = Bottom or left. 1 = Top or right.

GetPointFlags (PntNum)

Returns the point flags to a line coordinate. If the point number requested is out of range, all parameters are returned as 0. See the VrOne Data Structure for information on the p (Pen command), a (Arc flag), c (Code), f(Flags), and m(Mosaic width) parameters.

PntNum	Point number (0 - Line.GetNumXyz()-1)
returns	p, a, c, f, m flags

AddPoint (x, y, z, p=0, a=0, c=0, f=0, m=0)

Adds a coordinate point to the line at the end of line. See the VrOne Data Structure for more information on the p (Pen command), a (Arc flag), c (Code) , f(Flags), and m(Mosaic width) parameters. The p,a,c,f,m parameters are optional and default to 0.

x,y,z	Coordinate to add to the line (double precision)
p	Pen code. 0 = None. 1 = Up. 2 = Continue. 4 = End.
a	Arc flag. 0 = None. 1 = Beginning, end, or PRC. 2 = Midpoint. 3 = Point on arc.
c	Code (0-255).
f	Bit encoded flag (0-255).
m	Mosaic width (0-255).

InsPoint (PntNum, x, y, z, p=0, a=0, c=0, f=0, m=0)

Inserts a coordinate point on the line after the point number specified. See the VrOne Data

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Structure for information on the p (Pen command), a (Arc flag), c (Code) , f(Flags), and m (Mosaic width) parameters. The p,a,c,f,m parameters are optional and default to 0. If the point number is out of range, the command is ignored.

PntNu	Point number after which to store new point (0 - Line.GetNumXyz()-1)
x,y,z	Coordinate to add to the line (double precision).
p	Pen code. 0 = None. 1 = Up. 2 = Continue. 4 = End.
a	Arc flag. 0 = None. 1 = Beginning, end, or PRC. 2 = Midpoint. 3 = Point on arc.
c	Code (0-255).
f	Bit encoded flag (0-255).
m	Mosaic width (0-255).
returns	0 = OK. -1 = PntNum out of range.

ChgPoint (PntNum, x, y, z=0.0, p=0, a=0, c=0, f=0, m=0)

Changes an existing coordinate point on the line. See the VrOne Data Structure for information on the p (Pen command), a (Arc flag), c (Code), f(Flags), and m(Mosaic width) parameters. The z, p, a, c, f,m parameters are optional and default to 0. If the point number is out of range, the command is ignored.

PntNu	Point number to change (0 - Line.GetNumXyz()-1).
x,y,z	New coordinate (double precision).
p	Pen code. 0 = None. 1 = Up. 2 = Continue. 4 = End.
a	Arc flag. 0 = None. 1 = Beginning, end, or PRC. 2 = Midpoint. 3 = Point on arc.
c	Code (0-255).
f	Bit encoded flag (0-255).
m	Mosaic width (0-255).

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returns	0 = OK. -1 = PntNum out of range.

GetPoint (PntNum)

Returns a coordinate point from the line. If the point number requested is out of range, the coordinate position is returned as 0.

PntNu	Point number to return (0 - Line.GetNumXyz()-1).
returns	x,y,z (double precision) coordinates of point.

Backup ()

Backs the line up by deleting its last point.

returns	0 = OK. -1 = No more points.

DelPoint (PntNum)

Deletes a point from the line. If the point number is out of range, nothing is done.

returns	0 = OK. -1 = Point number out of range.

DelPoints (Begin, End, Mode)

Deletes a group of points from a line.

Begin	Begin line point number.
End	End line point number.
Mode	Delete mode. 0 = Delete specified points and points between them (default). 1 = Turn the "Begin" and "End" points into the first and last points on the line.
returns	0 = OK. -1 = "Begin" or "End" out of range, or "End" is greater than "Begin".

ShowPoints ()

Prints the coordinate points on the line to the standard output device. This is useful when debugging.

Reverse ()

Reverses the direction of the line.

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Offset (OfsDist)

Offsets the line by a defined distance. Line segment intersections are mitered.

OfsDis	Offset distance (ground units).

Move (Dx, Dy, Dz)

Moves the line in the xyz direction by defined distances.

Dx	Delta X move distance.
Dy	Delta Y move distance.
Dz	Delta Z move distance.

Scale (PivotX, PivotY, SclFac)

Scales the line from the specified point.

PivotX	Scale origin X.
PivotY	Scale origin Y.
SclFac	Scale factor.

Rotate (PivotX, PivotY, RotAng)

Rotates the line about the specified point.

PivotX	Rotation origin X.
PivotY	Rotation origin Y.
RotAng	Rotation angle clockwise in radians.

MirrorX (PntNum)

Mirrors the line in the X direction about a line point.

PntNum	Line point number about which to mirror line.

MirrorY (PntNum)

Mirrors the line in the Y direction about a line point.

PntNum	Line point number about which to mirror line.

Length (Mode)

Returns the line length.

Mode	Length type to return.

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	0 = Slope distance. 1 = Horizontal distance.
returns	Line length (ground units).

Area ()

Returns the line area.

returns	Line area in square ground units. If the line is open, it is closed for the area calculations.

Direction ()

Returns the line direction.

returns	Line direction. 0 = Clockwise. 1 = Counterclockwise.

ZRange ()

Returns the line Z range.

returns	Minimum and maximum line elevations.

Example (MinZ, MaxZ) = Line.ZRange()

See also Mbr()

Mbr ()

Returns the line's XY MBR (Minimum Bounding Rectangle).

returns	Minimum and maximum coordinates of the line.

Example (MinX, MinY, MaxX, MaxY) = Line.Mbr()
See also ZRange()

Azimuth ()

Returns the line's mean azimuth.

returns	Mean azimuth clockwise north up (in radians).

ClosestEnd (x, y)

Returns the closest line end to the specified point.

X,y	Coordinate poisition to check against line ends
returns	Closest end. 0 = Beginning of line. 1 = End of line.

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IsClosed ()

Returns the closure status of the line.

returns	Closure status. 0 = Line is open. 1 = Line is closed.

CloseDist ()

Returns the distance between the two endpoints on a line.

returns	Distance in ground units.

Close (CloseMode)

Closes the line.

CloseMode	Close method. 0 = Move endpoint to startpoint. 1 = Mean endpoints. 2 = Add line segment between endpoint and startpoint. 3 = Intersect end segments.

ClosePoint (x, y)

Returns the closest line point number to the coordinate sent.

X,y	Coordinate.
returns	Closest line point number.

X, y Coordinate position
Returns Closest point line number
Example `ClosePntNum = Line.ClosePoint (x, y)`

SnapPoint (SnapX, SnapY)

Snaps the point sent to the line.

SnapX	X coordinate of point to be snapped.
SnapY	Y coordinate of point to be snapped.
returns	(RetX, RetY, RetZ, Dist) RetX = X coordinate transformed to line. RetY = Y coordinate transformed to line. RetZ = Z coordinate transformed to line. Dist = Distance from snap coordinate to ret coordinate.

SnapPointAdd (SnapX, SnapY, SnapZ, p=0, a=0, c=0, f=0, m=0)

Snaps and adds a point to the line based on the coordinate sent. The point flags of p, a, c, f, m are optional.

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SnapX	X coordinate of point to be snapped.
SnapY	Y coordinate of point to be snapped.
SnapZ	Z coordinate of point to be snapped.
p	Pen code. 0 = None. 1 = Up. 2 = Continue. 4 = End.
a	Arc flag. 0 = None. 1 = Beginning, end, or PRC. 2 = Midpoint. 3 = Point on arc.
c	Code (0-255).
f	Bit encoded flag (0-255).
m	Mosaic width (0-255).
returns	Line point number of the new point.

AddPointDist (Dist, StoreCmd)

Adds a point to the line based on a distance from beginning of the line.

Dist	Distance from beginning of line to compute point.
StoreCmd	Store command. 0 = Do not store point on line. 1 = Store point on line.
returns	(RetX, RetY, RetZ, PntNum) RetX = X coordinate transformed to line. RetY = Y coordinate transformed to line. RetZ = Z coordinate transformed to line. PntNum = Line point number of new point (if point was stored), or line point number before return coordinate (if point was not stored).

IsPointInside (x, y)

Tests if the point is inside the line polygon. If the line is open, it is closed for this calculation.

X,y	Coordinate to test.
returns	0 = Point is not within the line polygon. 1 = Point is within the line polygon.

Plot ()

Plots the line to all open graphics devices. The current header parameters are used.

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Erase ()

Erases the line from all open graphics devices.

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2.1.2.11 PyVrMenuKeys

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Menu Keys Class Reference (PyVrMenuKeys)

Python VrMenuKeys Class More...

Description

This clas displays a standard menu keys dialog. The dialog can be customized and a callback function can be used to respond to the user pressing buttons on the menu keys dialog. This class can be used along with the PyVrApp class to create full event-driven applications in VrOne.

Member Function Documentation

PyVrMenuKeys (Title, NumLines)

Class constructor.

Title	Title string.
NumLines	Number of lines in information area (above buttons).

SetTitle (Title)

Sets title of dialog box.

Title	Title string.

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SetMkLabel (KeyNum, Label)

Sets a label on a single menu key button.

KeyNum	Button number to label (1-12).
Label	Label string.

EnableMkLabel (KeyNum)

Enables a single menu key button.

KeyNum	Button number (1-12).

DisableMkLabel (KeyNum)

Disables a single menu key button.

KeyNum	Button number (1-12).

SetMkLabels (Title, Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key0, Key11)

Sets all menu key button labels.

Title	Set dialog title.
Key1	Label for key 1.
Key2	Label for key 2.
Key3	Label for key 3.
Key4	Label for key 4.
Key5	Label for key 5.
Key6	Label for key 6.
Key7	Label for key 7.
Key8	Label for key 8.
Key9	Label for key 9.
Key10	Label for key 10.
Key0	Label for key 11.
Key11	Label for key 12.

PushMk ()

Saves menu key labels onto a stack. May be called multiple times. Use PopMk to restore menu keys that have been stored using PushMk.

PopMk ()

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Restores last menu keys labels that were stored using PushMk.

SetIaLabel1 (LineNum, Label)

Sets a single line label at top of Menu Keys dialog.

LineNum	Line number of label.
Label	Label string

SetIaLabel2 (LineNum, Keyword, Arg)

Sets a single line label at top of Menu Keys dialog in a keyword-argument format using a short argument.

LineNum	Line number of label.
Keyword	Keyword string.
Arg	Argument value.

SetIaLabel3 (LineNum, Keyword, Arg)

Sets a single line label at the top of Menu Keys dialog in a keyword-argument format using an int argument.

LineNum	Line number of label.
Keyword	Keyword string.
Arg	Argument value.

SetIaLabel4 (LineNum, Keyword, Arg, DecAccur)

LineNum	Line number of label.
Keyword	Keyword string.
Arg	Argument value.
DecAccur	Decimal accuracy of Arg

SetIaLabel5 (LineNum, Keyword, Arg)

LineNum	Line number of label.
Keyword	Keyword string.
Arg	Argument string.

SetIaLabel6 (LineNum, Keyword, Index, Lab0,...)

Sets a line of text in the Information Area using and index and a list of possible strings for that index.

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LineNum	Information Area line number. (0 - NumLabels-1).
Keyword	Keyword (i.e LAYMOD).
Index	Index to list of strings.
Lab0,...	Possible string items for Index.

ClearIa ()

Clears information area labels.

Hide ()

Hides menu keys dialog.

Show ()

Shows menu keys dialog.

Raise ()

Raises menu keys dialog to the top of other dialogs.

ShowLine (Line)

Shows information about a VrLine in the information area.

Line	VrLine object.

ShowCount (Line)

Shows point count information for one VrLine in the information area.

Line	VrLine object.

ShowPntNum (PntNum, Line, PntCnt)

Shows point number and point count information for one VrLine in the information area.

PntNum	Current point number.
Line	VrLine object.
PntCnt	Total point count.

ShowPntFlags (PntNum, Line)

Shows point flags information for one VrLine in the information area.

PntNum	Current point number.

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Line	VrLine object.

ShowSym (Sym)

Shows information about a VrSymbol in the information area.

Sym	VrSym object.

ShowText (Text)

Shows information about a VrText in the information area.

Text	VrText object.

ShowTextJust (Text)

Shosw justification information about a VrText in the information area.

Text	VrText object.

ShowWs (Ws)

Shows workspace number in the information area.

Ws	Workspace number

ShowEntNum (EntNum, EntType)

Shows entity number the information area.

EntNum	Entity number.
EntType	Entity type. 1= Line. 2= Splined line . 3= Symbol 4=Text (optional).

SetKeyCB (Function)

Sets Python callback function to be called when a menu key is pressed.

Function	Python function to handle menu key events. This function must be created in the Python script. The function should have the following format: 'def MyAppKeyCB (key):'

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2.1.2.12 PyVrPunt

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Vr Mapping

PyVrPunt Class Reference

VrOne Python Point class More...

Members

- PyVrPunt ()
- Init ()
- Reset ()
- Rec (WsNum)
- ReRec ()
- Load (WsNum, BufNum)
- GetFormat ()
- GetMode ()
- GetPenNum (Aws)
- GetNpoint ()
- GetLink ()
- GetFc ()
- GetConstr ()
- SetFormat (Format)
- SetPenNum (PenNum)
- SetNpoint (Npoint)
- SetLink (Link)
- SetFc (Fc)
- SetConstr (Constr)
- IsFull ()
- GetCount ()
- AddPunt (x, y, z, PuntA)
- AddPuntRgb (x, y, z, PuntA, r, g, b)

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- AddPuntNoDup (x, y, z, PuntA)
- AddPuntNoDupRgb (x, y, z, PuntA, r, g b)
- AddPuntNoDupXy (x, y, z)
- ChgPunt (PuntNum, x, y, z, PuntA)
- ChgPuntRgb (PuntNum, x, y, z, PuntA, r, g, b)
- ChgPuntGpsTime (PuntNum, GpsTime)
- ChgPuntA (PuntNum, PuntA)
- DelPunt (PuntNum)
- InsPunt (PuntNum, x, y, z, PuntA)
- InsPuntRgb (PuntNum, x, y, z, PuntA, r, g, b)
- GetPunt (PuntNum)
- GetPuntRgb (PuntNum)
- GetPuntGpsTime (PuntNum)
- GetPuntA (PuntNum)
- CopyHead (TarPunt)
- SetRad (Rad)
- GetRad ()
- SetRot (Rot)
- GetRot ()
- SetF1 (f1)
- GetF1 ()
- F1 ()
- SetF2 (f2)
- GetF2 ()
- F2 ()
- SetX (PuntNum, x)
- SetY (PuntNum, y)
- SetZ (PuntNum, z)
- x (PuntNum)
- y (PuntNum)
- z (PuntNum)
- SetLay (PuntNum, Lay)
- SetInt (PuntNum, Int)
- SetDsp (PuntNum, Dsp)
- SetRet (PuntNum, Ret)
- SetNre (PuntNum, Nre)
- SetSdf (PuntNum, Sdf)

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- SetEdg (PuntNum, Edg)
- SetCla (PuntNum, Cla)
- SetSyn (PuntNum, Syn)
- SetKey (PuntNum, Key)
- SetDel (PuntNum, Del)
- SetAng (PuntNum, Ang)
- SetFlt (PuntNum, Flt)
- SetSou (PuntNum, Sou)
- Lay (PuntNum)
- Int (PuntNum)
- Dsp (PuntNum)
- Ret (PuntNum)
- Nre (PuntNum)
- Sdf (PuntNum)
- Edg (PuntNum)
- Cla (PuntNum)
- Syn (PuntNum)
- Key (PuntNum)
- Del (PuntNum)
- Ang (get</arg)
- Flt (PuntNum)
- Sou (PuntNum)
- UpdateHeader ()
- GetMinMax ()
- GetClosest (x, y, z, SeaRad)
- GetIntMinMax ()
- GetClassUsed (Class[32])
- Backup ()
- Hack (PuntNum)
- Dist (PuntNum, x, y)
- Sort (Axis)
- Copy (TarPunt)
- Print ()
- SetCurBufNum (CurBufNum)
- GetCurBufNum ()
- SetCurPuntNum (CurPuntNum)
- GetCurPuntNum ()

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- InitPuntA ()
- CopyPuntA ()
- ComparePuntA ()

Description

This class allows you to manage points. Points in Vr are normally used as an efficient method to store LiDAR data. Points are managed in buffers, and each point contains an x,y,z location along with many attribute fields. Each buffer is currently set to hold 1000 points.

Several methods use a point attribute dictionary to specify the point attributes. The attribute dictionary is a standard Python dictionary holding the attributes for a single point. A dictionary may be created using the standard Python syntax or with the InitPuntA convenience method of this class. An attribute dictionary is returned from the GetPunt, GetPuntA methods, and is set using ChgPunt, ChgPuntA, or InsPunt. The same thing can be accomplished using the direct methods for changing attributes such as SetInt, SetDsp, etc., but it may be more convenient to create and work with dictionary objects. Using attribute dictionaries is more efficient when changing multiple attributes.

The available keys in the dictionary and their default values are as follows:

```
"Lay"      = 1   - Layer                    (1-30001)
"Int"      = 0   - Intensity                (0-65535)
"Dsp"      = 1   - Display flag             (0-1)
"Ret"      = 0   - Return number            (1-5)
"Nre"      = 0   - Number of returns        (1-5)
"Sdf"      = 0   - Scan direction flag      (0-1)
"Edg"      = 0   - Edge of flight line flag (0-1)
"Cla"      = 0   - Classification           (0-31)
"Syn"      = 0   - Synthetic flag           (0-1)
"Key"      = 0   - Key-point flag           (0-1)
"Del"      = 0   - Delete flag              (0-1)
"Ang"      = 0   - Scan angle               (-90 - +90)
"Flt"      = 0   - Flight number            (0-255)
"Sou"      = 0   - Point source Id          (0-65535)
"Red"      = 255 - Red component color      (0-255)
"Green"    = 255 - Green component color    (0-255)
"Blue"     = 255 - Blue component color     (0-255)
"GpsTime" = 0.0 - GPS Time                  (Double precision number)
```

The following sample code demonstrates loading a Punt buffer, and then setting some attributes on one point.

```
Punt = PyVrPunt ()                          # Create a new point

(ret) = Punt.Load (0, 0)                    # Load Punt buffer 0 from Workspace 0

if (ret == 0):                              # If the point loaded successfully
```

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```
(x, y, z, PuntA) = Punt.GetPunt (0) # Get the first point in the point buffer

PuntA['Del'] = 1                    # Set the deleted flag to 1
PuntA['Int'] = 500                  # Set the intensity to 1

Punt.ChgPuntA (PuntA)               # Change point attributes

Punt.ReRec()                        # Re-record the point buffer to the works
```

The following sample code demonstrates creating new Punt buffers. Notice how IsFull() is used to determine when the buffer should be recorded and reset.

```
Punt = PyVrPunt ()

# Get new set of point attributes

PuntA = Punt.InitPuntA ()

z = 0.0;
for i in range (0, 1000, 10):
   for j in range (0, 1000, 10):
      Punt.AddPunt (i, j, z, PuntA)
      if Punt.IsFull():
         (ret) = Punt.Rec (0)
         Punt.Reset()

      z = z + 1.0

(ret) = Punt.Rec (0)
```

Member Function Documentation

PyVrPunt ()

Point class constructor.

Init ()

Initializes the current point. Has same effect as allocating a new object.

Reset ()

Resets the point buffer.

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Rec (WsNum)

Records a point entity.

WsNum	Workspace	
returns	(ret)	
	ret	New Point entity number

ReRec ()

Re-records a point buffer.

Load (WsNum, BufNum)

Loads point buffer from Vr.

WsNum	Workspace.
BufNum	Point buffer number.

GetFormat ()

Gets LAS format for current point buffer.

returns	(format)	
	format	LAS Data format code (0 - 3).

GetMode ()

Sets the get mode

retu	(ret)

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rns		
	ret	Mode. 1= Line. 2= Spline. 3= Symbol. 4= Text. 5= Point.

GetPenNum (Aws)

Returns the entity color.

Aws	Currently active workspace.	
returns	(ret)	
	ret	Pen number (1-256).

GetNpoint ()

Returns the entity non-graphic pointer.

returns	(ret)	
	ret	Non-graphic pointer number.

GetLink ()

Returns the entity link.

returns	(ret)	
	ret	Link number.

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GetFc ()

Returns the entity feature code.

returns	(ret)	
	ret	Feature code (up to 48 characters).

GetConstr ()

Gets construction flag.

returns	(ret)	
	ret	Construction flag.

SetFormat (Format)

Sets LAS format for this point buffer.

Format	Data Format code (0 - 3).

SetPenNum (PenNum)

Sets the entity color.

PenNum	Pen number (1-256).

SetNpoint (Npoint)

Sets the entity non-graphic pointer.

Npoint	Non-graphic pointer (-2,147,483,648 to 2,147,483,648).

SetLink (Link)

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Sets the entity link.

Link	Link (-2,147,483,648 to 2,147,483,648).

SetFc (Fc)

Sets the entity feature code.

Fc	Feature code (Up to 48 characters).

SetConstr (Constr)

Sets construction flag.

Constr	Construction flag (0-1). 0 = Off. 1 = On.

IsFull ()

Tests whether a point buffer is full. This should be used when creating new Punt entities to check if they are full and need to be recorded.

GetCount ()

Returns the current buffer point count.

AddPunt (x, y, z, PuntA)

Adds a point to the point buffer.

x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.
PuntA	Point attributes dictionary.
returns	(ret)

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	ret	Point number in buffer.

AddPuntRgb (x, y, z, PuntA, r, g, b)

Adds a point with RGB data to the point buffer.

x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.
PuntA	Point attributes dictionary.
r	Red channel.
g	Green channel.
b	Blue channel.
returns	(ret)

	ret	Point number in buffer.

AddPuntNoDup (x, y, z, PuntA)

Adds a unique point to the point buffer. Does not allow point duplication.

x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.
PuntA	Point attributes dictionary.
returns	(ret)

	ret	Point number in buffer (-1 = Point is duplicate).

AddPuntNoDupRgb (x, y, z, PuntA, r, g, b)

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Adds a unique point with RGB data to the point buffer. Does not allow point duplication.

x	X coordinate of point to add.	
y	Y coordinate of point to add.	
z	Z coordinate of point to add.	
PuntA	Point attributes dictionary.	
r	Red channel.	
g	Green channel.	
b	Blue channel.	
returns	(ret)	
	ret	Point number in buffer (-1 = Punt is duplicate).

AddPuntNoDupXy (x, y, z)

Adds a unique point to the point buffer. Does not allow point duplication with the XY coordinates.

x	X coordinate of point to add.	
y	Y coordinate of point to add.	
z	Z coordinate of point to add.	
returns	(ret)	
	ret	Point number in buffer. -1 = Punt is duplicate.

ChgPunt (PuntNum, x, y, z, PuntA)

Changes a point in the point buffer.

PuntNum	Point number to change (LAST=Last).

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x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.
PuntA	Point attributes dictionary.

ChgPuntRgb (PuntNum, x, y, z, PuntA, r, g, b)

Changes a point in the point buffer.

PuntNum	Point number to change (LAST=Last).
x	X coordinate of point to add.
y	Y coordinate of point to add.
z	Z coordinate of point to add.
PuntA	Point attributes dictionary.
r	Red channel.
g	Green channel.
b	Blue channel.

ChgPuntGpsTime (PuntNum, GpsTime)

Changes the GPS Time of a point in the point buffer.

PuntNum	Point number to change (LAST=Last).
GpsTime	GPS Time.

ChgPuntA (PuntNum, PuntA)

Changes a point's attributes.

Punt	Point number to change (LAST=Last).

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Num	
PuntA	Point attributes dictionary.

DelPunt (PuntNum)

Deletes a point in the point buffer.

PuntNum	Number of the point to delete

InsPunt (PuntNum, x, y, z, PuntA)

Inserts a point into the point buffer.

PuntNum	Point after which to insert new point.
x	X coordinate of new point.
y	Y coordinate of new point.
z	Z coordinate of new point.
PuntA	Point attributes dictionary.

InsPuntRgb (PuntNum, x, y, z, PuntA, r, g, b)

Inserts a point with RGB data into the point buffer.

PuntNum	Point to insert after
x	X coordinate of new point.
y	Y coordinate of new point.
z	Z coordinate of new point.
PuntA	Point attributes dictionary.
r	Red channel.

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g	Green channel.
b	Blue channel.

GetPunt (PuntNum)

Gets a point from the point buffer.

PuntNum	Number of point to get (LAST=Last).	
returns	(x, y, z, PuntA).	
	x	X coordinate of new point.
	y	Y coordinate of new point.
	z	Z coordinate of new point.
	PuntA	Point attributes dictionary.

GetPuntRgb (PuntNum)

Gets a point with RGB data from the point buffer.

PuntNum	Number of point to get (LAST=Last).	
returns	(x, y, z, PuntA, r, g, b)	
	x	X coordinate of new point.
	y	Y coordinate of new point.
	z	Z coordinate of new point.
	PuntA	Point attributes dictionary.
	r	Red channel.
	g	Green channel.
	b	Blue channel.

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GetPuntGpsTime (PuntNum)

Gets the GPS Time for point.

PuntNum	Number of point for which to get GPS time.	

GetPuntA (PuntNum)

Gets a point attribute structure.

PuntNum	Number of point to get (LAST=Last).	
returns	(PuntA).	
	PuntA	Coordinate attributes dictionary

CopyHead (TarPunt)

Copies the header of the current punt to the punt sent.

TarPunt	Punt to which to copy header.

SetRad (Rad)

Sets radius.

Rad	Radius.

GetRad ()

Gets radius.

SetRot (Rot)

Sets rotation.

Ro	Rotation.

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t	

GetRot ()

Gets rotation.

SetF1 (f1)

Sets F1

f1	F1

GetF1 (), F1()

Gets F1

returns	(ret)	
	ret	F1

SetF2 (f2)

Sets F2

f2	F2

GetF2 (), F2()

Gets F2.

returns	(ret)	
	ret	F2

SetX (PuntNum, x)

Sets X coordinate of a point.

PuntNum	Number of point for which to set X coordinate.
x	X coordinate.

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SetY (PuntNum, y)

Sets Y coordinate of a punt.

PuntNum	Number of point for which to set Y coordinate.
y	Y coordinate.

SetZ (PuntNum, z)

Sets z coordinate of a point.

PuntNum	Point number for which to set Z coordinate.
z	Z coordinate.

x (PuntNum)

Gets X coordinate of a point.

PuntNum	Number of point for which to get X coordinate.

y (PuntNum)

Gets Y coordinate of a point.

PuntNum	Number of point for which to get Y coordinate.

z (PuntNum)

Gets Z coordinate of a point.

PuntNum	Number of point for which to get Z coordinate.

SetLay (PuntNum, Lay)

Sets a point's layer number.

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PuntNum	Number of point to be modified.
Lay	Layer into which to place the point (1-32001).

SetInt (PuntNum, Int)

Sets a point's intensity.

PuntNum	Number of point to be modified.
Int	Point intensity attribute (0-65535)

SetDsp (PuntNum, Dsp)

Sets a point's display flag

PuntNum	Number of point to be modified.
Dsp	Display attribute (0-1).

SetRet (PuntNum, Ret)

Sets a point's return number.

PuntNum	Number of point to be modified.
Ret	Return number attribute (1-5).

SetNre (PuntNum, Nre)

Sets a point's number of returns.

PuntNum	Number of point to be modified.
Nre	Number of returns attribute (1-5).

SetSdf (PuntNum, Sdf)

Sets a point's Scan Direction flag

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Punt Num	Number of point to be modified.
Sdf	Scan Direction flag attribute (0-1).

SetEdg (PuntNum, Edg)

Sets a point's Edge of Flight Line flag.

Punt Num	Number of point to be modified.
Edg	Edge of Flight Line flag attribute (0-1).

SetCla (PuntNum, Cla)

Sets a point's Classification.

Punt Num	Number of point to be modified.
Cla	Point Classification attribute (0-65535).

SetSyn (PuntNum, Syn)

Sets a point's Synthetic flag.

Punt Num	Number of point to be modified.
Syn	Synthetic flag attribute (0-1).

SetKey (PuntNum, Key)

Sets a point's Key Point flag.

Punt Num	Number of point to be modified.
Key	Key Point flag attribute (0-1).

SetDel (PuntNum, Del)

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Sets a point's Delete flag.

Punt Num	Number of point to be modified.
Del	Point Delete flag attribute (0-1).

SetAng (PuntNum, Ang)

Sets a point's Scan Angle.

Punt Num	Number of point to modify.
Ang	Scan Angle attribute (-90 to +90).

SetFlt (PuntNum, Flt)

Sets a point's Flight Line number.

Punt Num	Number of point to modify.
Flt	Flight Line number attribute (0-255).

SetSou (PuntNum, Sou)

Sets a point's Source Id.

Punt Num	Number of point to modify.
Sou	Point Source Id attribute (0-65535).

Lay (PuntNum)

Gets Layer attribute (1-30001).

Punt Num	Number of point to check.

Int (PuntNum)

Gets Intensity attribute (0-65535).

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Punt Num	Number of point to check.

Dsp (PuntNum)

Gets Display flag attribute (0-1).

Punt Num	Number of point to check.

Ret (PuntNum)

Gets Return Number attribute (1-5).

Punt Num	Number of point to check.

Nre (PuntNum)

Gets Number of Returns attribute (1-5).

Punt Num	Number of point to check.

Sdf (PuntNum)

Gets Scan Direction flag attribute (0-1).

Punt Num	Number of point to check.

Edg (PuntNum)

Gets Edge of Flight Line attribute (0-1).

Punt Num	Number of point to check.

Cla (PuntNum)

Gets Classification attribute (0-31).

Punt	Number of point to check.

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Num	

Syn (PuntNum)

Gets Synthetic flag attribute (0-1).

Punt Num	Number of point to check.

Key (PuntNum)

Gets Key Point flag attribute (0-1).

Punt Num	Number of point to check.

Del (PuntNum)

Gets Delete flag attribute (0-1).

Punt Num	Number of point to check.

Ang (get</arg)

Gets Scan Angle attribute (-90 to +90).

Punt Num	Number of point to check.

Flt (PuntNum)

Gets Flight Number attribute (0-255).

Punt Num	Number of point to check.

Sou (PuntNum)

Gets Point Source Id attribute (0-65535).

Punt Num	Number of point to check.

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UpdateHeader ()

Updates header information, minimum and maximum coordinates, minimum and maximum intensities, and classes that have been used.

GetMinMax ()

Gets minimum and maximum buffer coordinates.

returns	(MinX, MinY, MinZ, MaxX, MaxY, MaxZ)	
	MinX	Minimum X coordinate.
	MinY	Minimum Y coordinate.
	MinZ	Minimum Z coordinate.
	MaxX	Maximum X coordinate.
	MaxY	Maximum Y coordinate.
	MaxZ	Maximum Z coordinate.

GetClosest (x, y, z, SeaRad)

Gets the closest point in the point buffer to the search point.

x	X coordinate of search point.	
y	Y coordinate of search point.	
z	Z coordinate of search point.	
SeaRad	Search radius in ground units.	
returns	(ret)	
	re	Closest point number (-1=No points in buffer)

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GetIntMinMax ()

Gets the intensity minimum and maximum for points in buffer. Deleted points are not considered.

returns	(Min, Max)	
	Min	Minimum intensity.
	Max	Maximum intensity.

GetClassUsed (Class[32])

Gets the classifications of points in buffer.

Class[32]		
returns	(Class)	
	Class	Classification flags as a Python list with 32 entries. NOTE: The Class array is not initialized, so multiple calls can be made with it. No item is ever set to 0.

Backup ()

Deletes the last point in the buffer.

Hack (PuntNum)

Hacks from the specified point number to the end of the buffer. Leaves the point of PuntNum as last point in buffer.

PuntNum	Point number from which to hack.

Dist (PuntNum, x, y)

Computes the distance from a point in the buffer to the specified coordinates.

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PuntNum	Point number (0-Count-1 LAST=Last)	
x	X coordinate to which to compute distance.	
y	Y coordinate to which to compute distance.	
returns	(ret)	
	ret	Distance.

Sort (Axis)

Sorts point buffer

Axis	Sorting method. 0=X axis location.. 1=Y axis location. 2=Z axis location (elevation). 3=Intensity. 4=Return.

Copy (TarPunt)

Copies the content of the current Vr Point to the specified VrPoint

TarPunt	Vr Point to which to copy content.

Print ()

Prints the point buffer

SetCurBufNum (CurBufNum)

CurBufNum	Buffer number to become current.

GetCurBufNum ()

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returns	(ret)	
	ret	Current buffer number.

SetCurPuntNum (CurPuntNum)

Sets current point number

CurPuntNum	Point number to become current.

GetCurPuntNum ()

returns	(ret)	
	ret	Current point number.

InitPuntA ()

Initializes the Vr Point Attributes

returns	(ret, PuntA)	
	PuntA	Vr Point Attributes dictionary

CopyPuntA (TarPuntA, SorPuntA)

Copies the Vr Point Attributes of one dictionary to a target dictionary.

TarPuntA	Target Vr Point Attributes dictionary.
SorPuntA	Source Vr Point Attributes dictionary.

ComparePuntA (PuntA1, PuntA2)

Compares two coordinate attribute dictionaries.

PuntA1	Vr Point Attributes dictionary 1.
PuntA2	Vr Point Attributes dictionary 2.

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returns	(ret)	
	ret	0= Equal. 1= Not equal.

2.1.2.13 PyVrSym

Vr Mapping

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Symbol Class Reference (PyVrSym)

Holds and manipulates VrOne symbol data. More…

Members

- Init ()
- Load (WsNum, SymNum, DispFlag=-1)
- LoadLast ()
- Rec (WsNum, DispFlag=-1)
- ReRec (DispFlag=-1)
- Del ()
- Id (WsNum=-1)
- GetWsNum ()
- GetSymNum()
- SetLayer (Layer)
- SetGpoint (Gpoint)
- SetPenNum (PenNum)
- SetNpoint (Npoint)
- SetLink (Link)

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- SetFc (Fc)
- SetConstr (Constr)
- SetRad (Rad)
- SetRot (Rot)
- SetCoord (x, y, z)
- GetLayer ()
- GetGpoint ()
- GetPenNum ()
- GetNpoint ()
- GetLink ()
- GetFc ()
- GetConstr ()
- GetRad ()
- GetRot ()
- GetFkeyParams (FkeyName)
- GetCoord ()
- ReRec ()
- Plot ()
- Erase ()

Description

The VrOne/Python Symbol class is used to define VrOne Symbol data. A Symbol consists of a header and an xyz coordinate. An existing Symbol class may be loaded from the disk. Header information may be defined by a Python script or may be inherited from a VrOne Function Key. The user of this class should understand the VrOne Data Structure.

Example:

```
# Loads all the symbols in the current workspace, change the layers
# and graphic pointers and re-record them.
# Filename: ChangeSymbols.py
# WARNING: Changes data but is undoable

Ws     = PyVrWs()    # VrOne workspace manager object
Sym    = PyVrSym()   # VrOne symbol object
WsNum = Ws.Aws()     # Current workspace

Ws.UndoBegin (WsNum, "ChangeSymbols")          # Begin undo

for SymNum in range (0, Ws.GetSymCount (WsNum)):
```

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```
      Sym.Load (WsNum, SymNum)                  # Load symbol
      Sym.Erase()                               # Erase it from graphics
      Sym.SetLayer (23)                         # Change the layer
      Sym.SetGpoint (15)                        # Change the graphic
pointer
      Sym.ReRec()                               # Re-record it
      Sym.Plot()                                # Re-plot it

Ws.UndoEnd (WsNum)                              # End undo
```

Member Function Documentation

Init ()

Initializes the symbol to default values. This is useful when reusing the symbol class.

Load (WsNum, SymNum)

Loads a symbol from disk.

WsNum	Workspace number (0-255).	
SymNum	Symbol number.	
returns	(ret)	
	ret	Loaded symbol number. -1 = Workspace or symbol number out of range.

LoadLast ()

Loads the last saved symbol. If a Python script is run as a Function Key's OnEnd command it is possible for the script to further process the symbol that was just saved. See the AddCircle.py example.

returns	(ret)	
	ret	0 = OK. -1 = No last symbol exists.

Rec (WsNum, DispFlag=-1)

Records a symbol at the end of a workspace.

WsNum	Number of workspace to which to record (0-255).
DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display.

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returns	(ret)	
	ret	Symbol number. -1 = Workspace number out of range.

ReRec (DispFlag=-1)

Re-records a previously loaded symbol by marking the original location as deleted and placing the symbol at the end of the workspace.

DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display.	
returns	(ret)	
	ret	0 = OK. -1 = Could not record symbol.

Del ()

Deletes a symbol by marking its layer number as a negative number on disk. Pack Vr removes deleted entities from a workspace.

returns	(ret)	
	ret	0 = OK. 1 = Could not delete symbol. Symbol was never loaded.

Id (WsNum=-1)

Allows interactive symbol selection. Returns a symbol number that may be used to load the symbol from disk.

WsNum	Number of workspace to search (0-255). -1 = Search all open workspaces.	
returns	(ret)	
	ret	Symbol number selected. -1 = Symbol not selected.

Example:

```
# Select (Id) a symbol and print it
Ws      = PyVrWs()              # VrOne workspace manager
Sym     = PyVrSym()             # VrOne symbol object

if (Sym.Id() != -1):           # Did we get a symbol?
   # Print some information about the symbol
   print "Layer ", Sym.GetLayer()
   print "Gpoint", Sym.GetGpoint()
   print "Coord ", Sym.GetCoord()
```

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GetWsNum ()

When a symbol is loaded, the number of the workspace from which the symbol was loaded from is stored in the object. Gets this number.

returns	(ret)	
	ret	Workspace number (0-255). -1 = Symbol was never loaded from disk.

Example:

```
# Select (Id) a symbol and print it's Workspace and Symbol Number
Ws      = PyVrWs()              # VrOne workspace manager
Sym     = PyVrSym()             # VrOne symbol object

if (Sym.Id() != -1):           # Did we get a symbol?
   print "Workspace    ", Sym.GetWsNum()
   print "Symbol number", Sym.GetSymNum()
```

GetSymNum ()

When a symbol is loaded, its symbol number is stored in the object. Gets this number.

returns	(ret)	
	ret	Symbol number. -1 = Symbol was never loaded from disk.

Example

```
# Select (Id) a symbol and print it's Workspace and Symbol Number
Ws      = PyVrWs()              # VrOne workspace manager
Sym     = PyVrSym()             # VrOne symbol object

if (Sym.Id() != -1):           # Did we get a symbol?
   print "Workspace    ", Sym.GetWsNum()
   print "Symbol number", Sym.GetSymNum()
```

SetLayer (Layer)

Sets the symbol's layer.

Layer	Layer number (1-10001)

SetGpoint (Gpoint)

Sets the graphic pointer of the symbol. The graphic pointer determines the graphic representation of a Symbol, like as a fence or a tree symbol.

Gpoint	Symbol graphic pointer (1-1000)

SetPenNum (PenNum)

Sets the symbol's pen number, which determines the color to use when drawing a Symbol.

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NOTE: If a Pen Table is active, this command has no effect.

PenNum	Pen number (1-256).

SetNpoint (Npoint)

Sets the symbol's non-graphic pointer.

Npoint	Non-graphic pointer (-2,147,483,648 to 2,147,483,648).

SetLink (Link)

Sets the symbol's link.

Link	Symbol link (-2,147,483,648 to 2,147,483,648).

SetFc (Fc)

Sets the symbol's Feature Code.

Fc	Feature code (up to 48 characters).

SetConstr (Constr)

Sets the symbol's Construction display. The display of Symbols that have their construction flags set to 1 may be turned off.

Constr	Construction flag. 0 = On. 1 = Off.

SetRad (Rad)

Sets the symbol radius.

Rad	Symbol radius in ground units (double precision).

SetRot (Rot)

Sets the symbol rotation. The rotation is counterclockwise with zero along the X-axis.

Rot	Symbol rotation in degrees (double precision).

SetCoord (x, y, z)

Sets the symbol coordinate value.

X,y,z	Symbol coordinate values (double precision).

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GetLayer ()

Gets the symbol's layer.

returns	(ret)	
	ret	Layer number (1-10001). A return layer of 0 or less represents a deleted entity.

GetGpoint ()

Returns the symbol's graphic pointer. The graphic pointer determines the graphic representation of a Symbol, like a fence or a tree symbol.

returns	(ret)	
	ret	Symbol graphic pointer (1-1000).

GetPenNum ()

Returns the symbol's pen number. The pen number determines the color to use when drawing a symbol.

returns	(ret)	
	ret	Symbol pen number (1-256).

GetNpoint ()

Returns the symbol's non-graphic pointer.

returns	(ret)	
	ret	Symbol non-graphic pointer number (-2,147,483,648 to 2,147,483,648).

GetLink ()

Returns the symbol's link.

returns	(ret)	
	ret	Symbol link number (-2,147,483,648 to 2,147,483,648).

GetFc ()

Returns the symbol's feature code.

returns	(ret)

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	ret	Symbol feature code (up to 48 characters).

GetConstr ()

Returns the construction flag of the symbol. The display of symbols that have their construction flags set to 1 may be turned off.

returns	(ret)	
	ret	Symbol construction flag (0-1).

GetRad ()

Returns the symbol's radius.

(ret)	
ret	Radius in ground units.

GetRot ()

Returns the symbol's rotation. The rotation is counterclockwise with zero along the X-axis.

returns	(ret)	
	ret	Symbol rotation in degrees.

GetFkeyParams (FkeyName)

Fills the Symbol header data from a previously defined VrOne function key. If the function key requested does not exist, the Symbol header is filled with default parameters.

FkeyName	Function key name.	
returns	(ret)	
	ret	0 = OK. -1 = Function key does not exist.

GetCoord ()

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Returns a coordinate value from the symbol

returns	(x,y,z)	
	ret	Symbol coordinate value (double precision).

ReRec ()

Re-records the symbol on disk.

Plot ()

Plots the symbol to all open graphics devices. The current header parameters are used.

Erase ()

Erases the symbol from all open graphics devices.

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2.1.2.14 PyVrText

Vr Mapping

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Text Class Reference (PyVrText)

Holds and manipulates VrOne text data. More…

Members

- Init ()
- Load (WsNum, TextNum, DispFlag=-1)
- LoadLast ()
- Rec (WsNum, DispFlag=-1)
- ReRec (DispFlag=-1)
- Del ()
- Id (WsNum=-1)
- Copy (TargetText)
- GetWsNum ()

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- GetTextNum()
- SetLayer (Layer)
- SetPenNum (PenNum)
- SetNpoint (Npoint)
- SetLink (Link)
- SetFc (Fc)
- SetConstr (Constr)
- SetFontNum (FontNum)
- SetJustX (JustX)
- SetJustY (JustY)
- SetHgt (Hgt)
- SetWdt (Wdt)
- SetSize (Size)
- SetRot (Rot)
- SetSlt (Slt)
- SetText (TextLabel)
- SetCoord (x, y, z)
- GetLayer ()
- GetPenNum ()
- GetNpoint ()
- GetLink ()
- GetFc ()
- GetConstr ()
- GetFontNum ()
- GetJustX ()
- GetJustY ()
- GetHgt ()
- GetWdt ()
- GetSize ()
- GetRot ()
- GetSlt ()
- GetText ()
- GetFkeyParams (FkeyName)
- GetCoord ()
- Plot ()
- Erase ()

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Description

The VrOne/Python Text class is used to define VrOne Text label data. A text consists of a header, an xyz coordinate, and a text label string. An existing Text class may be loaded from disk. Header information may be defined by a Python script or may be inherited from a VrOne Function Key. The user of this class should understand the VrOne Data Structure.

Example:

```
# Loads all the text in the current workspace, changes the text
# label to the elevation of the entity.
# Filename: ChangeText.py
# WARNING: Changes data but is undoable

Ws    = PyVrWs()    # VrOne workspace manager object
Text  = PyVrText()  # VrOne text object
WsNum = Ws.Aws()    # Current workspace

Ws.UndoBegin (WsNum, "ChangeText")              # Begin undo

for TextNum in range (0, Ws.GetTextCount (WsNum)):

      Text.Load (WsNum, TextNum)                # Load text
      Text.Erase()                              # Erase it from graphics
      (x, y, z) = Text.GetCoord()
      Text.SetText ("Elevation=%.3f" % z)
      Text.ReRec()                              # Re-record it
      Text.Plot()                               # Re-plot it

Ws.UndoEnd (WsNum)                              # End undo
```

Member Function Documentation

Init ()

Initializes the text to default values. This is useful when reusing the text class.

Load (WsNum, TextNum)

Loads a text from disk.

WsNum	Workspace number (0-255)	
TextNum	Text number.	
returns	(ret)	
	ret	Loaded text's number. -1 = Workspace or text number out of range.

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LoadLast ()

Loads the last saved text. If a Python script is run as a Function Key's OnEnd command it is possible for the script to further process the text that was just saved. See the AddPosts.py example.

returns	(ret)	
	ret	0 = OK. -1 = No last text exists.

Rec (WsNum, DispFlag=-1)

Records text at the end of a workspace.

WsNum	Number of workspace from which to record text (0-255).	
DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display	
returns	(ret)	
	ret	Text number. -1 = Workspace number out of range.

ReRec (DispFlag=-1)

Re-records a previously loaded text by marking the original location as deleted and placing the text at the end of the workspace.

DispFlag	Optional display flag. -1 = Do not condition. 0 = Do not display. 1 = Display	
returns	(ret)	
	ret	0 = OK. -1 = Could not record text.

Del ()

Deletes the text by marking its layer number as a negative number on disk. Pack Vr removes deleted entities from a workspace.

returns	(ret)	
	ret	0 = OK. -1 = Could not delete text. Text was never loaded.

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Id (WsNum=-1)

Allows interactive text selection. Returns a text number that may be used to load the text from disk.

WsNum	Number of the workspace to search (0-255). -1 = Search all open workspaces	
returns	(ret)	
	ret	Text number selected. -1 = Text not selected.

Example:

```
# Select (Id) a text and print some information
Ws      = PyVrWs()              # VrOne workspace manager
Text    = PyVrText()            # VrOne text object

if (Text.Id() != -1):           # Did we get a text?

      print "Layer     ", Text.GetLayer()
      print "Height    ", Text.GetHgt()
      print "Width     ", Text.GetWdt()
      print "Rotation  ", Text.GetRot()
      print "Text label", Text.GetText()
```

Copy (TargetText)

Copies the current text to the target text passed.

TargetText	Text object to which to copy text.	

Example:

```
# Copy Text
Ws      = PyVrWs()              # VrOne workspace manager
Text    = PyVrText()            # VrOne text object
TarText = PyVrText()            # Text to copy to

if (Text.Id() != -1):           # Did we get a text label?
   print TarText.GetLayer()     # Print the current layer of TarText
   Text.Copy (TarText)          # Copy the identified text to TarText
   print TarText.GetLayer()     # Print new layer of TarText
```

GetWsNum ()

When a text is loaded, the workspace number from which the text was loaded is stored in the object. Gets this number.

returns	(ret)	
	ret	Workspace number (0-255). -1 = Text was never loaded from disk.

Example

```
# Select (Id) a text and print its workspace and text number
Ws      = PyVrWs()              # VrOne workspace manager
```

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```
Text    = PyVrText()            # VrOne text object

if (Text.Id() != -1):           # Did we get a text?
   print "Workspace  ", Text.GetWsNum()
   print "Text number", Text.GetTextNum()
```

GetTextNum ()

When a text is loaded, its text number is stored in the object. Gets this number.

returns	(ret)	
	ret	Text number. -1 = Text was never loaded from disk.

Example

```
# Select (Id) a text and print its workspace and text number
Ws      = PyVrWs()              # VrOne workspace manager
Text    = PyVrText()            # VrOne text object

if (Text.Id() != -1):           # Did we get a text?
   print "Workspace  ", Text.GetWsNum()
   print "Text number", Text.GetTextNum()
```

SetLayer (Layer)

Sets the text's layer.

Layer	Layer number (1-10001).	

SetPenNum (PenNum)

Sets the text's pen number, which determines the color to use when drawing a text label.
NOTE: If a Pen Table is active, this command has no effect.

PenNum	Pen number (1-256).	

SetNpoint (Npoint)

Sets the text's non-graphic pointer.

Npoint	Non-graphic pointer number (-2,147,483,648 to 2,147,483,648).	

SetLink (Link)

Sets the text's link.

Link	Text link number (-2,147,483,648 to 2,147,483,648).	

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SetFc (Fc)

Sets the text's Feature Code.

Fc	Feature code (up to 48 characters).	

SetConstr (Constr)

Sets the text's Construction display flag. The display of text labels that have their construction flags set to 1 may be turned off.

Constr	Construction display flag (0-1).	

SetFontNum (FontNum)

Sets the font for the text label.

FontNum	Text font number (1-12). See below for the corresponding fonts.	

1	CI	Complex Italic
2	CR	Complex Roman
3	CS	Complex Script
4	DR	Duplex Roman
5	GE	Gothic English
6	GG	Gothic German
7	GI	Gothic Italic
8	HS	Standard
9	SR	Simplex Roman
10	SS	Simplex Script
11	TI	Triplex Italic
12	TR	Triplex Roman

SetJustX (JustX)

Sets the text X-axis justification.

JustX	X-axis justification. 1 = Left. 2 = Center. 3 = Right. 4 = Decimal.	

SetJustY (JustY)

Sets the text Y-axis justification.

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JustY	Y-axis justification. 1 = Lower. 2 = Center. 3 = Upper.	

SetHgt (Hgt)

Sets the text height

Hgt	Text height in ground units (double precision).	

SetWdt (Wdt)

Sets the single-character text width.

Wdt	Text width in ground units (double precision).	

SetSize (Size)

Sets the text height and width. This is useful if the text size and width are the same.

Size	Text size in ground units (double precision).	

Size Text size in ground units (double precision)
Example `Text.SetSize (1.234)`

SetRot (Rot)

Sets the text rotation. The rotation is counterclockwise with zero along the X-axis.

Rot	Text rotation in degrees, (0 - 360, double precision).	

SetSlt (Slt)

Sets the text slant. A text slant of zero means no text slant.

Slt	Text slant in degrees (-180 - 180, double precision).	

SetText (Text)

Sets the text label.

Text	Text label (up to 512 characters).	

SetCoord (x, y, z)

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Sets the text coordinate value.

x,y,z	Text coordinate value (double precision).	

GetLayer ()

Gets the layer of the text.

returns	(ret)	
	ret	Layer number (1-10001). Any number 0 or lower represents a deleted entity.

GetPenNum ()

Gets the pen number of the text. The pen number determines the color to use when drawing text.

returns	(ret)	
	ret	Text pen number (1-256).

GetNpoint ()

Returns the non-graphic pointer number of the text.

returns	(ret)	
	ret	Text non-graphic pointer (-2,147,483,648 to 2,147,483,648)

GetLink ()

Returns the link of the text.

returns	(ret)	
	ret	Text link number (-2,147,483,648 to 2,147,483,648).

GetFc ()

Returns the feature code of the text.

returns	(ret)	
	ret	Text feature code (up to 48 characters).

GetConstr ()

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Returns the construction flag of the text. The display of text labels that have their construction flags set to 1 may be turned off.

returns	(ret)	
	ret	Text construction flag (0-1).

Returns Text construction flag (0-1)
Example `Constr = Text.GetConstr()`

GetFontNum ()

Returns the font number of the text

returns	(ret)	
	ret	Font number (1-12). See below for corresponding fonts.

1	CI	Complex Italic
2	CR	Complex Roman
3	CS	Complex Script
4	DR	Duplex Roman
5	GE	Gothic English
6	GG	Gothic German
7	GI	Gothic Italic
8	HS	Standard
9	SR	Simplex Roman
10	SS	Simplex Script
11	TI	Triplex Italic
12	TR	Triplex Roman

GetJustX ()

Returns the text X-axis justification.

returns	(ret)	
	ret	Text X-axis justification. 1= Left. 2 = Center. 3 = Right. 4 = Decimal.

GetJustY ()

Returns the text Y-axis justification.

returns	(ret)	
	ret	Text Y-axis justification. 1= Left. 2 = Center. 3 = Upper.

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GetHgt ()

Returns the text height.

returns	(ret)	
	ret	Text height in ground units (double precision).

GetWdt ()

Returns the text width.

returns	(ret)	
	ret	Text width in ground units (double precision).

GetSize ()

Returns the text size, a combination of the text height and width. The text height and width are averaged to form the text size.

returns	(ret)	
	ret	Text size in ground units (double precision).

GetRot ()

Returns the rotation of the text. The rotation is counterclockwise with zero along the X-axis.

returns	(ret)	
	ret	Text rotation in degrees.

GetSlt ()

Returns the slant of the text. A text slant of zero is no text slant.

returns	(ret)	
	ret	Text slant in degrees (-180 - 180, double precision).

GetText ()

Returns the text label.

returns	(ret)	
	ret	Text label (up to 512 characters).

GetFkeyParams (FkeyName)

Fills the text header data from a previously defined VrOne function key. If the function key

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requested does not exist, the text header is filled with default parameters.

FkeyName	Function key name.	
returns	(ret)	
	ret	0 = OK. -1 = Function key does not exist.

FkeyName Function key name
Returns 0=OK -1=Function key does not exist
Example `RetVal = Text.GetFkeyParams ("Pole")`

GetCoord ()

Returns the text's coordinate values.

returns	(x,y,z)	
	x	X coordinate of text.
	y	Y coordinate of text.
	z	Z coordinate of text.

Returns x, y, z (double precision)
Example `(x, y, z) = Text.GetCoord()`

Plot ()

Plots the text label to all open graphics devices. The current header parameters are used.

Erase ()

Erases the text label from all open graphics devices.

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2.1.2.15 PyVrWs

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Workspace Class Reference (PyVrWs)

Manages VrOne file operations. More…

Members

Workspace management

- Aws ()
- SetAws (WsNum)

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- Open (FileName, Create, Units, Scale)
- Close (WsNum)
- CloseByName (FileName)
- IsOpen (FileName)
- Pack (WsNum)
- Sort (WsNum, SortAxis)
- Backup (WsNum)
- FindLine (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad, SeaMode, RetMode)
- FindSym (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad)
- FindText (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad)
- FindClosestEnt (SeaWs, Win, SeaType, SeaX, SeaY, SeaZ, SeaRad, SeaMode, RetMode)
- IdEnt (SeaWs, SeaLines, SeaSymbols, SeaText)
- GetWsCount ()
- GetTargetScale (WsNum)
- GetTargetScaleIn (WsNum)
- GetUnits (WsNum)
- GetFileName (WsNum)
- GetMinMax (WsNum)
- StartWsWrite (StartWs, EndWs, ShowWarning, WarningTitle)
- EndWsWrite (StartWs, EndWs)
- SetReadOnly (WsNum, ReadOnly)
- GetReadOnly (WsNum)

Display management

- SetViewFlags (WsNum)
- GetViewFlags (WsNum)
- SetViewFlag (WsNum, Win, Viewable)
- GetViewFlag (WsNum, Win)

Line management

- GetLineCount (WsNum)
- GetLineMinMax (WsNum, LineNum)
- GetLineLayer (WsNum, LineNum)
- GetLineMode (WsNum, LineNum)
- DelLine (WsNum, LineNum)
- IsLineDeleted (WsNum, LineNum)

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Symbol management
- GetSymCount (WsNum)
- GetSymLayer (WsNum, SymNum)
- DelSym (WsNum, SymNum)
- IsSymDeleted (WsNum, SymNum)

Text management
- GetTextCount (WsNum)
- GetTextLayer (WsNum, TextNum)
- DelText (WsNum, TextNum)
- IsTextDeleted (WsNum, TextNum)

Undo management
- UndoBegin (WsNum, Name)
- UndoEnd (WsNum)

Description

A VrOne workspace is created when a VrOne vector file is opened. There may be up to 256 files opened at one time in VrOne. The Workspace Class manages VrOne file operations and may be queried for workspace status. When a VrOne file is opened and becomes a VrOne Workspace, some entity parameters such as Layer and Minimum Bounding Rectangle are stored in memory. This enables fast searching without accessing the disk drive, as the FindLayer12.py example below shows. The user of this class should understand the VrOne Data Structure.

NOTE: The workspace numbers start at one in VrOne but start at zero when programming in VrOne/Python.

The FindLine12.py example searches all open workspaces for entities in layer 12. The workspace object is queried for layer number and the disk is never accessed. This is much faster than loading each entity from disk and querying the entity object (PyVrLine, PyVrSym or PyVrText) for the layer number.

```
#
# Count lines, symbols and text in layer 12 in all open workspaces
# Filename: FindLayer12.py
#

Ws        = PyVrWs    ()        # VrOne workspace manager
WsNum     = 0                   # Workspace numbers start at 0
```

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```
LineCount = 0
SymCount  = 0
TextCount = 0

for WsNum in range (0, Ws.GetWsCount()):
      for LineNum in range (0, Ws.GetLineCount(WsNum)):
            if Ws.GetLineLayer (WsNum, LineNum) == 12:
                  LineCount += 1

      for SymNum in range (0, Ws.GetSymCount (WsNum)):
            if Ws.GetSymLayer (WsNum, SymNum) == 12:
                  SymCount += 1

      for TextNum in range (0, Ws.GetTextCount (WsNum)):
            if Ws.GetTextLayer (WsNum, TextNum) == 12:
                  TextCount += 1

print "There are", Ws.GetWsCount(), "workspaces open"
print "There are", LineCount, "lines in layer 12"
print "There are", SymCount,  "symbols in layer 12"
print "There are", TextCount, "text labels in layer 12"
```

Member Function Documentation

Aws ()

Returns the VrOne active workspace, which is the workspace in which new data is to be placed in VrOne. NOTE: The workspace numbers start at one in VrOne but start at zero when programming in VrOne/Python.

Returns Active workspace (0-255)

Example `WsNum = Ws.Aws()`

SetAws (WsNum)

Sets the active workspace. NOTE: The workspace numbers start at one in VrOne but start at zero when programming in VrOne/Python. There must be a VrOne file open in the workspace to make it active. If the workspace number is out of range then nothing is done.

WsNum Active workspace (0-255)

Example `Ws.SetAws (1)`

Open (FileName, Create, Units, Scale)

Opens a new workspace.

FileName	File name to open.
Create	1 - Create the file if it doesn't exist. (default=1) 2 - Do not create the file if it doesn't exist.
Units	Units to create file with 0 - UsFoot (default) 1 - Meter

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	2 - IntlFoot	
Scale	Scale to create file with (1"=n) (default=100)	
WsNum	Return workspace number (optional)	
Returns	Stat, WsNum, ErrorStrg	
	Stat	0 - OK, file existed and was opened. 1 - File did not exist and was created. 2 - File size check failed. (Fixed) 3 - Encountered non header record. (Fixed) -1 - Could not open file. -2 - File did not exist and it could not be created. -3 - Could not get file size. (system error) -4 - File damaged and could not be repaired. Is this a VrOne file? -5 - Maximum number of workspaces reached.
	WsNum	Number assigned to new workspace
	ErrorStrg	If there was an error, this is a description of the error. May be useful to show user.

Example	(Stat, RetWs, RetErrorStrg) = Ws.Open ("MyFile.vr", 0, 600)

Close (WsNum)

Closes the workspace specified.

WsNum	Workspace number to close..	
Returns	Stat, WsNum, ErrorStrg	
	Stat	0 = OK -22 = Workspace number out of range.

Example	Stat = Ws.Close (0)

CloseByName (FileName)

Closes the workspace described by filename.

FileName	File name that was used to open the workspace The one that was returned from GetFileName. If FileName is not open then nothing is done.	
Returns	Stat, WsNum, ErrorStrg	
	Stat	0 = OK -22 = Workspace number out of range.

Example	Stat = Ws.Close (0)

IsOpen (FileName)

Checks if workspace is open by file name.

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FileName	File name to check. Must be the same file name that was used to open the workspace (with full path).
Returns	0=Not Open, 1=Open

Example	(Stat, RetWs, RetErrorStrg) = Ws.Open ("f:/jobs/myfile.vr", 0, 600) if (Stat == 0): Stat = Ws.IsOpen ("f:/jobs/myfile.vr")

Pack (WsNum)

Packs workspaces.

WsNum	Wokspace to pack (-1 = Pack all open workspaces)
Returns	void

Example	Ws.Pack (0)

Sort (WsNum, SortAxis)

Sorts workspaces by layer and X or Y axis.

WsNum	Wokspace to pack (-1 = Pack all open workspaces)
SortAxis	Axis to sort on. 0=X, 1=Y
Returns	void

Example	Ws.Sort (-1, 0)

Backup (WsNum)

Backs up the file of the workspace specified. Copies workspace file to a file with a .vrb extension.

WsNum	Workspace to backup.
Returns	0=Ok, -1=Error

Example	Stat = Ws.Backup (0)

FindLine (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad, SeaMode, RetMode)

Finds the closest line to the point sent.

SeaWs	Workspace to search (-1=Search all open workspaces)
Win	Window number for search (-1=All)
SeaX, SeaY, SeaZ	Search point
SeaMode	Search mode 0 - Point search. Find the closest line point. 1 - Line search. Find the closest line then the closest point on that line.

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RetMode	Return mode 0 - Return line point. 1 - Return intersection of search point and line. 2 - Return closest end point	
Returns	Stat, RetWs, RetLineNum, RetPntNum, RetX, RetY, RetZ, RetDist	
	Stat	0 = OK, -1 = Search point was not within any existing MBR
	RetWs	Return workspace.
	RetLineNum	Return line number.
	RetPntNum	Return point number.
	RetX	Return X coordinate.
	RetY	Return Y coordinate.
	RetZ	Return Z coordinate.
	RetDist	Return distance from search point to line found.

Example	(ret, retws, retlinenum, retpntnum, retx, rety, retz, retdist) = Ws.FindLine (aws, -1, x, y, z, 10.0, 1, 0)

FindSym (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad)

Finds the closest symbol to the point sent.

SeaWs	Workspace to search (-1=Search all open workspaces)	
Win	Window number for search (-1=All)	
SeaX, SeaY, SeaZ	Search point	
Returns	Stat, RetWs, RetSymNum, RetX, RetY, RetZ	
	Stat	0 = OK, -1 = Search point was not within any existing MBR
	RetWs	Return workspace.
	RetSymNum	Return symbol number.
	RetX	Return X coordinate.
	RetY	Return Y coordinate.
	RetZ	Return Z coordinate.

Example	(ret, retws, retsymnum, retx, rety, retz) = Ws.FindSym (aws, -1, x, y, z, 10.0)

FindText (SeaWs, Win, SeaX, SeaY, SeaZ, SeaRad)

Finds the closest text label to the point sent.

SeaWs	Workspace to search (-1=Search all open workspaces)

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Win	Window number for search (-1=All)	
SeaX, SeaY, SeaZ	Search point	
Returns	Stat, RetWs, RetTextNum, RetX, RetY, RetZ	
	Stat	0 = OK, -1 = Search point was not within any existing MBR
	RetWs	Return workspace.
	RetTextNum	Return symbol number.
	RetX	Return X coordinate.
	RetY	Return Y coordinate.
	RetZ	Return Z coordinate.

Example	(ret, retws, retsymnum, retx, rety, retz) = Ws.FindSym (aws, -1, x, y, z, 10.0)

FindClosestEnt (SeaWs, Win, SeaType, SeaX, SeaY, SeaZ, SeaRad, SeaMode, RetMode)

Finds the closest entity to the point sent..

SeaWs	Workspace to search (-1=Search all open workspaces)	
Win	Window number for search (-1=All)	
SeaType	Entity types to search for SEA_LINE|SEA_SYM|SEA_TEXT (may be or'ed)	
SeaX, SeaY, SeaZ	Search point	
SeaMode	Search mode 0 - Point search. Find the closest line point. 1 - Line search. Find the closest line then the closest point on that line.	
RetMode	Return mode 0 - Return line point. 1 - Return intersection of search point and line. 2 - Return closest end point	
Returns	Stat, RetWs, RetEntNum, RetEntType, RetPntNum, RetX, RetY, RetZ, RetDist	
	Stat	0 = OK, -1 = Search point was not within any existing MBR
	RetWs	Return workspace.
	RetEntNum	Return entity number.
	RetEntType	Return entity type 1=Line 3=Symbol 4=Text
	RetPntNum	Return point number (if Line)
	RetX	Return X coordinate.
	RetY	Return Y coordinate.

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	RetZ	Return Z coordinate.
	RetDist	Return distance from search point to line found (if Line).

Example	(ret, retws, rettype, retentnum, retpntnum, retx, rety, retz, retdist) = Ws.FindClosestEnt (aws, -1, SEA_LINE|SEA_TEXT|SEA_SYM, x, y, z, 10.0, 1, 0)

IdEnt (SeaWs, SeaLines, SeaSymbols, SeaText)

Displays menu keys dialog and allows user to select any entity.

SeaWs	Workspace to search (-1=Search all open workspaces)	
SeaLines	Search for lines (0=No, 1=Yes)	
SeaSymbols	Search for symbols (0=No, 1=Yes)	
SeaText	Search for text (0=No, 1=Yes)	
Returns	Stat, RetWs, RetEntNum, RetEntType, RetPntNum, RetX, RetY, RetZ, RetDist	
	RetWs	Return workspace.
	RetEntNum	Return entity number.
	RetEntType	Return entity type 1=Line 3=Symbol 4=Text
	RetPntNum	Return point number (if Line)
	RetX	Return X coordinate.
	RetY	Return Y coordinate.
	RetZ	Return Z coordinate.

Example	(retWs, retEntNum, retEntType, retPntNum, retLockX, retLockY, retLockZ) = Ws.IdEnt ()

GetWsCount ()

Returns the number of open workspaces.

returns	(ret)	
	ret	Number of open workspaces (0-255).

GetTargetScale (WsNum)

Returns the target scale of a workspace in ratio form.

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Target scale in ratio form (1: n).

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GetTargetScaleIn (WsNum)

Returns the target scale of a workspace in inches form.

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Target scale in inch form (1" = n).

GetUnits (WsNum)

Returns the units of a workspace.

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Units. 0 = US Foot. 1 = Meter. 2 = International Foot.

GetFileName (WsNum)

Returns the file name of a workspace.

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Workspace file name.

GetMinMax (WsNum)

Returns the minimum and maximum coordinates for a workspace.

WsNum	Workspace number (0-255).	
returns	(MinX, MinY, MinZ, MaxX, MaxY, MaxZ)	
	MinX	Minimum X coordinate of the workspace.
	MinY	Minimum Y coordinate of the workspace.
	MinZ	Minimum Z coordinate of the workspace.
	MaxX	Maximum X coordinate of the workspace.
	MaxY	Maximum Y coordinate of the workspace.
	MaxZ	Maximum Z coordinate of the workspace.

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GetLineCount (WsNum)

Returns the number of lines in a workspace. NOTE: Deleted entities are removed during a VrOne pack. Deleted entitles are counted in GetLineCount().

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Number of lines in the workspace.

GetLineMinMax (WsNum, LineNum)

Returns the minimum and maximum coordinate (minimum bounding rectangle) of an existing line.

WsNum	Workspace number (0-255).	
LineNum	Line number.	
returns	(MinX, MinY, MinZ, MaxX, MaxY, MaxZ)	
	MinX	Minimum X coordinate of the line.
	MinY	Minimum Y coordinate of the line.
	MinZ	Minimum Z coordinate of the line.
	MaxX	Maximum X coordinate of the line.
	MaxY	Maximum Y coordinate of the line.
	MaxZ	Maximum Z coordinate of the line.

GetLineLayer (WsNum, LineNum)

Returns the layer of an existing line. VrOne stores layer, mode and other header data in memory making it possible to scan VrOne files without loading entities from the disk. This makes searching much faster then loading all entities from disk. See the FindLayer12.py example above.

WsNum	Workspace number (0-255).	
LineNum	Line number.	
returns	(ret)	
	ret	Layer number (1-10001).

GetLineMode (WsNum, LineNum)

Returns the mode of an existing line. VrOne stores layer, mode, and other header data in

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memory, making it possible to scan VrOne files without loading entities from the disk. This makes searching much faster then loading all entities from disk. See the FindLayer12.py example above.

WsNum	Workspace number (0-255).	
LineNum	Line number.	
returns	(ret)	
	ret	Line mode. 1 = Line. 2 = Splined line.

DelLine (WsNum, LineNum)

Deletes a line on disk by setting its layer to a negative number. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
LineNum	Line number.	
returns	(ret)	
	ret	0 = Line was deleted. 1 = Line was not deleted. WsNum or LineNum out of range.

IsLineDeleted (WsNum, LineNum)

Checks if an existing line is deleted. A deleted entity's layer number is zero or negative. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
LineNum	Line number.	
returns	(ret)	
	ret	0 = Line not deleted. 1 = Line deleted.

GetSymCount (WsNum)

Returns the number of symbols in a workspace. NOTE: Deleted entities are removed during a VrOne pack. Deleted entitles are counted in GetSymCount

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Number of symbols in the workspace.

GetSymLayer (WsNum, LineNum)

Returns the layer of an existing symbol. VrOne stores layer, mode and other header data in

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memory making it possible to scan VrOne files without loading entities from the disk. This makes searching much faster then loading all entities from disk. See the FindLayer12.py example above.

WsNum	Workspace number (0-255).	
SymNum	Symbol number.	
returns	(ret)	
	ret	Layer number (1-10001).

DelSym (WsNum, SymNum)

Deletes a line on disk by setting its layer to a negative number. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
SymNum	Symbol number.	
returns	(ret)	
	ret	0 = Symbol was deleted. 1 = Symbol was not deleted. Workspace or symbol number out of range.

IsSymDeleted (WsNum, SymNum)

Checks if an existing symbol is deleted. A deleted entities layer number is zero or a negative layer number. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
SymNum	Symbol number.	
returns	(ret)	
	ret	0 = Symbol not deleted. 1 = Symbol deleted.

WsNum Workspace number (0-255)
SymNum Symbol number (0-?)
Returns 0=Symbol is not deleted 1=Symbol is deleted
Example `if Ws.IsSymDeleted (WsNum, LineNum):`

GetTextCount (WsNum)

Returns the number of text labels in a workspace. NOTE: Deleted entities are removed during a VrOne pack. Deleted entitles are counted in GetTextCount.

WsNum	Workspace number (0-255).	
returns	(ret)	
	ret	Number of text labels in the workspace.

GetTextLayer (WsNum, TextNum)

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Returns the layer of an existing text label. VrOne stores layer, mode and other header data in memory, making it possible to scan VrOne files without loading entities from the disk. This makes searching much faster then loading all entities from disk. See the FindLayer12.py example above.

WsNum	Workspace number (0-255).	
TextNum	Text number.	
returns	(ret)	
	ret	Layer number (1-10001).

DelText (WsNum, TextNum)

Deletes a line on disk by setting its layer to a negative number. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
TextNum	Text number.	
returns	(ret)	
	ret	0 = Text was deleted. 1 = Text was not deleted. Workspace or text number out of range.

IsTextDeleted (WsNum, LineNum)

Checks if an existing text label is deleted. A deleted entity's layer number is zero or negative. Pack Vr file (PacVr) removes these deleted entities.

WsNum	Workspace number (0-255).	
TextNum	Text number.	
returns	(ret)	
	ret	0 = Text is not deleted. 1 = Text is deleted.

UndoBegin (WsNum, Name)

Marks the beginning of an undo block. File operations between the UndoBegin and UndoEnd command may be undone.

NOTE: Each UndoBegin MUST be paired with an UndoEnd. Failure to match undo statements will cause unpredictable results. Undo commands may NOT be nested.

WsNum	Workspace number (0-255).
Name	Name of operation (for user information only).

UndoEnd (WsNum)

Marks the end of an undo block. File operations between the UndoBegin and UndoEnd command may be undone.

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NOTE: Each UndoBegin MUST be paired with an UndoEnd. Failure to match undo statements will cause unpredictable results. Undo commands may NOT be nested.

WsNum	Workspace number (0-255).

SetViewFlags (WsNum)

Sets view flag for one window.

WsNum	Workspace in which to set view flag	
returns	(ViewFlags)	
	ViewFlags	List of flags with one for each window. Each entry is 0 or 1, indicating whether a Workspace is viewable or not in a particular window.

GetViewFlags (WsNum)

Gets workspace view flags for all windows

WsNum	Workspace index number.	
returns	(ret)	
	ret	List of flags with one for each window. Each entry is 0 or 1, indicating whether a Workspace is viewable or not in a particular window.

SetViewFlag (WsNum, Win, Viewable)

Set view flag for one window.

WsNum	Workspace index number.
Win	Window number (0 to MAX_WINS).
Viewable	0=Workspace not viewable. 1=Workspace viewable.

GetViewFlag (WsNum, Win)

Gets the view flag for one window.

WsNum	Workspace index number.	
Win	Window number (0 to MAX_WINS)	
returns	(ret)	
	ret	0=Workspace not viewable. 1=Workspace viewable.

StartWsWrite (StartWs, EndWs, ShowWarning, WarningTitle)

Sets all inactive workspaces to writable. This is necessary if the user has the option set to keep inactive workspaces as read only and the Python script is designed to change entities directly in

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inactive workspaces (without making the workspace active). A call to EndWsWrite should be made when processing is complete.

StartWs	Starting workspace range (0-2000).	
EndWs	Ending workspace range (0-2000).	
ShowWarning	0 = Do not show warning if all workspaces are read-only. 1 = Show warning if all workspaces are read-only.	
WarningTitle	Title string to display in warning dialog (used only if ShowWarning is set to 1 and all workspaces are read-only).	
returns	(ret)	
	ret	0=Workspace not viewable. 1=Workspace viewable.

EndWsWrite (StartWs, EndWs)

Should be called after processing on inactive workspaces is complete. A call to StartWsWrite should be made before processing begins.

StartWs	Starting workspace range (0-2000).
TextNum	Ending workspace range (0-2000).

SetReadOnly (WsNum, ReadOnly)

Sets read-only status for a workspace. If a file is open in write mode in another process, setting ReadOnly on will fail. Use the GetReadOnly to verify state.

WsNum	Workspace number.
ReadOnly	1 = Set workspace to read only. 0 = Set workspace to writable.

GetReadOnly (WsNum, ReadOnly)

Get read only status for a workspace.

Workspace number.	
(ret)	
ret	1 = Workspace is read only. 0 = Workspace is writable.

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2.1.2.16 VrPromBox



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Mapping

Prompt Box Class Reference (VrPromBox)

Allows easy creation of parameter dialogs (Prompt Boxes). More...

Members

- PromBox (Title, EditWidthChars, Modal)
- AddMessage (Message)
- AddImage (ImgWidth, ImgHeight, ImgFileName)
- AddColumn (EditWidthChars)
- AddPage (Name)
- AddShort (Prompt, Value, Min, Max)
- AddInt (Prompt, Value, Min, Max, Max)
- AddDouble (Prompt, Value, Decimal, Min, Max, Max)
- AddStrg (Prompt, Value, MaxChars)
- AddBrowse (BrowsePostfix, BrowseDir, BrowseType)
- SetBrowsePath (BrowsePath)
- AddCombo (Prompt, NumItems, DefaultItem, EditFlag)
- AddComboItem (Strg)
- AddList (Prompt, NumItems, Height, DefaultItem)
- AddListItem (Strg)
- AddCheck (Prompt, Checked)
- AddButton (Label)
- AddColorButton (Label, Color)
- AddLabel (Label)
- AddTip (Strg)
- AddWhatsThis (Strg)
- SetTab (TabNum)
- SetEnable (EnableFlag, Item)
- SetEdit (EditFlag)
- SetHidden (Item, HiddenFlag)

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- SetFocus ()
- ClearField (Item)
- ChangeMessage (Message)
- ChangeShort (Item, Value)
- ChangeShortByPrompt (Prompt, Value)
- ChangeInt (Item, Value, WhatsThisValue)
- ChangeIntByPrompt (Prompt, Value, WhatsThisValue)
- ChangeDouble (Item, Value)
- ChangeDoubleByPrompt (Prompt, Value)
- ChangeStrg (Item, Value, WhatsThisValue)
- ChangeStrgByPrompt (Prompt, Value, WhatsThisValue)
- ChangeCombo (Item, Value)
- ChangeComboByPrompt (Prompt, Value)
- ChangeComboPrompt (Item, Value)
- ChangeComboPromptByPrompt (Prompt, Value)
- ChangeList (Item, Value)
- ChangeListByPrompt (Prompt, Value)
- ChangeCheck (Item, Checked)
- ChangeCheckByPrompt (Prompt, Checked)
- ChangeButton (Item, NewLabel)
- ChangeButtonByPrompt (Prompt, NewLabel)
- ChangeColorButton (Item, NewLabel, Color)
- ChangeColorButtonByPrompt (Prompt, NewLabel, Color)
- ChangeLabel (Item, NewLabel)
- GetShort (Item)
- GetShortByPrompt (Prompt)
- GetInt (Item)
- GetIntByPrompt (Prompt)
- GetDouble (Item)
- GetDoubleByPrompt (Prompt)
- GetStrg (Item)
- GetStrgByPrompt (Prompt)
- GetCombo (Item)
- GetComboByPrompt (Prompt)
- GetList (Item)
- GetListByPrompt (Prompt)
- GetCheck (Item)

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- GetCheckByPrompt (Prompt)
- GetColorButton (Item)
- GetColorButtonByPrompt (Prompt)
- Display (WarpMouse)
- Hide ()
- Show ()
- SetPosition (x, y)

Description

Creates a dialog box with programmable entry fields (prompts). Fields are laid out automatically with options for multiple columns and tabbed dialogs. The dialog is built up using calls to Add… methods. It then displays with the Display method. The Display method returns "0", for example, if the user presses 0. After the return from Display, the user-entered parameters can be queried using the Get… methods. See testprombox.py for examples.

Member Function Documentation

PromBox (Title, EditWidthChars, Modal)

Class constructor

Title	Title for window border.
EditWidthChars	Edit field width in characters.
Modal	Is box modal? (default=TRUE)

AddMessage (Message)

Adds message to the top of the prompt box. This is for user information

Message	Message string.

AddImage (ImgWidth, ImgHeight, ImgFileName)

Adds an image to the top of the prompt box.

ImgWidth	Image width (pixels).
ImgHeight	Image height (pixels).
ImgFileName	Image file name with path (can be .bmp file). This is for user information

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AddColumn (EditWidthChars)

Adds a dialog column after the current item.

EditWidthChars	Width of edit field in characters. -1= Same as first column (default).

AddPage (Name)

Adds a new page resulting in a tabbed dialog interface

Name	Page name (shown on tab).

AddShort (Prompt, Value, Min, Max)

Prompt	Prompt string.
Value	Default value.
Min	Minimum allowed value (Optional).
Max	Maximum allowed value (Optional).

AddInt (Prompt, Value, Min, Max)

Adds a prompt for an integer.

Prompt	Prompt string.
Value	Default value.
Min	Minimum allowed value (Optional).
Max	Maximum allowed value (Optional).

AddDouble (Prompt, Value, Decimal, Min, Max)

Adds a prompt for a double.

Prompt	Prompt string.
Value	Default value.
Decimal	Number of decimal places to display.
Min	Minimum allowed value (Optional).
Max	Maximum allowed value (Optional).

AddStrg (Prompt, Value, MaxChars)

Adds a prompt for a string.

Prompt	Prompt string.
Value	Default value.
MaxChars	Maximum number of characters allowed. (up to

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	512)

AddBrowse (BrowsePostfix, BrowseDir, BrowseType)

Adds a browse button to the previous prompt.

BrowsePostfix	File name postfix (Example: .dxf).
BrowseDir	Directory (default=NULL=Default directory).
BrowseType	0= Save dialog (default). 1= Open dialog (file must exist). 2= Directory (directory must exist).

SetBrowsePath (BrowsePath)

Sets the default browse path which is used if the existing file name is NULL.

BrowsePath	Browse path (64 char).

AddCombo (Prompt, NumItems, DefaultItem, EditFlag)

Adds a combo box.

Prompt	Prompt string.
NumItems	Number of items in combo box.
DefaultItem	Default item (0-18).
EditFlag	Are fields editable?

AddComboItem (Strg)

Adds item to current combo box. Use AddCombo to start combo box.

Strg	String to add.

AddList (Prompt, NumItems, Height, DefaultItem)

Adds a list box. Use AddListItem to add string items to list box.

Prompt	Prompt string.
NumItems	Maximum number of items in combo box.
Height	Height of list box (chars).
DefaultItem	Default item (0-NumItems-1)

AddListItem (Strg)

Adds item to current list box. Use AddList to start list box.

Strg	String to add.

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AddCheck (Prompt, Checked)

Adds a check box.

Prompt	Prompt string.
Checked	Initial checked state (0=Not checked, 1=checked)

AddButton (Label)

Adds a push button

Label	Label for button

AddColorButton (Label, Color)

Adds a color push button

Label	Label for color button
Color	Integer representation of RGB color

AddLabel (Label)

Adds a label field. This may be used to label a group of prompts

Label	Label for button

AddTip (Strg)

Adds a tool tip to the previous prompt.

Strg	ToolTip to add (any length)

AddWhatsThis (Strg)

Adds a What's This to the previous prompt.

Strg	Whats this to add (any length)

SetTab (TabNum)

Sets tab order number for previous prompt.

TabNum	Tab order number to set

SetEnable (EnableFlag, Item)

Enables/Disables the previous prompt.

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EnableFlag	0 = Disable 1 = Enable (default)
Item	Item number (0-MAXPROMPTS) -1=Ok button -2=Cancel button

SetEdit (EditFlag)

Enables/Disables editing for the previous prompt.

EditFlag	0 = Disable 1 = Enable (default)

SetHidden (Item, HiddenFlag)

Hides/Shows an item.

Item	Item number (0-MAXPROMPTS) -1=Ok button -2=Cancel button
HiddenFlag	0 = Hide 1 = Show

SetFocus ()

Sets focus to the previous prompt.

ClearField (Item)

Clears a field to blank

Item	Item number (0=first item).

ChangeMessage (Message)

Changes the value of a previously defined message

Message	New message

ChangeShort (Item, Value)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value.

ChangeShortByPrompt (Prompt, Value)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value.

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ChangeInt (Item, Value, WhatsThisValue)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value.
WhatsThisValue	New whats this value. (NULL if no change)

ChangeIntByPrompt (Prompt, Value, WhatsThisValue)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value.
WhatsThisValue	New whats this value. (NULL if no change)

ChangeDouble (Item, Value)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value.

ChangeDoubleByPrompt (Prompt, Value)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value.

ChangeStrg (Item, Value, WhatsThisValue)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value. (NULL if no change)
WhatsThisValue	New whats this value. (NULL if no change)

ChangeStrgByPrompt (Prompt, Value, WhatsThisValue)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value. (NULL if no change)
WhatsThisValue	New whats this value. (NULL if no change)

ChangeCombo (Item, Value)

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Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value.

ChangeComboByPrompt (Prompt, Value)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value.

ChangeComboPrompt (Item, Value)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Value	New value.

ChangeComboPromptByPrompt (Prompt, Value)

Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Value	New value.

ChangeList (Item, Value)

Changes the highlighted item in a list box.

Item	Item number (0=first item).
Value	String to hightlight

ChangeListByPrompt (Prompt, Value)

Changes the highlighted item in a list box.

Prompt	Prompt of item to change.
Value	String to hightlight

ChangeCheck (Item, Checked)

Changes the value of a previously defined item.

Item	Item number (0=first item).
Checked	Checked state (0=Not checked, 1=checked)

ChangeCheckByPrompt (Prompt, Checked)

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Changes the value of a previously defined item.

Prompt	Prompt of item to change.
Checked	Checked state (0=Not checked, 1=checked)

ChangeButton (Item, NewLabel)

Changes a buttons label

Item	Item number (0=first item).
NewLabel	New button label (0=No change)

ChangeButtonByPrompt (Prompt, NewLabel)

Changes a buttons label

Prompt	Prompt of item to change.
NewLabel	New button label (0=No change)

ChangeColorButton (Item, NewLabel, Color)

Changes a buttons label

Item	Item number (0=first item).
NewLabel	New button label (0=No change)
Color	New button color

ChangeColorButtonByPrompt (Prompt, NewLabel, Color)

Changes a buttons label

Prompt	Prompt of item to change.
NewLabel	New button label (0=No change)
Color	New button color

ChangeLabel (Item, NewLabel)

Changes a label

Item	Item number (0=first item).
NewLabel	New label (0=No change)

GetShort (Item)

Gets short item value. Searches by item number.

Item	Item number (0=first item).
returns	(ret)

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	ret	Current value

GetShortByPrompt (Prompt)

Gets short item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetInt (Item)

Gets integer item value. Searches by item number.

Item	Item number (0=first item).	
returns	(ret)	
	ret	Current value

GetIntByPrompt (Prompt)

Gets integer item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetDouble (Item)

Gets double item value. Searches by item number.

Item	Item number (0=first item).	
returns	(ret)	
	ret	Current value

GetDoubleByPrompt (Prompt)

Gets double item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetStrg (Item)

Gets string item value. Searches by item number.

Item	Item number (0=first item).	
returns	(ret)	

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	ret	Current value

GetStrgByPrompt (Prompt)

Gets string item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetCombo (Item)

Gets combo item value. Searches by item number.

Item	Item number (0=first item).	
returns	(ret)	
	ret	Current value

GetComboByPrompt (Prompt)

Gets combo item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetList (Item)

Gets list item value. Searches by item number.

Item	Item number (0=first item).	
returns	(ret)	
	ret	Current value

GetListByPrompt (Prompt)

Gets list item value. Searches by prompt.

Prompt	Prompt of item to get.	
returns	(ret)	
	ret	Current value

GetCheck (Item)

Gets checkbox item value. Searches by item number.

Item	Item number (0=first item).

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GetCheckByPrompt (Prompt)

Gets checkbox item value. Searches by prompt.

Prompt	Prompt of item to get.

GetColorButton (Item)

Gets color button item value. Searches by item number.

Item	Item number (0=first item).

GetColorButtonByPrompt (Prompt)

Prompt	Prompt of item to get.

Display (WarpMouse)

Constructs and displays the dialog box.

WarpMouse	Place mouse in center of dialog? (default=TRUE)	
returns	(ret)	
	ret	0 = OK pressed -1 = Cancel pressed or no prompts defined.

Hide ()

Hides the dialog box.

Show ()

Shows the dialog box

SetPosition (x, y)

Sets the position of the dialog box. By default, the dialog is positioned in the middle of the window. If this is called before Display then it will be placed at the location sent.

x	X position of window
y	Y position of window

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2.1.3 Point Draping

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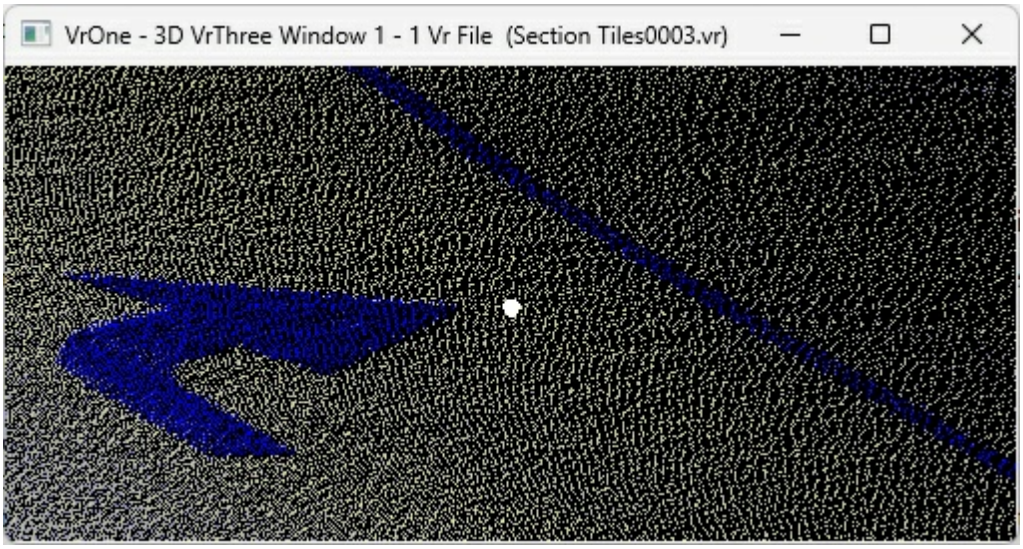
Vr Mapping

Point Draping (VrOne/VrTwo)



Overview

Point Draping allows the cursor (measuring point) to be draped onto VrPoints, which are typically LiDAR or Digital Surface Model (DSM) points. This feature is available in VrOne and VrTwo, while VrThree (VrLiDAR) has its own version called Cursor Draping. Point Draping operates in real-time, recalculating the cursor's elevation with each movement in the x and y directions. It is a global mode, meaning it is always available in VrOne and VrTwo.

Modes

There are two possible modes for Point Draping

- **Single Drape** - The cursor is draped one time with the "Z HL" (High/Low) key-in or the "Z TRI" (Triangle) key-in.
- **Continuous Drape** - The cursor is continuously draped as it is moved in the x, y direction.

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Data collected with any of the interactive applications uses the draped elevation.

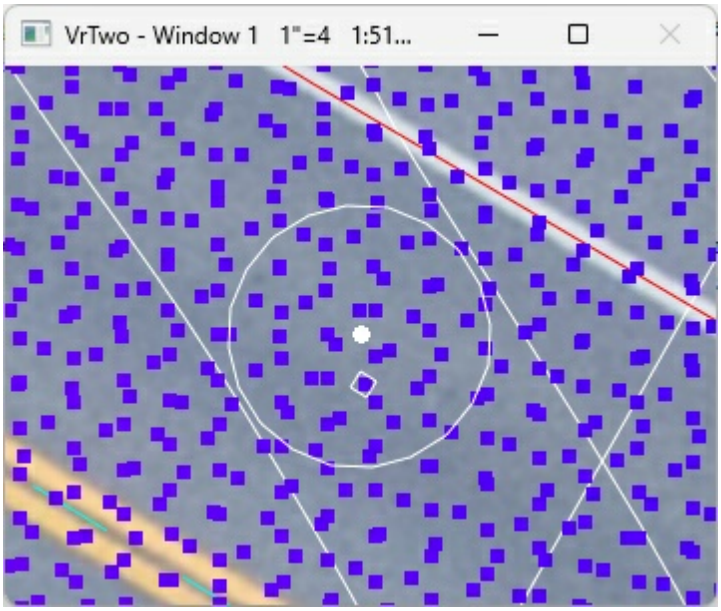
Methods

The High/Load Point Buffer

There are two possible methods of draping the cursor. Both methods use the High/Low point buffer. This buffer stores VrPoints within a user defined radius of the cursor location. A buffer Z tolerance is used to define the minimum and maximum Z of the buffer. The result of these three parameters is a cylinder of 3D VrPoints which can be used, real-time, by the draping applications.

The Point Drape Application (PoiDraApp) is available to show and edit the Point Drape parameters.

High/Low Method



High/Low Point Drape Method

This method uses a High/Low searching method to determine the elevation of the cursor. Please see High/Low Point Search for more information about this existing search method. High/Low point searching is an option in several Vr Mapping applications such as Insert Line (InsLin) and Insert Symbol (InsSym). The High/Low point search is useful if the source LiDAR data contains vegetation. By setting the search for the lowest point in the buffer, the chances of obtaining the ground elevation is increased. The High/Low point is chosen based on the user parameters and is recomputed each time the cursor is moved in the x,y direction..

Triangle Method

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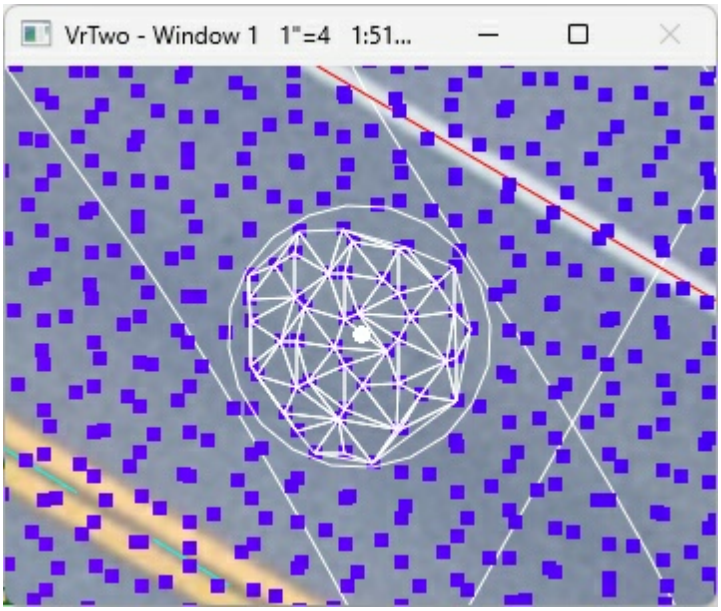

Triangle Point Drape Method

A surface model is created using the points in the buffer and break lines to create 3D triangles. This is the same method used with the Run Dtm command. The formation of the triangles occurs real-time each time the cursor is moved in the x,y direction. The elevation is computed at the cursor location based on the triangle that it falls within. The search radius for this method may be small because only a few points are needed to form a 3D triangle around the cursor location. The buffer may contain up to 10,000 point per cursor movement. If the number of points in the buffer exceeds 10,000 then no triangles will be displayed. The cursor elevation is adjusted each time the cursor is moved in the x,y direction.
In the example above, 3D triangles are formed from the points inside the High/Low buffer along with break lines whose layers are defined in Z Source dialog (ZSou). The triangles on the edge of the radius circle are nor fully formed but the triangles in the center are. The elevation is taken from the triangle at the cursor location.

Configuration

Point draping is a user defined mode in Z Source (ZSou) and the parameters may be set using a dialog with the ZSou key-in with no parameters.

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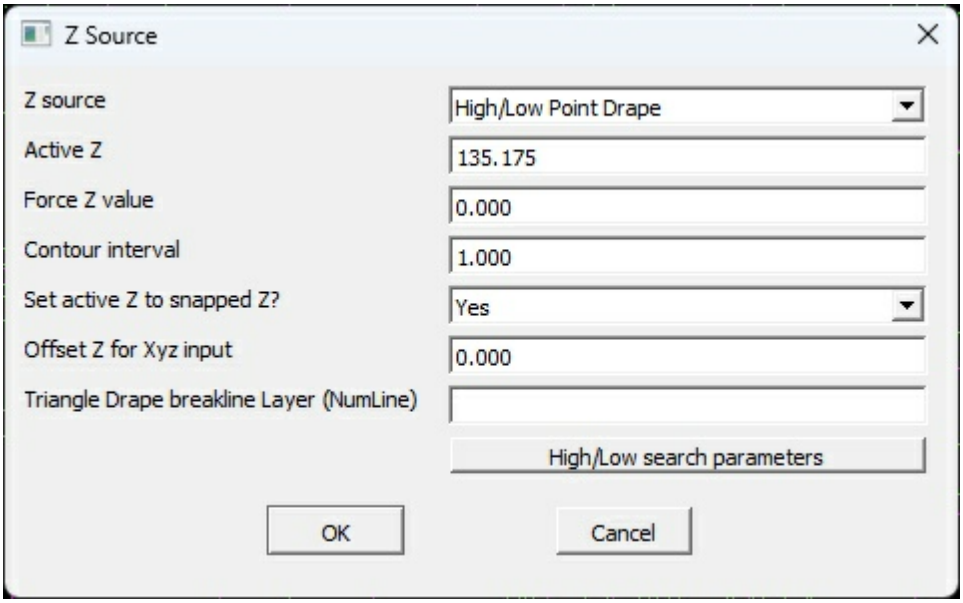
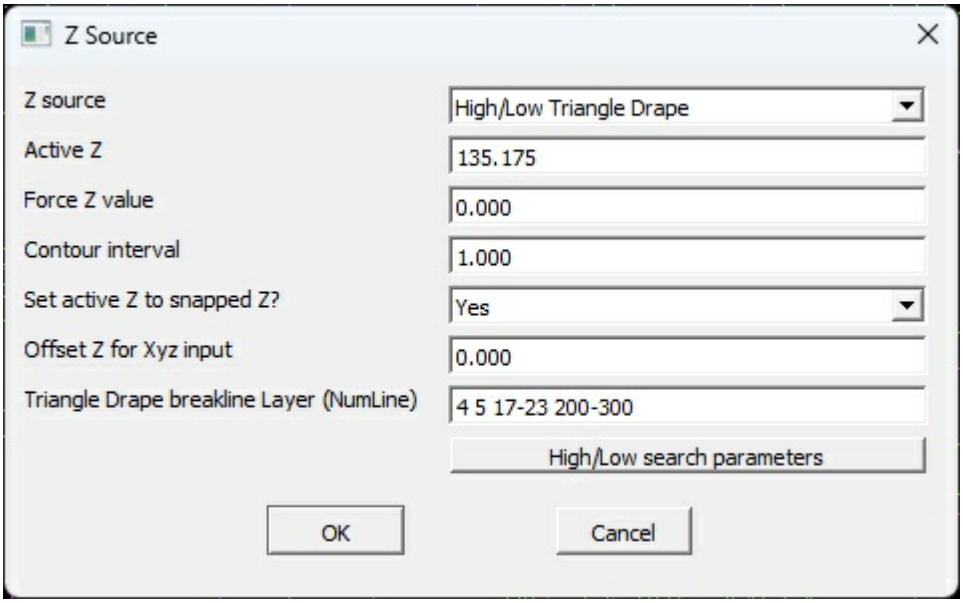


Z Source set to High/Low Point Drape



Z Source set to Triangle Drape

Triangle Drape breakline layer (NumLine) - If the Z Source is set to High/Low Triangle Drape, break lines may be added to the triangulation by defining the layers containing the break lines. These layers are defined by a Number Line

A key-in may be used to change the Z Source without the dialog as shown below. This allows the Z Source to be changed from anywhere key-ins are supported. This would include Macros, Function Keys, 3D mouse button assignments, and general key-ins.

Key-in	**Definition**
ZSou ACTZ	Xyz input device or the Active Z

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ZSou DTM	Drape to the previously computed DTM surface
ZSou FORZ	Use the Force Z which is a user defined constant
ZSou HL	Use High/Low point search
ZSou TRI	Create 3D triangles from the points in the buffer

Point Draping added May 2024 - Version 07.01.23
Jan 2025 - Added support for break lines - Version 07.01.24

2.1.3.1 Point Drape App

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Vr Mapping

Point Drape App (PoiDraApp)

Type: Interactive application

Detailed Description

The Point Drape Application enables users to visualize and configure the parameters for draping cursor elevation onto VrPoints (such as LiDAR or DSM points). While this application simplifies the process, it is not essential for using Point Draping, as parameters can also be set through key-ins or dialog boxes.

Point Draping allows the cursor (measuring point) to be draped onto VrPoints, which are typically LiDAR or Digital Surface Model (DSM) points. This feature is available in VrOne and VrTwo, while VrThree (VrLiDAR) has its own version called Cursor Draping. Point Draping operates in real-time, recalculating the cursor's elevation with each movement in the x and y directions. It is a global mode, meaning it is always available in VrOne and VrTwo.

Point Draping uses various parameters to produce the elevation interpolation for the cursor location. The Point Drape Application is an interactive application that visually displays these parameters and their results. Its sole purpose is to show these parameters graphically and assist in setting them. This feature supports two drape methods: the High/Low Method and the Triangle Method. For more information, please refer to the Point Draping documentation.

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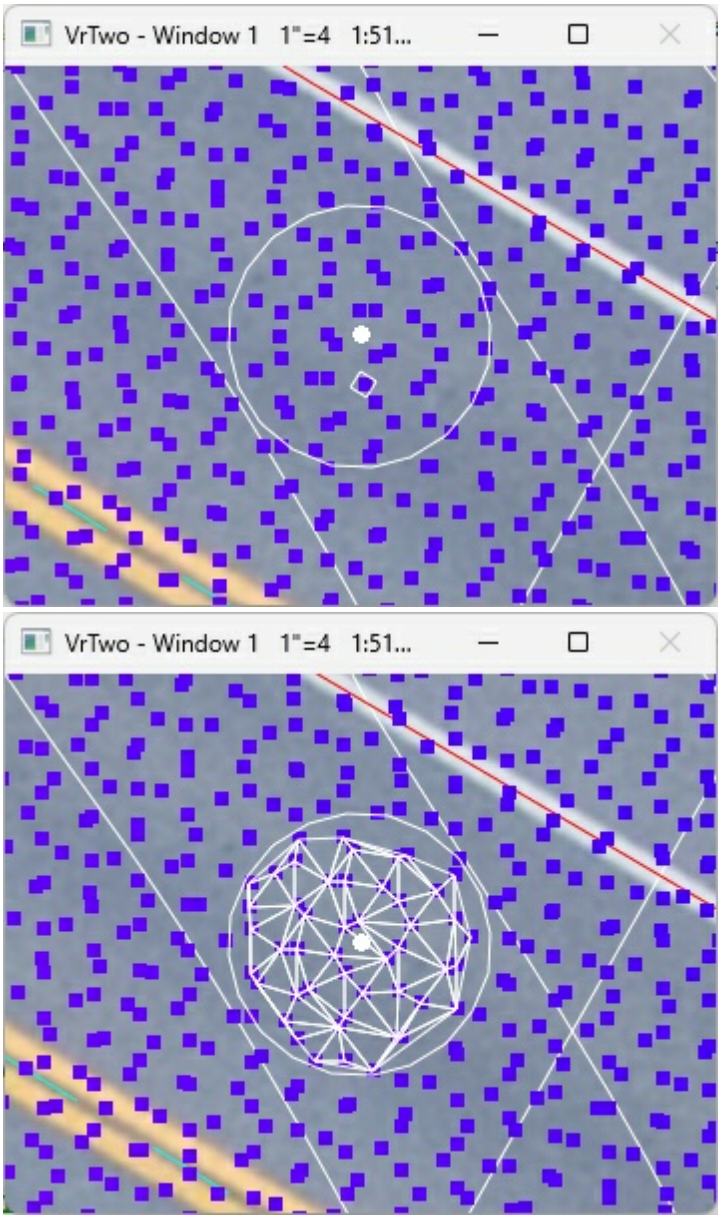

The High/Low method and the Triangle method of Point Draping

Methods

The High/Load Point Buffer

There are two possible methods of draping the cursor. Both methods use the High/Low point buffer. This buffer stores VrPoints within a user defined radius of the cursor location. A buffer Z tolerance is used to define the minimum and maximum Z of the buffer. The result of these three parameters is a cylinder of 3D VrPoints which can be used, real-time, by the draping applications.

The Point Drape Application (PoiDraApp) is available to show and edit the Point Drape parameters.

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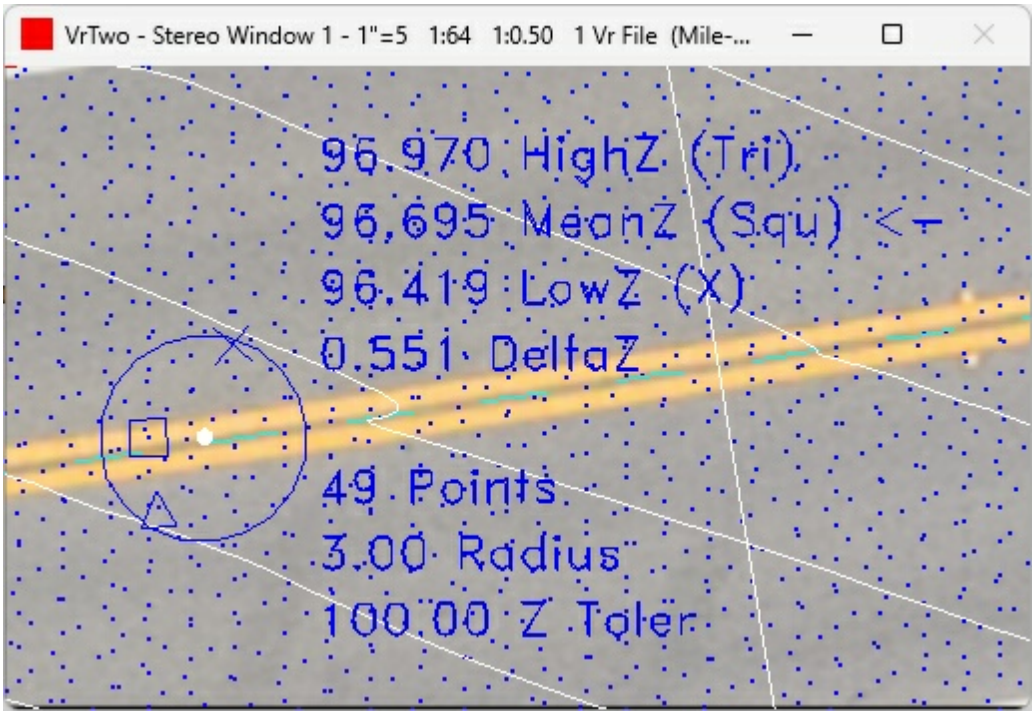
High/Low Method



High/Low Point Drape Method

This method uses a High/Low searching method to determine the elevation of the cursor. Please see High/Low Point Search for more information about this existing search method. High/Low point searching is an option in several Vr Mapping applications such as Insert Line (InsLin) and Insert Symbol (InsSym). The High/Low point search is useful if the source LiDAR data contains vegetation. By setting the search for the lowest point in the buffer, the chances of obtaining the ground elevation is increased. The High/Low point is chosen based on the user parameters and is recomputed each time the cursor is moved in the x,y direction..

Following are the graphics that are shown when using the High/Low Point Drape Method.

- The highest (HighZ) point in the buffer is displayed with a triangle and its value is shown.
- The mean (MeanZ) point is displayed with a square and its value is shown. Note that the mean elevation is computed from the maximum elevation and the minimum elevation (LowZ+HighZ)/2. The point with a square is the closest to the computed mean elevation
- The lowest (LowZ) point is displayed with an X and its value is shown
- The '<-' notation after HighZ or LowZ or MeanZ indicates the elevation used in the "Search for" selection in the High Low Point Search parameters.
- The DeltaZ is the elevation difference from the lowest (LowZ) elevation to the highest (HighZ) elevation based on all the points in the high/low point buffer. This value is shown.

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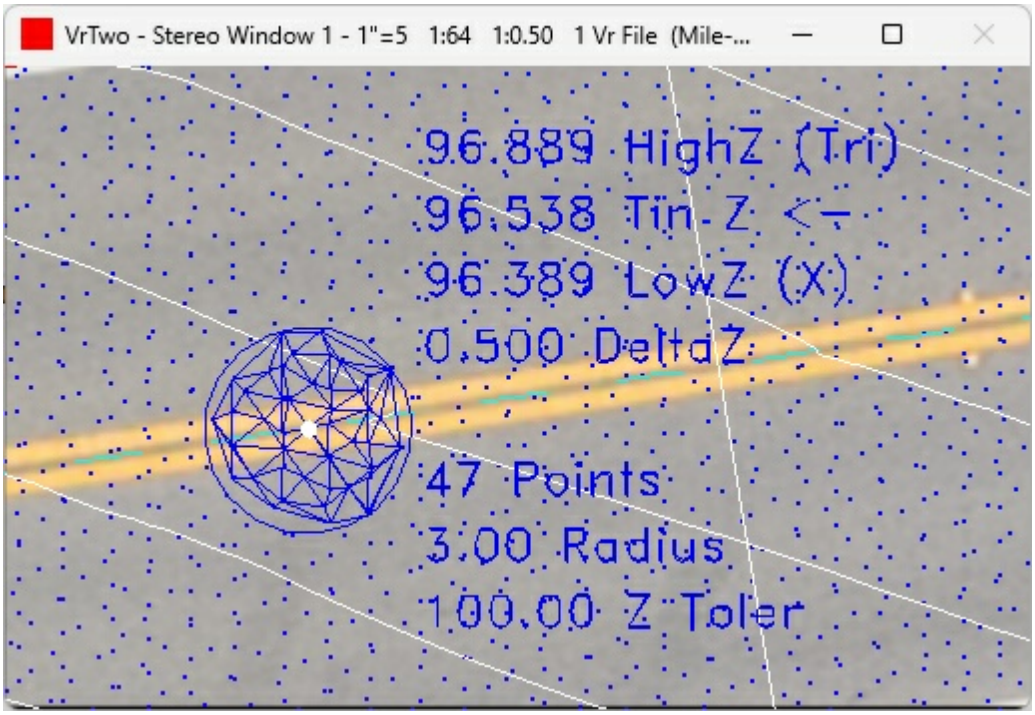
- The number of points are the amount of VrPoints that were found within the search (Radius) radius in the x,y direction. The elevation of these points are within the Z Tolerance (Z Toler) above and below the cursor elevation. These values are shown.

The Triangle Method



Triangle Method

A surface model is created using the points in the buffer to create 3D triangles. This is the same method used with the Run Dtm command. The formation of the triangles occurs real-time each time the cursor is moved in the x,y direction. The elevation is computed at the cursor location based on the triangle that it falls within. The search radius for this method may be small because only a few points are needed to form a 3D triangle around the cursor location. The buffer may contain up to 10,000 point per cursor movement. If the number of points in the buffer exceeds 10,000 then no triangles will be displayed. The cursor elevation is adjusted each time the cursor is moved in the x,y direction.
In the example above, 3D triangles are formed from the points inside the High/Low buffer. The triangles on the edge of the radius circle are nor fully formed but the triangles in the center are. The elevation is taken from the triangle at the cursor location

Following are the graphics that are shown when using the Triangle Method.

- The highest (HighZ) point elevation is show but is considered as one of the points used to form 3D triangles.
- The triangle elevation (Tin Z) point is shown and it the computed elevation is used to drape the cursor.

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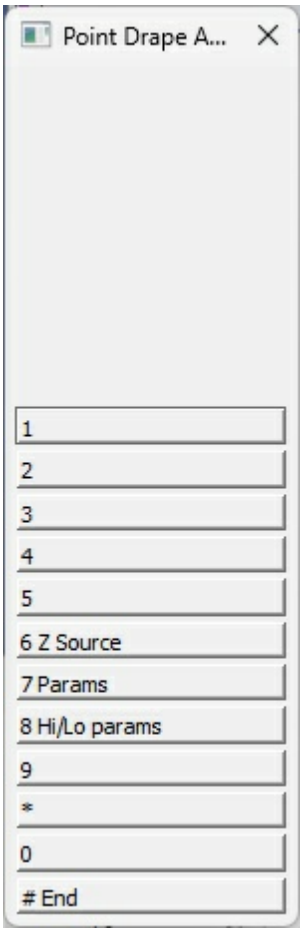
- The lowest (LowZ) point elevation is shown but is considered as on of the point used to form 3D triangles.
- The '<-' notation is always displayed after the triangle elevation (Tin Z) indicating that it is the elevation used to drape the cursor.
- The DeltaZ is the elevation difference from the lowest (LowZ) elevation to the highest (HighZ) elevation based on all the points in the high/low point buffer.
- The number of points are the amount of VrPoints that were found within the search (Radius) radius in the x,y direction. The elevation of these points are within the Z Tolerance (Z Toler) above and below the cursor elevation.

Button Assignments

Point Drape App - Main



Point Drape App - Menu Keys

When Insert Edge starts, initial points along the edge line need to be digitized. This initial data provides seed information so the application can follow the edge and place a 3D line.

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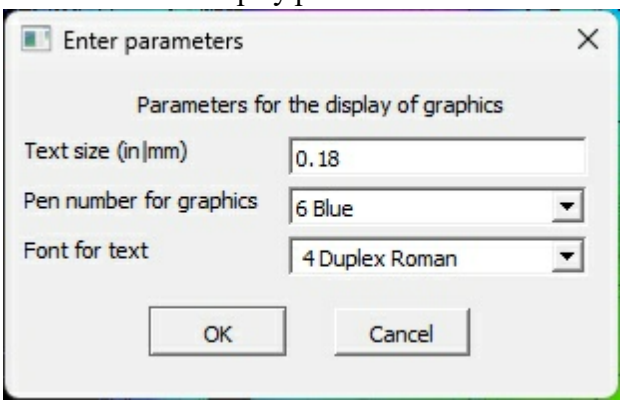
	Button	Description
1		
2		
3		
4		
5		
6	Z Source	Set the Z Source and High/Low parameters
7	Params	Enter parameters
8	Hi/Lo params	Set the High/Low parameters
9		
*		
0		
#		

Button 6 - Z Source
Set the Z Source and High/Low parameters. See Z Source.

Button 7 - Params
Sets or edits the display parameters.



Point Drape App - Edit Parameters dialog

Text size (in|mm)
Text size for the display of the draping data. This is in inches or millimeters depending on the Prompt Units.

Pen number for graphics
The pen number sets the color for the graphics. The pen number color is determined by the active Pen Table which is shown in the pull-down.

Font for text
Defines the text font to use for the display of the draping data text.

Button 8 - Hi/Lo params
Set the High/Low parameters. See High Low Point Search

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Local Commands

The following key-ins may be used to change run-time parameters. They may be keyed in, placed in macros or more commonly placed in the Local Args field in a Function Key.

Key-in	Description	Range
TexSiz=	Text size	In inches or millimeters
PenNum=	Pen number to set graphics color	1-20
FontNum=	Font number for graphics text	1-12

Point Drape App added May 2024 - Version 07.01.23

2.2 VrThree (VrLiDAR)

Vr Mapping

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VrThree (VrLiDAR)

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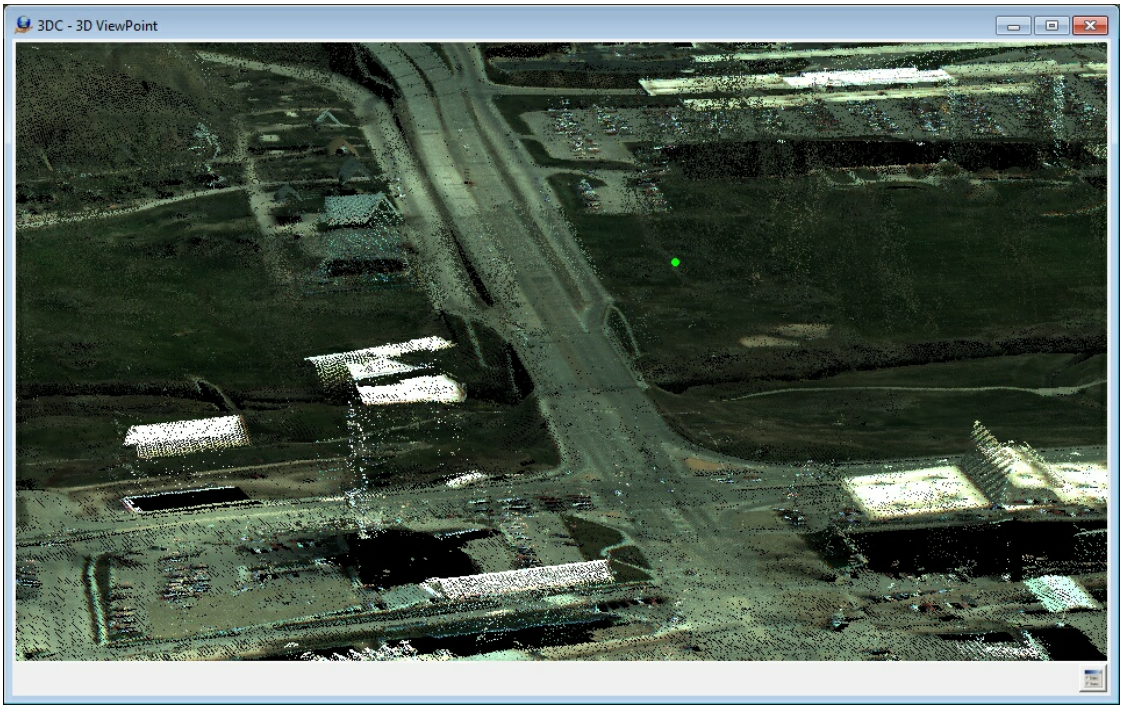

LiDAR data displayed in RGB

Overview

LiDAR (Light Detection And Ranging) is an optical sensing technology that measures the distance to a target by illuminating the target with light, often using pulses from a laser. LiDAR point collection results in georeferenced XYZ points with attribute data for each point.

VrThree (VrLiDAR) integrates LiDAR data and processing into the VrMapping's VrOne and VrTwo mapping software. In addition to LiDAR data, the applications can handle any 3D point data from other sources such as High Density Surface Models (DSM).

VrThree (VrLiDAR) consists of:

- Vr data base (.vr) support for LiDAR data, including LiDAR point attributes.
- Import and export of LiDAR data.
- Integration of LiDAR processing into existing mapping applications where applicable.
- Implementation of LiDAR specific applications, such as VrThree (VrLiDAR).

An example of the integration of LiDAR data into an existing Vr Mapping applications can be found in the Vr Mapping application Cut Polygon. Cut Polygon was designed to cut traditional map data such as lines, symbols, and text; now, it can cut LiDAR data. Similarly, LiDAR-specific applications can function with other data types. For example, VrThree, which was designed to display LiDAR and other point clouds and collect and edit vector data on top of this data, has the ability to display vector data only (no images).

Documentation for individual applications can be found in the VrOne/VrTwo List Of Commands

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Viewing Environments

2D in VrOne

Displays large quantities of LiDAR data. Optionally, rectified images can be displayed as a backdrop. Useful for cutting and management applications.

Photogrammetric Stereo

Displays LiDAR points with traditional photo-based photogrammetry using VrTwo in static or roaming mode. Any supported camera and sensor types may be used.

LiDARgrammetry

Displays synthetic stereo images (derived from LiDAR point intensity data) using VrTwo in static or roaming modes.

VrThee (VrLiDAR)

Displays point data in true three-dimensional stereo imagery with dynamic view. Vectors, symbols, and text may be collected on top of the point data. Two cursor modes are supported: Cursor Draping (cursor is held to the LiDar surface in the Z-axis) and Free Motion (cursor may move freely through the Z-axis). Static and roaming modes are supported. See Getting Started With VrThree (VrLiDAR) for more information.

LiDAR data is opened in Vr Mapping as a standard VrOne file and is displayed with corresponding vector map data in all environments.

The LiDAR Database

LiDAR point data with attributes, like lines, symbols, and text, is contained in the VrOne database (.vr) file as VrPoints. See VrOne Database Structure for more information about the database and see VrPoint (LiDAR) Entity for more information on the storage of LiDAR data in the VrOne database.

VrThree (VrLiDAR) Applications

VrThree (VrLiDAR) integrates LiDAR data into existing mapping applications and implements LiDAR-specific applications. The following is a list of Vr Mapping applications that deal with LiDAR data. More information on any of these applications can be found the VrOne/VrTwo List of Commands.

A High/Low point searching method is available when using some of the LiDAR interactive collection and batch applications. High/Low point searching is an addition to various insert applications such as Insert Line (InsLin) and Insert Symbol (InsSym). It selects the highest, lowest or mean elevation point from a group of VrPoints within a user-defined radius of the digitized point.

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As of Vr Mapping version 05.05.00, work is ongoing on the integration of the VrPoint (LiDAR) portion of the data base into existing applications. Applications marked with a '+' are integrated into the VrPoints (LiDAR) database.

VrThree (VrLiDAR)	3DSC or Vr3 or VrThree or 3DC	+
ASCII In	AscIn	+
ASCII Out	AscOut	+
Bump Elevation	BumEle	+
Catenary to POA (Point of Attachment)	CatPoa	+
Change Units	ChaUni	+
Change Elevation	ChaEle	+
Change Layer	ChaLay	+
Classify 3D	Cla3d	+
Classify Points or Bare Earth	ClaPoi or BarEar	+
Copy Polygon	CopPol	+
Copy Window	CopWin	+
Count Points	CouPoi	+
Cut Polygon	CopPol	+
Cut Sheet	CutShe	+
Cut Window	CutWin	+
Delete Close Point	DelClo	+
Delete Duplicates	DelDup	+
Delete Outside Boundary	DelOut	+
Delete Points In Polygon	DelPoi	+
Delete Window	DelWin	+
Drape	Dra	+
Drape Cursor	DraCur	+
Drape Polygon	DraPol	+
Edit Point	EdiPoi	+

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Fast Delete	FasDel	+
High/Low Point Search	various	+
Identify Any	IdentAny	
Insert Catenary	InsCat	+
Insert Edge	InsEdg	+
Insert Paint Line	InsPai	+
Inverse	Inv	+
Label Point	LabPoi	+
Keypoint	KeyPoi	+
LAS In	LasIn	+
LAS Out	LasOut	+
Move Polygon	MovPol	+
Move Window	MovWin	+
Polygon Elevation	PolEle	+
Point Display Parameters	PoiDis or PO	+
Points In	PoiIn	+
Points Out	PoiOut	+
Round Elevation	RouEle	+
Search Elevation	SeaEle	+
Set Elevation	SetEle	+
Shift Workspace	ShiWs	+
Swap Axis	SwaAxi	
Tile Points	TilPoi	+
Global Change	Glob	+
Plot	Plo	
Window Clip View	WinCli	+

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2.2.1 VrThree (VrLiDAR)

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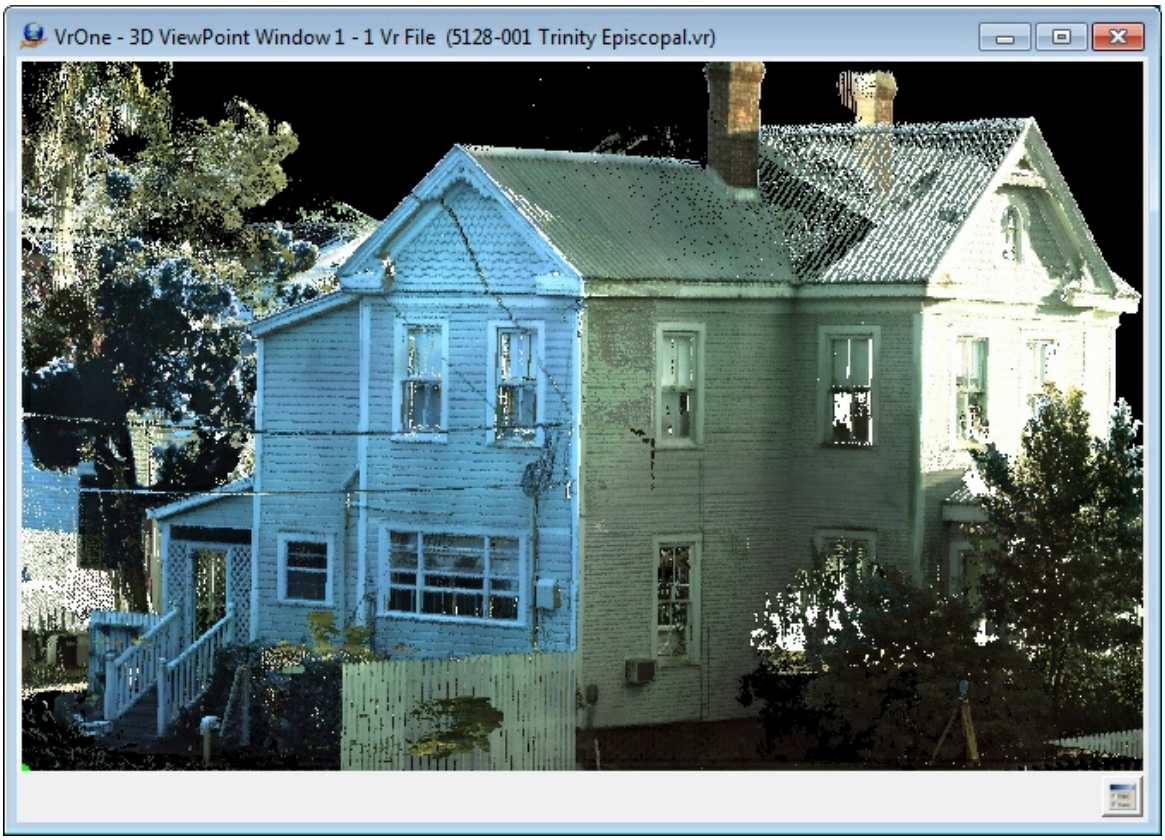
Vr Mapping

VrThree (VrLiDAR) (3DSC or Vr3 or VrThree)



Description

VrThree (VrLiDAR) is a 3D stereo environment. The VrThree window displays point and vector data contained by VrOne data files and is designed for the collection of vector data using LiDAR and (or) point clouds as reference. This window is designed for point and vector data without any imagery.

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For more information on configuring, starting and using this environment, please see Getting Started with VrThree (VrLiDAR).

A list of available applications and commands for VrThree (VrLiDAR) can be found at VrThree (VrLiDAR) Applications.

The display controls for VrThree can be found at VrThree (VrLiDAR) Display Controls.

2.2.2 VrThree (VrLiDAR) Applications

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Vr Mapping

VrThree (VrLiDAR) Applications

VrThree (VrLiDAR) integrates point cloud (LiDAR, DSM) data into existing mapping applications and implements point cloud-specific applications. The following is a list of Vr Mapping applications that work with point cloud data. A complete list of all applications available in VrOne/VrTwo and in VrThree (VrLiDAR) can be found in the List of Commands.

A High/Low point searching method is available when using some of the LiDAR interactive collection and batch applications. High/Low point searching is an addition to various insert applications such as Insert Line (InsLin) and Insert Symbol (InsSym). It selects the highest, lowest or mean elevation point from a group of VrPoints within a user-defined radius of the digitized point.

Following is a list of applications that are compatible with VrThree (VrLiDAR).

Application	Key-in
VrThree (VrLiDAR)	3DSC or Vr3 or VrThree or 3DC
ASCII In	AscIn
ASCII Out	AscOut
Bump Elevation	BumEle

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Catenary to POA (Point of Attachment)	CatPoa
Change Units	ChaUni
Change Elevation	ChaEle
Change Layer	ChaLay
Classify 3D	Cla3d
Classify Points or Bare Earth	ClaPoi or BarEar
Copy Polygon	CopPol
Copy Window	CopWin
Count Points	CouPoi
Cut Polygon	CopPol
Cut Sheet	CutShe
Cut Window	CutWin
Delete Close Point	DelClo
Delete Duplicates	DelDup
Delete Outside Boundary	DelOut
Delete Points In Polygon	DelPoi
Delete Window	DelWin
Drape	Dra
Drape Cursor	DraCur
Drape Polygon	DraPol
Edit Point	EdiPoi
Fast Delete	FasDel
High/Low Point Search	various
Insert Catenary	InsCat
Insert Edge	InsEdg
Insert Paint Line	InsPai
Insert Road	InsRoa
Inverse	Inv
Label Point	LabPoi

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Keypoint	KeyPoi
LAS In	LasIn
LAS Out	LasOut
Move Polygon	MovPol
Move Window	MovWin
Polygon Elevation	PolEle
Point Display Parameters	PoiDis or PO
Points In	PoiIn
Points Out	PoiOut
Round Elevation	RouEle
Search Elevation	SeaEle
Set Elevation	SetEle
Shift Workspace	ShiWs
Swap Axis	SwaAxi
Tile Points	TilPoi
Global Change	Glob
Plot	Plo
Window Clip View	WinCli

2.2.3 VrThree (VrLiDAR) Display Controls

Vr Mapping

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VrThree (VrLiDAR) Display

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Controls

The following operations are available for display control for the 3D VrThree display/collection environment.

Operation	Keyboard Key	Description
Center	Ctrl + Right Mouse	Centers the display in X, Y and Z at the current cursor location.
Reset	Home	Resets the view position to top view, zoom all
Reset Top	Shift + Home	Resets the view position to top view at the current scale and at the current cursor location.
Reset Top X Axis	Ctrl + Home	Resets the view position to top view at the current scale holding the current rotation about the Z axis.
Rotate	Shift + Left Mouse	Rotates the view about the current view origin.
Spin	Shift + Right Mouse	Spins the view about the current view origin.
Rotate X +	Up Arrow	Rotates the view about the positive X axis.
Rotate X + 45 degrees	Ctrl + Up Arrow	Rotates the view about the positive X axis in 45 degree increments.
Rotate X -	Down Arrow	Rotates the view about the negative X axis.
Rotate X - 45 degrees	Ctrl + Down Arrow	Rotates the view about the negative X axis in 45 degree increments.
Rotate Y +	Left Arrow	Rotates the view about the positive Y axis.
Rotate Y + 45 degrees	Ctrl + Left Arrow	Rotates the view about the positive Y axis in 45 degree increments.
Rotate Y -	Right Arrow	Rotates the view about the negative Y axis.
Rotate Y - 45 degrees	Ctrl + Right Arrow	Rotates the view about the negative Y axis in 45 degree increments
Rotate Z +	Page Up	Rotates the view about the positive Z axis.
Rotate Z + 45 degrees	Ctrl + Page Up	Rotates the view about the positive Z axis in 45 degree increments.
Rotate Z -	Page Down	Rotates the view about the negative Z axis.
Rotate Z - 45 degrees	Ctrl + Page Down	Rotates the view about the negative Z axis in 45

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		degree increments.
Look Back	Shift + Page Up	Spins the view 180 degrees.
Drag	Ctrl + Left Mouse	Drags the view.
Zoom	Shift + Wheel	Zooms in/out.
Zoom 4x	Ctrl + Wheel	Zooms in/out 4x.
Cursor Drape/Free Motion	Del	Toggles Cursor Draping (On= default).
Z Control	Wheel	If Cursor Draping is off, the wheel will move the Z in the ground or view plane. Wheel sensitivity can be set with the Device Mouse (DevMou) command.
Fast Z Control	Shift + Ctrl + Wheel	If Cursor Draping is off, the wheel will quickly move the Z in the ground or view plane. Wheel sensitivity can be set with the Device Mouse (DevMou) command.
Toggle View Plane or Ground Plane Tracking	Ctrl + V	If Cursor Draping is off, the cursor can be tracked along the view or ground plane. Typically, the ground plane is tracked and is the default.
Center on Digitize	End	Toggles automatic re-centering when a point is digitized (Instead of using Ctrl-RightMouse).
Adjust Clipping Plane	Ctrl + Alt – Wheel	Adjusts the far clipping plane. Hides objects that are further away from the view origin.
Exaggerate Z Display	Alt + Wheel	Exaggerates the display of the Z axis.
Toggle Roaming	Insert	Toggles roaming.
Toggle Display Decimation	Shift + D	Toggles point display decimation. When turned on, fewer points are displayed during rotating, dragging, and zooming.
Toggle Near/Far Clipping Planes	Alt + C	Toggles view clipping from the current 3D center using the existing near and far clip distances. See Point Display (PoiDis)
Increment Near Clip	Alt + Up Arrow Key	Extends the near clip distance. See Point Display (PoiDis).
Decrement Near Clip	Alt + Down Arrow Key	Shortens the near clip distance. See Point Display (PoiDis).
Increment Far Clip	Alt + Page Up	Extends the far clip distance. See Point Display (PoiDis).

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Decrement Far Clip	Alt + Page Down	Shortens the far clip distance. See Point Display (PoiDis).

The display application Window Clip View rotates the view in VrThree (VrLiDAR) along a user digitized base line (about the z axis) to the x display axis.

For more information about Point display filters, clipping planes and Point color parameters see Point Display (PoiDis).

2.3 VrDSM

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Vr Mapping

Vr Digital Surface Model Creation (VrDSM)

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Digital Surface Model (DSM) from UltraCam UCE80 displayed in 3D VrThree

Overview

Digital Surface Models (DSM) contain information about the first surface on the ground including the topographic surface, buildings, vegetation and other objects. By comparing information about a scene from two vantage points (stereo model), three-dimensional information can be extracted.

VrDSM utilizes robust stereo matching techniques along with user defined parameters to produce accurate point cloud information.

Vr Mapping's implementation of DSM generation performs a fully automatic production of point clouds from stereo models. The use of CPU threading processing produces tens of millions of points per minute. Full format aerial film data at full resolution takes 3-4 minutes per model and produces hundreds of millions of points.

Most digital models process in less than two minutes. Point clouds are fully compatible with stereo viewing in VrTwo (including over the original stereo models for QC), and in VrThree (VrLiDAR)'s 3D VrThree software.

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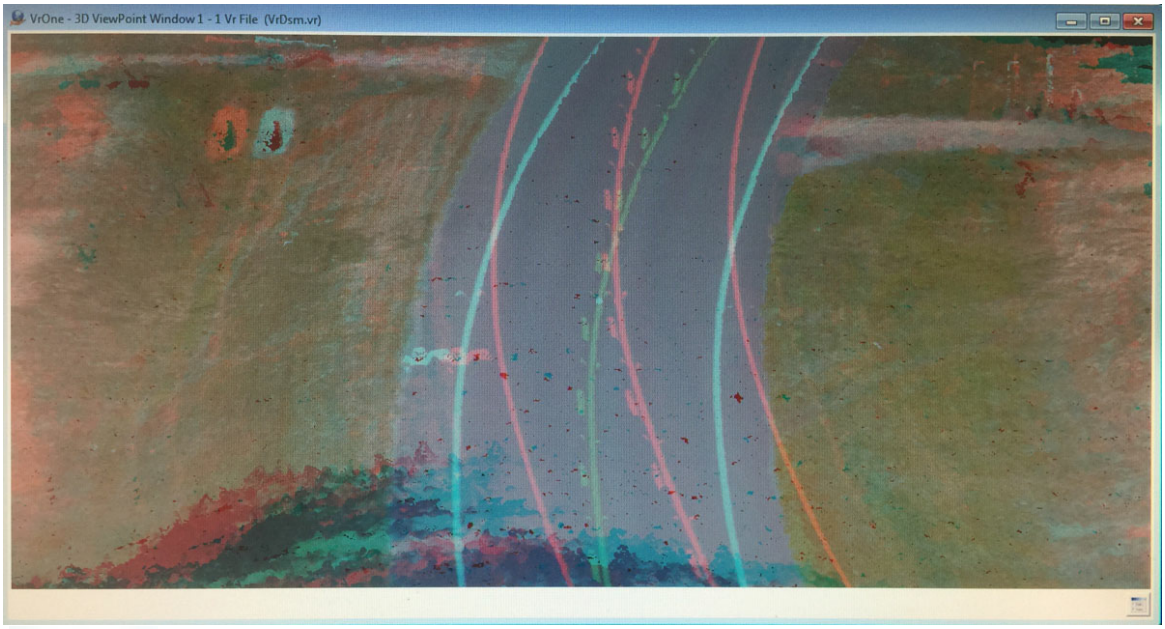



Anaglyph (red/cyan) point cloud (DSM) display in 3D VrThree

Command Reference

File

Exits VrDsm



File pull down menu

Exit

Exits VrDsm. If any parameters have been changed, a dialog will be displayed allowing the recording of the DSM generation parameters.

Parameters

Defines, loads and records DSM generation parameters.

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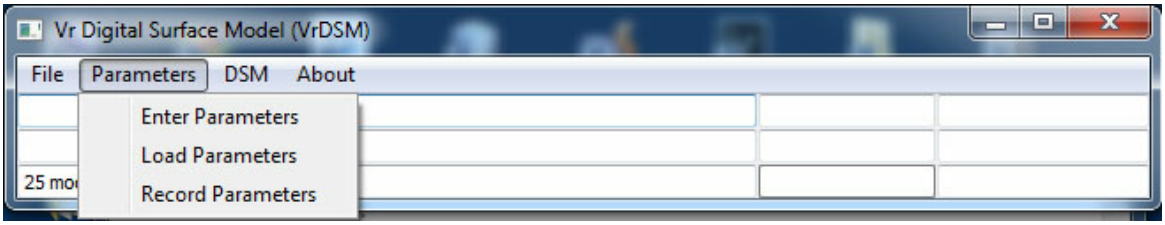
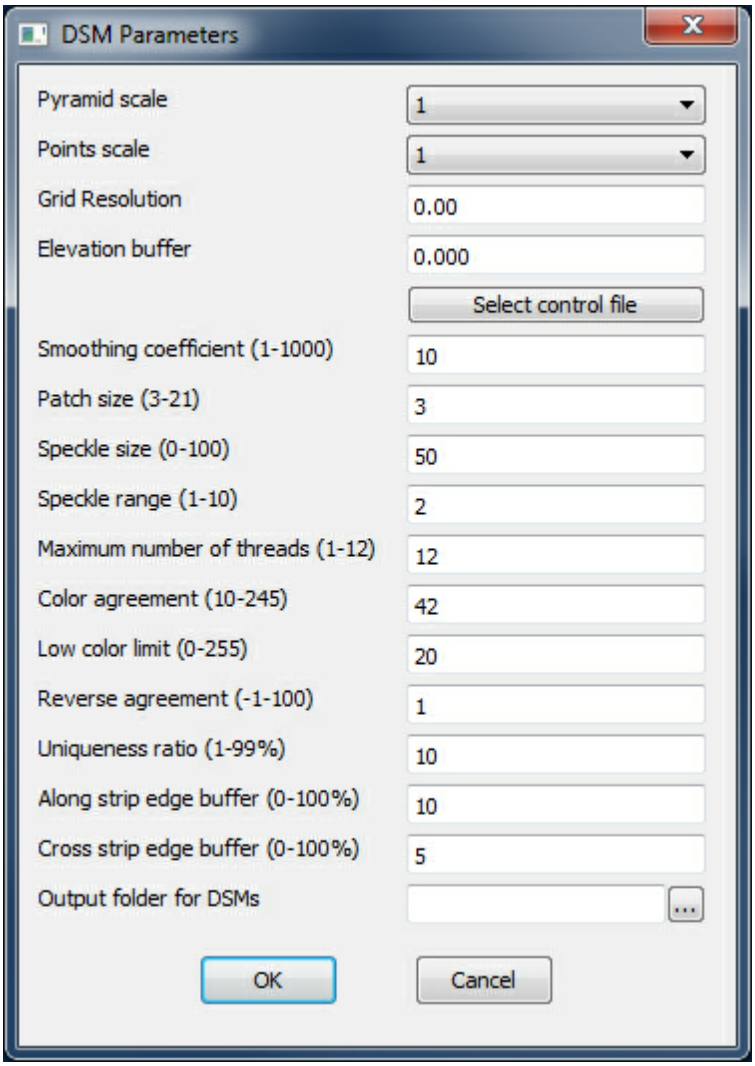


Parameter pull down menu

Enter Parameters

Allows the entry/edit of DSM generation parameters



DSM parameters dialog

Pyramid scale

Pyramid scale to use for DSM extraction. The higher the scale the less points. default=1

Points scale

Pyramid scale to use for saving points. This makes it possible to get the full resolution quality and lower resolution density. default=1

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Grid Resolution
Optional post processing to thin the data to an approximate grid. To disable set to zero.

Elevation buffer
A points file is used to determine the valid elevation range for extraction. The elevation range of the points that project into individual models will be extended by this buffer amount.

Select Control File
Used to define the input ground point file. This file can be a VR control file (*.cor), a bundle intersection report, a socet GPF file, or a Match AT project file. The VR bundle intersection report is the recommended format.

Smoothing coefficient (1-1000)
The higher then number, the smoother the points. default=10

Patch size (3-21)
Pixel matching patch size. Typically, an odd number between 3 and 11. default=3

Speckle size (1-100)
Maximum size of smooth disparity regions to consider their noise 'speckles' and invalidates them. A 50-200 range is typical, and a setting of 0 disables. default=50

Speckle range (1-10)
Defines the disparity difference that is considered as 'speckle' if Speckle Size is non-zero. 1 or 2 is normal. default=2

Maximum number of threads (1-n)
Limits the number of threads the DSM process uses in order to prevent the system from running out of resources. default=Maximum number of threads available

Color agreement (10-245)
Epipolar images are 8 bits per channel, and this limits how different colors between matched pixels can be. A lower value indicates a more perfect color match default=42.

Low color limit (0-255)
As the image values approach pure black matching becomes unreliable. A value to 0 will match everything while a value of 255 will match nothing. default=20

Reverse agreement (-1-100)
Matching is done left to right and right to left. The results must match with plus or minus the 'Reverse agreement'. default=1

Uniqueness ration (1-99%)
Margin in percent by which the best computed match should win the second best. default=10

Along strip edge buffer (0-100%)
Edge buffer (in percent of the epipolar image x dimension) to exclude from the DSM. default=10

Cross strip edge buffer (0-100%)
Edge buffer (in percent of the epipolar image y dimension) to exclude from the DSM. default=5

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Output folder for DSMs
Defines the output folder for resulting DSMs. blank=Use same folder as the first defined .vmo file

Load Parameters
Loads previously recorded DSM parameters

Record Parameters
Records current DSM Parameters

DSM

Defines stereo input models and generates DSMs



DSM pull down menu

Define Models
Allows the definition of the stereo models (.vmo) files to be used to create DSMs

Generate DSMs
Generates DSMs based on the current parameters.

About



About pull down menu

About
Displays information about VrDsm including the version number.

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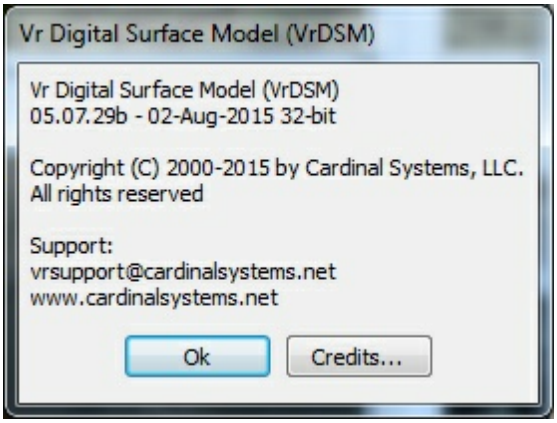

The About dialog

2.4 Vr Ortho

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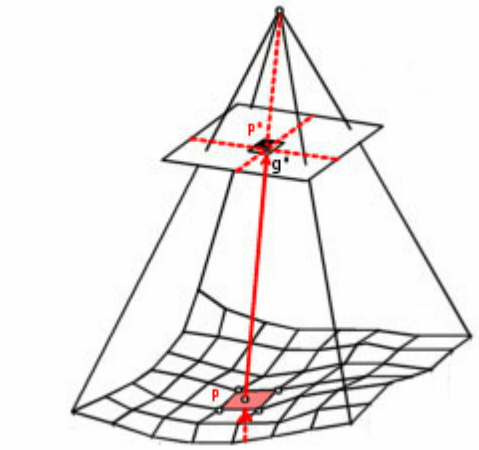
Vr Mapping

VrOrtho



VrOrtho is a standalone program that generates digital orthophotos from aerial photography.

The software is powerful, able to process small jobs interactively or large jobs in batch mode. When VrOrtho is used in conjunction with VrOne, integration of Digital Terrain Model data is seamless and transparent. Results of the orthophoto process are easily reviewed in VrOne.

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VrOrtho keeps the Vr Mapping Software tradition by offering a user-oriented, easy-to-use orthophoto production package. An intuitive work flow may be maintained with project management and image status features.

This application creates ortho rectified images from multiple raw input images. VrOrtho accepts TIFF, JPEG, MrSID, and JPEG200 image formats as input and outputs images in TIFF or JPEG format.

The ortho rectification process consists of transforming standard perspective images without uniform scale into geographically referenced images with the perspective removed to provide uniform scaling. The ortho images contain geographic referencing in the form of TIFF world files with a .tfw extension, GeoTIFF tags inside a TIFF file, or JPG world files with a .jgw extension. The world files and GeoTIFF tags contain the ground coordinates of the upper left corner of the image and a pixel size in ground for the X and Y directions. When used on a standard aerial mapping job, the ortho process results in a series of overlapping ortho images. A mosaicing application, like VrMosaic, can then tie the orthos together into a seamless image mosaic.

In order to perform the ortho rectification process, VrOrtho must have a DTM ground surface for the area to be rectified and must have images that have been fully oriented. The DTM ground surface may be computed from standard VrOne vector files containing points and break lines or be loaded from a VrOne surface file. If the DTM ground surface is specified as a VrOne vector file with points and break lines, the surface is computed as necessary directly from the VrOne file (s). If a surface file is used, the surface is loaded directly from the file, potentially saving a great deal of processing time.

VrOrtho Documentation

2.4.1 Documentation

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

Vr Ortho

Type: Stand-alone Application (vrortho.exe)

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Orthophoto Generation Application.



Orthophoto

Overview
VrOrtho Basics
Project Setup
Command Reference

Overview

This application creates ortho rectified images from multiple raw input images. VrOrtho accepts TIFF, JPEG, MrSID, and JPEG200 image formats as input and outputs images in TIFF or JPEG format.

The ortho rectification process transforms standard perspective images without uniform scale into geographically referenced images with the perspective removed to provide uniform scaling. The ortho images contain geographic referencing in the form of TIFF world files with a .tfw extension, GeoTIFF tags inside a TIFF file, or as JPG world files with a jgw extension. The world files and GeoTIFF tags contain the ground coordinates in the upper left corner of the image and a pixel size in ground units for the x and y direction. When used on a standard aerial mapping job, the ortho process results in a series of overlapping ortho images. The ortho images can then be brought into a mosaicing application such as VrMosaic to tie the orthos together into a seamless image mosaic.

In order to perform the ortho rectification process, VrOrtho must have a DTM ground surface for the area to be rectified and must have images that have been fully oriented. The DTM ground surface may be computed from standard VrOne vector files, containing points and break lines, or may be loaded from a VrOne surface file. If the DTM ground surface is specified as a VrOne vector file with points and break lines, the surface will be computed as needed directly from the VrOne file(s). If a surface file is used, the surface is loaded directly from the file, potentially saving a significant amount of processing time.

The image orientation process may be performed completely inside VrOrtho or it can be

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imported from other sources. The two required orientation steps are interior and exterior orientation. Interior orientation is the calibration of images to known fiducial locations. Interior orientation is available inside Image Utility, VrTwo orientation, and VrOrtho. When dealing with large numbers of images, Image Utility provides a method for automatic interior measurement. VrOrtho automatically recognizes interior orientations that have been performed with VrTwo orientation or Image Utility. Exterior orientation is camera station location and rotation for each image. Exterior orientations can be imported from VrTwo Orientation or Aerial Triangulation software or may be computed inside VrOrtho using single image resection. Single image resection consists of identifying at least 3 known ground location in the image; a ground control file is required for this step.

Once the images have been orientated and a ground surface defined, VrOrtho is ready to generate the output ortho images. This process is done in a batch mode, where one or more input images are selected and a single output ortho image is created for each input image. By default, each output ortho image covers the entire area of its corresponding input image. In many cases, the raw input images will have unneeded image data around the edges of the image. It is possible to change the default settings to eliminate the extra image data so the output orthos only contain the relevant portion of the input image. If the ortho images will be used in a mosaicing process, the ortho areas should be defined so that there is sufficient overlap between adjoining images.

The image on the left below shows a typical aerial image with fiducials and data strip information on the outside of the image. The yellow line encloses the area that will be used when creating the final ortho image after changing the VrOrtho default settings to eliminate extra image information. The image on the right is the output ortho image created from the input image.

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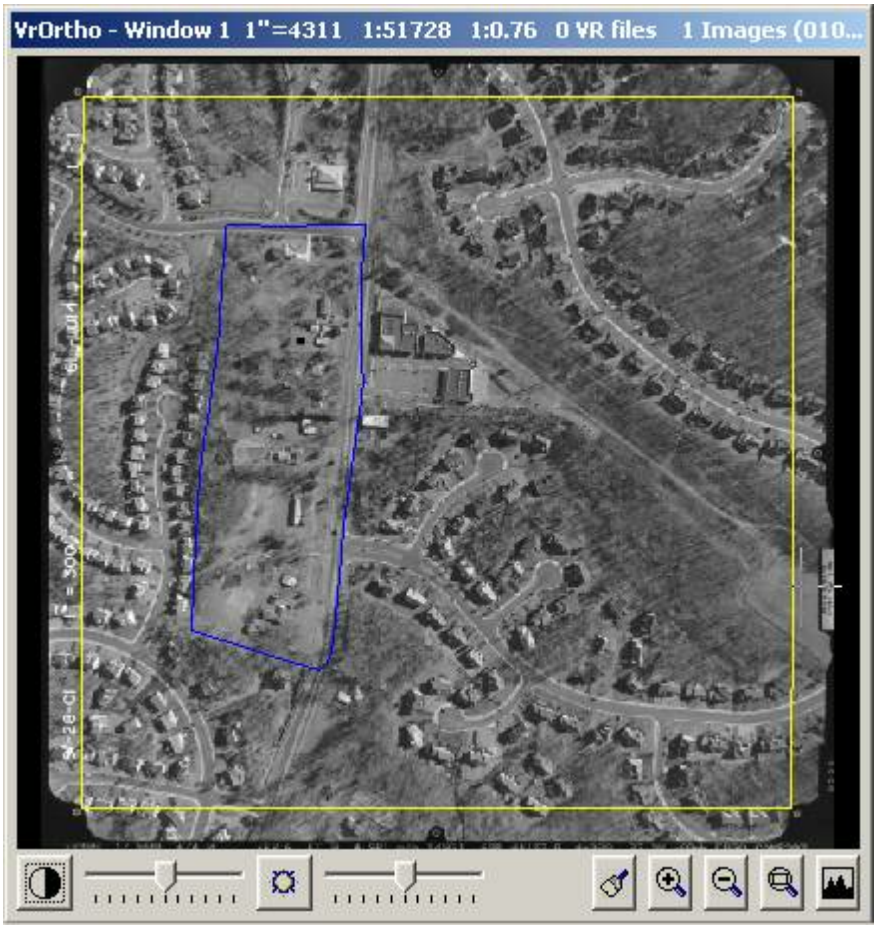

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In addition to using default settings to define the ortho areas for the images, VrOrtho also provides a ortho area editing application that allows a user-defined ortho area for each input image. Using the ortho area editor, any portion of the input image may be selected, included polygon shaped areas.

Before creating the final ortho images there are several output options to consider. These include the output pixel size in ground, background colors, and handling of pixels that fall outside the DTM surface area. These options are discussed in more detail in the reference section.

Here is a sample work flow using Vr Mapping software to ortho images:

1. Obtain raw photos in digital form.
2. Create a new project using VrOrtho, define project settings, and add raw photos to project.
3. Perform interior orientation on images using VrOrtho if they have not already been oriented.
4. Perform exterior orientation on images using VrOrtho single photo resection or by importing exterior orientation data.

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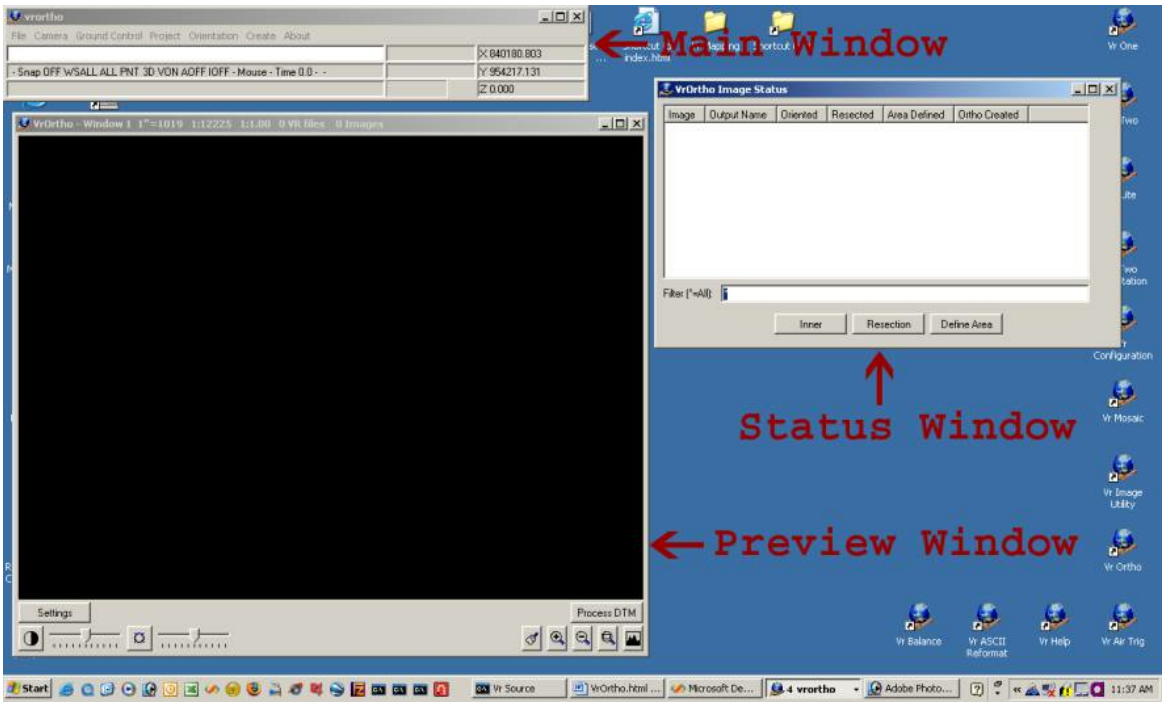
5. Define ortho areas using default settings or by using ortho area editor.
6. Define output pixel size.
7. Create ortho images.
8. The ortho images are now ready to be used by the VrMosaic application to define seam lines and create final output mosaic images.

VrOrtho Basics

VrOrtho will start by opening the Main Window, the Ortho preview window, and the ortho status window.



Starting an Application (Command)

Start commands by pulling down a menu and selecting an item. Alternatively, start commands with a key-in using the command name. Each command's key-in is listed in parentheses in the pull down menu after the command.

The Main Window

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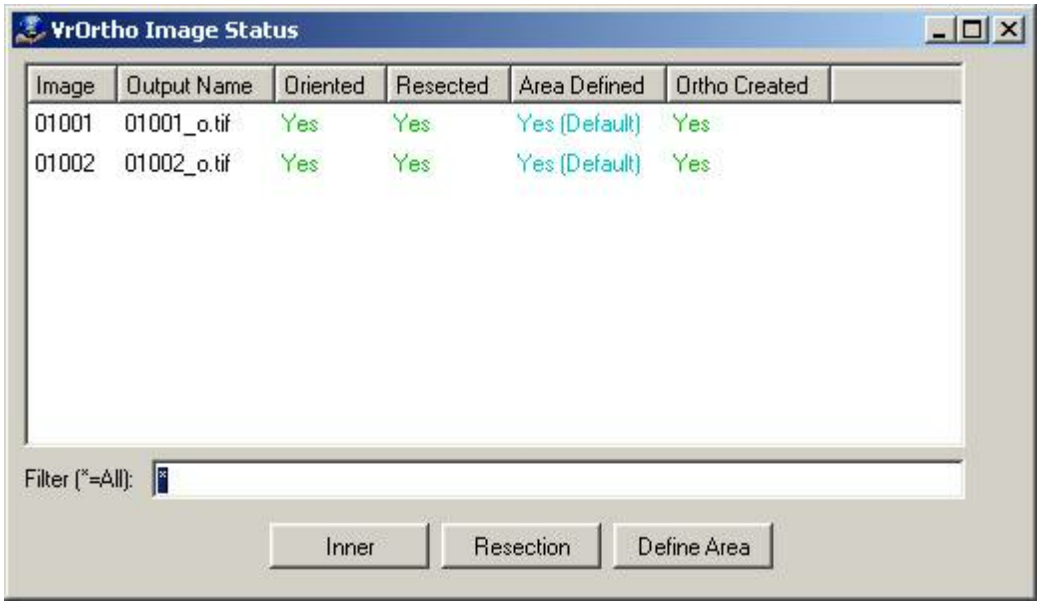
The Main Window in VrOrtho contains the command pull down menus, a key-in area, two information areas, a progress bar and the coordinate display.

Command names may be typed into the key-in area at almost any time.

On the border of the Main Window is the active project.

The Image Status Window



The Image Status window displays a current status for each input image. This window can also be used to start the Interior, Orientation, Single Image Resection, and Define Ortho Area commands by highlighting a single image and pressing the appropriate button.

The Ortho Preview Window

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The Ortho Preview Window displays a preview of the output ortho image areas and, if they have been generated, of the ortho images. This window can be used to quickly verify that ortho areas are defined correctly. The original input image bounds and the DTM surface boundary are also displayed. The "Process DTM" can be used to force the currently defined DTM surface to be processed, allowing the DTM boundary to be displayed. This window may be used to zoom and pan around the image outlines. Use the Page Up and Page Down keys to zoom in and out. Use the arrow keys to pan. The icons in the lower right corner of this window may also be used for zooming.

Pressing the "Settings" button causes the following dialog to display:

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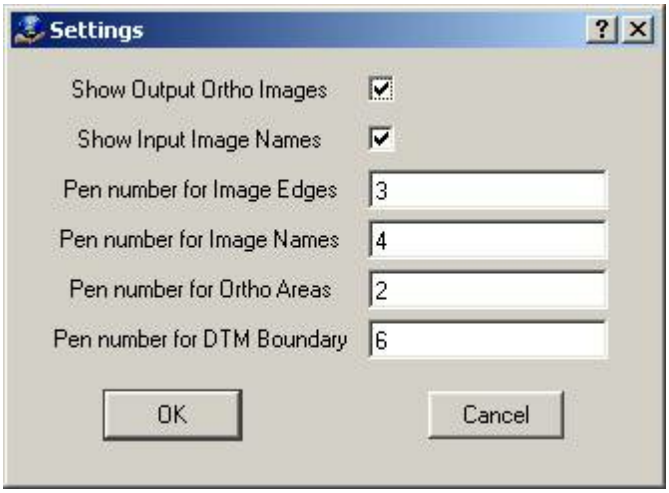

Show Output Ortho Images

Displays the ortho images in the preview window.

Show Input Image Names

Displays the input image names in the upper left corner of each input image boundary.

Pen number for Image Edges

Controls the color used to display the input image boundaries. The color is taken from the currently configured pen table for VrOne.

Pen number for Image Names

Controls the color used to display the input image names. The color is taken from the currently configured pen table for VrOne.

Pen number for Ortho Areas

Controls the color used to display the output ortho areas. The color is taken from the currently configured pen table for VrOne.

Pen number for DTM Boundary

Controls the color used to display the DTM boundary lines. The color is taken from the currently configured pen table for VrOne.

Project Setup

Project setup consists of creating a new project file and defining the project parameters. The steps to take before starting a project vary based on how the image orientation is to be defined. If a camera definition file has not yet been defined, it should be created using Camera->New Camera. If importing interior orientations form VrTwo or Image Utility, a camera file should already exist.

If importing exterior orientations, no other steps are required before starting the project. If single image resection will be used to compute exterior orientations, a coordinate file must be defined. If a VrOne-compatible coordinate file (.cor

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extension) is not already available, one can be created using the Ground Control->New Coordinate File command.

The new ortho project is created by selecting Project->New Project. See command reference for detailed explanations of project settings.

After the project setup has been completed, use Create->Create Orthos to generate the output ortho images.

Command Reference

File Menu

Open Status Window
Opens the Image Status window if it is closed.

Open Overview Window
Opens the Ortho Overview window if it is closed.

Create Image Pyramids
Allows image pyramids to be created in batch mode. Image pyramids are stored for each image displayed by Vr Mapping software. The image pyramids provide overviews at different image resolutions, allowing fast image display at all zoom levels. Normally, image pyramid are created as needed by VrOrtho and this option should not need to be used.



Select whether or not existing pyramid files should be overwritten with new files. This is useful if the image pyramids are outdated or corrupted. The following dialog is then displayed.

Exit
Exits VrOrtho.

Camera Menu

New Camera
Displays a dialog box to create a camera definition file.

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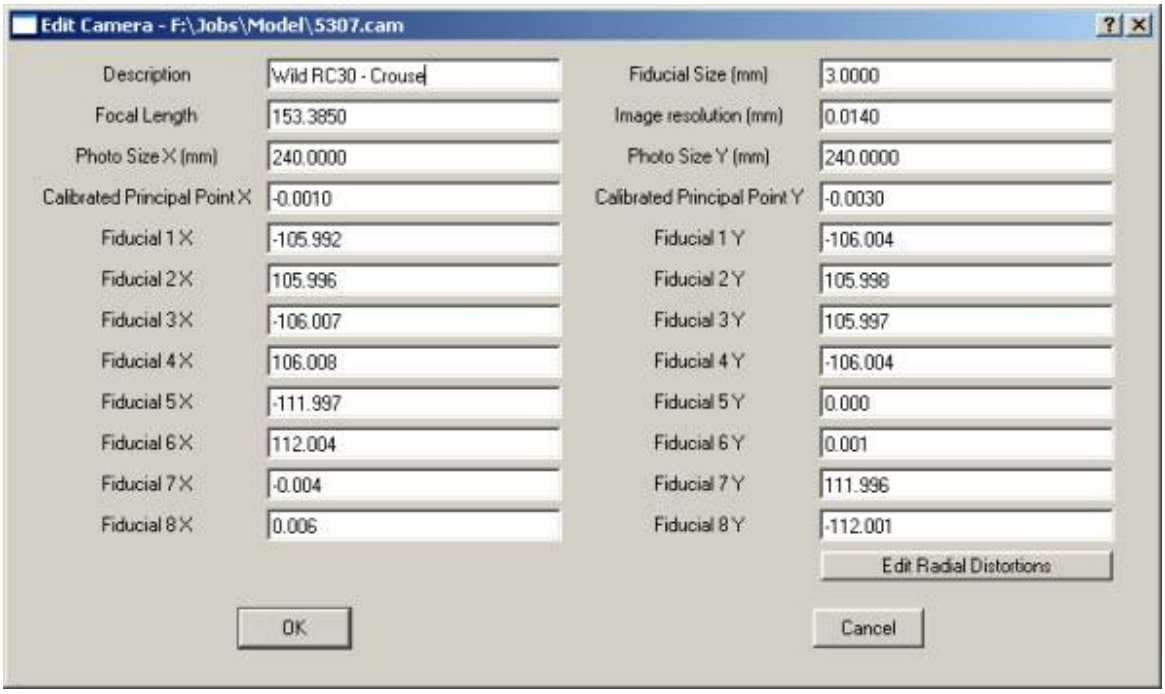
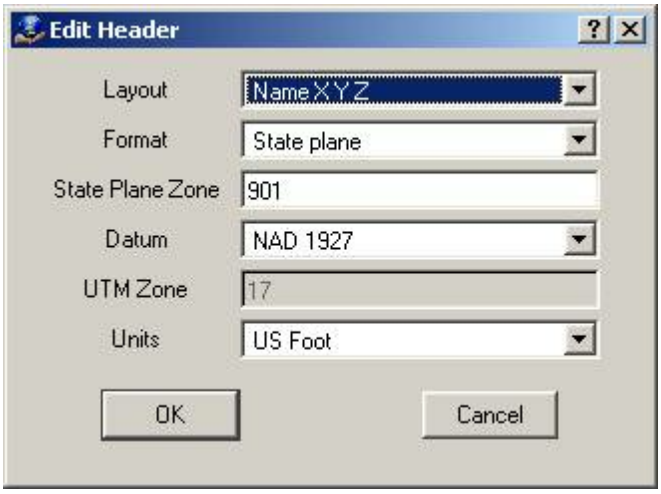


Use the camera calibration data to enter all information about the camera being defined. Each input image in the VrOrtho project is assigned to a camera file (usually, all images in a single project will share a single camera file).

Edit Camera
Displays a dialog box to select a camera definition file.

New Coordinate file
Displays a dialog box to create a coordinate file.



Select the desired layout format and units for the ground control file. The default settings are typically suitable. After these settings are defined, the coordinate definition dialog will display.

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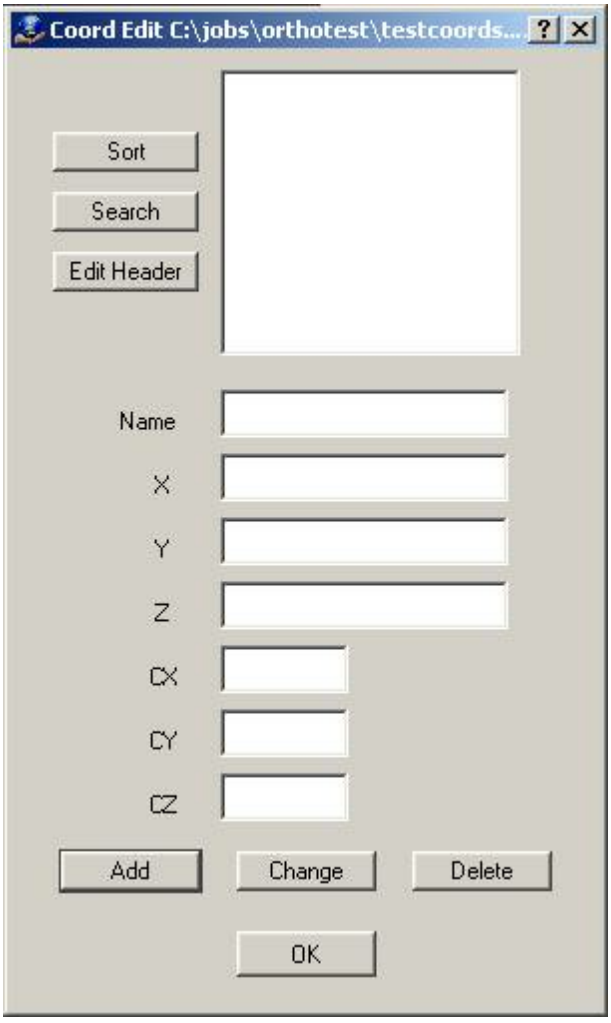

Use this dialog to define any ground control points that fall on the images being orthoed.

Edit Coordinate file

Displays a dialog box that allows a coordinate file to be selected.

Project Menu

New Project

Displays a dialog box to create a project file.

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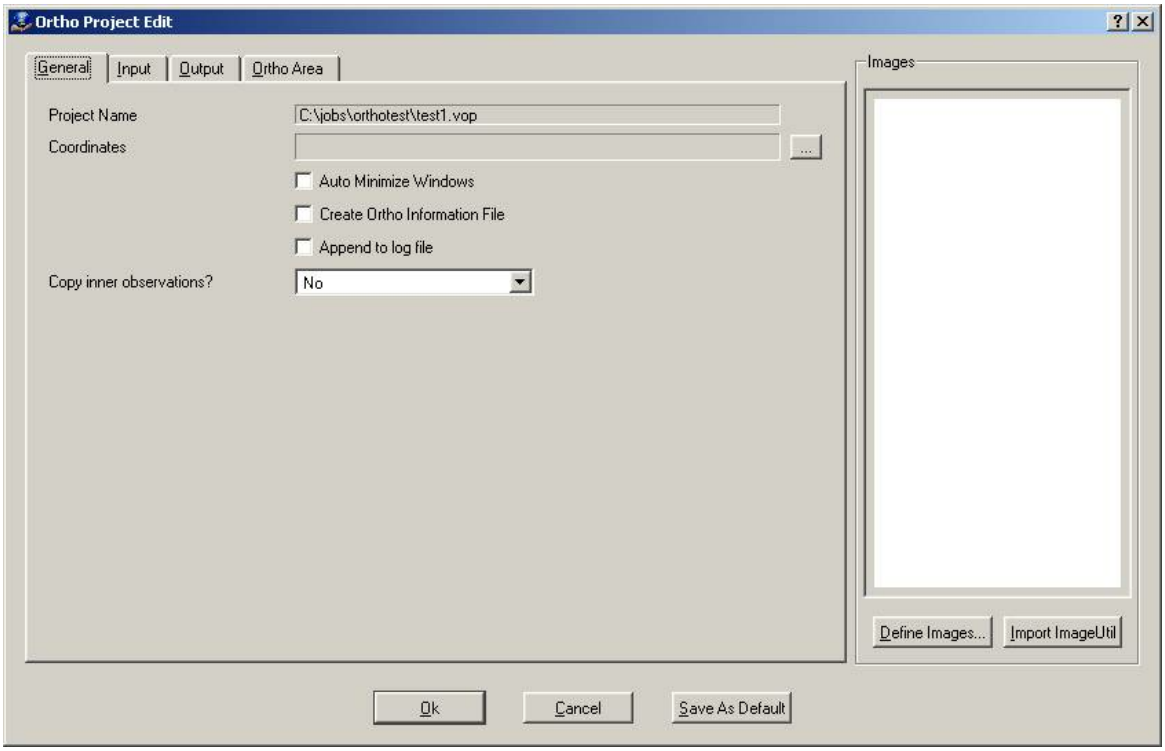

The right side of the dialog displays the current project's input images. These images may be defined in VrOrtho using the "Define Images…" button, or the list of images may be imported from an Image Utility project.

The following dialog is displayed if "Define Images…" is pressed.

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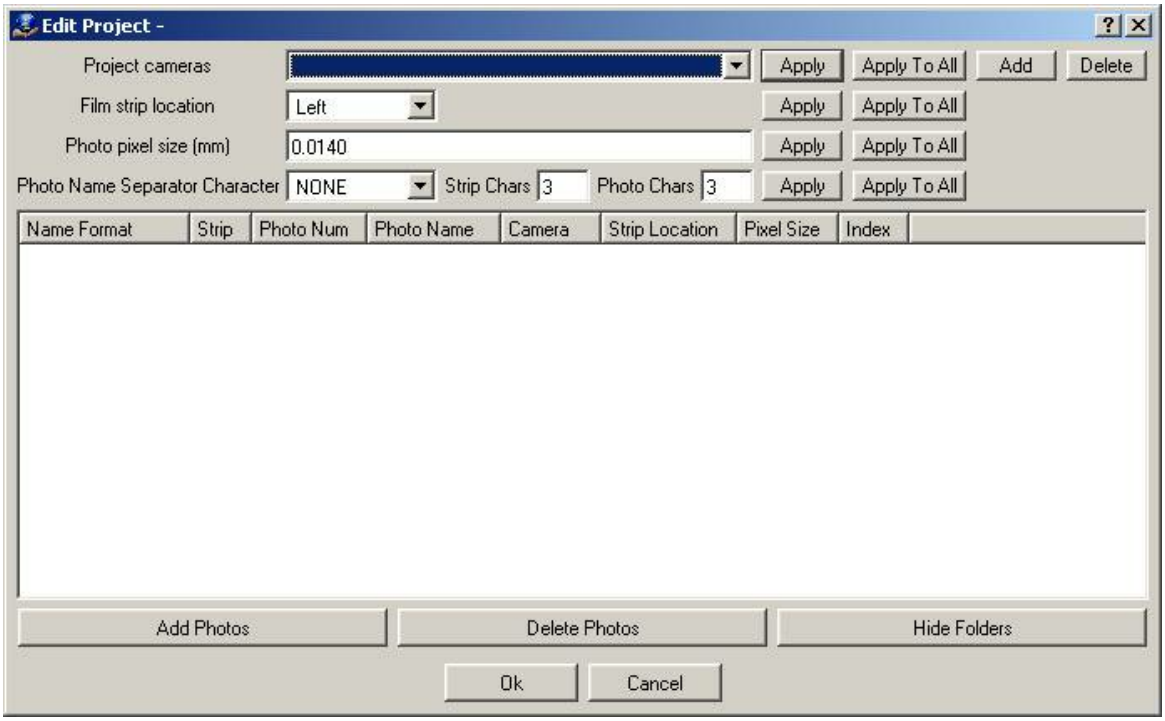

Pressing “Add Photos” displays a dialog to select and add one or more images to the project. Pressing "Delete Photos” deletes all currently highlighted photos. Pressing “Hide Folders” hides the folder locations of the image and camera names. The “Hide Folders” button changes to “Show Folders” when pressed, and then can be used to display the folder locations again.

To define a setting for all images, set the appropriate value then press “Apply To All” next to the setting. To define a setting for an individual image or images, highlight the image(s) first then press “Apply” next to the setting. The currently defined settings are applied to new photos as they are added to the project.

- **Project cameras** – Multiple cameras may be defined for a project. Use the “Add” button to add cameras to the project (the camera definition file must already exist). Use “Delete” to remove the currently highlighted camera from the project.
- **Film strip location** – The image film strip location can be set to Left, Right, Top, or Bottom.
- **Photo pixel size (mm)** – Defines the pixel size in millimeters for the image.
- **Photo Name Separator Character, Strip Chars, Photo Chars** – These three settings define how the image name is interpreted to produce a Strip and Photo number.

“Import ImageUtil…" prompts the user to select an existing Image Utility (.iup) file. All input images defined in the Image Utility project are imported into the VrOrtho project. “Define Images…” can be used to verify that the images have been imported with the correct settings.

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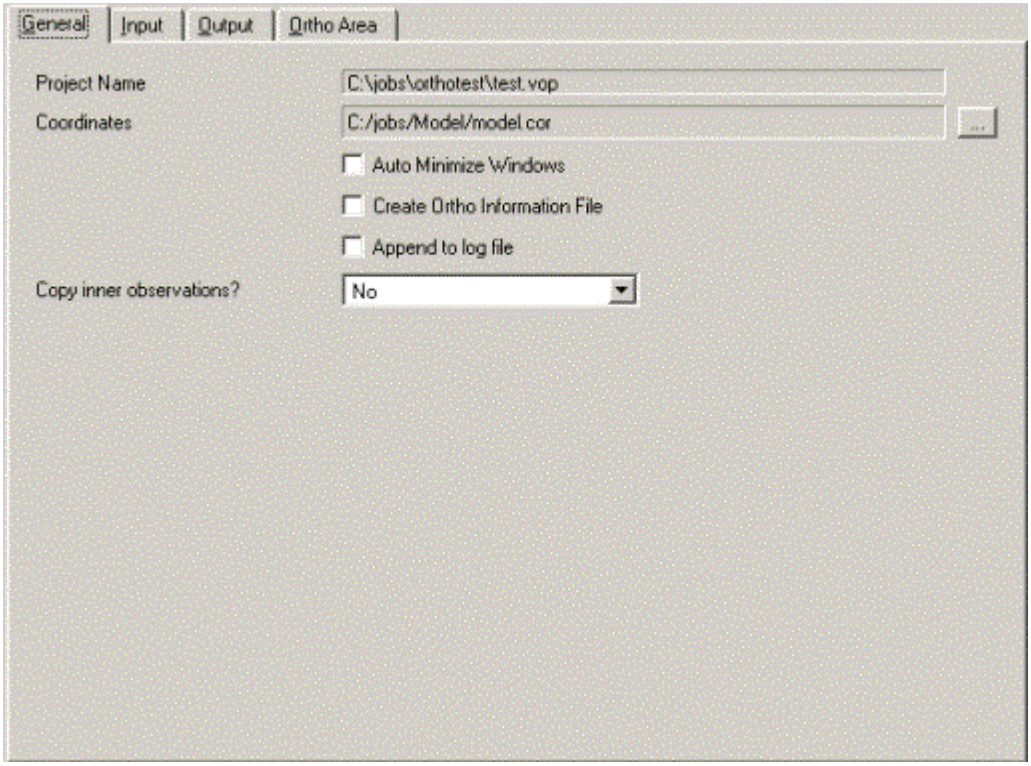
The project dialog is divided into four tabs: General, Input, Output, Ortho Area.

General Tab

The general tab shows general project settings.



Project Name
Displays the file name for the current project.

Coordinates
Displays the coordinate file for the current project. This can be left blank if importing exterior orientations.

Auto minimize windows
Specifies whether to minimize all VrOrtho windows when ortho processing begins. The percentage complete will be displayed on the minimized taskbar button. If VrOrtho is running with Windows XP, taskbar button grouping may need to be disabled for the status to be visible.

Create ortho information file
Specifies whether an ortho information file should be created for each ortho image. This file will have the same name as the ortho image but will have a .voi extension. The information file is an ASCII file with information about the processing parameters used to created the ortho image (resampling mode, DTM source, etc.).

Append to log file
Specifies whether to append to the vrortho.log file after each run. Otherwise, the log file will be cleared each run.

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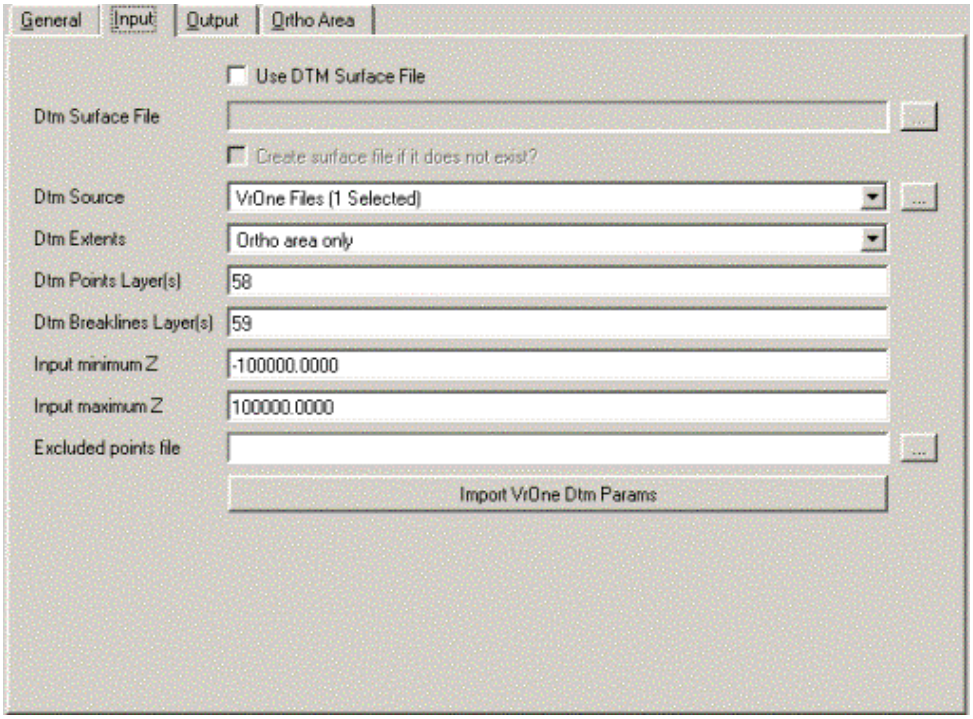
Copy inner observations

Specifies whether an image with no observations should inherit the observations from the first image in the image list.

Input Tab

The input tab shows input data settings.



Use DTM Surface file

Specifies whether a surface file should be used for the DTM surface during ortho generation.

DTM Surface file

Defines the DTM surface file to use instead of reading the VrOne DTM data if "Use DTM Surface File" is enabled. This can result in much faster DTM processing times.

Create surface file if it does not exist?

Creates the DTM surface file from the VrOne vector data the first time the DTM surface is processed. This is only relevant if "Use DTM Surface File" is enabled. DTM source data must be available.

DTM Source

Defines the source data to use when generating the underlying DTM surface.
The options are as follows:

- **Vr Files** - Use the "…" button to display the files selected. Use the "Add" and "Remove"

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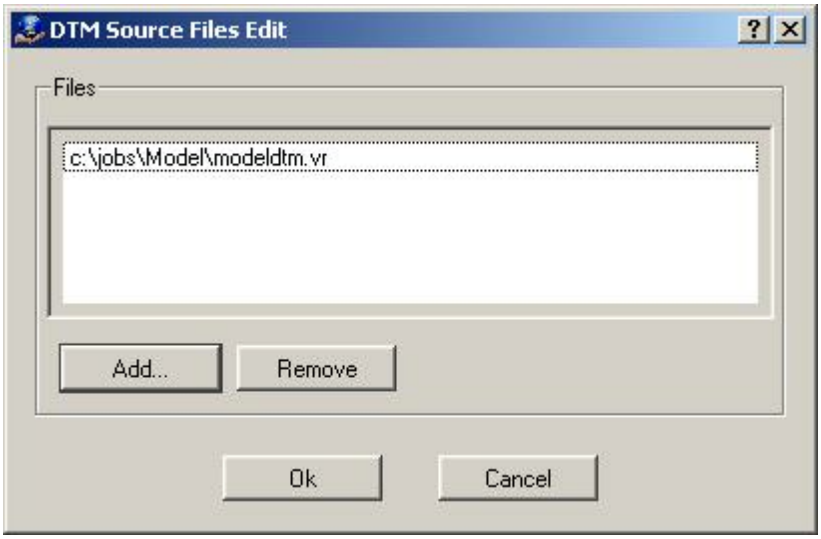
buttons to add or remove VrOne vector files to or from the list.



- Control Points - Uses all points in the project control file as the DTM surface.
- Approximate Z - Uses a single elevation for the entire DTM surface. The elevation is taken from the "Approximate Z" value on the Output tab.

DTM Extents

Defines how much of the DTM area to compute when creating orthos. This is only when not loading a surface file. If set to full, the entire input DTM area is computed. This will only be computed once before ortho output begins. If set to Ortho area only, only the area needed for the image being processed will be computed. A new surface will be computed for each output ortho image.

DTM Points layer(s)

Defines the VrOne layers that contain points to be used for the computation of the DTM surface.

DTM Breaklines layer(s)

Defines the VrOne layers that contain break lines to be used for the computation of the DTM surface.

Input minimum Z

Defines a minimum Z value for points to be added to DTM. This does not apply when reading an existing surface file.

Input maximum Z

Defines a maximum Z value for points to be added to DTM. This does not apply when reading an existing surface file.

Excluded points file

Defines file to which excluded points should be written. Formatted one per line

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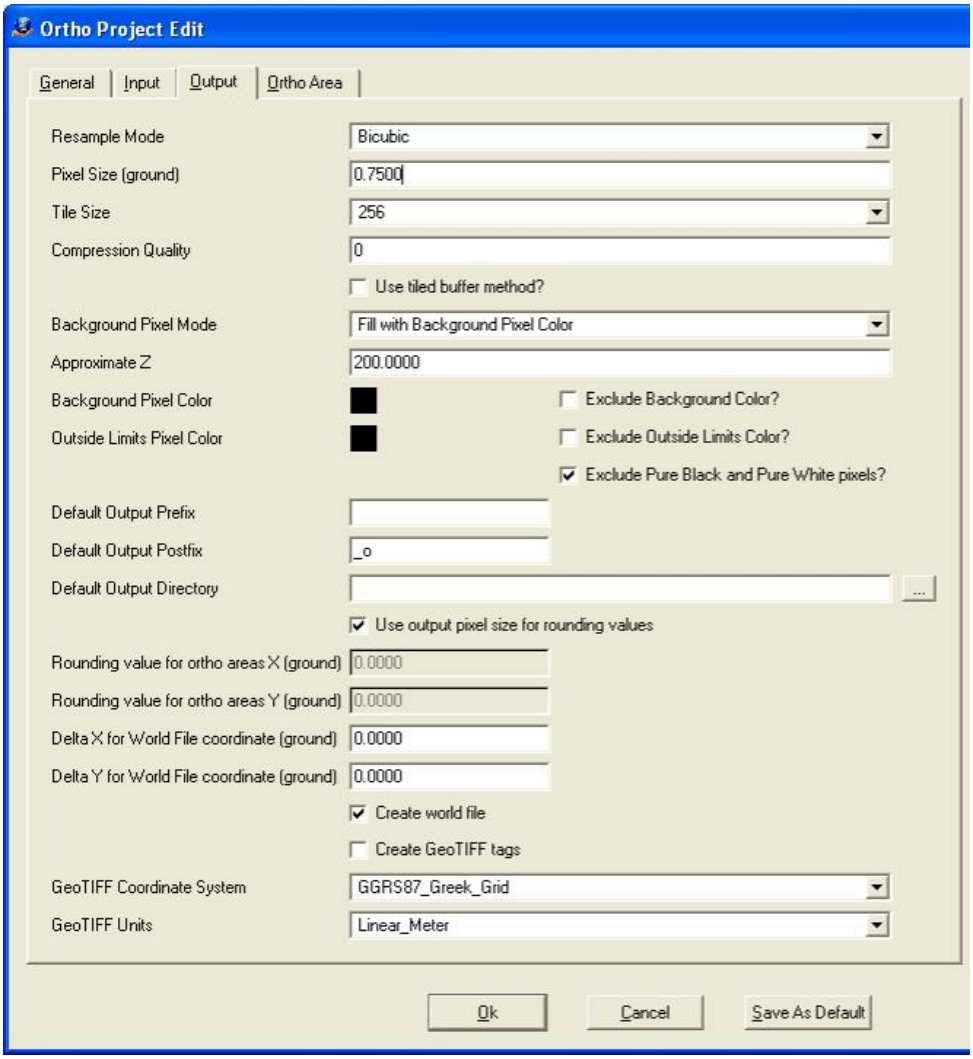
with comma separation.

Import VrOne Dtm Params

Allows the import of a .dtm parameter file saved in VrOne or VrTwo.

Output Tab

The output tab shows ortho image output settings.



Resample Mode

Specifies the resample mode used to create the output orthophoto. Bicubic is the slowest, but typically results in the best output image.

Pixel Size (ground)

Defines the pixel size of the output orthophoto in ground units. It does not have to be the same size as the input photo pixel size.

Tile Size

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Defines width and height of the tiles in output TIFF images. Options are “None”, “32”, “64”, “128”, “256”, or “512”. Set to “None” to produce non-tiled TIFF images.

Compression quality

Defines how much the output image will be compressed. Expressed as a value from 0 to 100. Lower numbers result in greater compression and more loss of image quality. Higher numbers achieve greater image quality and larger file sizes. A good default value is 70, providing a compression ratio of ~8:1 for color images with minimal loss of quality.

Use tiled buffer method?

Specifies whether small chunks of data should be processed at a time.Check this option if memory is limited and large rotated raw images are being processed. When images are rotated near 45 degrees, they sometimes require too much memory to work with the normal VrOrtho resampling methods (Full Image or Window Mode). Using tiled buffer method avoids memory problems but can be significantly slower than other methods. If this is not checked, Full Image or Window mode will be used automatically.

Background Pixel Mode

Specifies what action to take when a pixel to be resampled falls outside the DTM area. Either the “Approximate Z” will be assigned and the pixel will be resampled or the target pixel will be assigned the value specified in the “Background Pixel Color”.

Approximate Z

Defines the elevation to use for pixels that fall outside the DTM area during resampling if the Background Pixel Mode is set to "Use approximate Z value".

Background Pixel Color

Specifies the pixel (color) value to use for pixels that fall outside the DTM area during resampling if the “Background Pixel Mode” is set to “Fill with Background Pixel Color”.

Exclude Background Color?

Specifies whether valid image pixels that are the same color as the Background pixel color should be written with a slightly different color. This is useful when blending with VrMosaic.

Outside Limits Pixel Color

Specifies the pixel (color) value to use for a new pixel that falls outside the ortho limits during resampling. This may occur if the ortho area is defined by a polygon.

Exclude Outside Limits Color?

Specifies whether valid image pixels that are the same color as the Outside

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Limits pixel color should be written with a slightly different color. This is useful when blending with VrMosaic.

Exclude Pure Black and Pure White pixels?

Specifies whether valid image pixels that are the pure black or pure white should be written with a slightly different color. This prevents image pixels from being viewed as background pixels during mosaic processing.

Default Output Prefix

Defines prefix to be added to the beginning of each default orthophoto output file name.

Default Output Postfix

Defines postfix to be added to the end of each default orthophoto output file name.

Default Output Directory

Defines directory into which to place all ortho output files. If left blank, ortho output files will be placed in the project directory.

Use output pixel size for rounding values

Specifies whether the upper left corner of each ortho image should be aligned to an even interval of the output pixel size. This ensures proper alignment during mosaic processing.

Rounding value for ortho areas X (ground)

Defines value to which the lower left and upper right X values of each ortho area should be rounded. Set to zero for no X rounding.

Rounding value for ortho areas Y (ground)

Defines value to which the lower left and upper right Y values of each ortho area should be rounded. Set to zero for no Y rounding.

Delta X for World File coordinate (ground)

Defines value to apply to the upper left corner X of the World File. The World File is generated when an orthophoto is created. Set to zero to leave the coordinate unchanged.

Delta Y for World File coordinate (ground)

Defines value to apply to the upper left corner Y of the World File. The World File is generated when an orthophoto is created. Set to zero to leave the coordinate unchanged.

Create world file

Specifies whether an external .tfw world file should be created with each output TIFF image. The .tfw file contains georeferencing information for the ortho image and is supported by most mapping applications.

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Create GeoTIFF tags

Specifies whether georeference information should be added internally to the output TIFF images using the GeoTIFF tag format. This format is supported by most mapping applications.

GeoTIFF Coordinate System

Sets the coordinate system information tag so other applications can automatically detect the coordinate system used by the image. Applies when VrOrtho is using GeoTIFF tags.

NOTE: This does not change the actual georeferencing information of the ortho image and is for informational purposes only. VrOrtho does not use the coordinate system of the data it is processing and does not verify that this setting is correct.

GeoTIFF Units

Sets the coordinate system units tag so other applications can automatically detect the units used by the ortho image. Applies when VrOrtho is using GeoTIFF tags.

NOTE: This does not change the actual units of the ortho image and is for informational purposes only. VrOrtho does not use the units of the data it is processing and does not verify that this setting is correct.

Ortho Area

The output tab shows ortho area settings.

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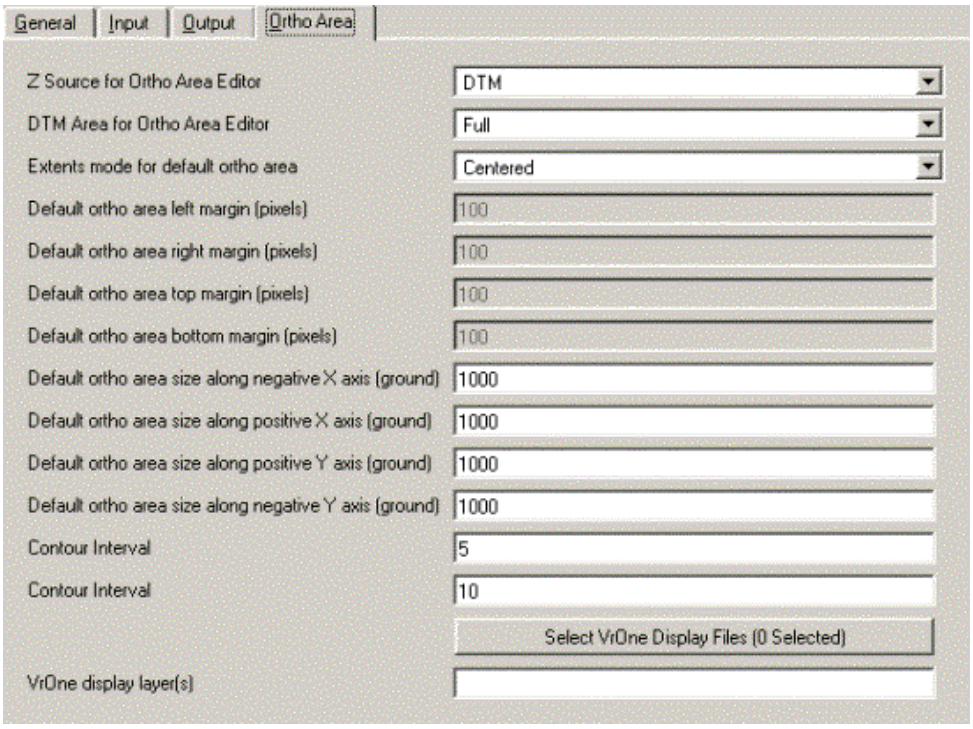

Z Source for Ortho Area Editor

Specifies how to determine cursor Z position. "DTM" computes a DTM surface for the image being used., resulting in a more accurate cursor location in the ortho area edit but slower processing times when entering the editor. “Approx Z” uses the current Approximate Z to compute the cursor location, leading to a less accurate cursor location but quicker editor start-time.

DTM Area for Ortho Area Editor

Specifies the area for which the DTM surface should be formed. “Full” forms a DTM surface from the entire DTM extents. This does not affect the DTM surface used when creating the final output orthos. The DTM surface is not recalculated for each image that is displayed in the ortho area editor. “Image Extents” forms a DTM surface from the entities within the current image extents. The DTM surface is recalculated for each image that is displayed in the ortho area editor.

Extents mode for default ortho area

- **Image** - Ortho area covers the entire image extents.
- **Fiducials** - Ortho area is defined by the four corner fiducial positions.
- **Centered** - Ortho area is centered around the perspective center of photo and aligned to ground coordinate system.

If "Image" or "Fiducials" mode is selected, the following options will be

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available:

Default ortho area left margin (pixels)

Determines how far right to move the left side of the default ortho area extents. This only affects ortho areas defined by default (not selected by the user).

Default ortho area right margin (pixels)

Determines how far left to move the right side of the default ortho area extents. This only affects ortho areas defined by default (not selected by the user).

Default ortho area top margin (pixels)

Determines how far down to move the top side of the default ortho area extents. This only affects ortho areas defined by default (not selected by the user).

Default ortho area bottom margin (pixels)

Determines how far up to move the bottom side of the default ortho area extents. This only affects ortho areas that are defined by default (not selected by the user).

If "Centered" mode is selected, the following options will be available:

Default ortho area size along negative X axis (ground)

Determines how far to extend the ortho area along the negative X axis starting at the perspective photo center. This only affects ortho areas defined by default (not selected by the user).

A Default ortho area size along positive X axis (ground)

Determines how far to extend the ortho area along the positive X axis starting at the perspective photo center. This only affects ortho areas defined by default (not selected by the user).

Default ortho area size along negative Y axis (ground)

Determines how far to extend the ortho area along the negative Y axis starting at the perspective photo center. This only affects ortho areas defined by default (not selected by the user).

Default ortho area size along positive Y axis (ground)

Determines how far to extend the ortho area along the positive X axis starting at the perspective photo center. This only affects ortho areas defined by default (not selected by the user).

Contour Interval

Defines the contour interval to use when displaying contours in Ortho Area Editor.

Contour Index Interval

Defines the contour index interval to use when displaying contours in Ortho Area Editor. Index contours are displayed in a different color than other contours.

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Select VrOne display Files

Any VrOne files selected are displayed on top of the images in the Ortho Area editor. This is useful for seeing where defined seam lines fall on the images.

VrOne display layer(s)

Specifies which VrOne layers contain entities to be plotted during ortho area editing.

Open Project

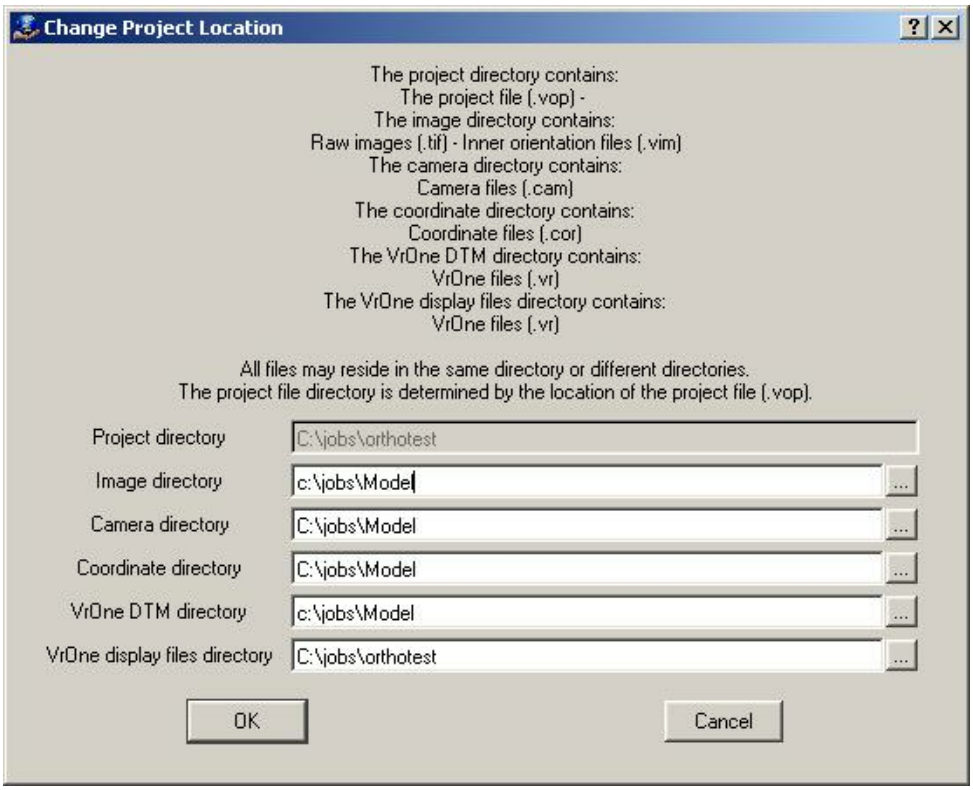
Displays a dialog box to open an existing project file. If a project is already open, it will be closed before the new one is opened.

Edit Project

Displays a dialog box to edit the project settings. See New Project for details.

Change Project Location

Changes the project file location when the project files are moved from one directory or drive to another. A dialog will be displayed to select an existing VrOrtho project file. Once the file is selected the following dialog is displayed.



Enter the new directory locations for the items displayed and press "OK". If the directory locations were entered correctly, the project should now open without any problems.

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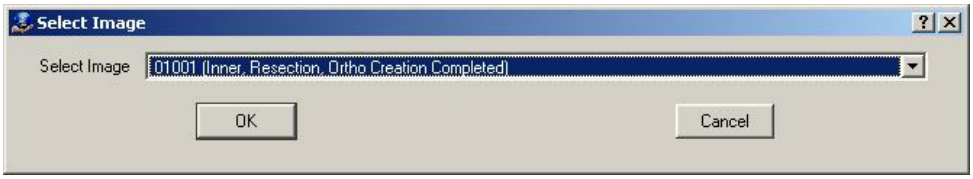
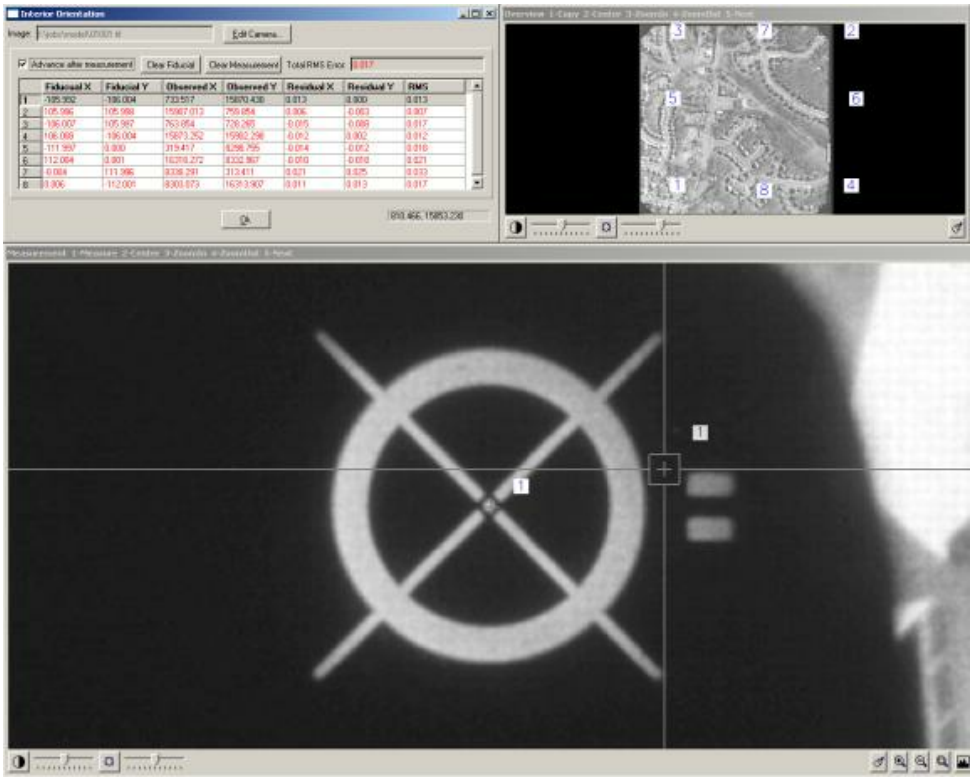
Orientation Menu

Inner Orientation

Displays a dialog box to select a single image on which to perform manual inner orientation. All project images will be available in the dropdown menu. A status for each image will also be displayed.



After an image is selected, the single image inner orientation application is displayed. Either the display icons or standard VrOne zoom keys (PgUp, PgDn, Direction Arrows) can be used to find and measure each fiducial. Single image inner orientation displays three windows: the status, overview, and measurement windows



The Status Window

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	Fiducual X	Fiducial Y	Observed X	Observed Y	Residual X	Residual Y	RMS
1	-105.992	-106.004	733.517	15870.430	0.013	0.000	0.013
2	105.996	105.998	15907.013	759.854	0.006	-0.003	0.007
3	-106.007	105.997	763.854	728.265	-0.015	-0.008	0.017
4	106.008	-106.004	15873.252	15902.298	-0.012	0.002	0.012
5	-111.997	0.000	319.417	8298.755	-0.014	-0.012	0.018
6	112.004	0.001	16318.272	8332.967	-0.010	-0.018	0.021
7	-0.004	111.996	8338.291	313.411	0.021	0.025	0.033
8	0.006	-112.001	8303.073	16313.907	0.011	0.013	0.017

Displays the name of the image being measured and a table of all fiducial measurements.

The row for the fiducial currently being measured will be highlighted. Clicking on any row in the table makes that fiducial current and causes the measurement window to zoom to that fiducial.

- **Edit Camera…** - Displays a dialog box to edit the current camera definition.
- **Advance after measurement** – Specifies whether measuring a fiducial should cause the next highest fiducial number to become current. The measurement window will zoom to the next fiducial.
- **Clear Fiducial** – Sets the X and Y location for the currently highlighted fiducial to 0.0. This removes the fiducial from the inner orientation process.
- **Clear Measurement** – Clears the measurement for the currently highlighted fiducial.
- **Total RMS Error** – Displays the Total RMS Error based on the currently measured fiducials. This is updated in real-time.

The Measurement Window

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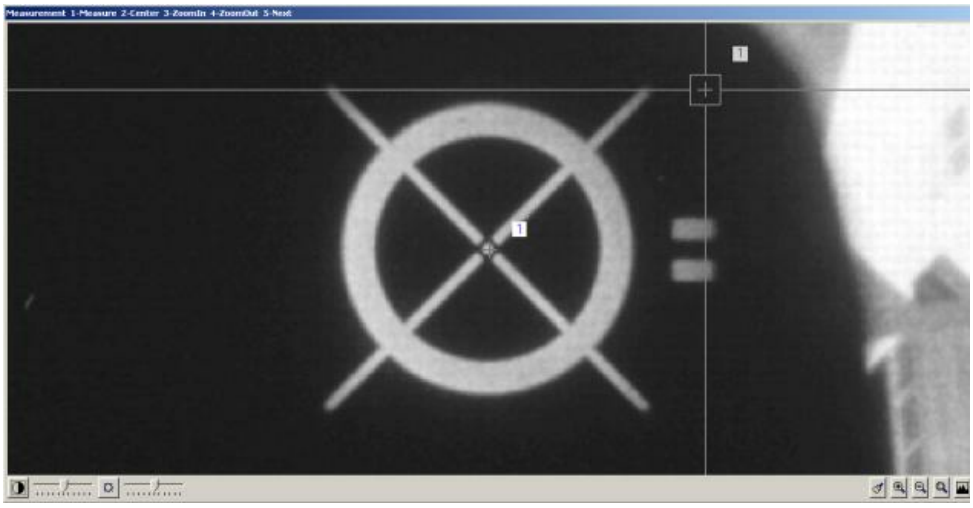

Allows measurement of fiducials. A fiducial is measured by placing the cross hairs over the center of the fiducial and clicking the left mouse button. If a fiducial has already been measured, a cross and a number are displayed indicating the measurement location and the fiducial number.

The Overview Window



Displays the entire image with fiducial number labels. Pressing the left mouse button causes the window to zoom to the region below the square mouse cursor. The Page Up and Page Down keys change the size of the zoom window.

Import VrTwo Orientation

Displays a dialog box where a Vrtwo orientation can be imported. VrTwo orientation files have .orp extensions and are saved using the model names defined in VrTwo orientation. Multiple .orp files can be imported at once.

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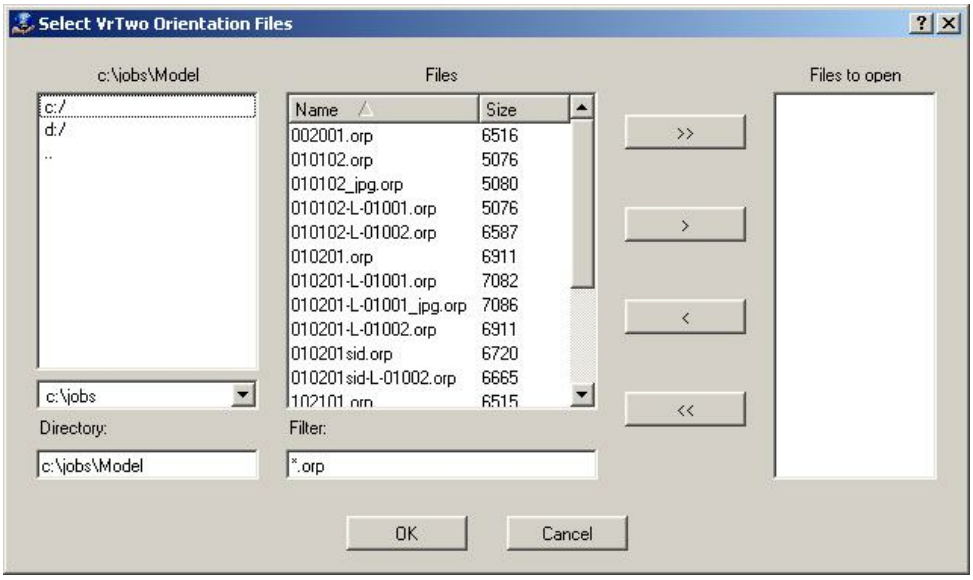
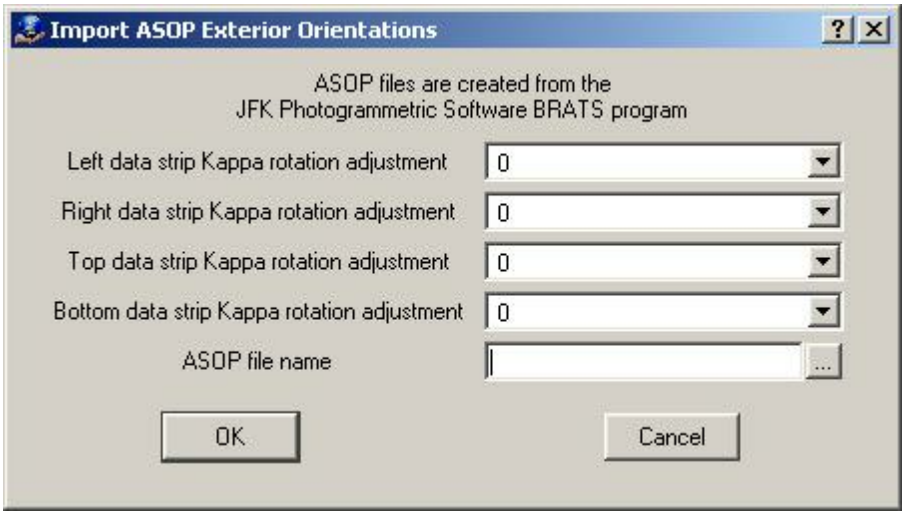


Import Exterior Orientations->ASOP - JFK

Displays a dialog box where exterior orientation can be imported from ASOP – JFK files.



Import Exterior Orientations->ORN - Aerosys

Displays a dialog box where exterior orientation can be imported from ORN - Aerosys files.

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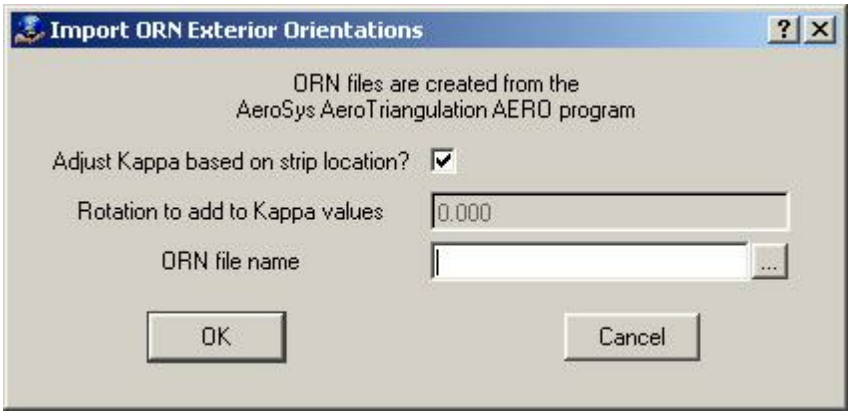
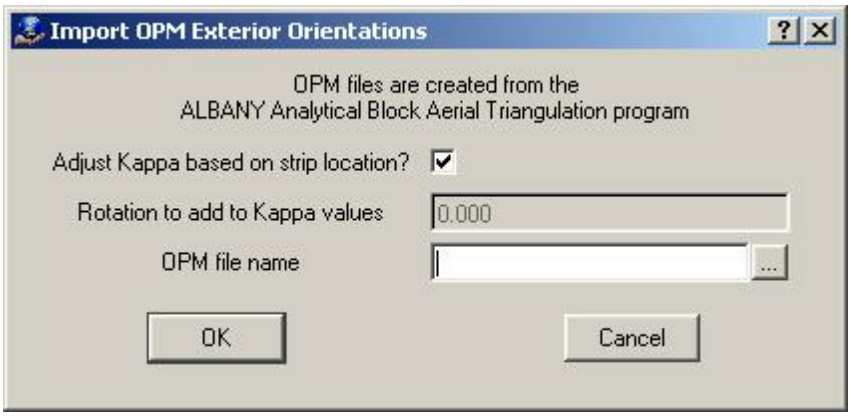


Import Exterior Orientations->OPM - Albany

Displays a dialog box where exterior orientation can be imported from OPM – Albany.



Import Exterior Orientations->PATB

Displays a dialog box where exterior orientation can be imported from PATB files.

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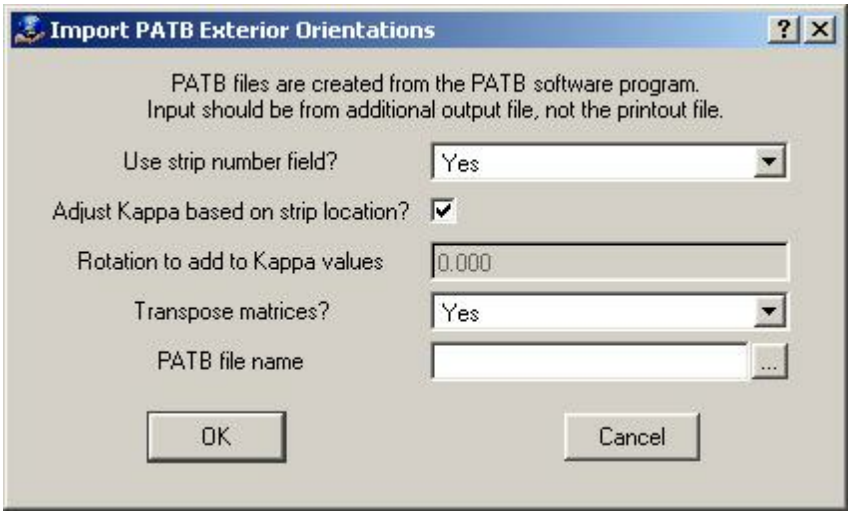
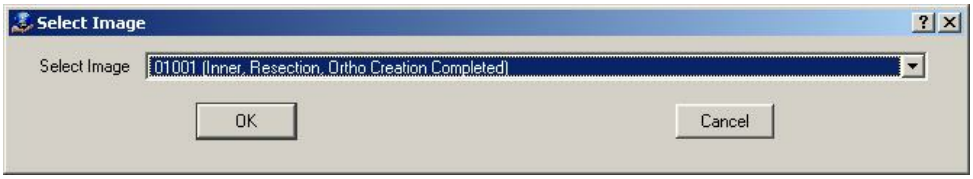


Set Ortho Area

Displays a dialog box to select a single image to be displayed in the ortho area editor. The ortho area editor is a tool to visually define the area to be extracted from an input image. When the ortho area editor is entered for the first time for an image, the default area is displayed based on the project settings. If the ortho area is changed while in the editor, it will be saved and used when the ortho is created. This provides a way to rectify small or irregularly shaped areas from images.



After an image is selected, the following windows display.

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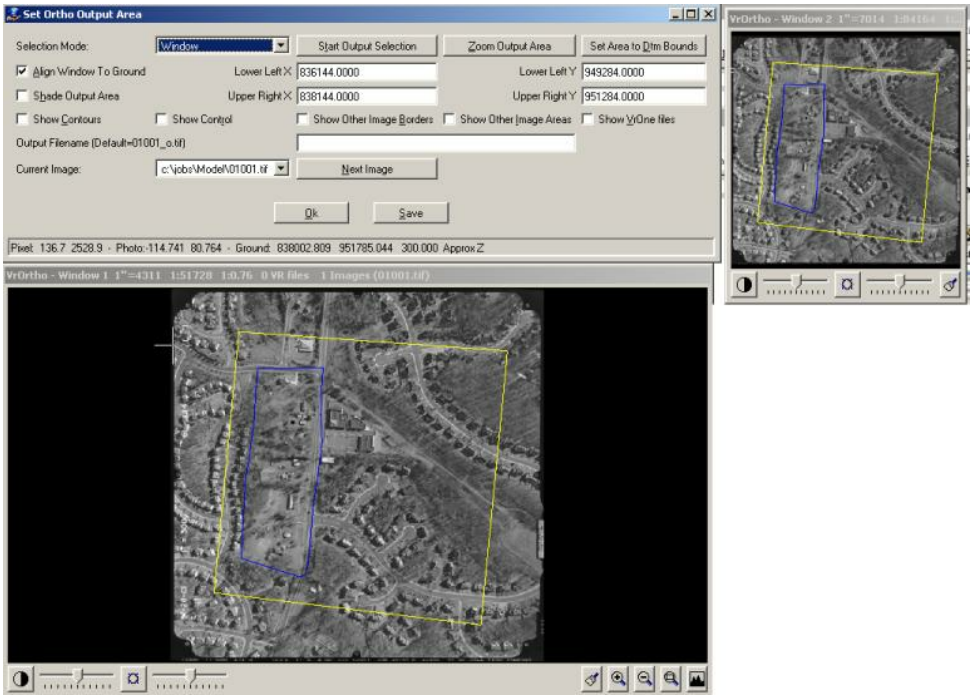

The top left dialog box contains the main options for defining the current ortho area. The upper right window is an overview of the entire image. The lower left window is the measurement window. The overview and measurement windows have display icons to change brightness and contrast, zoom, and pan. The standard VrOne zoom keys (PgUp, PgDn, Direction Arrows) can also be used to zoom and pan.

Settings Window

Selection mode

Changes the selection mode. The area can be defined as a window or a polygon.

Start Output Selection

Defines the ortho. If "Window" selection mode is on, the following menu keys dialog is displayed.

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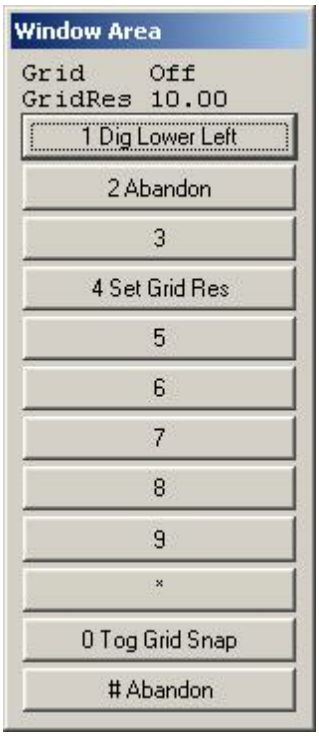

Use the left mouse button to digitize the lower left corner of the desired ortho area. The prompt will change to display "Dig upper right". Use the left mouse button to digitize the upper right corner of the ortho area. To align the ortho area to an even grid, select “0. To Grid Snap” or press F11 to toggle grid snap mode. The grid spacing can be controlled by selecting “4. Set Grid Res” or by pressing F4.

If "Polygon" selection mode is on, the following menu keys dialog is displayed.

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Use the left mouse button to digitize the points that define the polygonal ortho area. It is not necessary to digitize a closing point. Press the right mouse button to finish the polygon collection. Use F3 to backup if a point is mistakenly digitized. To align the ortho area to an even grid, select “0. To Grid Snap” or press F11 key to toggle grid snap mode. The grid spacing can be controlled by selecting “4. Set Grid Res” or by pressing F4.

Zoom Output Area

Zooms the measurement window to fit the ortho area.

Set Area to DTM Bounds

Sets the output area to a polygon that follows along the boundary of the currently computed DTM surface.

Align Window to Ground

Forces the window to align to the ground coordinate system instead of the image edges provided that "Window" mode is selected. This prevents images from containing corner pixels.

Lower Left X, Lower Left Y, Upper Right X, Upper Right Y

Allows ground coordinates to be set directly (rather than through point digitization in the measurement window) provided that "Align Window to Ground" is enabled.

Shade Output Area

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Specifies whether the interior of the ortho area should be crosshatched to make it more visible.

Show contours

Specifies whether contours should be displayed based on the currently computed DTM surface. The contour intervals are controlled in the project settings.

Show control

Specifies whether the ground control points defined in the coordinate file should be displayed on the image provided that a coordinate file is defined in the project.

Show other image borders

Specifies whether image borders should be displayed for all images in the project.

Show other image areas

Specifies whether ortho areas should be displayed for all images in the project. Only the active image area will be edited.

Show VrOne files

Specifies whether VrOne vector data should be displayed on the image. The VrOne files and layers to display are defined in the project settings.

Output filename

Defines an output filename which overrides the default output filename generated by the project settings. Leave this field empty to keep the default name.

Current Image

Displays the current image and allows a different image from the project to be selected. If a new image is selected, the ortho area will load the new image.

Next Image

Switches to the next image in the project.

Clear Inner Orientations

Displays a dialog box to clear inner orientation on one or more images in the current project.

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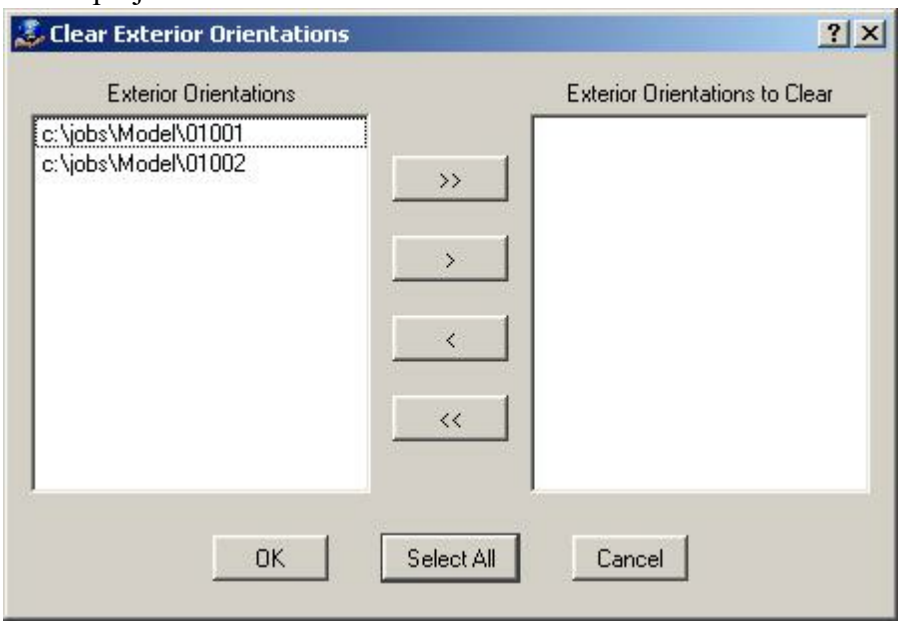
Clear Exterior Orientations

Displays a dialog box to clear exterior orientations on one or more images in the current project.



Clear ortho areas

Displays a dialog box to clear ortho areas on one or more images in the current project.

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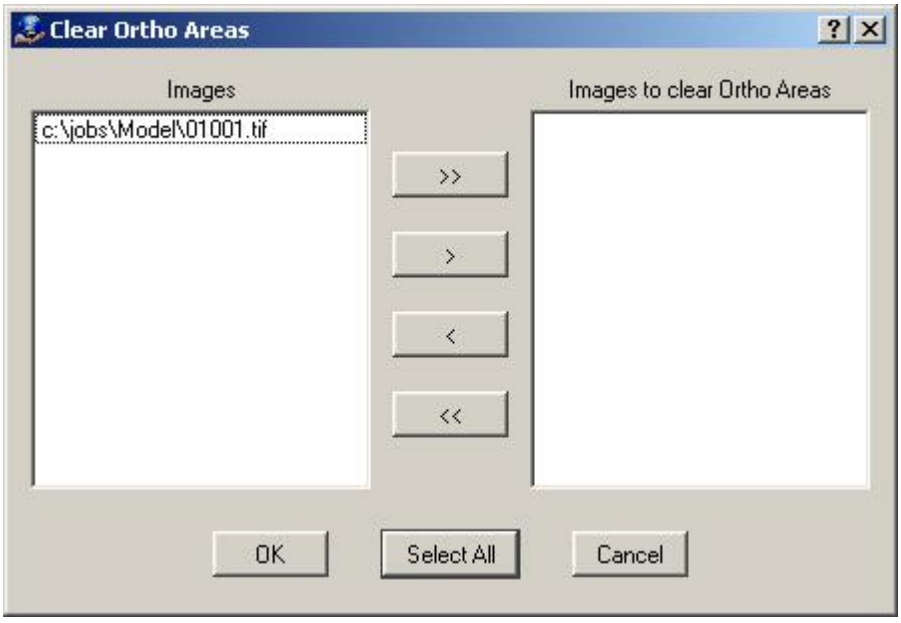
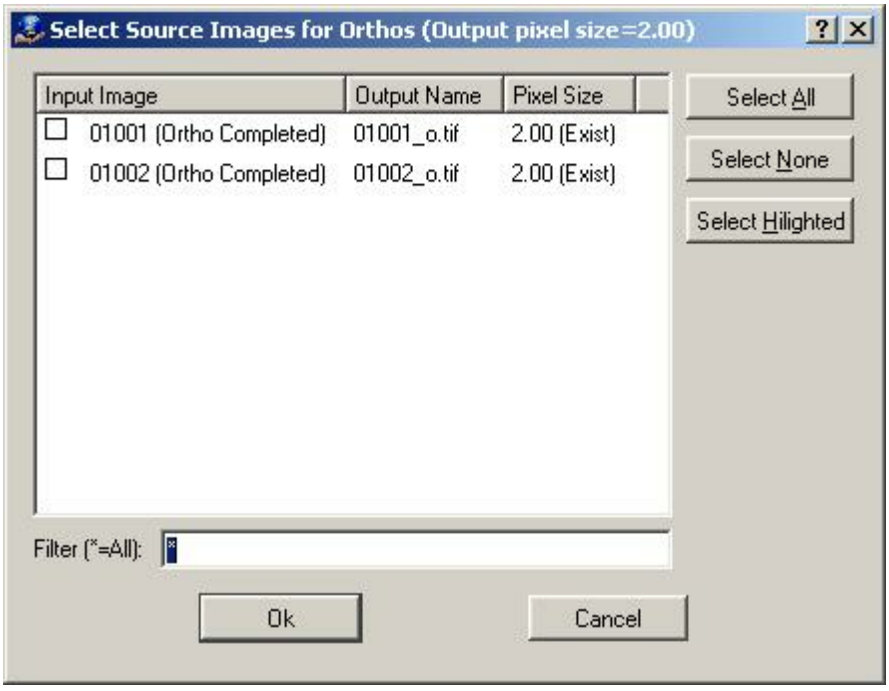


Create Menu

Create Orthos

Displays a dialog box to select multiple images for ortho generation.



Displays the current output name for each image. Any images that do not already have an ortho image or that have an ortho image with a different pixel size than

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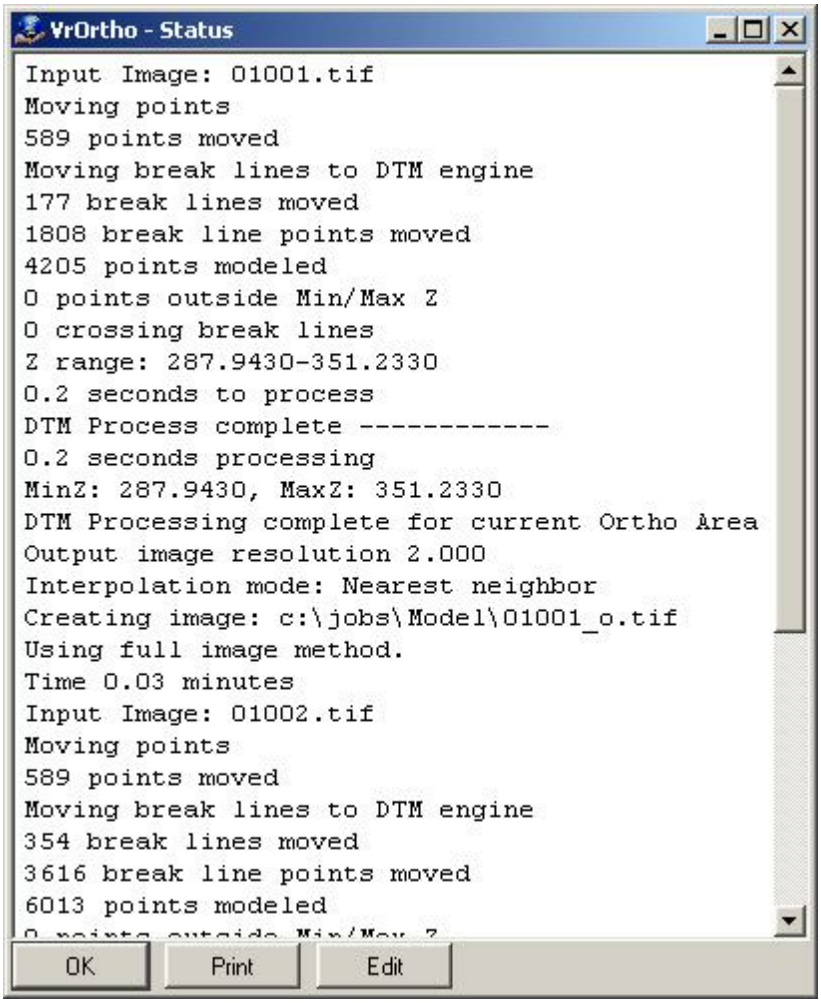
the current setting are selected automatically. Select the input images for which orthos should be generated then press "OK". A dialog box will display the output status.



2.5 Vr Air Trig

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

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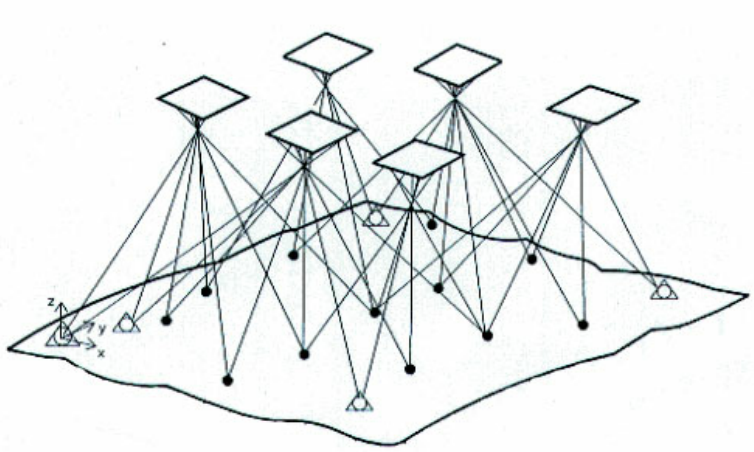
Vr Aerial Triangulation (VrAirTrig)



Vr Aerial Triangulation (VrAirTrig) with VrAdjust is a stand-alone program for the collection and processing of aerial triangulation data

VrAirTrig adheres to the standard Cardinal Systems' philosophy: "easy to learn, easy to use, and affordable". The project management tool helps manage large jobs with the speed and flexibility needed for maximum efficiency in production.

This innovative program enables the technician to lay out images of the complete project and to display all readings as either "to be read" or "completed". VrAirTrig's intuitive interface allows the setup, reading, and export of aerial triangulation measurements on up to 2000 images of unlimited size.

This application allows the collection of strip and tie points on a large number of images and performs a block adjustment using aerial triangulation methods. The Aerosys adjustment software is integrated directly with VrAirTrig to perform seamless adjustments. Several third party adjustment packages may also be used through an export and import mechanism.

Points may be measured with any of three methods: Mono-comparator, Semi-automatic correlation assist, and Stereo. Each method is described in more detail in the VrAirTrig documentation.

VrAirTrig Documentation
VrAirTrig Tutorial
AeroSys Download and Install
AeroSys Settings and Configuration

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2.5.1 Documentation

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

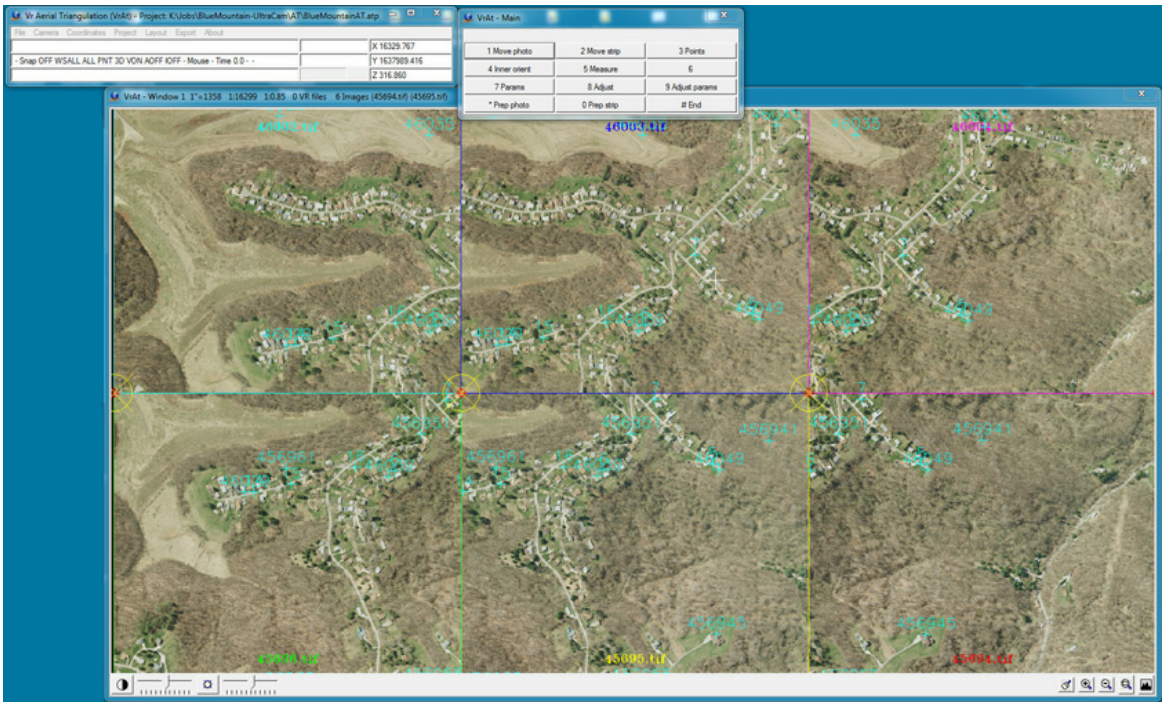
Vr Mapping

Vr Aerial Triangulation (VrAirTrig)

Type: Stand-alone application (vrat.exe)

Aerial triangulation measurement and optional adjustment application.

See also: Tutorial Vr Aerial Triangulation



The VrAirTrig with the Layout environment

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Overview

VrAirTrig Basics
- Starting an Application
- Using VrAirTrig
- Automatic_Tie_Point_Workflow

Automatic Tie Pointing FAQ

File
- Preference (Pre)
- Exit (Exi)

Camera
- New Camera (NewCam)
- Edit Camera (EdiCam)
- Edit Radial Distortions

Coordinates
- New Coordinate File (NewCoo)
- Edit Coordinate File (EdiCoo)
- Convert Coordinate File (ConCoo)
- Null Axis Value (NullAxi)

Project
- New Project (NewPro)
- Open Project (OpePro)
- Edit Project (EdiPro)
- Change Drive (ChaDri)
- Delete Project (DelPro)

Layout
- Set Photo Positions (SetPho)
- Open Layout (OpeLay)
- Layout_Menu_Map

Export

About

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Check for New Version (CheVer)
About (Abo)

Layout Applications
Measure
Remeasure Point
Stereo Measurement

Reference
Vr Mapping Coordinate File Format
Film Strip Location
Photo Name Format
Point Name Format

Overview

Vr Aerial Triangulation (VrAirTrig) with VrAdjust is a stand-alone program for the collection and processing of aerial triangulation data

VrAirTrig adheres to the standard Cardinal Systems' philosophy: "easy to learn, easy to use, and affordable".

The project wizard tool helps manage large jobs with the speed and flexibility needed for maximum efficiency in production.

This innovative program enables the technician to layout images of the complete project and to display all readings as either "to be read" or "completed".

VrAirTrig's intuitive interface allows the setup, reading, and export of aerial triangulation measurements on up to 10000 images of unlimited size.

This application allows the collection of strip and tie points on a large number of images and performs a block adjustment using aerial triangulation methods. The VrAdjust and Aerosys adjustment software are integrated directly with VrAirTrig to perform seamless adjustments. In addition, several third party adjustment packages may also be used through an export and import mechanism.

Automatic tie point measurement is supported and requires no DEM approximations or airborne GPS.

Points may also be measured manually or semi-manually using the following methods: Mono-comparator, Semi-automatic correlation assist, Stereo, and multi-image auto propagation. Each method is described in more detail in the VrAirTrig LayoutApplications.

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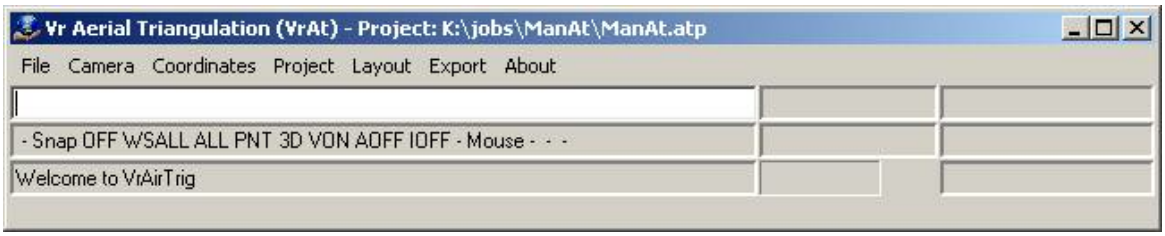
VrAirTrig Basics

VrAirTrig will start by opening the Main Window.



The VrAirTrig Main Window

The VrAirTrig Main Window contains command pull down menus, a key-in area, two information areas, a progress bar, and the coordinate display.

Command names may be entered in the key-in area at almost any time.

The currently loaded project is shown in the top border of the Main Window.

Starting An Application (Command)

A command may be started by selecting an item from a drop down menu. Alternatively, a command may be started via key-in.

Using VrAirTrig

VrAirTrig is used to measure a common points between images in order to do a block adjustment (aka bundle adjustment). This adjustment calculates the most probable values for the camera exterior orientations and generates XYZ coordinates of all the image points.

VrAirTrig is project based; it requires a project to be created before any processing can be done. A project in VrAirTrig comprises a list of images, camera files, and other parameters required for measurement and adjustment.

Points measured in VrAirTrig can be adjusted using the VrAdjust (AeroSys) option. When using this option, many passes may be taken on the data with an adjustment in between. VrAdjust also helps drive to unmeasured control points and determine blunders. Measurements made in VrAirTrig may also be exported to another adjustment program.

The following files are needed to set a stereo model:

- Images with suitable overlap for stereo viewing. This overlap is normally 60%.
- Camera calibration. This is used to create a Vr Mapping camera (.cam) file
- A ground coordinate file consisting of ground surveyed points.

Manual Workflow in VrAirTrig:

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1. Create the camera calibration (.cam) file.
2. Create a VrAirTrig project.
3. Lay out the images in the Layout application.
4. Prepare the image strips by placing the pass points.
5. Add ground control points.
6. Measure a strip of images.
7. Transfer common points to the strips above and below the first strip measured.
8. Measure the next strip.
9. When measurements are complete, run the adjustment.
10. Identify and correct errors in measurement, control point identification, and ground control.
11. Repeat the adjustment process if needed.

The Vr Image Utility program can prepare the images for the project by attaching the strip location, image pixel size, and camera to each image. It can also perform automatic interior orientations. If several programs (such as VrTwo Orientation, Vr Orthophoto, or Vr Aerial Triangulation) will use the same images, Vr Image Utility should be used to set up the images so other programs can import the project file.

Automatic Tie Point Workflow

Automatic tie point work can be thought of in three stages:

1. Setup: creating projects, cameras, doing interior orientations, and importing exterior orientation parameters
2. Point generation: Getting a set of automatic or semi-automatic points generated
3. Winnowing: Final cleanup of the generated points

Setup

Most AutoTie support issues are, at their root, setup issues. Cameras must be set up correctly. The interior orientations must be done correctly (this is automatic for digital images, but requires fiducial marks to be measured in Image Utility for scanned film images). The images may need strip and photo numbers assigned. Finally, exterior orientations (if available) need to be imported correctly.

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Strip and photo numbers are needed for autotie without EOs. There are several ways to set them up on the 'Strip and Photo Numbers' tab of the project wizard. The most basic is to parse them from the image names. Alternatively, if EO's have been imported the software can attempt to determine a set of strip and photo automatically. To use this option click the 'Derive from EOs' button on the Strip and Photo numbers tab. If the fully automatic method fails, AssStr provides a semi-automatic way to accomplish the same task. As a last resort the numbers can be assigned manually.

If EOs are available then it is critical to insure that the EO's are imported correctly prior to running AutoTie. In particular, it is frequently necessary to add biases to the kappa angles. This is done on the 'Orientations and Control' tab of the project wizard. Once EO's are imported the number of control points that project into each image is displayed in right-must column of the table on this tab. The first thing to check is that the there are control points that project into the images (clicking on column headers will sort the rows by the values in that column). The two most common causes for no control points in the images are: the control file was setup as Easting-Northing but is actually Northing-Easting and the control and EOs are in different coordinate systems. If points project into the images, double clicking on the number of control points an image with display thumbnails of the control point in all images that see it. If the thumbnails appear correct than the setup is good. If the thumbnails appear random than the EOs likely need a kappa bias. Adding a kappa bias is an option when you import EOs as a flat file.

Point Generation

We'll consider the workflows for images with EO's and without EO's separately.

Workflow With EO's

1. AutoTie or FasTie. Both methods are fully automatic, and have the same parameters, but FasTie is the better choice for most blocks. AutoTie is less sentive to some user parameters, but is also very meticulous and much slower. The parameters that have the greatest impact on results are

   · Bundle measurement sigma: This is the estimated standard deviation of pixel measurements in the block. If EO's are poor it is necessary to loosen this parameter so that blocks can get going (otherwise everything appears to be outliers). In general it is better to be overly large than too small. A good default range when running AutoTie is 3-20, but if you drive to a control point and see that it is 40 pixels out you should raise it accordingly. Also note that cross strip alignments are typically worse than along strip, so if possible drive to a observe a control point that falls in at least two strips. It is also possible

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to put in a couple of across strip manual points and run a one iteration bundle to get an initial accuracy estimate.

- Interest points per path: Images are divided in approximately square grids and feature extraction, matching, etc. are done grid by grid. This makes things run much faster and gives better results. A first step in this process is to look at each patch and extract the most interesting points. In order to limit processing time the user can put a ceiling on how many points per patch will be kept. However, if this number goes to low the whole process can fail. It is recommend that user stick with 500 pixel patch sizes and 150-600 points per patch. Cooperative images (e.g. suburban, agricultural, or rural with sparse trees) can get away with lower points per patch. Forests and jungles require higher points per patch.

- LS Match sigma: The final stage of AutoTie is Least Squares matching. In this process transformations between patches of pixels are calculated and error propagation can be done to estimate the quality of the match. These estimated accuracies are somewhat analogous to the familiar correlation coefficient in that they reflect on the quality of the match. However, they have the advantage of being in useful units (pixels) as opposed to unit-less correlation. In most cases using the default value of 0.2 gives very good results. However, in very difficult blocks (i.e. thick forests, equatorial jungles, tall leafless trees) this parameter is sensitive. Finding the sweet spot between getting to many false positives and have to little data can be tricky, and it is recommended that you run some tests on a small sub block to make sure it is working. The typical symptom of a LS Match sigma that is too high is poor across strip matches. The typical symptom of a LS Match Sigma that is too low is lack of across strip matches. Feature matching and LS matching can be done separately to allow for some experimentation with this parameter. To do so uncheck LS Match in the AutoTie parameter box when doing FasTie, then back up your ATM files (BacAtm), finally run separate LS Match(es) using the LsMat command afterward.

Workflow without EO's

It is sometime useful to think of this work flow as the quickest way to get a set of EO's.

1. Manually measure some across strip ties using the typical layout tools. Search for overlap between strips can be very slow, and occasionally unreliable. Hence having a few manual ties really speeds things up. The recommended practice is to add three points in the corners of the sidelap to the second and second to last image in each strip. These three points should each be measured in at least two images in the other strip. As shown in the picture. This is more data than strictly necessary, but it is also enough to link the strips even if AutoTie across them fails. If the second or second to last image is heavily forested, has a lot of water, etc.

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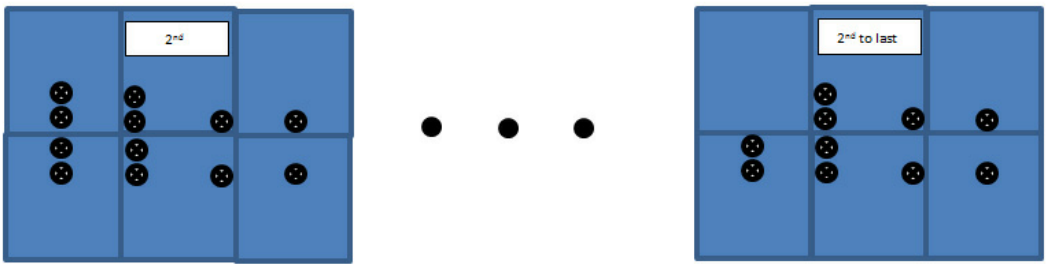
then the across strip links should be moved to the nearest image with more conducive features. If the entire strip is difficult it may be best to leave out the ties and do them manually latter.



2. Back up you ATM files (optional, but recommended)

3. Semi-Automatic AutoTie (SemTie): This command will link along the strips and attempt to grow links out ward from the manual across strip ties. It does not attempt to fill in the whole block but rather sticks to close around the manual links (this avoids perpetuating any errors). For this reason some users choose to add a few additional cross strip links to long strips. The parameters that have the greatest impact on results are

   · Max number of points per image: The more points the better. Remember that SemTie is not the final step. Points will be refined and thinned latter, so have 'too much' at this point is not an issue. Collecting at least 3 times as much data as is ultimately desired is recommend in this step.

   · Interest points per path: Images are divided in approximately square grids and feature extraction, matching, etc. are done grid by grid. This makes things run much faster and gives better results. A first step in this process is to look at each patch and extract the most interesting points. In order to limit processing time the user can put a ceiling on how many points per patch will be kept. However, if this number goes to low the whole process can fail. It is recommend that user stick with 500 pixel patch sizes and 150-600 points per patch. Cooperative images (e.g. suburban, agricultural, or rural with sparse trees) can get away with lower points per patch. Forests and jungles require higher points per patch.

4. Back up you ATM files (optional, but recommended)

5. Free net adjustment (FreNet): Build a set of model space EOs using the frenet adjustment. Clean out auto tie blunders as needed. The bundle interactive GUI (BunInt) can be used to build EO's and clean AutoTies strip by strip or the black box command (FreNet) is available.

6. Import the model space EOs using the ImpGps command.

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7. Run a Least Squares Match (LsMat) to refine the measurements, thin the data, and push points through all the images. The parameter that has the greatest impact on results is:

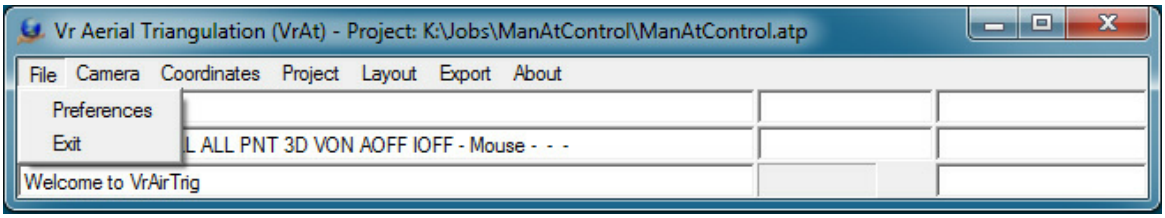
   · LS Match sigma: The final stage of AutoTie is Least Squares matching. In this process transformations between patches of pixels are calculated and error propagation can be done to estimate the quality of the match. These estimated accuracies are somewhat analogous to the familiar correlation coefficient in that they reflect on the quality of the match. However, they have the advantage of being in useful units (pixels) as opposed to unit-less correlation. In most cases using the default value of 0.2 gives very good results. However, in very difficult blocks (i.e. thick forests, equatorial jungles, tall leafless trees) this parameter is sensitive. Finding the sweet spot between getting to many false positives and have to little data can be tricky, and it is recommended that you run some tests on a small sub block to make sure it is working. The typical symptom of a LS Match sigma that is too high is poor across strip matches. The typical symptom of a LS Match Sigma that is too low is lack of across strip matches.

8. Clear EOs (CleEos) to get ready to move to control space.

Clean up

The free net adjustment is a very powerful way to clean out miss-matches, and must be used if there are no EOs available. It is however comparatively slow. So, provided that the EO's that were available to import and are at least reasonably good, it is sufficient to bundle adjust (BunAdj) and clean auto ties (CleAut) until satisfied. Otherwise use free net (FreNet) and clean auto tie (CleAut). Remember though, it is recommended that you back up the ATM files before starting however because clean auto tie is irreversible.

File



The File pull-down menu from the VrAirTrig Main Window

Preferences (Pre)

Sets operating parameters for the VrAirTrig Program.

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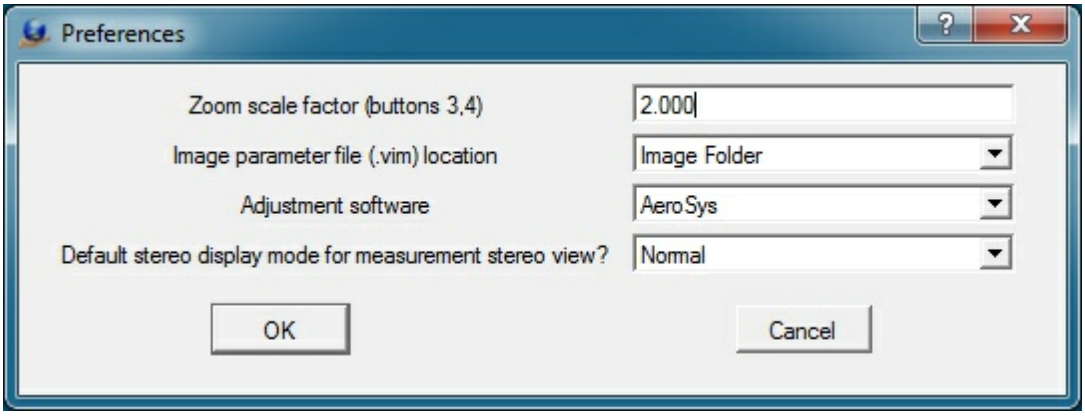

The VrAirTrig Preferences dialog box

Zoom scale factor (buttons 3, 4)

Several orientations, including Relative Orientation, allow zooming in and out on the images. Zoom scale factor sets the scale factor to use while zooming with button 4 (center mouse button).

Image parameter file (.vim) location

Each image used by VrAirTrig has an associated parameter (.vim) file. This file contains the interior orientation values and other image parameters. The image parameter file has the same name as the image but with a .vim file extension. These parameter files may be stored in the same directory as the images ("Image Folder") or they may be stored in the project folder ("Project Folder").

Adjustment software

List available adjustment software. Selection VrAdjust makes Ajdustment/AutoTie layout menu active.

Default stereo display mode for measurement stereo view?

Specifies the mode for stereo viewing:

- **Normal** - Uses a stereo compatible screen, emitter, and stereo glasses.
- **Anaglyph** - Displays in red - blue (or others). This will run on almost any computer and stereo hardware is not required.

Exit (Exi)

Exits the VrAirTrig program.

Camera

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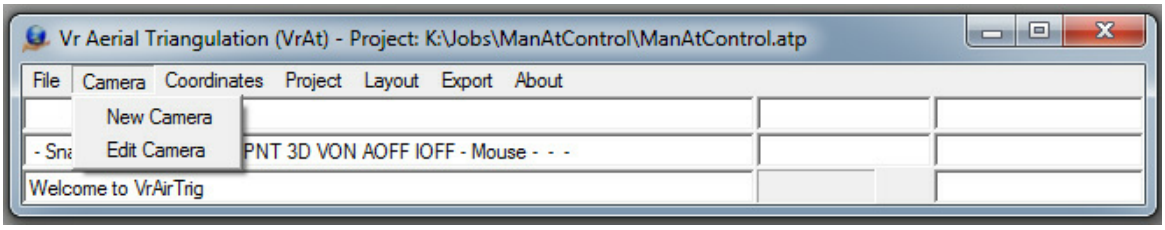


The Camera pull-down menu from the VrAirTrig Main Window

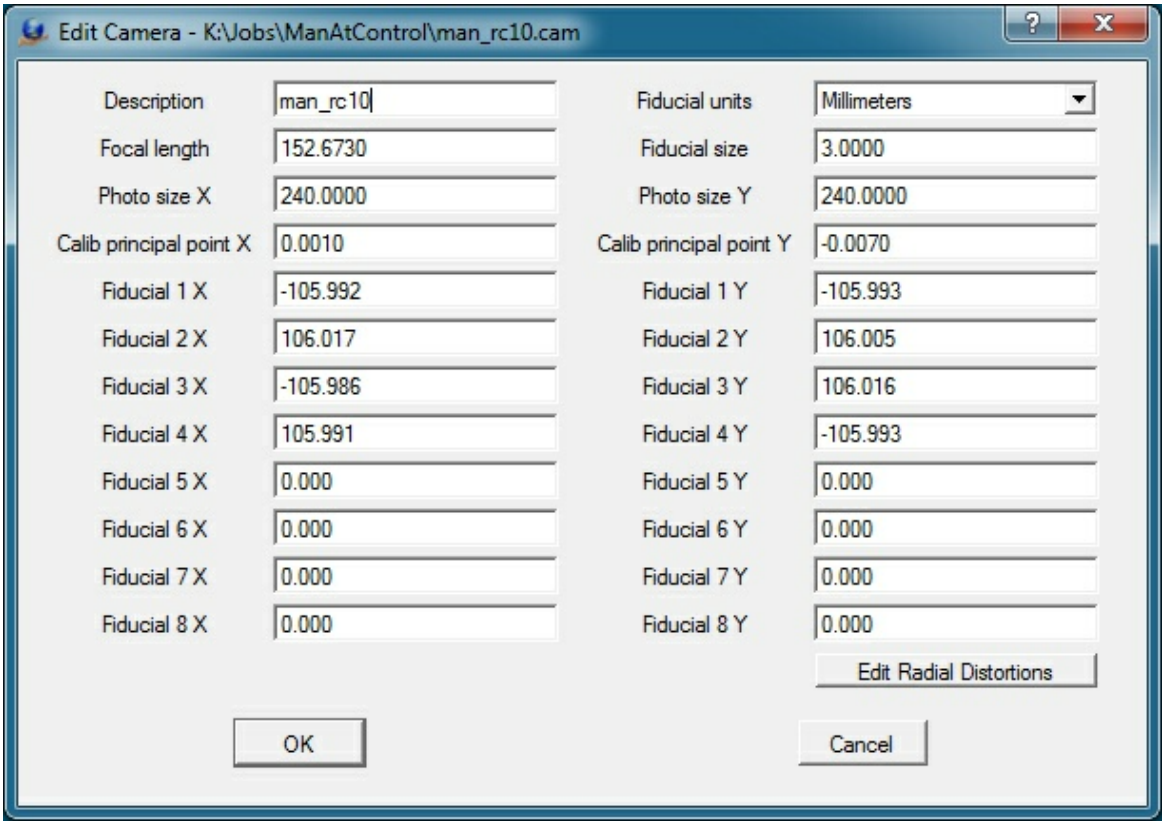
Creates, edits and imports camera calibration parameters.

New Camera (NewCam)

Creates and edits a new camera calibration file. Prompts the uesr for the file name for the new camera. Camera files in Vr Mapping have a .cam file name extension.

Edit Camera (EdiCam)

Edits an existing camera calibration file. The camera edited does not need to be one of the current cameras; any existing camera file may be edited. When edit camera starts, the user is prompted for a camera file name. Upon exiting, the has the opportunity to save the modified camera calibration parameters.



The Edit Camera dialog box

Description

Describes the camera for user reference. This description is for information only and is not used in model orientation.

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Fiducial units
Specifies the units of the coordinate positions (millimeters, inches, or pixels). Many programs used to calibrate handheld cameras output the focal length of the camera in pixels. The coordinates entered to represent the fiducial positions must be in the same units as those specified here.

Focal length
Defines the camera lens' focal length, the distance from the focal point to the center of the lens. This value is provided by the camera calibration report. Focal length units should be the same as those used for the fiducial positions.

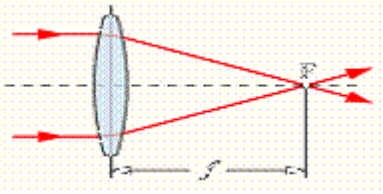

Photo size X Y
Specifies image dimensions. Photo size dimensions should be the same as those used for the fiducial positions.

Calib principal point X Y
Specifies the calibrated principal point (also known as the point of best symmetry). This coordinate position is available from the camera calibration report. Calibrated principal point coordinate units should be the same as those used for the fiducial positions.

Fiducial X Y
The coordinate positions for up to eight fiducials may be entered and must be in the user-specified Fiducial units. Most aerial cameras have eight fiducials. It is strongly recommended that all eight be entered and used to compute interior orientation. If only four fiducials are used, errors may occur and make residuals useless in determining if the wrong camera calibration was selected.

Edit Radial Distortions

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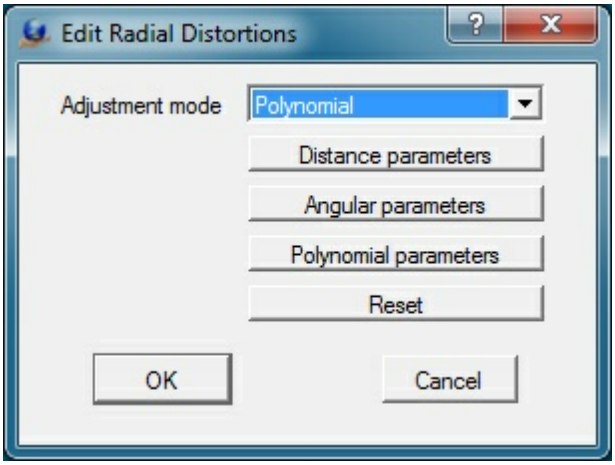

Lens distortion causes image positions to be displaced from their ideal or true locations. In aerial cameras, these distortions are normally minimal but they can still have an effect on accuracy. Some digital cameras have large lens distortions and radial distortions must be entered for accurate mapping results.

Adjustment mode

Most camera calibration programs output radial distortion values as polynomial parameters. Though angular parameters are listed, this output type is currently unsupported.

Distance Parameters

Radial distortions, represented by concentric rings about the camera lens' calibrated principal point, may be entered as distance parameters. The radial distortions shown below are from a small format camera and show high radial distortion values.

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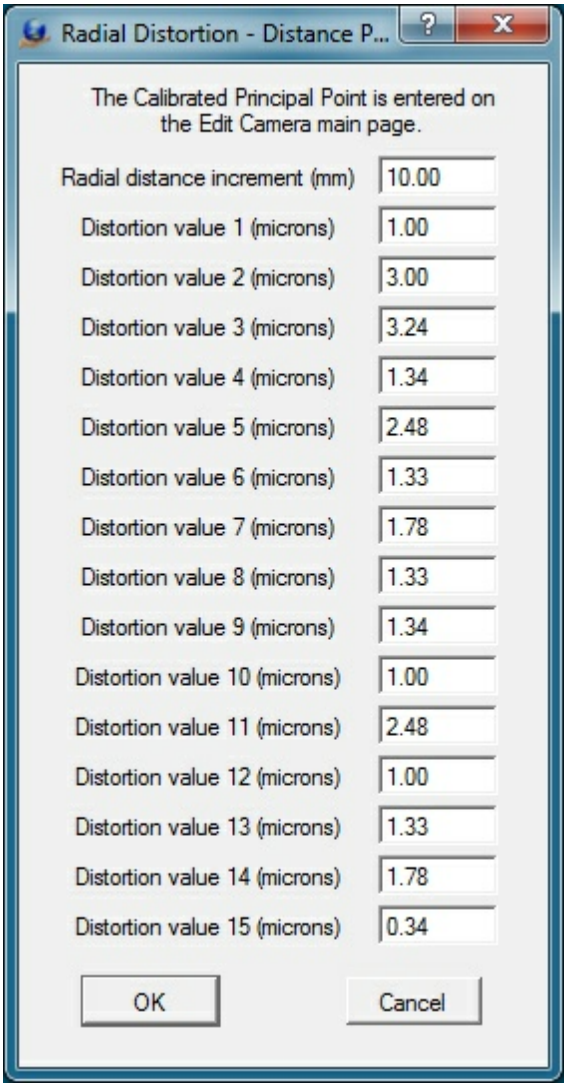

Defining radial distortions by distance

Radial distance increment

Represents the distance between the concentric rings that make up the distance parameters. Radial distance increment units should be the same as those used for Fiducial positions.

Distortion value n

Specifies distortion values for each distance. There may be up to 15 values. Distortion value units should be the same as those used for Fiducial positions.

Angular Parameters

Computation of radial distortions by angular parameters is currently unsupported. Please use distance or polynomial parameters.

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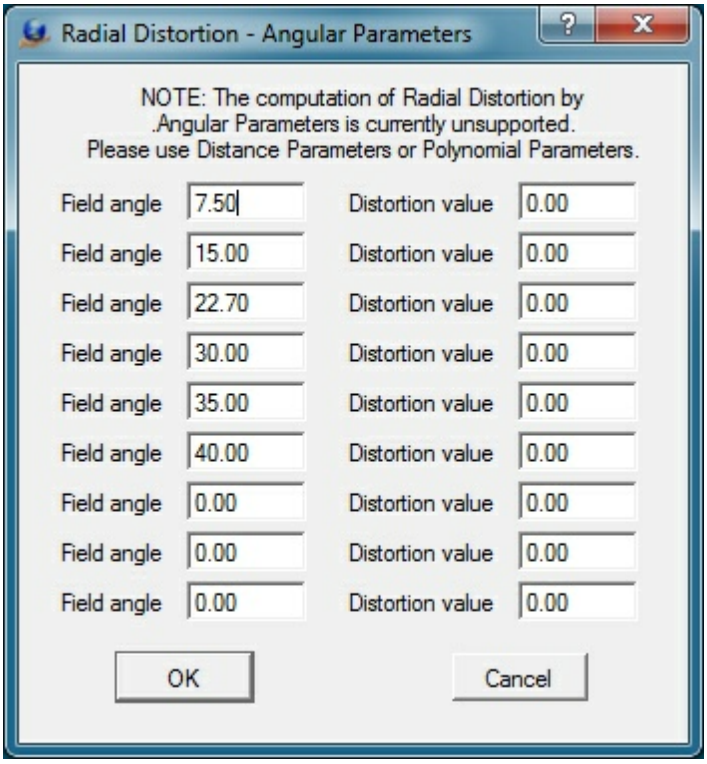

Defining radial distortions by angle

Polynomial Parameters

The polynomial values and principal point or autocollimation are provided by the camera calibration report. The mathematical model used is based on the Simultaneous Multi-camera Analytical Calibration (SMAC) method. Care should be taken when entering these parameters, as entry errors cause model orientation errors and distortions which affect model accuracy.

Entry of Exponential Notation

The k0-k4 values and the p1-p4 values are entered into the Polynomial Parameters dialog box in exponential notation. The values entered from the USGS camera calibration report may have the decimal place moved one position to the left depending on the number entered. For example:

```
USGS value:  0.1403x10-3
Value typed:  .1043e-3
Shown value: 1.403000e-004
```

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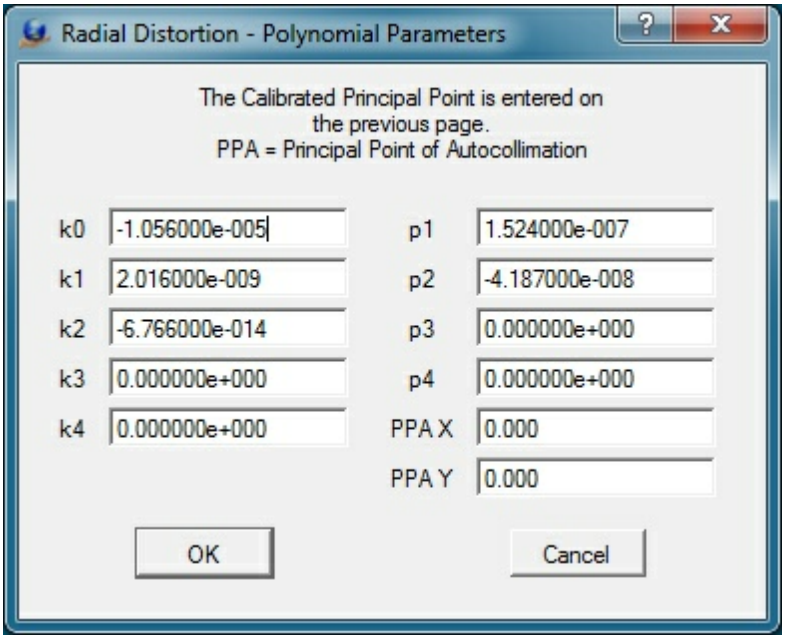


The Radial Distortions dialog box for entering the polynomial parameters

K0-K4

Defines up to five K coefficient values. These are coefficients of symmetric radial lens distortion from the camera calibration report. These values are entered in exponent form.

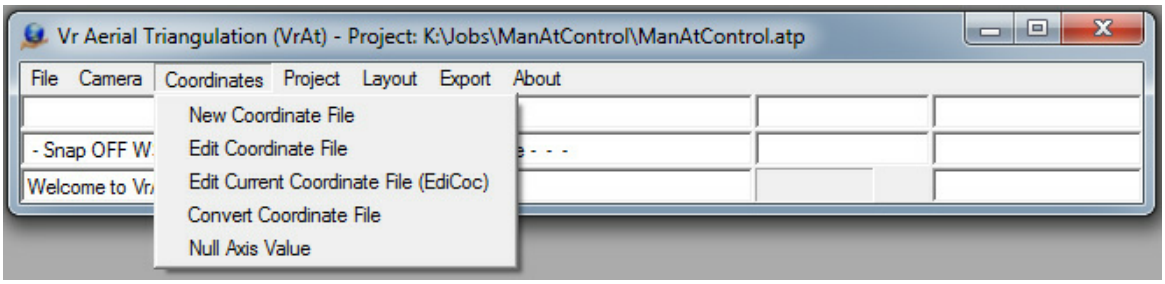
P1-P4

Defines to four P coefficient values. These are the coefficients of de-centering distortion from the camera calibration report. These values are entered in exponent form.

PPA X Y

Defines the principal point of autocollimation as provided by the camera calibration report.

Coordinates



The Coordinates pull-down menu from the VrAirTrig Main Window

The Coordinates menu provides functions to create and edit coordinate files. It is possible to import existing coordinate files with a simple name change. Please refer to Vr Mapping Coordinate File Format for information on the format and layout of the coordinate files used in VrTwo.

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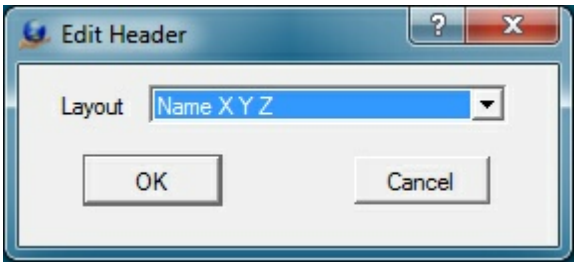
New Coordinate File (NewCoo)

Creates a new coordinate file. The Format, State Plane Zone, Datum, UTM Zone and Units in the Edit Header dialog box are for user reference only. Prompts the user for a coordinate file name and coordinate file parameters.



The New Coordinate dialog box

Layout

Specifies the fields to be placed in the coordinate file and their order. Options are:

```
Name X Y Z Cx Cy, Cz
Name Y X Z Cy Cx, Cz
X Y Z Name Cx Cy, Cz
Y X Z Name Cy Cx, Cz
Name X Y Z
Name Y X Z
X Y Z Name
Y X Z Name
X Y Name
Y X Name
```

Where:
Name – Point name
X Y Z – Coordinates
Cx Cy Cz – X Y Z point weights

Edit Coordinate File (EdiCoo)

Edits coordinates in an existing coordinate file. Editing options include Add, Change, and Delete. When this command is started, the user can open any coordinate (.cor) file and the edited file may be saved upon exiting the application.

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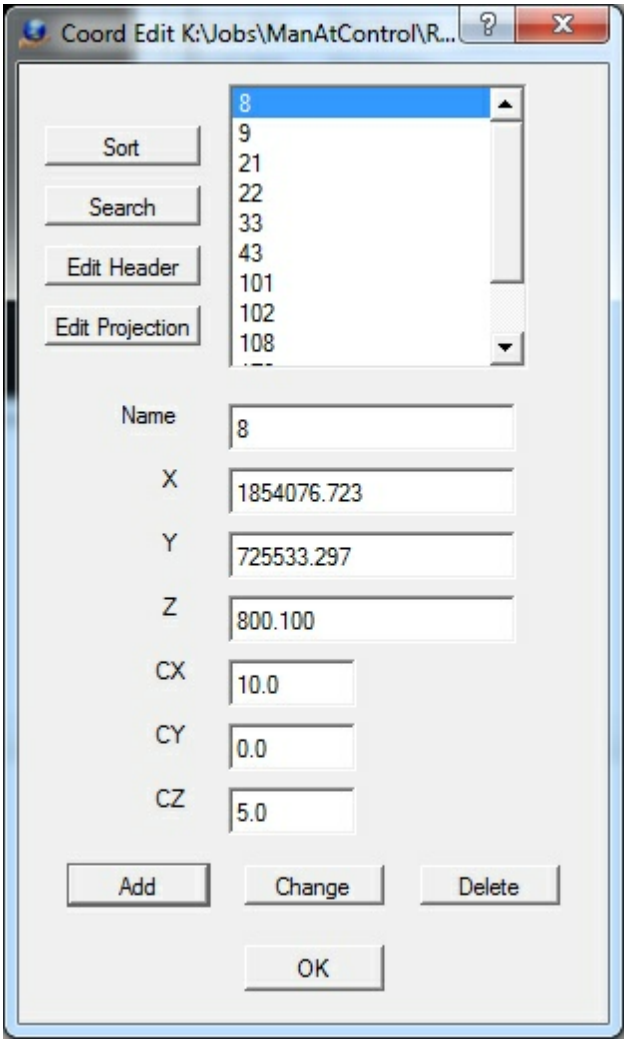

The Edit Coordinates dialog box

Sort
Sorts the coordinate file based on the point name.

Search
Searches for a coordinate point by name. If the point name is found, it becomes the current point.

Edit Header
Edits the coordinate file header.

Name
Defines the point name. It must be alphanumeric and may be up to 32 characters in length.

X Y Z
Defines coordinate values for the point.

CX CY CZ
Defines point weights. These may be used in the coordinate file depending on the File Layout. Normally, point weights are expressed in ground units.

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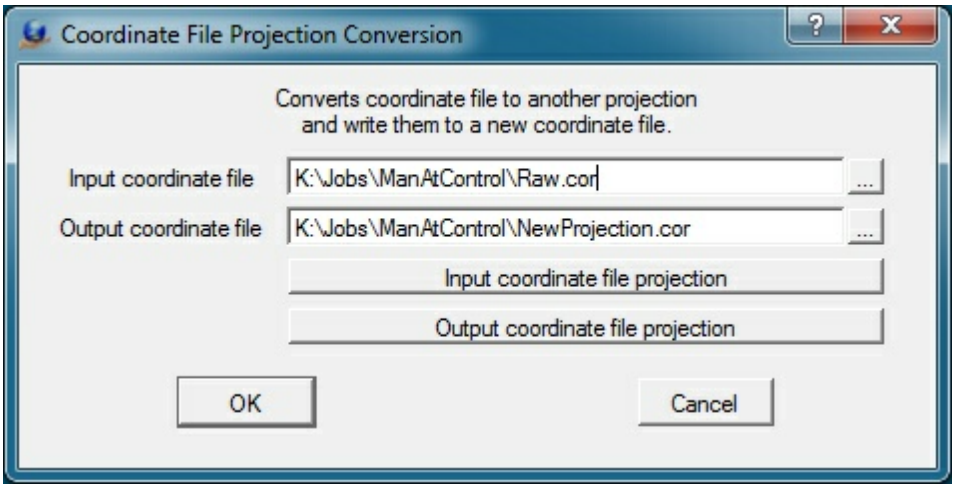
Add
Adds the current point to the coordinate file

Change
Updates the current point with the current Name, X, Y, Z, CX, CY and CZ values.

Delete
Deletes the current point.

Convert Coordinate File (ConCoo)

Converts an existing coordinate file from its current coordinate projection to a different one. Reads an existing VrOne coordinate file, re-projects it, and writes a new coordinate file. See Coordinate Projections for more information.



The Coordinate File Project Conversion dialog box

Input coordinate file
Defines the name of the existing coordinate (.cor) file.

Output coordinate file
Defines the name of the output coordinate file.

Input coordinate file projection
Defines or edits the input coordinate file projection. See Coordinate Projections for more information.

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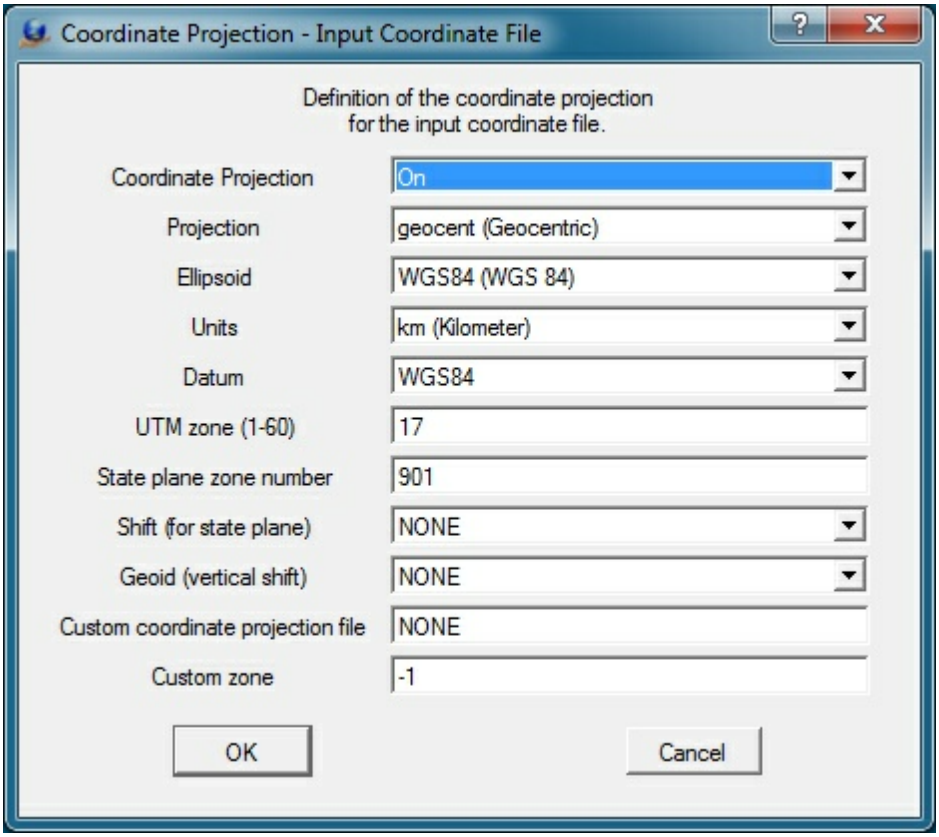

The input coordinate projection definition dialog box

Output coordinate file projection

Defines or edits the output coordinate file projection. See Coordinate Projections for more information.

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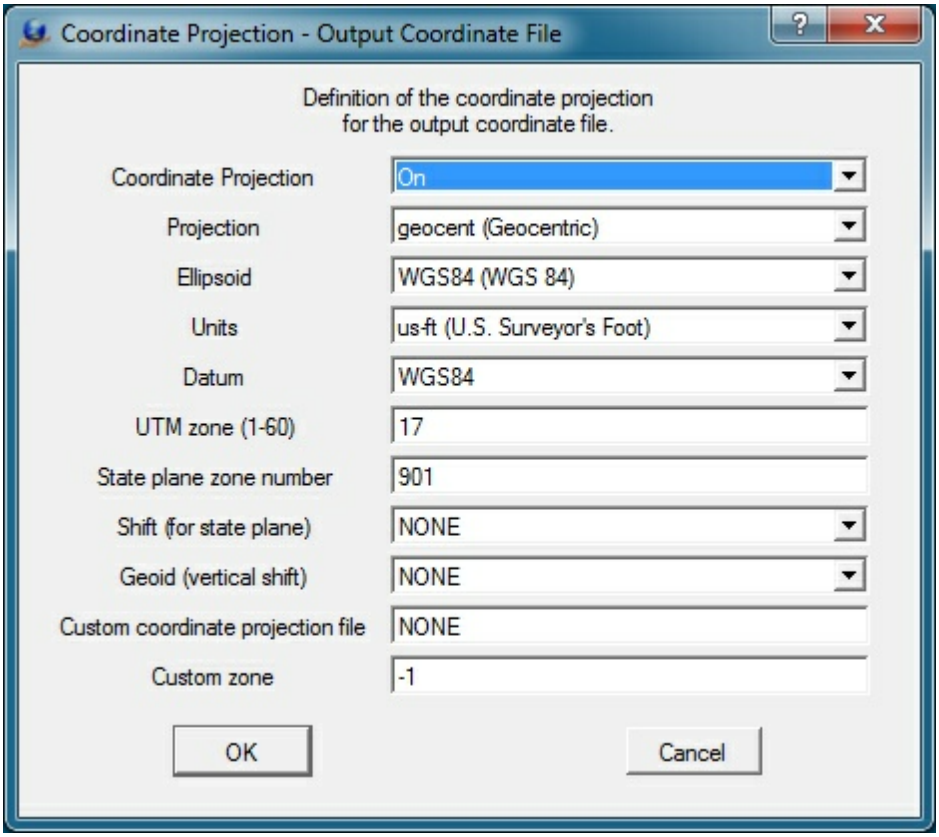

The output coordinate projection definition dialog box

Null Axis Value (NulAxi)

Some points do not have values for all three coordinate axes. The Null Axis Value is an arbitrary figure to which one of a point's 3 coordinate values can be assigned to indicate that it is lacking that value. This value is typically zero, but in cases where zero is a valid coordinate value in the map data, an extreme value like -999 should be used. For example, an elevation-less point could be assigned the coordinates (10, 10, -999) to indicate that it lacks a Z coordinate.

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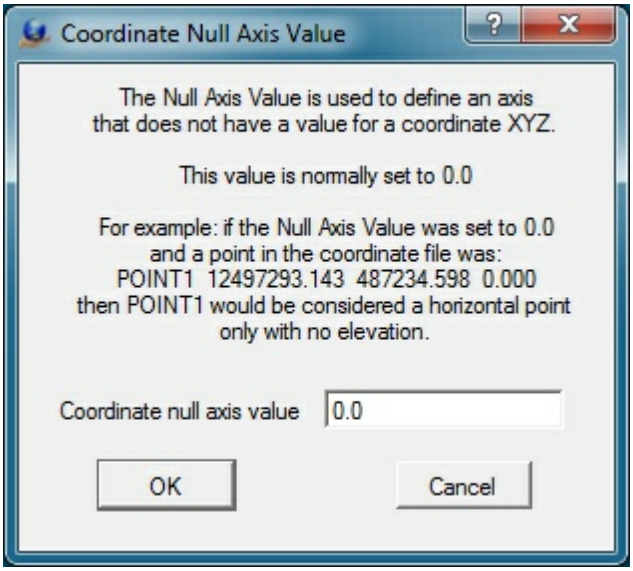
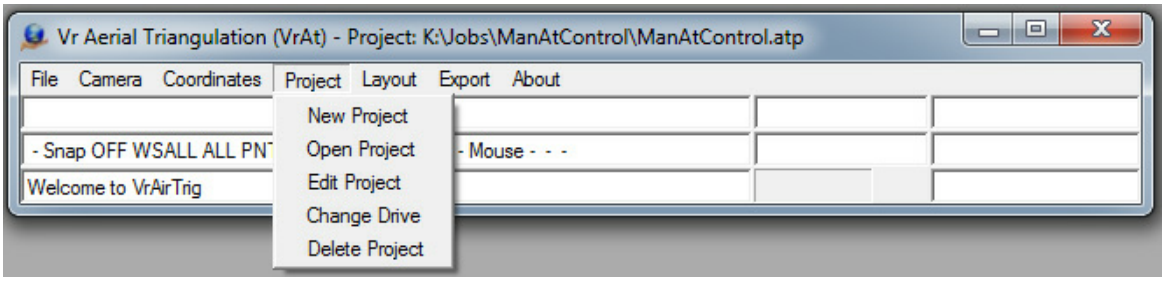


The Null Axis definition dialog box

Project



The Project pull-down menu from the VrAirTrig Main Window

New Project (NewPro)

Creates a new project and allows Edit Project to be engaged.

Open Project (OpePro)

Opens an existing project. It is not necessary to close the current project before opening another. All current project parameters are saved automatically before another is opened.

Edit Project (EdiPro)

Edits the current project.

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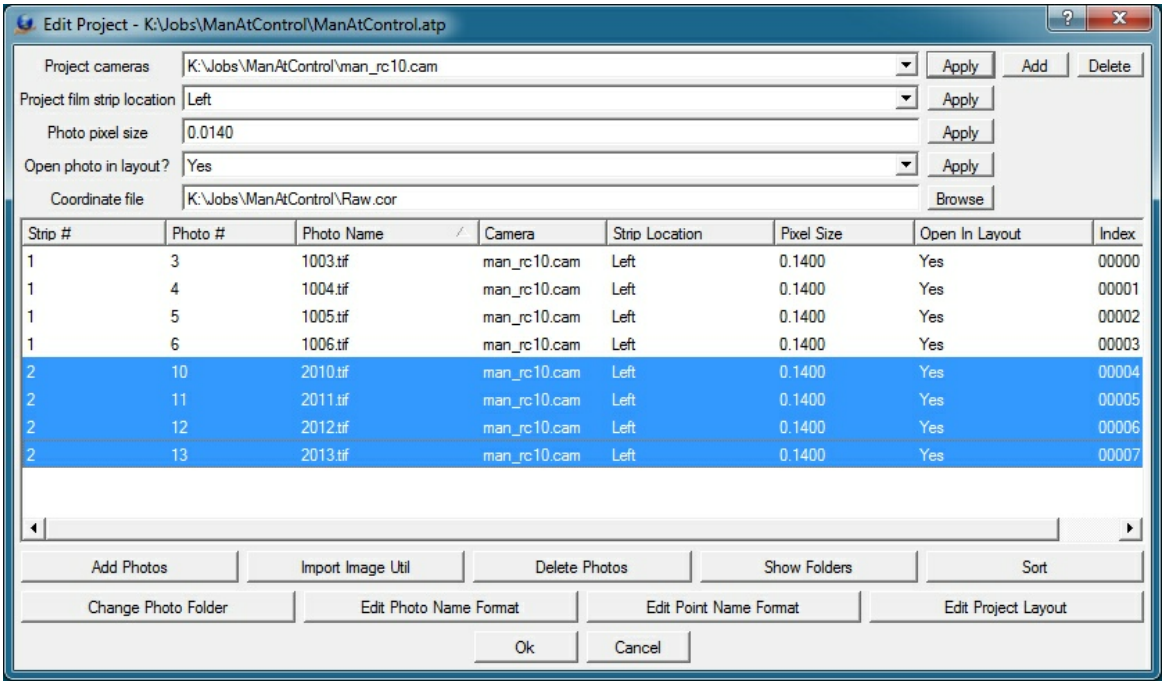

The Edit Project dialog box

Manages project and photo parameters. If there is already a project set up in Image Utility and Interior Orientations have been performed, use the Import ImageUtil option. This reads the list of images from the Image Utility project and automatically recognizes the image settings and interior orientation.

Each image has a camera file, strip location, pixel size, and "open in layout" flag. Use this dialog to assign the correct parameters to all images in the project. A camera file must be added to the project from this dialog before any photos can be added. The photo strip and photo numbers are displayed in the list of photos and are extracted from each photo name. The parameters may be set by pressing the Edit Photo Name Format button.

Placing the mouse pointer on an image and dragging highlights the image in the dialog box. Holding the shift key and clicking the mouse highlights a range of images. Holding the control (Ctrl) key and clicking the mouse highlights additional images. The first four fields ("Project cameras", "Project film strip location", "Photo pixel size" and "Open in layout?") in the Edit Project dialog box are templates which can be copied to a photo or group of photos. To copy these parameters, highlight the photo or photos and press the Apply button on the right side of the of the template field.

Project cameras

Defines up to 10 project cameras (.cam) files.

Film strip location

Specifies the film strip location in reference to the rotation of the image. This parameter is not dependent on the direction of flight, but the orientation of the image as viewed by the user. See Film Strip Location for more information.

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Photo pixel size
Defines the size of each pixel based on the fiducial coordinate units. Normally expressed in millimeters, but may be in inches or pixels. If the fiducial coordinates are in pixels, the photo pixel size is 1.

Open in layout?
A project in VrAirTrig may consist of thousands of photos. During the measurement process, it is useful to work in one area, so it is not necessary to display all of the project photos in the Layout window. The "Open in layout" flag may be set for a photo or group of photos.

Add photos
Adds photos to the project using the Vr Open file dialog box.

Import Image Util
Imports photo parameters from the Image Utility program into the VrAirTrig project given that the current project was already set up in Image Utility.

Delete Photos
Deletes the highlighted photo or group of photos.
NOTE: Pressing the button deletes without verification.

Show Folders
Toggles display of folder names with the display of each photo name and camera name.

Sort
Sorts the photos by "Strip-Photo Numbers" or "Photo Names".

Change Photo Folder
Changes the location of a photo or group of photos by replacing the file folder name. This operation does not move the photos.

Edit Photo Name Format
Various processes require use of an image strip and photo number. These numbers are typically encoded in the image file name and the Photo Name Format describes the method for extracting this information. See Photo Name Format for more information.

Edit Point Name Format
Determines the format for the point names and the initial poisitions for these points when photo strips are prepared with pass points. See Point Name Format for more information.

Edit Project Layout
During the measurement process, points are transferred from one photo to another as they are propagated to all photos they fall within. For this process, the approximate project photo overlap, sidelap, and strip numbering direction must be known.

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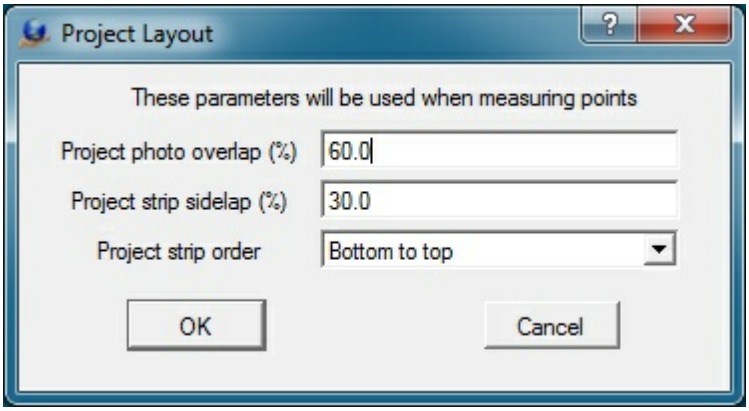

Project Layout dialog box

Project photo overlap (%)
Defines the project photo overlap as a percentage. The typical overlap for aerial phtography is 60%.

Project strip sidelap
Defines the project photo sidelap as a percentage. The typical sidelap for aerial photography is 30%.

Project strip order
Defines project strip numbering order. Options are "Bottom to top", "Top to bottom", and "Strip". "Strip" defines flight lines that are continuous strips without overlap.

Change Drive (ChaDri)

Moves the contents of a VrAirTrig project project to another file. This routine does not move any of the files to another folder, but assumes they have already been moved. The Change Drive routine modifies the necessary VrAirTrig parameter files to reflect the move.



The Change Drive dialog box

There are some limitations on the data that can be moved to another folder:

- All photos must be in the same folder;
- There can only be one camera file.

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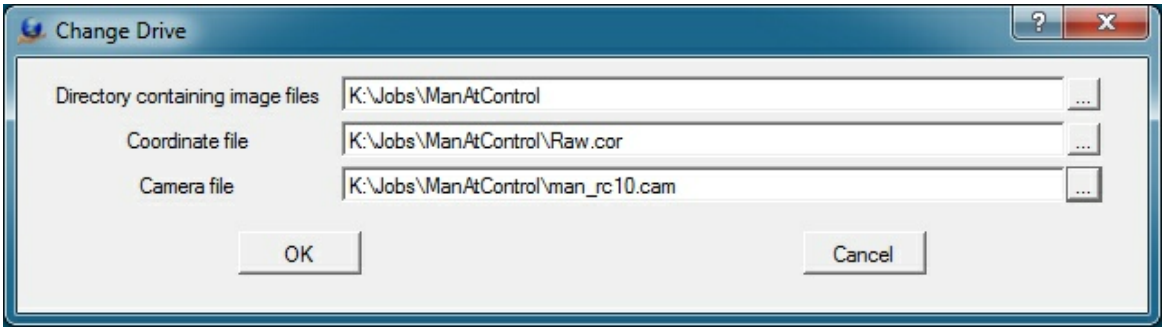
If there is more than one camera file, the camera files must first be reassigned in Edit Project.



The Change Drive dialog box showing the new location for the project files

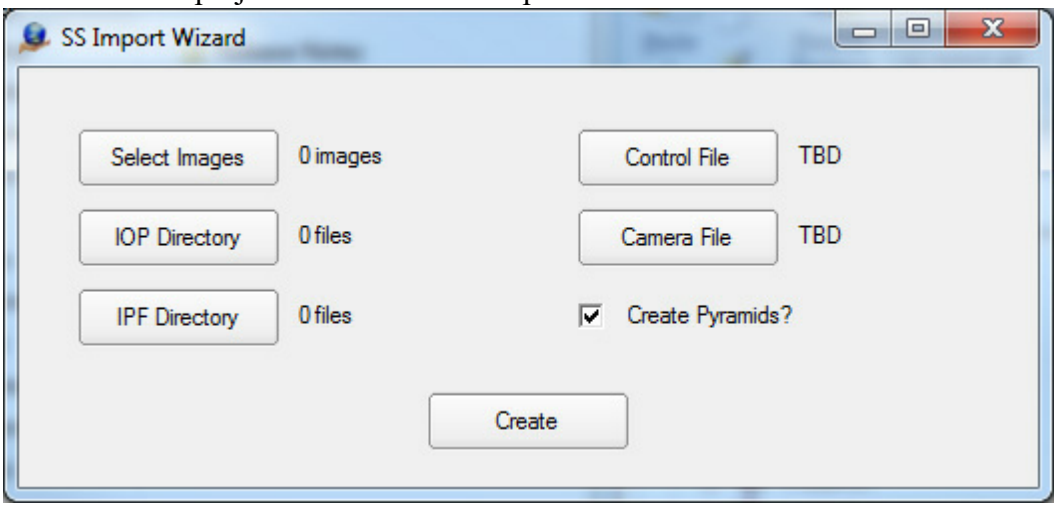
Directory containing image files
Defines the directory that contains all project images.

Coordinate file
Defines the new location of the coordinate (.cor) file.

Camera file
Defines the new location of the camera (.cam) file.

SS Import Wizard (SsImp)

Creates a VrAt project from Socket Set import files.



The camera file must have been created previously, and TIFs, IOPs, and IPFs must reside in a single directories.

Delete Project (DelPro)

This function is currently not active.

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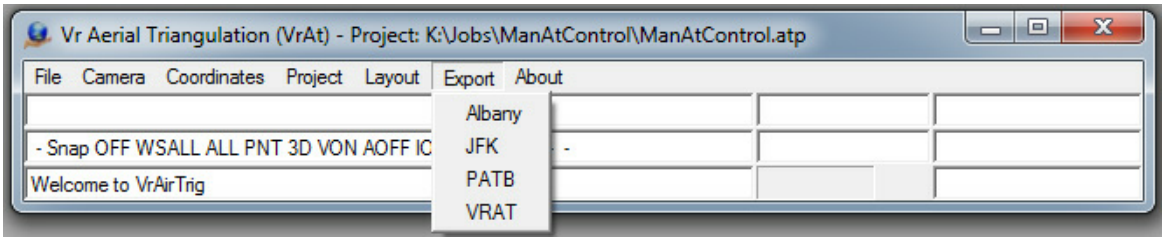
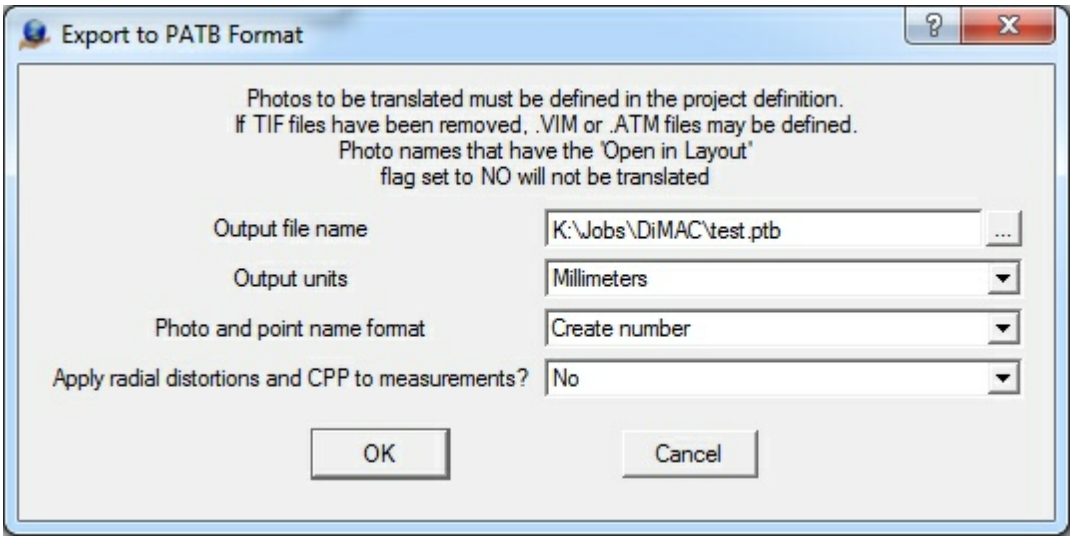
Export



The Export pull-down menu from the VrAirTrig Main Window

Measurements made in VrAirTrig can be exported in several formats, including Albany, JFK, PATB, and VRAT (VrAirTrig). Other aerial triangulation programs can use these measurements to perform the bundle adjustment. The measurements can also be used by the VrTwo Orientation program for model setups.



The Export dialog for output in PATB format

Output file name

Defines the output file name for the measurements.

Output units

Specifies units for the output file (Millimeters or Microns).

Photo and point name format

Determines the output name format. The exported photo and point names may be output in numberic ("Create number") or alphanumeric ("Create name") characters . "Create number"

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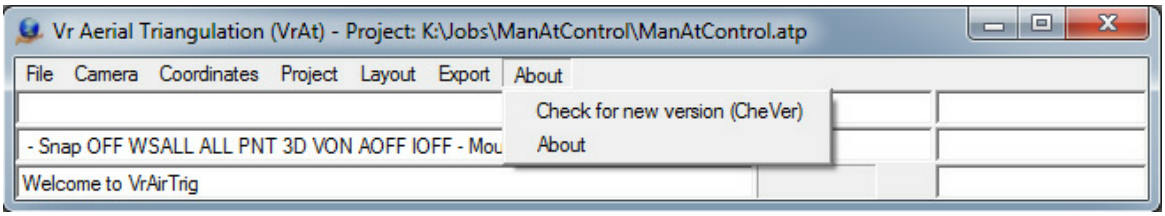
removes any non-numeric characters from the photo and point names during output. "Create name leaves photo and point names unchanged.

Apply radial distortions and PPA to measurements?
Specifies whether radial distortions and principal point offsets should be applied to the measurement output. "No" should be selected if the target triangulation program, to which the file is being exported, will apply these values.

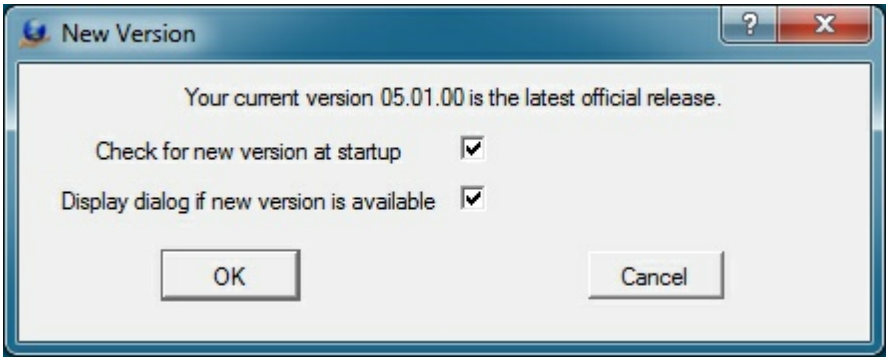
About



The About pull-down menu from the VrAirTrig Main Window

Check For New Version (CheVer)

Checks the Cardinal Systems web page for a more current version of the software.



The Check for a New Version dialog box

Check for new version at startup
Specifies whether to check for a new version on program startup.

Display dialog if new version is available
Specifies whether to display a dialog box if a new version is available.

About (Abo)

Displays the current software version and the software solution platform (32 or 64-bit) for the currently running version.

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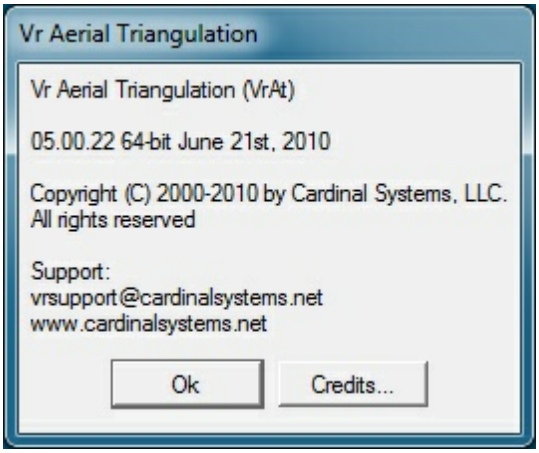

The About dialog box

Credits

Displays the copyrights of the third party software used by Vr Mapping.

Layout Applications

Three measurement environments are available:

- **Model mode (**Measure**)** – Displays two images in a model format. A least-squares best fit is computed once at least six points have been measured. This helps avoid point identification errors. If a point has more than one ray, the point is held on one image. The corresponding image is then adjusted to the held image. Remeasure can be started from Measure. This is useful when a point is not visible from a new strip and must be moved on all images.
- **Remeasure mode (**Remeasure Point**)** – Displays image patches of all images which contain the point. A point may be remeasured using one of the three measurement methods: mono-comparator mode, correlate mode, or measure in stereo.
- **Stereo (**Stereo Measurement**)** - The current point may be measured in stereo.

Measure

Measures points on photos in a Relative Orientation format. Two photos are used at a time. This method measures pass, tie, and control points between overlapping and sidelapping photos. It starts from the Layout environment.

There are three point measurement methods. Any of the three methods can be used at each point. Ground features change from point to point; one point may be on a city street and the next in trees. No one measurement technique will suit every point. The three measurement methods are:

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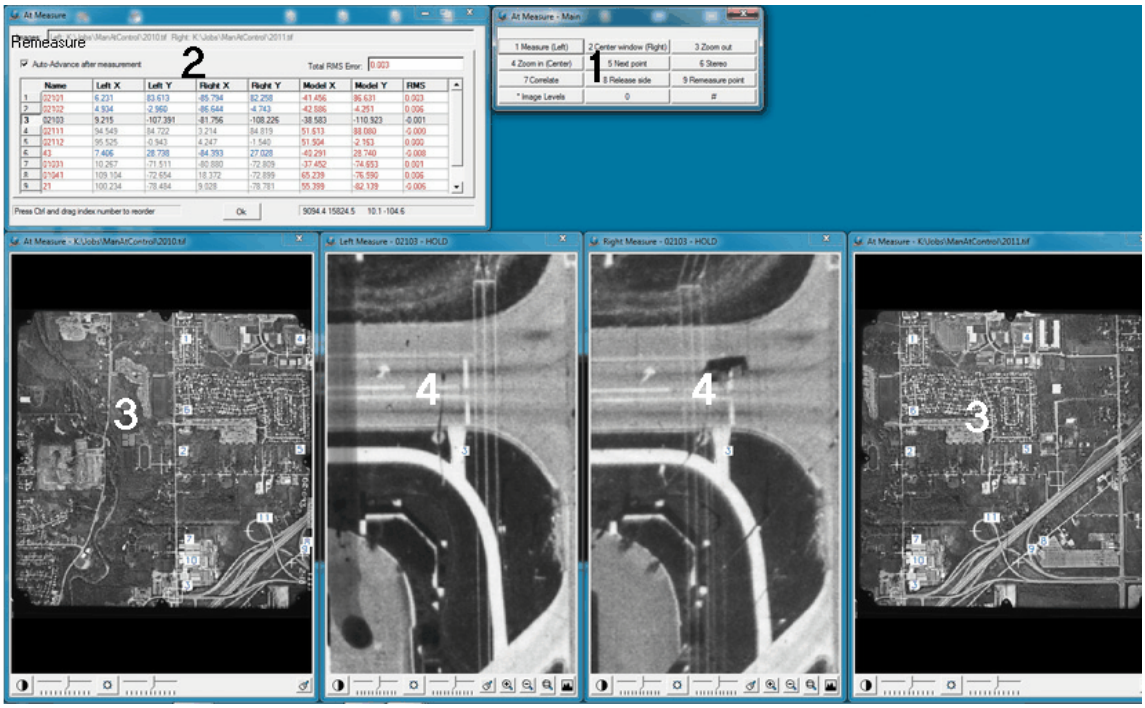
- **Mono-comparator** - A common point is selected in the left photo. The same point is selected in the right photo."Measure" (button 1) is used to measure the point on the left and right photos. The left mouse button should be used to make the measurements.
- **Semi-automatic correlation assist** - The cursor is positioned (do not press any buttons) in one of the measurement windows. Then, "Correlate" (use F7 to avoid moving the cursor) is engaged to find the corresponding location in the other photo. The correlation will display the matching point in the other measurement window. The cursor may be placed in the left or right measurement window. After correlation, the results are displayed in the At Measure dialog box and in the Menu Keys dialog box. A result of 0.9 to 1.0 is good, 0.8 to 0.9 acceptable, 0.7 to 0.8 poor, and anything less than 0.7 unacceptable (correlation should be rejected).
- **Stereo** - Photos are displayed in stereo. The parallax is cleared at the point location. This operation is similar to the method used on analytical stereo-plotters. Features include image correlation, dove prism adjustment (rotation of one photo), and photo scale factor adjustment (changing the scale of one photo). Both photos can be rotated 0, 90, 180 and 270 degrees to better display stereo for point measurement between strips. Pressing "Stereo" (button 6) starts stereo measurement.

Before Measure starts, two photos must be identified. These photos must be overlapping and/or sidelapping.



The VrAirTrig Measurement environment

Measure launches several windows:

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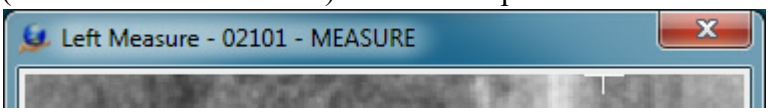
1. Menu Keys Dialog Box - Displays the active menu and the functions associated with it. Buttons in this window may be pressed with the mouse or engaged with their associated function keys (F1-F12). During measurement, several of these buttons are mapped onto the mouse. and in these cases the mouse buttons should be used instead of pressing the buttons in the dialog box. When a button has been mapped to the mouse, the necessary click is indicated with "Left", "Right", or "Center". This allows actions to be taken without moving the cursor during measurement.

2. At Measure Dialog Box - Displays point names, left and right coordinates, model coordinates and residuals for each point, along with the current Total RMS Error. Displays unmeasured points in red. Displays measured points in blue.

3. Overview Windows - Display the entire left and right photos.

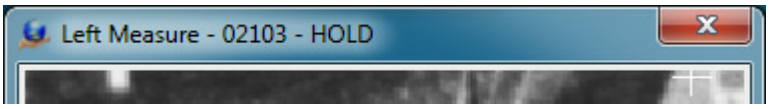
4. Measurement Windows - Used for measurements. Measurements are made by placing the cursor in one of the windows and performing one of the three measurement methods.

Each measurement window's top border contains the photo name and the measurement status ("MEASURE" or "HOLD") of that side's point.



Measurement window indicating the point may be measured

If the status is MEASURE, a point can be measured in that side.



Measurement window indicating the point is held and cannot be measured

If a point in the left or right side has already been measured in two or more other photos (two or more rays), it is flagged "HOLD". A held point may not be measured unless it is released by pressing "Release Side" (button 8). This is a safety feature, ensuring that points that have been measured in two or more photos are not moved when a new photo is observed. To release a side, press F8 while keeping the cursor in the target measurement window. If one side is flagged as HOLD and the other side is flagged as MEASURE, the point in the MEASURE side may be measured to match the point in the HOLD side.

If one side is held and the other side can be measured, the cursor can be in either measurement window when correlation is used. It does not need to be on the point when the "Correlate" button is pressed. The measure side will be correlated to the held side.

To change a point location in all photos, use "Remeasure point" (button 9).

The following are the functions available in "Measure":

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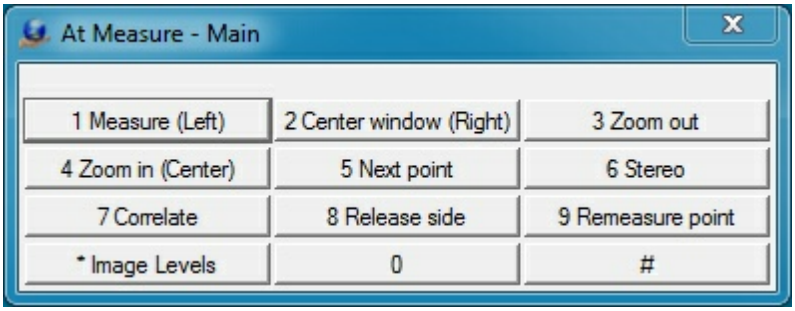

The VrAirTrig Layout Measure Main Menu Keys

1 Measure (Left)
Measures points. Press button 1 in one of the measurement windows to measure a point. The same point is measured in the other window.When in one of the Overview windows, the cross cursor will change to a square. Clicking the left mouse button centers the measurement window to the area under the cursor.

2 Center window (Right)
Centers the current window at the current cursor location.

3 Zoom out
Zooms the current window out x2. If the cursor is in one of the Measurement windows, both Measurement windows are zoomed out.

4 Zoom in (Center)
Zooms the current window in x2. If the cursor is in one of the Measurement windows, both Measurement windows are zoomed in.

5 Next point
Moves to the next point.

6 Stereo
Changes from the left and right measurement method to a stereo method. The two Measurement windows are replaced by a single stereo window for measurement of the current point. See Stereo Measurement for more information.

7 Correlate
The cursor is positioned (do not press any buttons) in one of the measurement windows. Then, "Correlate" (use F7 to avoid moving the cursor) is engaged to find the corresponding location in the other photo. The correlation will display the matching point in the other measurement window. The cursor may be placed in the left or right measurement window. After correlation, the results are displayed in the At Measure dialog box and in the Menu Keys dialog box. A result of 0.9 to 1.0 is good, 0.8 to 0.9 acceptable, 0.7 to 0.8 poor, and anything less than 0.7 unacceptable (correlation should be rejected).

8 Release side
Releases the side in which the cursor is currently positioned. This side can now be remeasured. Useful if a side is being held because it has been measured in two or more photos

9 Remeasure point

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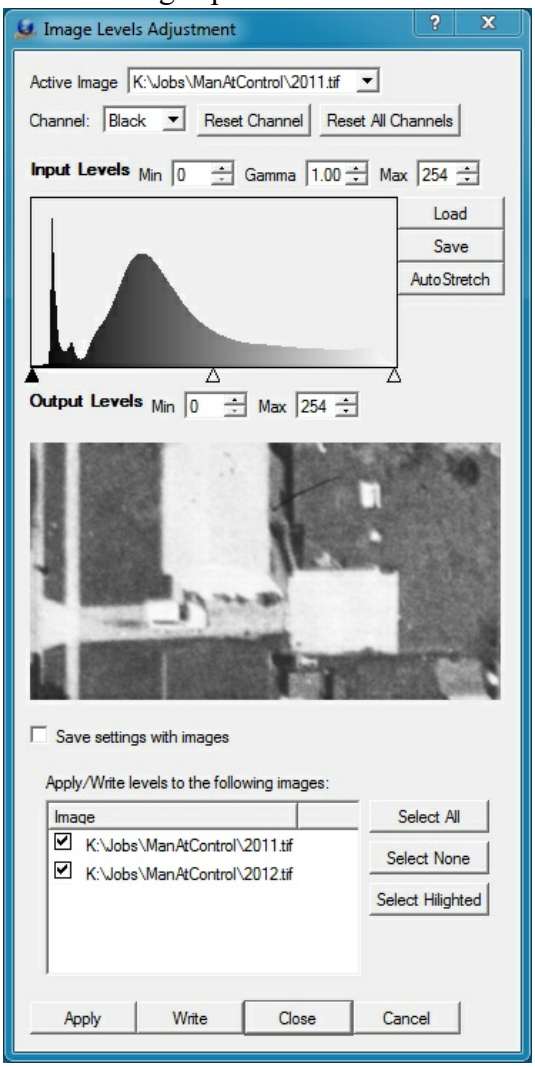
Displays image patches of all images which contain the point. A point may be remeasured using one of the three measurement methods.

*** Image Levels**
Makes level adjustments to opened images. Input, output, and gamma settings can be altered. Level adjustment settings can be saved with each image so that it they are automatically loaded when the image opens.



The Image Levels Adjustment dialog box

Press "Ok" in the At Measure window to exit Measure and return to the previous Layout menu.

Remeasure Point

Displays image patches of all images which contain the point. A point may be remeasured using one of the three measurement methods: mono-comparator mode, correlate mode, or measure in stereo. Point hold flags are ignored; any point can be changed.

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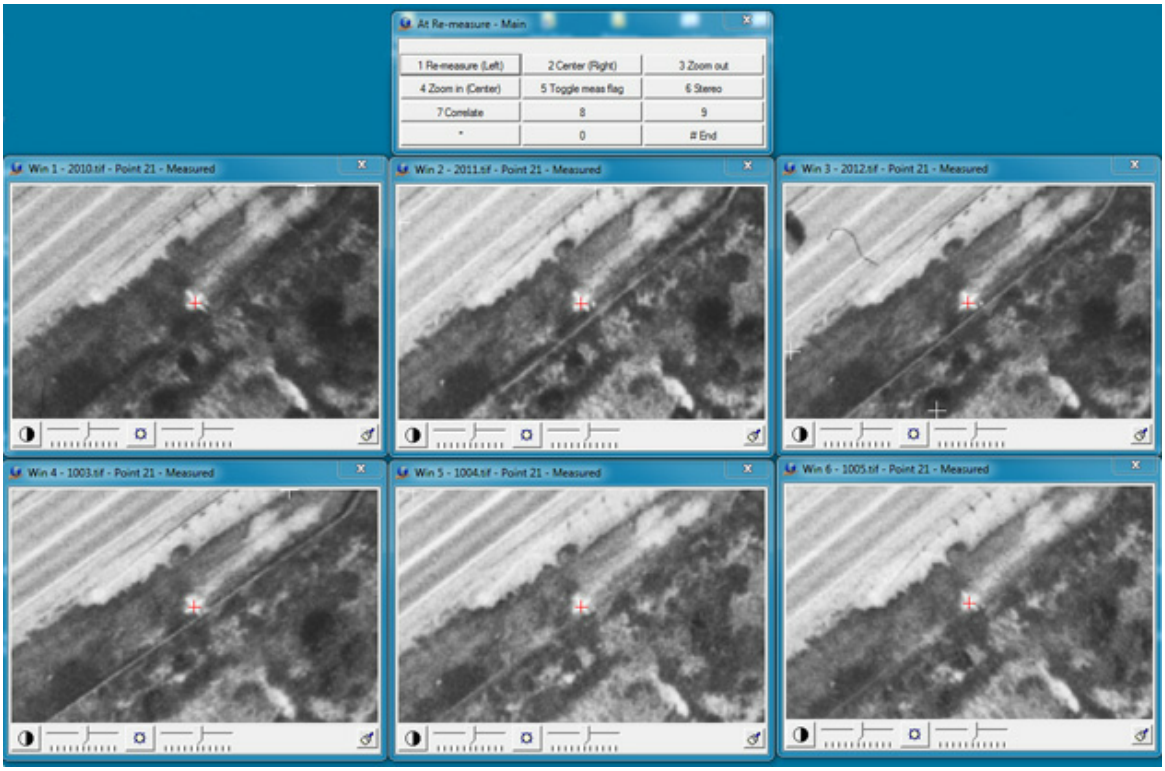

The VrAirTrig Remeasure Point environment



The VrAt Remeasure Point Menu Keys

1 Remeasure (Left)

Remeasures the point at the current cursor location in the image patch.

2 Center (Right)

Centers the current image patch at the cursor location.

3 Zoom out

Zooms out all image patch displays x2.

4 Zoom in (Center)

Zooms in all image patch displays x2.

5 Toggle meas flag

Allows an image patch to be identified for its flag to be toggled between measured and unmeasured. Useful when Remeasure is started using a point that has not yet been measured, as is the case when Drive Point is used in Layout.

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6 Stereo
Allows to image patches to be identified and starts the Stereo Measurement application. See Stereo Measurement for more information.

7 Correlate
Allows a source image patch to be identified and target image patches to be correlated to the base patch.

 # End
Exits Remeasure Point and returns to the previous menu.

Stereo Measurement



The VrAirTrig Stereo Measurement window (Anaglyph)

During the Measure and Remeasure Point applications, a point can be measured in stereo. Once the point is measured, the program returns to the previous environment.

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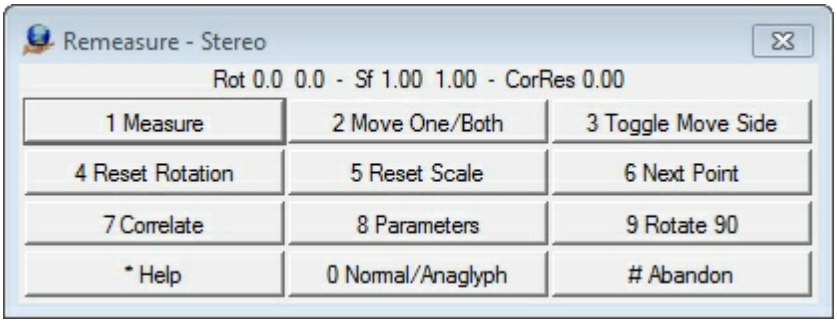

The VrAirTrig Stereo Measure Menu Keys

1 Measure
Measures the point in stereo and records the position on both images.

2 Move One/Both
Toggles the movement of the images from both moving to one moving. When the mode is set to one image moving, parallax can be cleared at that location.

3 Toggle Move Side
Toggles the image side to move between left and right when clearing parallax.

4 Reset Rotation
Resets the current image rotation. See Rotating One Image.

5 Reset Scale
Resets the current image scale to 1.0. See Scaling One Image.

6 Next Point
Advances to the next point

7 Correlate
Correlates the two images with a common point.

8 Parameters
Sets stereo parameters.

9 Rotate 90
Rotates both images 90 degrees. Useful when viewing stereo between strips, as sidelap does not produce viewable stereo in this situation.

*** Help**
Displays help.

0 Normal/Anaglyph
Toggles between standard and anaglyph stereo display modes.

 # Abandon
Quits stereo mode and returns to the previous environment without making a measurement.

Additional Features and Controls When in Stereo Mode

- **Changing the Cursor Color** – Roll the mouse wheel to change between cursor colors of green, red, black, white, yellow or blue.

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- **Changing the Cursor Size** – Press and hold the Alt on the system keyboard and roll the mouse wheel.
- **Rotating One Image** – It is possible to interactively rotate one image by holding the Shift key on the system keyboard and moving the mouse in a positive or negative Y direction. This is useful when there are high rotation angles between the images and such may be the case when viewing images from two strips (flight lines). This adjustment makes stereo viewing more comfortable in these situations. This motion is similar to the "Squint knob" or "Dove prisms" on analytical stereo plotters.
- **Scaling One Image** – It is possible to scale one image by holding the Ctrl key on the system keyboard and moving the mouse in a positive or negative Y direction. This is useful when the scale of the two images is not consistent between the images and such may be the case when viewing images from two strips (flight lines). This adjustment makes stereo viewing more comfortable in these situations. This motion is similar to the independent zoom controls found on many analytical stereo plotters.
- **Zoom Up** – Also known as Zoom Out. Press Page Up on the system keyboard
- **Zoom Down** – Also known as Zoom In. Press Page Down on the system keyboard.
- **Center Images** – Press the Home key on the system keyboard to center both images at the current cursor location.
- **Load More Image** – Two image patches are used to display stereo. If the cursor moves large X and/or Y distances, the edges of the current image patches can be reached. Press the Home key to load more image data around the current cursor location.
- **Disengage Cursor** – It may be necessary to disengage the stereo cursor in order to perform an operation with the system mouse pointer like resizing a window. Press the Insert key to disengage the stereo cursor. Press the Insert key again to re-engage the stereo cursor.

Reference

Vr Mapping Coordinate File Format

The Vr Mapping coordinate file (.cor) comprises a header and a list of point names, coordinates, and optional weights. Fields may be arranged in several different orders. The file is an ASCII file and may be viewed with any text editor. Documentation about the file format is included in each file header. The following is a typical Vr Mapping coordinate file.

```
# Coordinate File
# Layout  - Field Order              Min number of fields
#  0        NAME X Y Z CX CY CZ                3
#  1        NAME Y X Z CY CX CZ                3
#  2        X Y Z NAME CX CY CZ                4
#  3        Y X Z NAME CY CX CZ                4
#  4        NAME X Y Z                         3
```

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```
#  5        NAME Y X Z                          3
#  6        X Y Z NAME                          4
#  7        Y X Z NAME                          4
#  8        X Y NAME                            3
#  9        Y X NAME                            3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
# Datum   - Datum
# 0         NAD1927
# 1         NAD1983
#
# UtmZone - UTM Zone
# 1-60      UTM zone number
#
# Units   - Coordinate units
#  0        Us Foot
#  1        International Foot
#  2        Meters
#  3        Inches
#  4        Pixels
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
       201   837831.194130   951352.037020   303.8200
       202   836399.079330   951266.642540   337.6800
       203   837994.618340   950634.951710   299.6000
       204   836711.670600   950565.198920   326.3200
       205   836018.411470   950724.804370   309.2900
```

Any record starting with a # symbol is considered a comment. The Layout is the most important keyword in the file as it specifies the order of the fields.

Importing a File to Use as a Vr Mapping Coordinate (.cor) File

Any ASCII file in the following format may be read by Vr Mapping. The file must have a .cor file name extension and the fields must be separated by one or more blanks or tabs. Following is an example of an ASCII file that would be acceptable to reading by Vr Mapping. This file consists of a point name followed by X Y and Z.

```
        35  1410993.867000   667652.883000   268.0300
```

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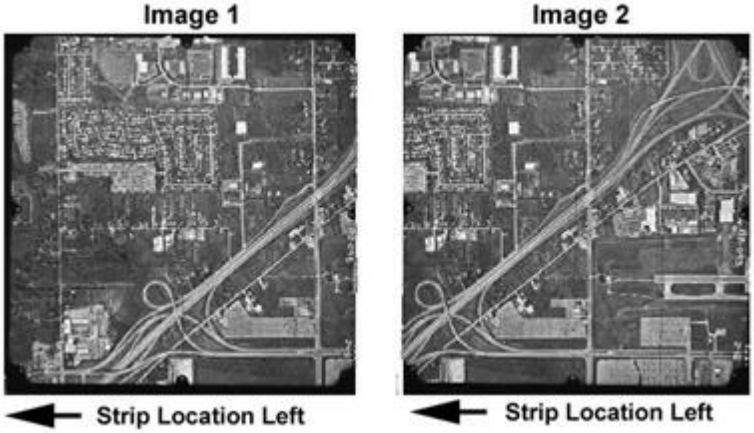
36	1421351.907000	670064.772000	251.8240
37	1432756.960000	660002.435000	438.6740
38	1426080.595000	651648.623000	417.5070
39	1437426.118000	648649.673000	256.5350
99999	1440539.957000	647417.838000	241.1880
2727011	1410534.575000	658885.235000	294.5090
2727012	1412335.275000	659061.598000	280.9620
2727021	1410279.378000	661225.872000	260.6650
2727022	1412458.095000	661055.148000	284.6200
2727023	1413884.366000	661259.361000	425.0660
2727031	1410433.453000	663554.024000	267.3830
2727032	1412556.566000	663154.921000	244.1890
2727033	1414464.428000	663015.598000	460.9970

Film Strip Location

Location of the cameras data strip in reference to the rotation of the image. This parameter is not dependent on the direction of flight, but rather the orientation of the image as seen by the user. The following is an example of strip locations.

The data strip is to the left.



This is the same model as above, but with the images rotated 180 degrees. The strip location is now to the right.

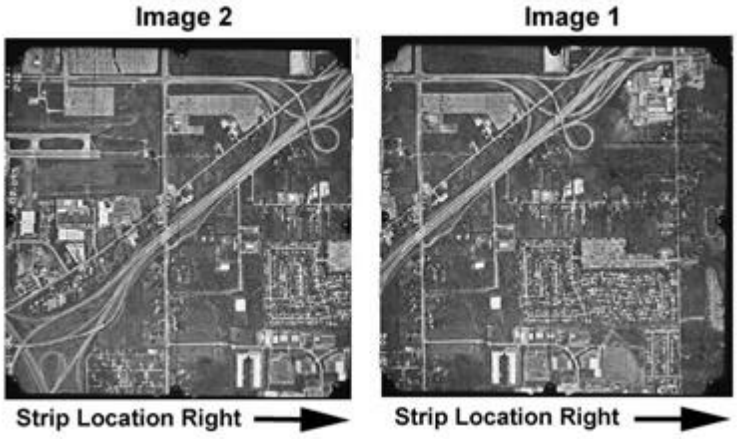


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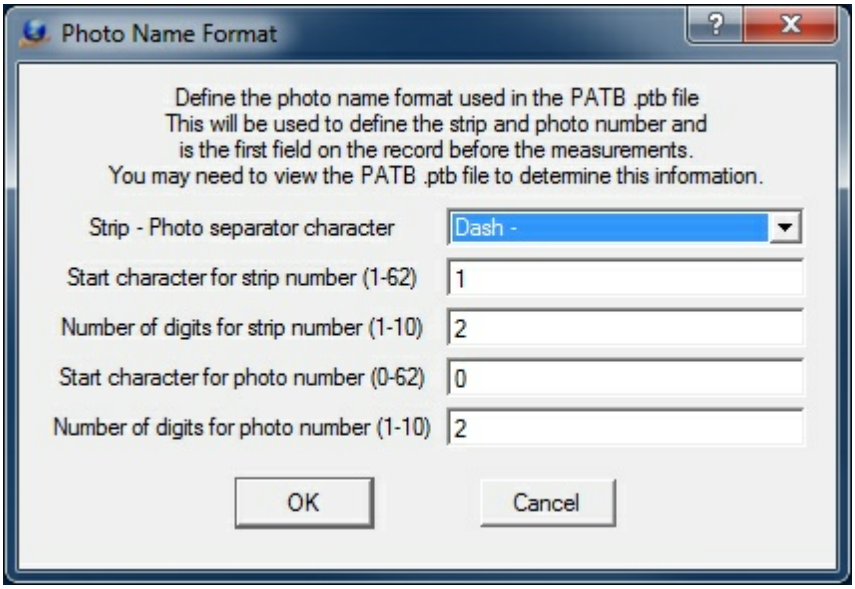
Photo Name Format

Various processes, such as aerial triangulation and model orientation, require use of an image strip and photo number. These numbers are typically encoded in the image file name and the Photo Name Format describes the method for extracting this information.



The parameters describe the Photo Name Format. If the separator character is used to describe the format, the remainder of the parameters are not needed and can be ignored. If the file name does not have a separator character, the start character and number of characters must be used.

The photo separator character may be Underbar '_', Dash '-', or Tilde (~). Following are several examples of the Photo Name Format:

```
Photo name:                         23-56.tif
Photo separator character:          Dash
Start character for strip number:   any
Number of digits for strip number:  any
Start character for photo number:   any
Number of digits for photo number:  any
Strip number:                       23
Photo number:                       56

Photo file name:                    23056.tif
Photo separator character:          None
Start character for strip number:   1
Number of digits for strip number:  2
Start character for photo number:   3
Number of digits for photo number:  3
Strip number:                       23
Photo number:                       56
```

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```
Photo file name:                  23056.tif
Photo separator character:        None
Start character for strip number: 1
Number of digits for strip number: 3
Start character for photo number: 4
Number of digits for photo number: 2
Strip number:                     230
Photo number                      56
```

Point Name Format

When photo strips are prepared with pass points, the Point Name Format determines the format for the point names and the initial position for these points. The number of pass points per photo can be set (maximum 9).

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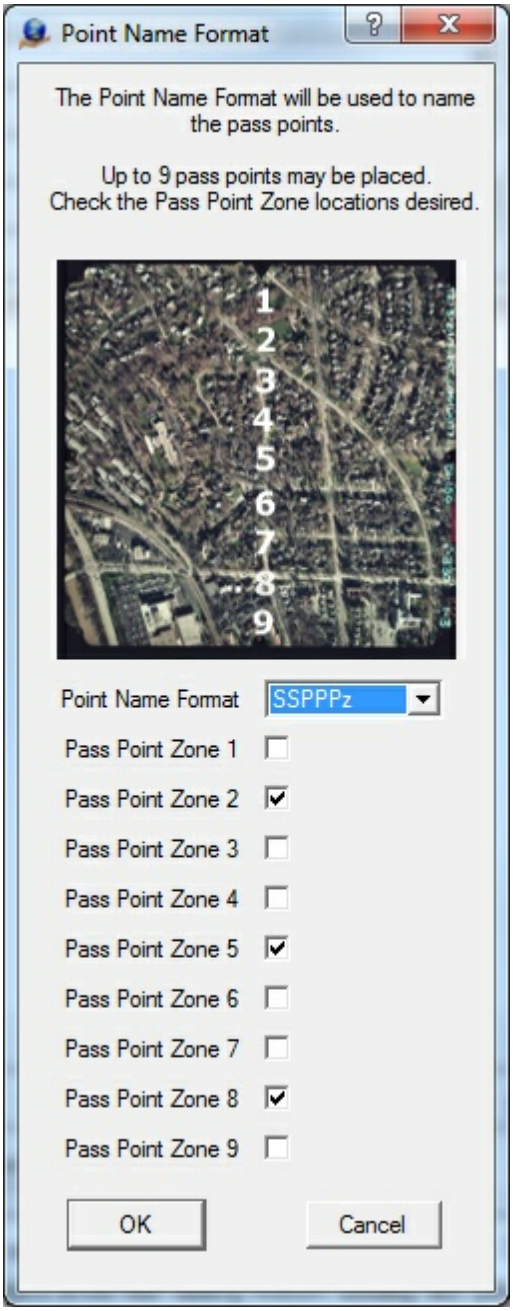

The Point Name Format dialog box

Point Name Format

Defines the format for the point names when preparing a strip of photos. The following are the options for this format and examples of each:

Format	Example: Strip Number:2 Photo Number:5 Zone:3
S_Pz	2_53
S-Pz	2-53
SPz	253
SPPz	2053

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```
SSPPz          02053
SPPPz          20053
SSPPPz         020053
SSSPPPz        0020053
```

Pass Point Zone
Up to nine pass points may be placed on each photo. The locations of these points are called zones and the number of pass points and the zone locations may be selected by using the check boxes next to each zone.

Auto Tie FAQs / Custom Workflows

How do we densify a block of measurements? Some users want to use AutoTie only after they have minimally tied a block of images manually. The Auto Densify (AutDen) was written for them. It does not look for any new overlaps, but adds more data to those that are already known. That is if imageA and imageB already have some ties between them then it will attempt to add more. If EO's have been imported (see ImpGps) this process will also extend matches into new images.

What is the best way to thin data? Least Squares match (LsMat). The LsMat command can be used to thin data, refine data, and push measurements through to more images (if EO's have been imported).

How do we deal with EO's in one coordinate system and control in another? Auto Tie is designed to work in any rectangular coordinate system. So the approach taken is to do the auto tie in one system and then switch to the other.

1. Use the EO's to help generate the auto ties normally.
2. Bundle adjust and clean the auto ties normally as well.
3. Then clear the EO's (see CleEos) so that there won't be used in the bundle adjustment.
4. Measure at least three ground control points
5. Run the black box bundle adjustment command, BunAdj.
6. Use drive control (from the layout points menu) to measure the rest of the control

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What is the fastest/best way to run a strip job? This answer depends, but the short version is: Just like any other block. If you have EO's then use the work flow given EO's. If you don't you must follow the workflow without EO's, which requires the user to provide some ties between the strips.

In the special case of single strip job the SemTie work flow is frequently the fastest whether you have EOs or not. This is counterintuitive, but to run SemTie does not require EO's to be imported or even a correct camera file. Further on a single strip no manual measures are required. Hence, as soon as strip and photo numbers can be assigned it can run- users can worry about importing EO's, setting up cameras, etc. later if at all. Users with small jobs really appreciate this simplicity.

Can blocks be run in sections? Yes, the Auto Tie Parameter 'Min Auto Tie Sequence number' allows user to start auto tie numbering arbitrarily and avoid duplicate point names in sub-blocks. For example: In a 30 strip job, strips 1-11 could be run with a 'Min Auto Tie Sequence number' of 0, strips 11-21 with a 'Min Auto Tie Sequence number' of 1000000, and strips 21-30 with a 'Min Auto Tie Sequence number' of 2000000 (If there might be more than a million auto ties in a sub-block use additional zeros). Care must be taken that the ATM files of the separate runs do not overwrite each other. The surest way to do this is to set up different projects (IN DIFFERENT DIRECTORIES) that reference the sub sets of images, but it can also be accomplished with the BacAtm command. The ATM files can then even be combined for a final bundle.

How do we get more multi-ray (cross-strip) points? The best way to do this is to get lots of along strip matches and good EO's then use LsMat to push the along strip matches through to the other images. The best way to go about doing it depends on what data is already available. For instance:

- If there are no EO's then the SemTie (no EO) workflow can be followed to get along strip matches and EO's.
- If EO's are available, but not reliable, FasTie or AutoTie may not work (this usually only happens if EO's are grossly in error). In this case it is possible to fall back to the SemTie workflow or simply put in enough manual points to get the EO's reasonable, bundle, import the ExtOri report as new GPS values, and return to following the EO workflow.
- If EO's are good, but points are sparse it may be sufficient to run a densification (AutDen)

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- If EO's are good and points are sufficient dense simply run LsMat.

In all of these examples the LS match max axial sigma parameter needs to be set well. If it is too small it there will be too few matches. A range of (0.05-0.25) usually works well.

How do we know if the points are good? Statistics and residuals are great tools (as in bundle residual reports), but in addition I highly recommend that users look at a sample of the points. Choose cross strip points scattered around the project to get a feel for their quality. In particular watch for systematic errors (features match within strips but not across them). Running a free net is also a good idea. It can be slow, but it will also reveal any problems in the block more reliably than a bundle. A few strategically added manual points can also help gauge the quality of a block- if the bundle wants to flag the manual points as blunders there may be an issue with the auto ties. In short, be conscientious, particularly in forests and jungles. If a block would be hard for a human it will be hard for a computer.

2.5.2 Project Setup

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Vr Mapping

The Project Setup Wizard

Type: Utility within VR AT for project setup.

This utility walks users through setting up a project and verifying that input data is correct prior to starting AT. It is a windows wizard style interface and as such is largely self documenting. The instructions here are given for completeness and reference. Fore ease of use and consistency the style of the interface is very similar in VR AT, VR Model Set and VR Ortho/Mosaic.

The Wizard is accessed through the command ribbon (see image below) or by the command ProWiz.

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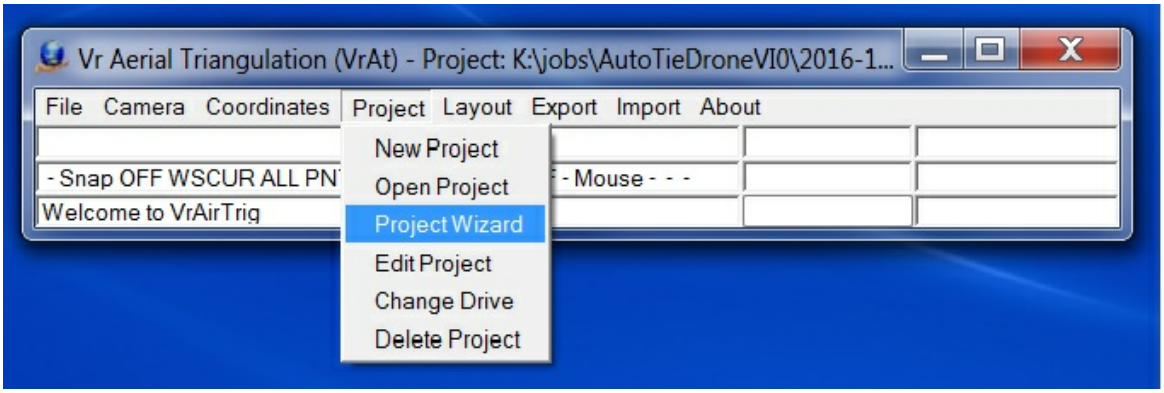

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Tab2: Orientation and Control
    Control Files
    Importing Interior Orientations
    Importing Exteriors Orientations
    Double-click of Control Points Field
Tab3: Strip and Photo Numbers
Tab4: Save and Exit

Tab 1: Cameras and Photos

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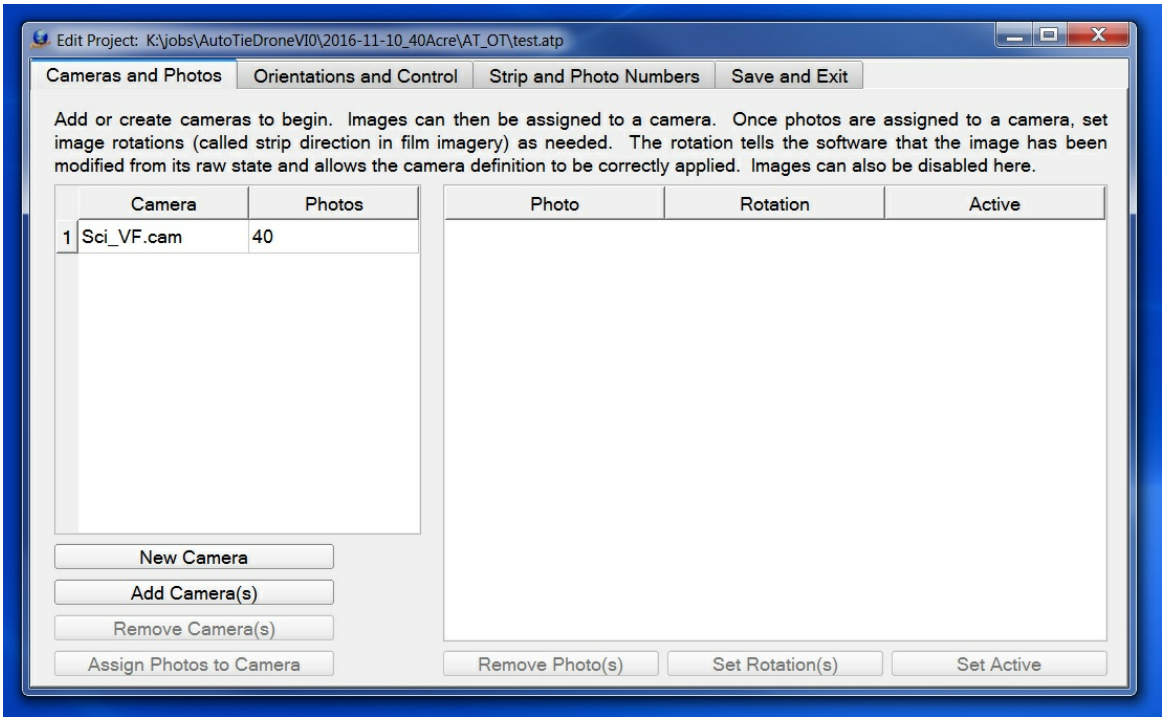

The first tab is for organizing your cameras and photos. Cameras must be defined first because images are required to be assigned to a specific camera. The 'New Camera' and 'Add Camera (s)' button accomplish this. Both use the camera edit utility. Once a camera is in the project double clicking on it's name will open in the camera edit utility.

To add images to project click on the name of camera the images will be assigned to in the left table. When a single camera is selected the 'Assign Photos to Camera' button on the bottom left becomes active. Click this button and navigate to choose the images. The names of images assigned to selected cameras are displayed in the right table. The number of photos assigned to each camera is listed next to the camera name in the left table.

Select groups of images to 'Remove Photo(s)', 'Set Rotations', and/or 'Set Active' using the buttons below the right table. If there are no images selected then these buttons will be disabled.

'Remove Photo(s)' removes them from the project but does not delete or otherwise modify the files.

Users are advised to avoid having to set rotations. It is only necessary to set rotations if the images have been saved rotated on the disk. If they have then VR needs to know so that principal point offsets and distortion parameters can be correctly applied. However, this is a road that usually leads to confusion. It much less confusing to rotate how images are displayed rather than save them rotated and try to get the rotations set correctly.

Setting and image inactive is functionally similar to removing it from the project, but may be easier for project management.

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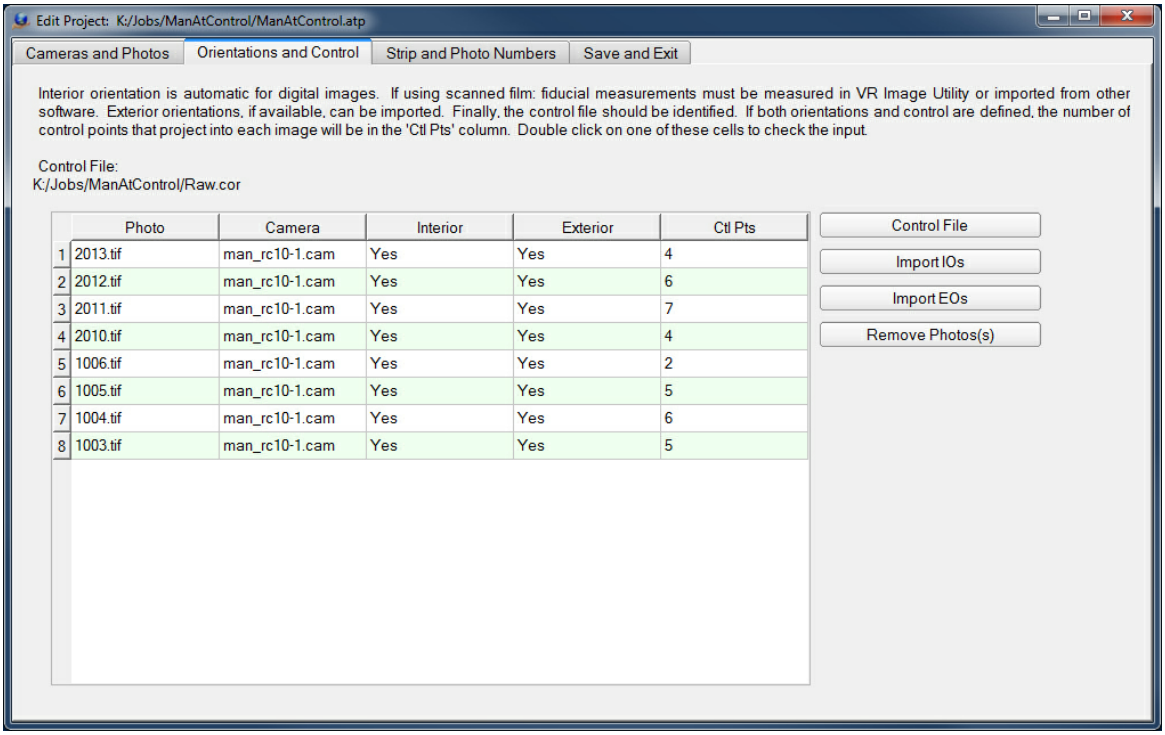
Tab 2: Orientations and Control



Control Files

On the 'Orientations and Control' tab of the project wizard the 'Control File' button is used to select ground control file. The control file can be file formatted as follows:

```
PtName1 X Y Z
PtName2 X Y Z
PtName3 X Y Z
...
```

VR adds some default header information when it saves the file.
File Example:

```
# Coordinate File
# Layout  - Field Order              Min number of fields
#   0         NAME X Y Z CX CY CZ                 3
#   1         NAME Y X Z CY CX CZ                 3
#   2         X Y Z NAME CX CY CZ                 4
#   3         Y X Z NAME CY CX CZ                 4
#   4         NAME X Y Z                          3
#   5         NAME Y X Z                          3
#   6         X Y Z NAME                          4
```

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```
#  7         Y X Z NAME                              4
#  8         X Y NAME                                3
#  9         Y X NAME                                3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
# Datum   - Datum
# 0         NAD1927
# 1         NAD1983
#
# UtmZone - UTM Zone
# 1-60      Utm zone number
#
# Units   - Coordinate units
#  0        Us Foot
#  1        International Foot
#  2        Meters
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
          5  1862600.861000   724626.555000   807.1600
         14  1862956.537000   726104.024000   810.4900
         27  1862097.709000   729995.080000   793.1600
         29  1865529.981000   731805.394000   808.5700
         30  1861813.412000   731226.056000   794.1000
        103  1875804.906000   722601.108000   894.5390
        104  1876434.487000   726668.853000   899.2450
        107  1868807.915000   727037.911000   797.9120
        110  1873497.612000   726632.340000   912.9600
        227  1863885.554000   727376.236000   810.9500
        528  1864669.954000   723806.413000   816.2600
```

Importing Interior Orientations

Interior orientations are automatic for digital images.

For scanned film images the interior orientations can be imported using the 'Import IO' button. See Import, Interior Orientations for more information.

Importing Exterior Orientations

Exterior Orientations can be imported using the 'Import EOs' button. Many formats are

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supported. See Import, Exterior Orientations for more information. At present only importing EO files is supported.

Double-click of Control Points Field

If the number of Control Points is greater than zero, the number of control points field may be double clicked to view photo thumbnails of a control point area. If the number of control points is greater than one a dialog will allow the selection of the control point to view.



Photo thumbnails displaying the area around a control point

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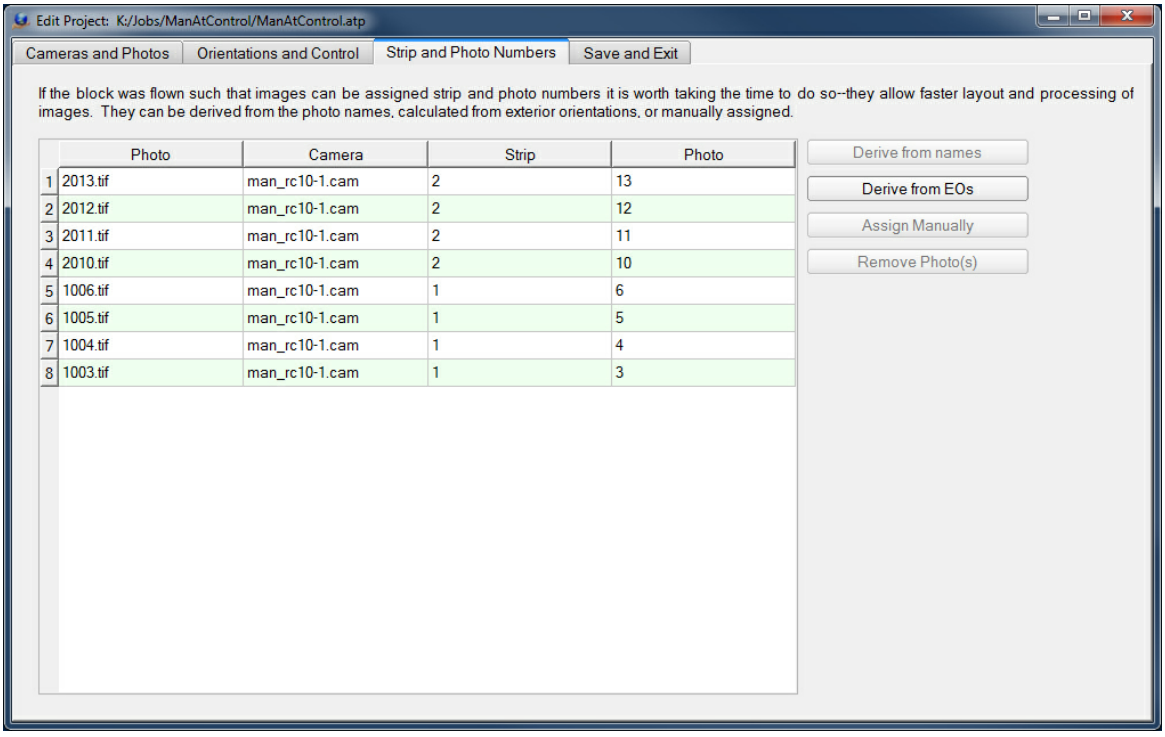
Tab 3: Strip and Photo Numbers



Strip and Photo Numbers

Photo strip and photo numbers make job organization and management easier. The Strip and Photo Numbers tab allows the assignment of strip and photo numbers to photos. Although this

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capability exists for the convenience of project organization, it may be needed for importing some exterior orientation formats such as Aerosys, Albany, ISAT and JFK. Strip and photo numbers allow models to be named in a meaningful way that communicates the individual model's relation to the whole project.

For most jobs strip and photo, numbers can be calculated automatically based on the image EOs. If there are no EOs or it is necessary to match the strip and photo numbers in and EO file the strip and photo numbers can be overwritten manually or derived from the photo names.

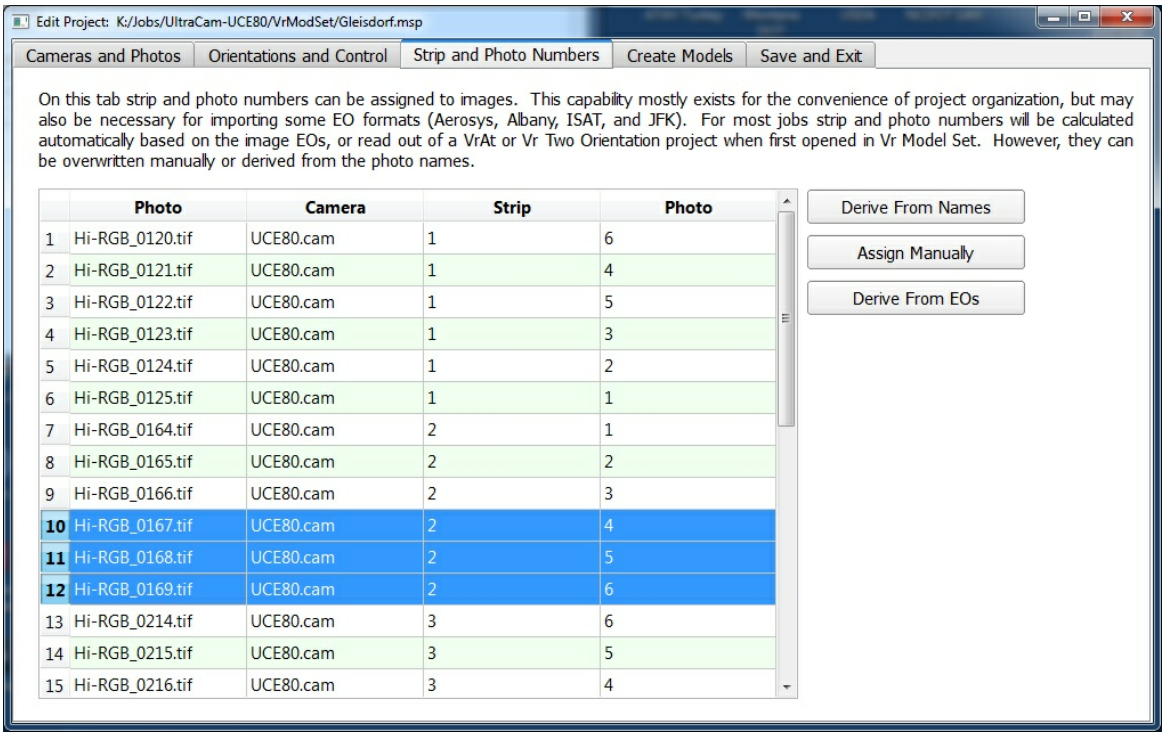

	Photo	Camera	Strip	Photo
1	Hi-RGB_0120.tif	UCE80.cam	1	6
2	Hi-RGB_0121.tif	UCE80.cam	1	4
3	Hi-RGB_0122.tif	UCE80.cam	1	5
4	Hi-RGB_0123.tif	UCE80.cam	1	3
5	Hi-RGB_0124.tif	UCE80.cam	1	2
6	Hi-RGB_0125.tif	UCE80.cam	1	1
7	Hi-RGB_0164.tif	UCE80.cam	2	1
8	Hi-RGB_0165.tif	UCE80.cam	2	2
9	Hi-RGB_0166.tif	UCE80.cam	2	3
10	Hi-RGB_0167.tif	UCE80.cam	2	4
11	Hi-RGB_0168.tif	UCE80.cam	2	5
12	Hi-RGB_0169.tif	UCE80.cam	2	6
13	Hi-RGB_0214.tif	UCE80.cam	3	6
14	Hi-RGB_0215.tif	UCE80.cam	3	5
15	Hi-RGB_0216.tif	UCE80.cam	3	4

The Strip and Photo Numbers tab in the Edit Project dialog

Derive from Names

Obtains the strip and photo numbers based on the photo files names. A photo or group of photos may be highlighted and pressing the "Derive from Names" button will display the following dialog.

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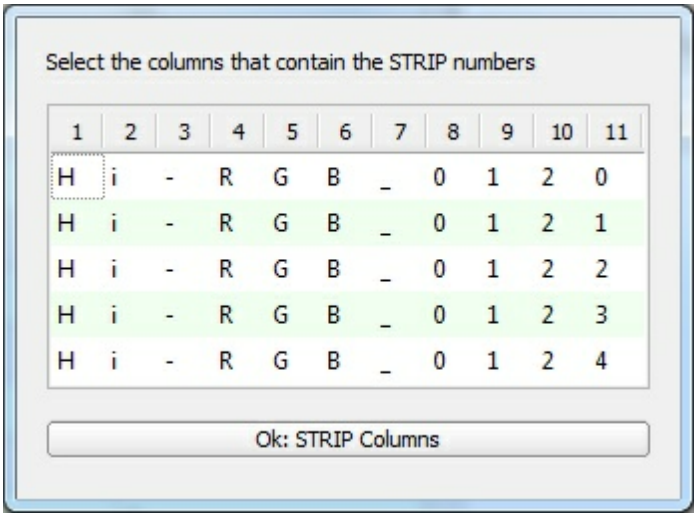

Select strip and photo number columns

In the above example the first five photo names are displayed (Hi-RGB_1020.tif). The columns that make up the strip number can be highlighted then the Ok button can be pressed. The columns that make up the photo number can then be highlighted and the Ok button can be pressed. For example, if columns 8 and 9 were selected and the strip number and columns 10 and 11 were selected as the photo number then photo Hi-RGB_1020.tif would be assigned a strip number of 10 and a photo number of 20.

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Tab 4: Save and Exit

Clicking on this tab saves the project and exits the wizard. Alt-s can be used to save the project at any time.

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2.5.3 Auto Tie

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Automatic Tie Pointing

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Introduction and Work Flow

The workflows below are largely the same. Their performance is, in large part, determined by the input data. The project wizard is designed to help make this happen. The "Orientations and Control" tab's control thumb nail viewing is an excellent to check imported EO and control data.

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If EO data has been imported, it is wise to measure control before running auto tie. The AT layout can be used to visually confirm strip and photo numbers. In short, it is critical to get the inputs correct before running auto tie. It is frequently better to leave data out than use poor or erroneous data.

With EOs

1. Setup the project using the wizard. Be sure the EOs are imported correctly and strip and photo numbers are assigned correctly.
2. Measure the ground control using the drive control utility in the layout points menu
3. Run auto tie from the drop down menu, the layout 'adjust' menu, or key in "AutTie" or "FasTie".
4. Bundle Adjust and clean auto ties as needed.

With Image Positions

1. Setup the project using the wizard. Be sure the image positions are imported correctly.
2. Run auto tie from the drop down menu, the layout 'adjust' menu, or key in "AutTie" or "XyzTie".
3. Bundle Adjust to complete the EO solutions
4. Measure the ground control using the drive control utility in the layout points menu
5. Bundle Adjust and clean auto ties as needed.

With Strip and Photo Numbers

1. Setup the project using the wizard. Be sure the image strip and photo numbers are assigned correctly.
2. Use auto patch ties or manual ties (from the layout 'Add Points' menu) to tie strips together. A few well tied images at each each of the strip is sufficient.
3. Run auto tie from the drop down menu, the layout 'adjust' menu, or key in "AutTie" or "SemTie".
4. Measure at least three ground control using the drive control utility in the layout points menu
5. Bundle Adjust and clean auto ties as needed.

Oblique Images

5. Setup the project using the wizard. Be sure the EOs are imported correctly.
6. Measure the ground control using the drive control utility in the layout points menu
7. Run auto tie from the drop down menu, the layout 'adjust' menu, or key in "AutTie" or "FasTie".

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8. Bundle Adjust and clean auto ties as needed.

With Nothing

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Input Data

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FAQ

How do we densify a block of measurements?

Some users want to use AutoTie only after they have minimally tied a block of images manually. The Auto Densify (AutDen) was written for them. It does not look for any new overlaps, but adds more data to those that are already known. That is if imageA and imageB already have some ties between them then it will attempt to add more. If EO's have been imported (see ImpGps) this process will also extend matches into new images.

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What is the best way to thin data?

Least Squares match (LsMat). The LsMat command can be used to thin data, refine data, and push measurements through to more images (if EO's have been imported).

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How do we deal with EO's in one coordinate system and control in another?

Auto tie is designed to work in any rectangular coordinate system. So the approach taken is to do the auto tie in one system and then switch to the other.

1. Use the EOs to help generate the auto ties normally.

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2. Bundle adjust and clean the auto ties normally as well.
3. Then clear the EO's (see CleEos) so that there won't be used in the bundle adjustment.
4. Measure at least three ground control points
5. Run the bundle.
6. Use drive control (from the layout points menu) to measure the rest of the control

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What is the fastest/best way to run a strip job?

This answer depends, but the short version is: Just like any other block. If you have EOs then use the work flow given EOs. If you don't you must follow the work flow without EOs, which requires the user to provide some ties between the strips.

In the special case of single strip job the SemTie work flow is frequently the fastest whether you have EOs or not. This is counterintuitive, but to run SemTie does not require EOs to be imported or even a correct camera file. Further on a single strip no manual measures are required. Hence, as soon as strip and photo numbers can be assigned it can run- users can worry about importing EOs, setting up cameras, etc. later if at all.

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Can blocks be run in sections?

Yes, the Auto Tie Parameter 'Min Auto Tie Sequence number' allows user to start auto tie numbering arbitrarily and avoid duplicate point names in sub-blocks. For example: In a 30 strip job, strips 1-11 could be run with a 'Min Auto Tie Sequence number' of 0, strips 11-21 with a 'Min Auto Tie Sequence number' of 1000000, and strips 21-30 with a 'Min Auto Tie Sequence number' of 2000000 (If there might be more than a million auto ties in a sub-block use additional zeros). Care must be taken that the ATM files of the separate runs do not overwrite each other. The surest way to do this is to set up different projects (IN DIFFERENT DIRECTORIES) that reference the sub sets of images, but it can also be accomplished with the BacAtm command. The ATM files can then even be combined for a final bundle.

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How do we get more multi-ray (cross-strip) points?

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The best way to do this is to get lots of along strip matches and reasonable EO's then use LsMat to push the along strip matches through to the other images. The best procedure depends on what data is already available. For instance:

- If there are no EOs follow the SemTie workflow.
- If EO's are available, but not reliable, FasTie may not work (this usually only happens if EOs are grossly in error). In this case it is possible to fall back to the SemTie workflow or put in enough manual points and patch ties to correct the EOs.
- If EO's are good, but points are sparse it may be sufficient to run a densification (AutDen)
- If EO's are good and points are dense simply run LsMat.

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How do we know if the points are good?

Statistics and residuals are great tools (as in bundle residual reports), but in addition looking at a sample of the points and checking their distribution is highly recommended. When reviewing points, choose cross strip points scattered around the project to get a feel for their quality. Running a free net is also a good idea. It will also reveal any problems in the block more reliably than a bundle. A few strategically added manual points can also help gauge the quality of a block- if the bundle wants to flag the manual points as blunders there may be an issue with the auto ties. In short, be conscientious, particularly when dealing with forests and jungles. If a block would be hard for a human it will be hard for a computer.

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Auto Tie Commands

Each of the automatic tie point measurement methods is built primarily on feature matching technology similar to the now famous "Scale Invariant Feature Transform" or SIFT. Winnowing of measurements is done using RANSAC type robust analysis. Feature matches are optionally refined (and further winnowed) using an optimized version of Gruen's adaptive least squares matcher. There is also some limited use of normalized cross correlation when doing point propagation.

The various commands below are designed to function with different amounts of input data. ' AutTie' is the general command that will automatically pick a method based on the available data.

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The parameters in the table below are all of those that are used in the various methods. Every method does no use every parameter.

Parameter	Default	Range	Description
Maximum points per image	295	20-1000	Maximum number of points to add to each image.
Maximum threads to use	Max	0-Max	The maximum number of threads that AutoTie will be allowed to use. The higher the max threads the faster it will process, but using the maximum may leave your computer nearly unusable for anything else while it processes.
Edge Buffer	0%	0-25%	Percent of image border to exclude from automatic tie pointing.
Least squares match?	Yes	Yes or No	Least squares matching can be used to further refine feature matching. It does, however, take time and tends to winnow out measures in areas with large perspective effects (i.e. trees, building edges, etc.).
Least squares match template size	21	7-301	The size of the patch used for LS matching. Larger patches (61-101 pixels) sometimes work better in trees. Smaller patch sizes (15-25 pixels) tend to work better for oblique images and man-made environments.
Minimum auto tie sequence number	0	0-1,000,000,000	Auto tie numbering will start at an index not less than this parameter.
Resume previous auto tie	No	Yes or No	Some auto methods create log files and have a restart capability. Selecting 'Yes' will cause the program to continue where it left off. This is useful in case of a power outage or other interruption.

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Automatic Tie Points (AutTie)

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Auto tie is the general command that will automatically run the most powerful method it can based on the available data. This behavior can be manually overridden by keying in the command for a specific auto tie method (e.g. BruTie, FasTie, SemTie, OblTie or XyzTie). This command can be executed from the drop down menu or by using the key in "AutTie". Thus, for many data sets it is never necessary to open layout.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

See the auto tie parameter list here.

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Auto Tie Given Image Positions (XyzTie)

XyzTie is specialized for tying nadir looking images with measured positions. The "AutTie" command (from the drop down menu or the key in) will also execute this command if the images all have measured positions by do not all have measured orientations.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

See the auto tie parameter list here.

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Automatic Tie Point Densification (AutDen)

When executed from the key in (AutDen) or from the layout Adjust menu auto densify attempts to automatically densify tie points among all the images open in layout. It is also possible to run auto densify on smaller set of images by using the version available on the layout add points menu. This process differs from auto tie pointing because it does not attempt to detect overlap among images; it adds more points among images that already have some points connecting them. Thus, if two images have no points measured between them auto densify will not add any.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

See the auto tie parameter list here.

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Brute Force Auto Tie (BruTie)

BruTie is the last resort auto tie method. It is the least reliable and the slowest method, however, it does not require EOs, strip and photo numbers, or camera data. This command will not be started by the "AutTie" command. It must be keyed in.

See the auto tie parameter list here.

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Fast Auto Tie (FasTie)

FasTie is the preferred auto tie method for images with EOs. The "AutTie" command (from the drop down menu or the key in) will also execute this command if the images all have measured EOs.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

See the auto tie parameter list here.

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Oblique Tie (OblTie)

This command is an alternative user override to the typical work flow with EOs that is intended for oblique images. A comprehensive set of feature matching among the images is done. Disabling least squares matching is recommend for oblique images. The "AutTie" command will not run this method; it must be keyed in.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

See the auto tie parameter list here.

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Semi-Automatic Auto Tie (SemTie)

This command is part of the auto work flow without EOs. Strip and photo numbers are required for this method. Images are automatically linked along strips. A limited number of prior cross strips ties are needed as seeds for connecting the strips.

The user is prompted for bundle parameters when executing this command because the bundle is used to winnow and thin measurements at various stages of the process.

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Other Related Commands

Backup ATM Files (BacAtM)

Copies all the ATM files (point measurements) to a user specified directory. The can be restored with the restore ATM command (ResATM).

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Clean Auto Tie (CleAut)

Residual information in pixels is available for every point in the image network after running a VrAdjust bundle. This command allows the user to quickly delete all auto ties (image points with names beginning with 'AT') which have residuals above the user defined threshold. A single thresholding value is used, and is compared to the magnitude of the total residual vector. For example, every point has an x residual (Vx) and a y residual (Vy); the total residual magnitude is sqrt(Vx*Vx + Vy*Vy). To assist with choosing a threshold percentiles of the total residual magnitudes are provide in the bundle residual reports; it is recommend to choose a value between the 95th and 99th percentile.

Parmeter	Default	Description
Delete residuals greater than:	1.5	Delete automatic tie points with residuals greater than this parameter. (units are pixels)

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Clear Exterior Orientations (CleEos)

This command clears all imported EO data. It is sometimes necessary to unload previously imported exterior orientations so that the program will not consider them in during the bundle adjustment or auto tie.

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Delete Auto Ties (DelAut)

Delete all Auto Ties in a project

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Delete Low Ray Count Points (DelLow)

This command quickly deletes points with less than a certain ray count. This can be useful for thinning data, but is most often used to delete 2-ray points. 2-ray points have the geometric weakness that all error in depth (errors along epipolar lines) is undetectable. Hence, if the bundle points are going to be used for a surface (e.g. for orthographic resampling) it is sometimes better to remove the two ray points first.

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Least Squares Match (SemTie)

Does patch based least squares matching to refine all the points currently in the block. It will overwrite auto ties, but creates duplicates of other points to refine. If EO's have been defined with import GPS or bundle has been run the measurements with also be extended into new images. The maximum pts per image parameter lets the user do optional point thinning as well. Note that prior to LS matching a bundle is done to refine the imported EOs.

Parameter	Default	Range	Description
Maximum points per image	295	20-1000	Maximum number of points to add to each image.
Maximum threads to use	Max	0-Max	The maximum number of threads that AutoTie will be allowed to use. The higher the max threads the faster it will process, but using the maximum may leave your computer nearly unusable for anything else while it processes.
Least squares match template size	21	7-301	The size of the patch used for LS matching. Larger patches (61-101 pixels) sometimes work better in trees. Smaller patch sizes (15-25 pixels) tend to work better for oblique images and man-made environments.

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Restore ATM Files (ResAtm)

Restores a set of saved ATM files.

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2.5.4 VR Adjust

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Simultaneous Bundle Block Adjustment

Type: Utility accessed from VR Air Trig

The VR bundle adjustment produces optimized camera positions and orientations form measurements of common points in the images.

It can be run as free network adjustment or full adjustment. The free network adjustment ignores control and GPS inputs in order to access the consistency and sufficiency of the image tie points. The full bundle incorporates all inputs.

Contents:

Bundle Parameters
Bundle Tweaking GUI
Bundle Reports
- Bundle Report, Highlights
- Bundle Report, Control
- Bundle Report, Residuals
- Bundle Report, EO Fit
- Bundle Report, Ext Ori
- Bundle Report, Intersection Details
- Bundle Report, Points Adjusted
- Bundle Report, Points Unadjusted
- Bundle Report, Constraints

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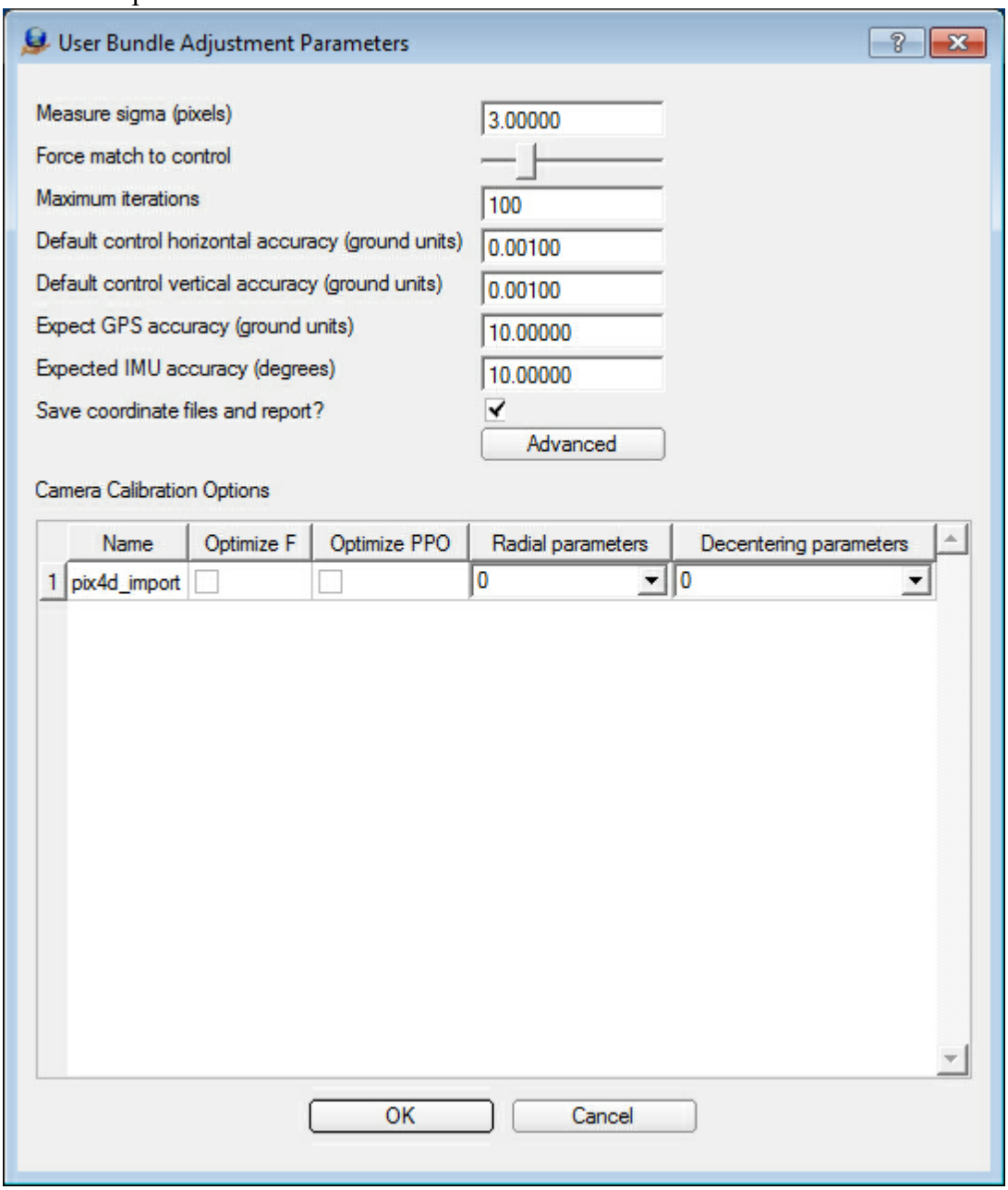
Bundle Parameters

The bundle parameters window:



Measure sigma (pixels): This is the estimate standard deviation of the image measurements in pixels. Pixels are used for the unit because they are universal. Human operators, feature matching and template matching (e.g. cross correlation) all have predictable measurement standard deviations in pixels. Millimeters is less consistent because pixel size range from 1-30+ microns. 1.0 is the default and typically works well. For challenging imagery or uncalibrated cameras 2-4 may be more appropriate.

Force to match control: This slider changes how manual points are weighted. Hence, in a

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manually tied project it has little effect. In and auto tied project sliding it to the right has the affect of redistributing error from manual points to auto tie points. As most manual points tend to be control points it also has the affect of making the block match the control more closely. When all the way to the left manual and auto tie points are weight identically. It raises exponentially as it is moved right until manual points are weight 1000 times more heavily than auto ties.

Maximum iterations: The maximum iterations the bundle will run. The default is 100, and is typically sufficient.

Default control horizontal accuracy (ground units): An estimate of the standard deviation of the measured control points in the X and Y axis directions. Is common practice to set this to near zero (e.g. 0.001). In most bundle software, this is not recommended, however it works well here. For more information see the discussion of check points.

Default control vertical accuracy: An estimate of the standard deviation of the measured control points in the Z axis direction. Is common practice to set this to near zero (e.g. 0.001). In most bundle software, this is not recommended, however it works well here. For more information see the discussion of check points.

Expected GPS accuracy (ground units): An estimate of the standard deviation of the airborne GPS (all three axes). It is usually better to estimate too high rather than too low.

Expected IMU accuracy (degrees): An estimate of the standard deviation of the airborne IMU data in degrees. This applied to the combined total rotational difference.

Save Coordinate files and report? Three reports of the ground coordinate data are generated if this is checked (Intersections Details, Points Adjusted, and Points Unadjusted). For large blocks this can take time. Hence, the option is given to not write the reports.

Camera Calibration Options

There will be a row in the camera calibrations options table for each camera in the project. The parameters below are available for each camera separately in its respective row.

Optimize F If checked the focal length of the camera will be optimized as a variable in the bundle adjustment

Optimize PPo If checked the principal point offsets will be optimized as variables in the bundle adjustment

Radial Parameters The number radial distortion parameters that will be optimized as variables in the bundle adjustment. Using three is typical. Leaving it zero disables calibration of these parameters.

Decentering Parameters The number of decentering parameters that will be optimized as variables in the bundle adjustment. Using two is typical. Leaving it zero disables calibration of these parameters.

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Advanced Bundle Parameters

Users can access the advanced bundle parameters by clicking on the 'Advanced' button on the bundle parameters window.
Statistical Significance Level: While building a set of initial values for the camera positions and orientations there are various statistical test that are done. For example: Are the number of outliers in these two solution significantly different? This parameter controls how significantly different they must be. It has no effect on a bundle that already has initial values (as from airborne GPS and IMU).

Max Blunder Percent: While building a set of initial values for the camera positions and orientations there are various intermediate adjustments. This variables declares any intermediate solution with too many outliers to be unsatisfactory. It has no effect on a bundle that already has initial values (as from airborne GPS and IMU).

Max RANSAC trials: Variations of the RANSAC algorithm are used to detect and exclude blunders while building initial values for the bundle. This limits how long they will run to avoid infinite searches.

Image Measurement Max radius: This parameter is used when dealing with high distortion images. It allows user to exclude date near the image edges starting at the corners and working inward in concentric rings. The value is in percent and is the maximum percent of the distance from center of the image to the corner for data included in the adjustment. See drawing below.

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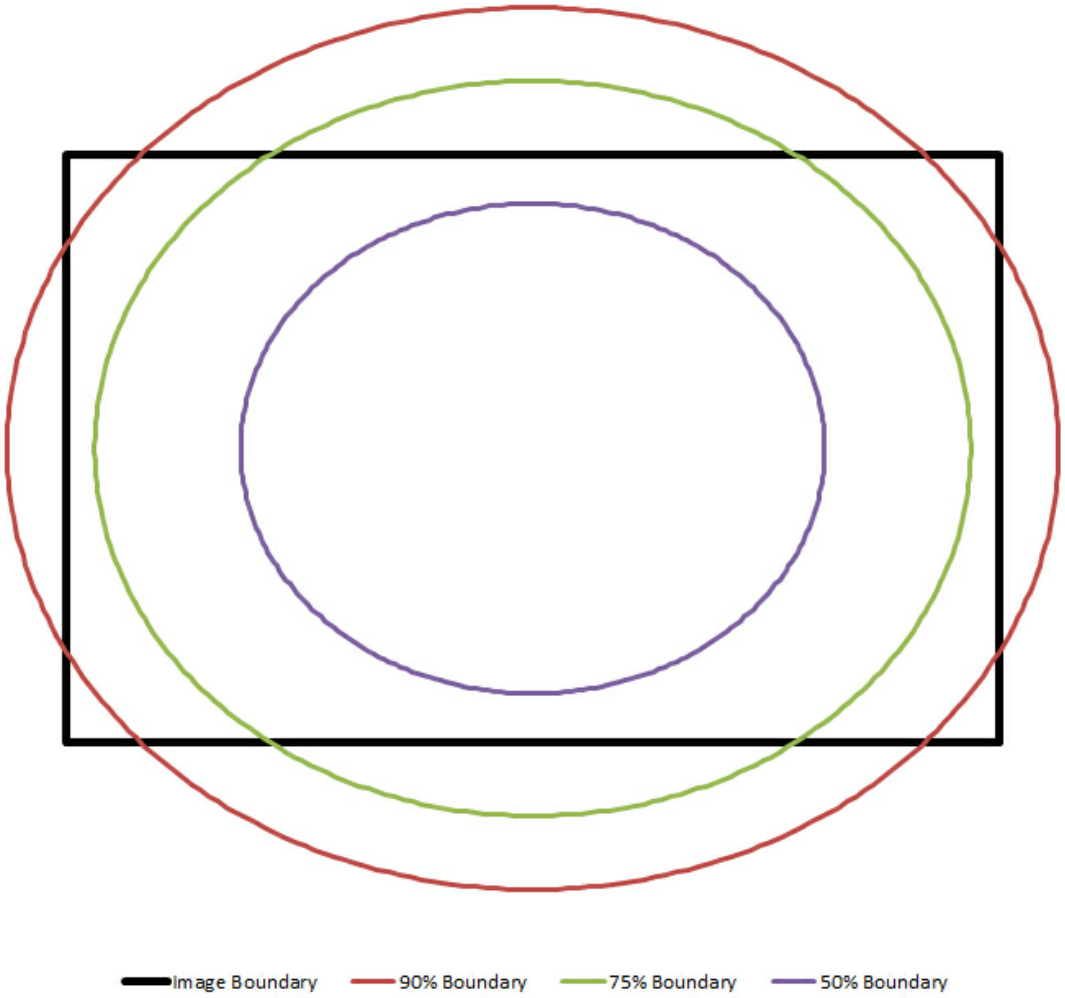

From the image above, observe that an 75-90% setting only cuts out the corners.
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Bundle Tweaking GUI

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Bundle Reports

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Bundle Report, Highlights

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The highlights report attempts to put all the information that a user needs to determine if a block is satisfactory in a single fairly short report. The information is not comprehensive, and review of the other reports may be necessary.

Section 1: Control Fit

The area provides fairly comprehensive reporting of the control point residuals

When talking about control point residuals the report refers to 'Bundle' and 'Check' residuals. 'Bundle residuals' are the residuals that have been historically listed in bundle reports. They report how far a point's coordinates moves in the adjustment. The information is not irrelevant but it can be difficult to interpret because it is very closely linked to the users horizontal and vertical control accuracies (see bundle parameters). As these parameters approach zero the control bundle residuals will approach zero. This happens regardless of any other data in the adjustment. The effective result of this is that users can easily force the residuals to zero, and finding the best parameter setting that accurately reflects reality can be challenging even for experienced users. To help with this 'Check' residuals are reported. Check coordinates are calculated after the bundle has run by intersecting the image measurements of each control point and comparing the result to the pre-adjustment control point coordinates. These coordinates cannot be forced to zero, and are much better predictors of how well stereo models will match the control coordinates. Many VR users have reported that they quickly start ignoring the control bundle residuals in favor of the check coordinates.

- 'Control Points With Probable Blunders' - Is a list of control points whose bundle coordinates moved significantly. The means that at least one of the axis coordinates moved more than three times the user specified accuracy estimate.
- 'Control RMSE in ground units' - The root mean square error (RMSE) of the control points motion in the bundle adjustment. Is is broken down by axis.
- 'Greatest control residuals in ground units' - The greatest magnitude motion of any control point broken down by axis.
- 'Residuals Table (ground units)' - All of the control point residuals are listed in the table. They are listed in descending order by the significance of their bundle residuals. Which means the point with the most improbably large bundle residuals is listed first. The point with the second most improbably large residual is listed second, and so on.

Section 2: Bundle Residuals

This area provides a statistical summary of the bundle image measurement residuals.

- Point counts are given by the number of rays and by point type (control, manual, cross strip auto tie, and along strip auto ties).
- RMSE for image measurements are broken down by point type (control, manual, cross strip auto tie, and along strip auto ties).
- The distribution of 2D measurement residuals is summarized by percentiles of all points and controls points.
- The worst control image space residuals are listed.

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- Model mapping precision is predicted.
- The parameters used in the bundle adjustment are recorded.

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Bundle Report, Control

This report provides a detailed break down of how well the bundle matched the control. The data is reported first in ground units and then in ground sample distance (GSD) units. Reporting in GSD units is useful in a way analogous to how using pixels for image measurement is useful. That is to say that, there are fairly predictable expected root mean square errors (RMSE) in the horizontal and vertical axes for nadir looking images. The horizontal RMSE should be around 0.25-0.75 GSD, which means the largest horizontal residuals should be around 1.5-2.25 GSD. The vertical axis is not as precise, and the RMSE should be around 0.5-1.25 GSD. This implies that the maximum vertical errors should be around 1.5-3.75 GSD. While these ranges will generally hold they do represent a floor to expected errors. If the imagery is noisy, compressed, has motion blur, is poorly focused, is excessively light or dark, is not nadir looking, the camera is poorly calibrated, or the camera is unstable then the general rules presented here will not hold.

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Bundle Report, Residuals

The amount of data is reported at the top of this report. Total image point counts are given first and then the inlier/outlier breakdown. Following that is a breakdown of the inliers by the number of observations rays.

Residual Summary Stats (Pixels)

The inlier/outlier counts and measurement RMSE are given by point type (control, manual, cross strip, and auto tie). Following that is a breakdown of the 2D residual vector lengths by percentile. These percentiles are useful for choosing thresholds for cleaning away auto ties.

Individual Point Residuals (Pixels)

In the first part of this section, "Sorted Control Residuals", all of the control residuals are listed in descending order from the point with the largest residuals to the point with the least. In the second section, "Sorted Residuals", the worst residuals are listed (also in descending order). Up to 1000 measurements are listed in the section section. Capping the number of points prevents a slow sorting of hundreds of thousands of points in large blocks.

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Bundle Report, EO Fit

The EO fit report documents how much the measured EO parameters moved during the

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adjustment. Delta X, Y, and Z document how far the measured camera positions moved. The "Position Delta" is the combined offset vector length, sqrt(DeltaX^2 + DeltaY^2 + DeltaZ^2). The angular delta are given similarly; they are first broken down by axis and then given as a combined single magnitude. In the case of rotations, the combined magnitude is the smallest single rotation about any direction vector that transforms from the measured to the final rotation.

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Bundle Report, Ext Ori

The ExtOri report is an ISAT format exterior orientation file. It lists the EO data for each image, one image per line. The column values are image name, x coordinate, Y coordinate, Z coordinate, omega (rotation about the X-axis), phi (rotation about the once-rotated Y axis), and kappa (rotation about the twice-rotated Z-axis). The EO values in this report are what generally constitutes the 'results' of the adjustment. They are imported to set models for mapping, create ortho photos, produce DSMs, etc. This report is, therefore, primarily intended to be machine readable.

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Bundle Report, Intersection Details

The Intersections Details reports lists statistics for the solutions for the 3D coordinates of all the points in the bundle adjustment. This can be a long list of points and take a long time to write. For this reason writing this report can be disabled using the the "Save coordinate files and reports" check box of the bundle parameters.

Data for each point

- Point name
- Number of image measurements (Rays)
- Number of inlier image measurements (Used)
- Best intersection angle list the intersection among the image rays that is closest to 90 or 270 degrees. This is a simple way to picture the strength of intersection geometry of the rays.
- X, Y, and Z coordinates
- Propagated standard errors for the X, Y, and Z coordinates (sX, sY, and sZ)

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Bundle Report, Points Adjusted

The adjusted points report is a simple list of the calculated 3D coordinates of the all the points in the adjustment. It is formatted as a VR control file so that it can be directly used in other VR modules (e.g. ortho photo or model set). The control coordinates in this report are the adjusted

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coordinates from the bundle.

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Bundle Report, Points Unadjusted

The adjusted points report is a simple list of the calculated 3D coordinates of the all the points in the adjustment. It is formatted as a VR control file so that it can be directly used in other VR modules (e.g. ortho photo or model set). The control coordinates in this report are unaltered from the original input into the bundle.

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Bundle Report, Constraints

Constraints are additional measurement data added to the bundle. VR Adjust currently supports adding distance constraints between points and between images. If there are constraints, statistics of their fit in adjustment are in this report.

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2.5.4.1 Bundle, Interactive

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Vr Mapping

Bundle, Interactive

The interactive bundle adjustment is intended for close range applications and blocks with manual measurements. It is useful for isolating issues and finding miss measurements.

Details regarding bundle parameters and reports are given elsewhere and are not repeated here. This subject covers how to use the step-by-step interactive GUI only.

Contents

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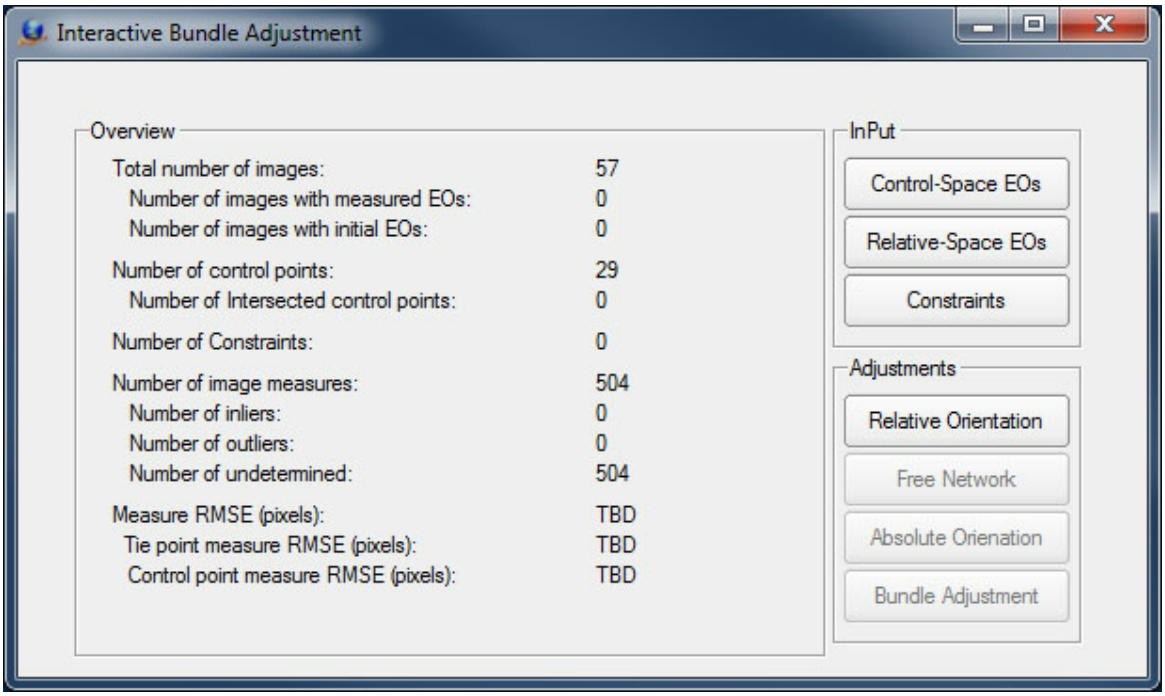
Bundle Overview
Block Statistics
Input data
Work flow
Relative Orientations
Relative Orientation Parameters
Statistically Similar Solutions (SSS)
Absolute Orientation
Free-Network
Block Adjustment

Bundle Overview



The main bundle interactive window or overview window is shown above. The block statistics are shown in the left box and input and processing options are on the right.

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Block Statistics

The block statistics or overview, shows the current status of the block. The first section of data deals with images. It shows the number of total images, the number of images that have measured exterior orientations (EOs), and the number of images that have initial values for the

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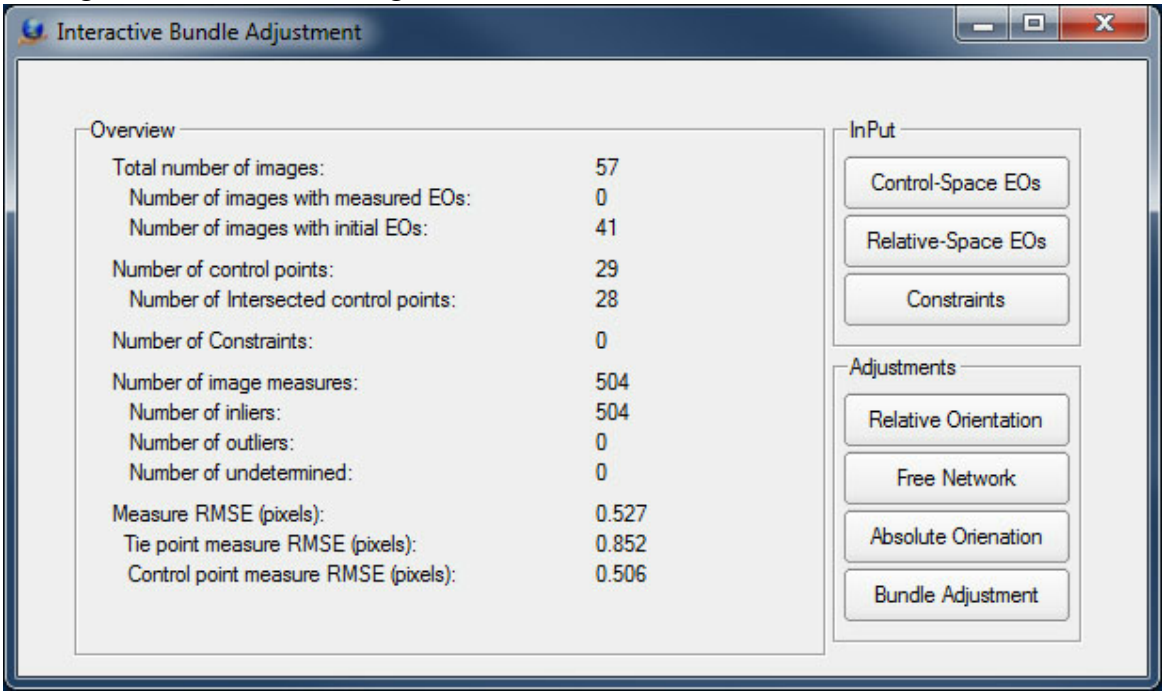
bundle adjustment. If a block has measured EOs then users can skip directly to bundling. If not it is necessary to follow the workflow to build a set of initial values. In the image above, it shows that there are no images with initial EOs. This indicates that no work has been done, and the building the initial values must begin with a Relative Orientation.



In the overview shown above there are now initial values for 41 of the 57 images. Further, most of the control points are now defined (intersected). Note that the Free Network, Absolute Orientation, and Bundle Adjustment buttons are active. The active buttons indicate that the three operations can be performed with the subset of the data that is currently active (has initial values).

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Input Data

The input box is in the top right of the overview window. Is used to restart processing at saved intermediate solutions, and to enter constraints.

The top two buttons are functionally very similar. When clicked, the user is prompted to select a bundle exterior orientation report (...BundleReportExtOri.txt). This report contains previous solutions and allows the block to be restored to previous states. "Control-Space" refers to solutions that are done after absolute orientation and are thus in the coordinate systems of the control. Using this button tells the software to enable the Bundle Adjustment option instead of just the Free Network.

The Constraints button is used to define distance constraints between points or images. The

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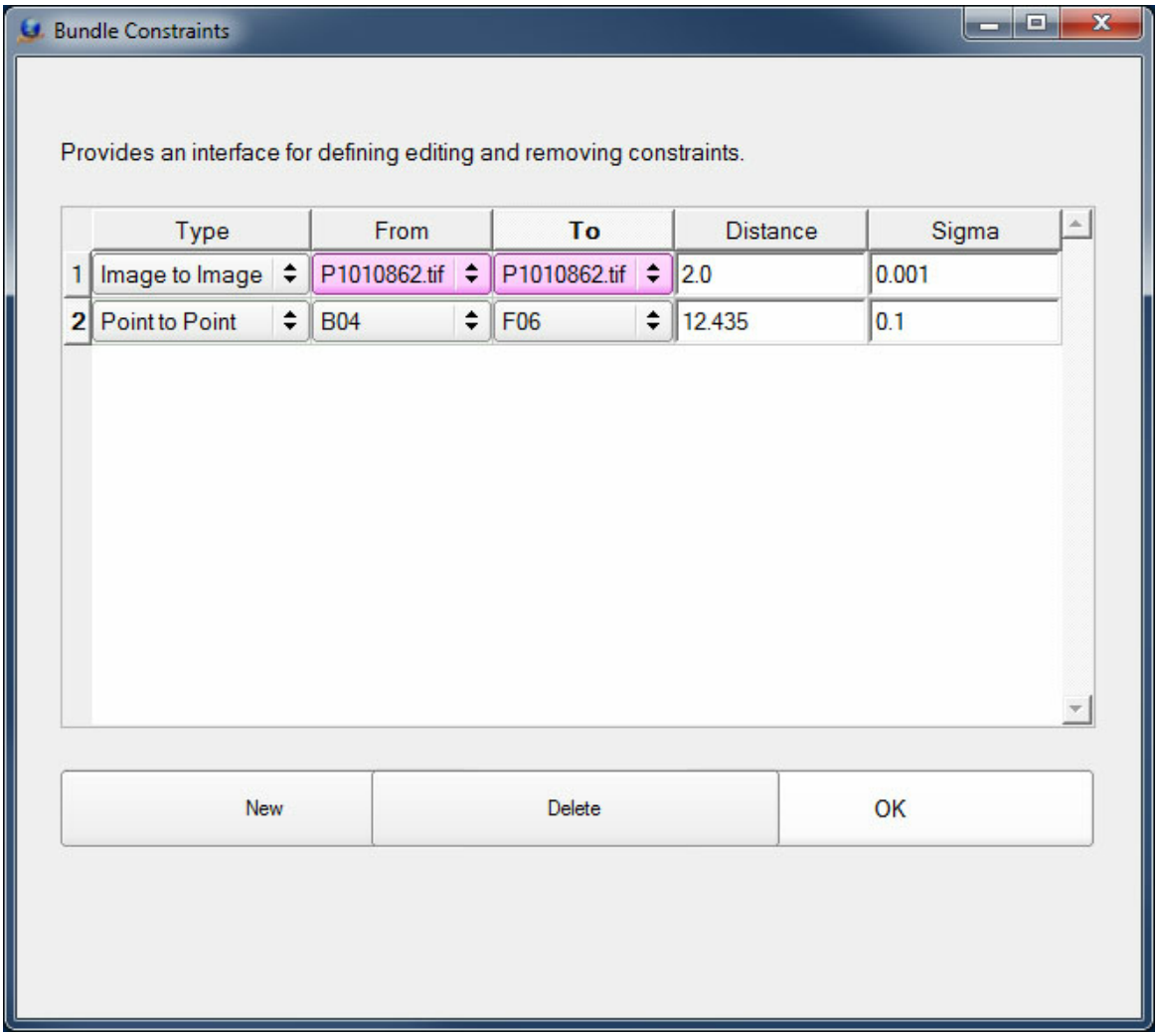
interface is shown below. Note that in the absence of control points these constraints define part of the coordinate system. Hence, leaving all of them loosely defined can leave part of the coordinate system loosely defined and solutions unstable. For that reason one of the distance constraints is shown with a small sigma below. It is good practice to hold at least one distance tightly define in the absence of control points.



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Workflow

The buttons in the right-bottom section imply a work flow. The nominal work flow is:

1. Run relative orientations and choose one to be the start of the block.
2. Run free network adjustments on growing numbers of images at least until there is enough control data to do an absolute orientation.
3. Run bundles on growing numbers of images until complete.

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The workflow, however, is not as rigid as that implies. Users can, for example:
1. Restart anytime by returning to select a new relative orientation (starting image pair).
2. Run free works even after transforming to Control Space (this can be useful for diagnosing issue with control measurements).
3. Re-run absolute orientation as they desire to redo control alignments.
4. Remove images from the active set (using controls in Free Network and Bundle interfaces).
5. Use the input buttons on the overview to restart or merge sub-blocks by importing multiple EO files. When importing multiple files care should be taken to make sure they are in the same coordinate system. In general this can only be done by import control-space EOs.

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Relative Orientations

Block building begins by doing relative orientations. The relative orientation interface is designed to allow users to:
1. Process many pairs of images
2. Compare solutions statistics
3. Choose a pair as the beginning point for the new block

In order process the relative orientations make a selection from the listed pairs of images by drag or clicking on the row numbers to select them (see image below). Note that ctl-click and shift-click also work for making selections. In large projects there are frequently thousands of potential pairs of starting images. The "Pairs Per Page" and "Page" combo boxes can be used to navigate through them. However, this is rarely necessary because the most likely pairs to be useful are sorted to be near the top.

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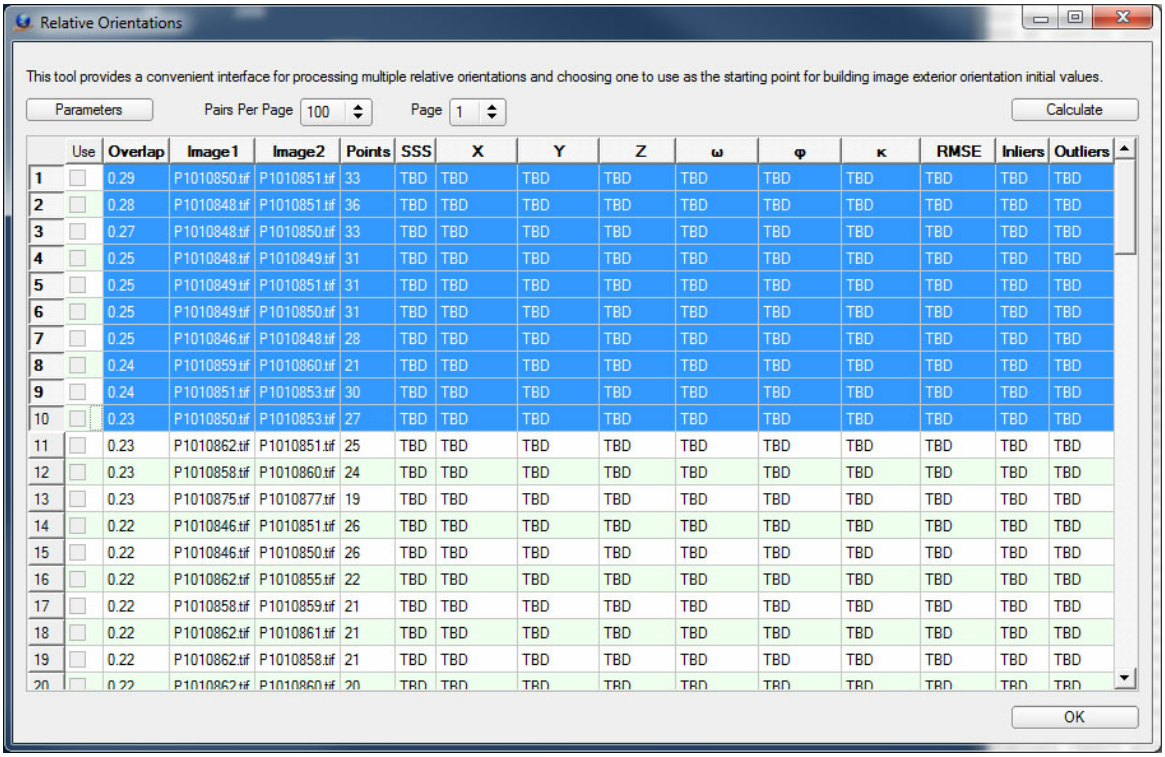

	Use	Overlap	Image1	Image2	Points	SSS	X	Y	Z	ω	φ	κ	RMSE	Inliers	Outliers
1		0.29	P1010850.tif	P1010851.tif	33	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
2		0.28	P1010848.tif	P1010851.tif	36	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
3		0.27	P1010848.tif	P1010850.tif	33	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
4		0.25	P1010848.tif	P1010849.tif	31	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5		0.25	P1010849.tif	P1010851.tif	31	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
6		0.25	P1010849.tif	P1010850.tif	31	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
7		0.25	P1010846.tif	P1010848.tif	28	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
8		0.24	P1010859.tif	P1010860.tif	21	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
9		0.24	P1010851.tif	P1010853.tif	30	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
10		0.23	P1010850.tif	P1010853.tif	27	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
11		0.23	P1010862.tif	P1010851.tif	25	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
12		0.23	P1010858.tif	P1010860.tif	24	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
13		0.23	P1010875.tif	P1010877.tif	19	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
14		0.22	P1010846.tif	P1010851.tif	26	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
15		0.22	P1010846.tif	P1010850.tif	26	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
16		0.22	P1010862.tif	P1010855.tif	22	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
17		0.22	P1010858.tif	P1010859.tif	21	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
18		0.22	P1010862.tif	P1010861.tif	21	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
19		0.22	P1010862.tif	P1010858.tif	21	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
20		0.22	P1010862.tif	P1010860.tif	20	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

The "Calculate" button near the top right will then run all the selected relative orientations and populate the table with values (see below). The relative orientation is expressed as a unit vector from Image1 to Image2 and the Euler anlges rotations between the images (omega, phi, and kappa). The number of points, root mean square error in pixels (RMSE), and the number of inliers and outliers are listed. Rows with SSS > 0 have To Be Determined stats, this is discussed below.

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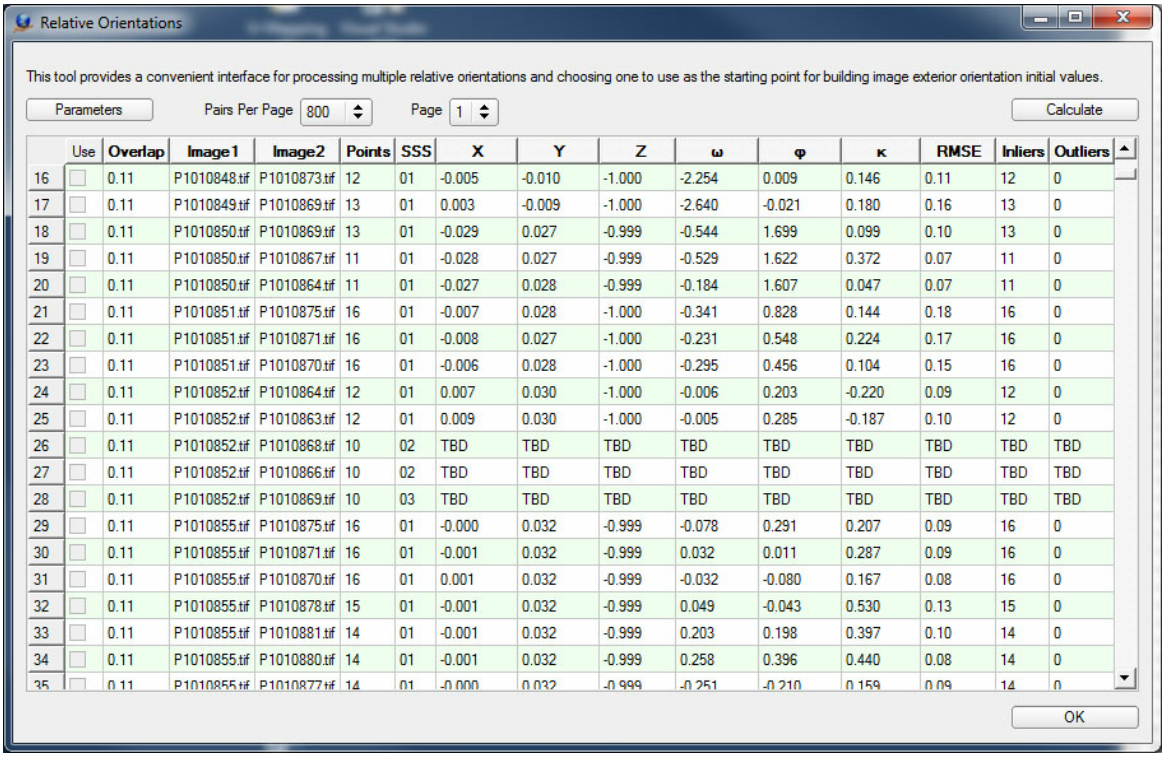

	Use	Overlap	Image1	Image2	Points	SSS	X	Y	Z	ω	φ	κ	RMSE	Inliers	Outliers
16	☐	0.11	P1010848.tif	P1010873.tif	12	01	-0.005	-0.010	-1.000	-2.254	0.009	0.146	0.11	12	0
17	☐	0.11	P1010849.tif	P1010869.tif	13	01	0.003	-0.009	-1.000	-2.640	-0.021	0.180	0.16	13	0
18	☐	0.11	P1010850.tif	P1010869.tif	13	01	-0.029	0.027	-0.999	-0.544	1.699	0.099	0.10	13	0
19	☐	0.11	P1010850.tif	P1010867.tif	11	01	-0.028	0.027	-0.999	-0.529	1.622	0.372	0.07	11	0
20	☐	0.11	P1010850.tif	P1010864.tif	11	01	-0.027	0.028	-0.999	-0.184	1.607	0.047	0.07	11	0
21	☐	0.11	P1010851.tif	P1010875.tif	16	01	-0.007	0.028	-1.000	-0.341	0.828	0.144	0.18	16	0
22	☐	0.11	P1010851.tif	P1010871.tif	16	01	-0.008	0.027	-1.000	-0.231	0.548	0.224	0.17	16	0
23	☐	0.11	P1010851.tif	P1010870.tif	16	01	-0.006	0.028	-1.000	-0.295	0.456	0.104	0.15	16	0
24	☐	0.11	P1010852.tif	P1010864.tif	12	01	0.007	0.030	-1.000	-0.006	0.203	-0.220	0.09	12	0
25	☐	0.11	P1010852.tif	P1010863.tif	12	01	0.009	0.030	-1.000	-0.005	0.285	-0.187	0.10	12	0
26	☐	0.11	P1010852.tif	P1010868.tif	10	02	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
27	☐	0.11	P1010852.tif	P1010866.tif	10	02	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
28	☐	0.11	P1010852.tif	P1010869.tif	10	03	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
29	☐	0.11	P1010855.tif	P1010875.tif	16	01	-0.000	0.032	-0.999	-0.078	0.291	0.207	0.09	16	0
30	☐	0.11	P1010855.tif	P1010871.tif	16	01	-0.001	0.032	-0.999	0.032	0.011	0.287	0.09	16	0
31	☐	0.11	P1010855.tif	P1010870.tif	16	01	0.001	0.032	-0.999	-0.032	-0.080	0.167	0.08	16	0
32	☐	0.11	P1010855.tif	P1010878.tif	15	01	-0.001	0.032	-0.999	0.049	-0.043	0.530	0.13	15	0
33	☐	0.11	P1010855.tif	P1010881.tif	14	01	-0.001	0.032	-0.999	0.203	0.198	0.397	0.10	14	0
34	☐	0.11	P1010855.tif	P1010880.tif	14	01	-0.001	0.032	-0.999	0.258	0.396	0.440	0.08	14	0
35	☐	0.11	P1010855.tif	P1010877.tif	14	01	-0.000	0.032	-0.999	-0.251	-0.210	0.159	0.09	14	0

Good choices to "Use" for the starting relative orientation have stable solutions (SSS =1), low RMSE (< 1.0), and few outliers. Row 22 was chosen below (by check the box) because it meets these criteria. Click "Ok" in the bottom right to finalize the selection and close the window.

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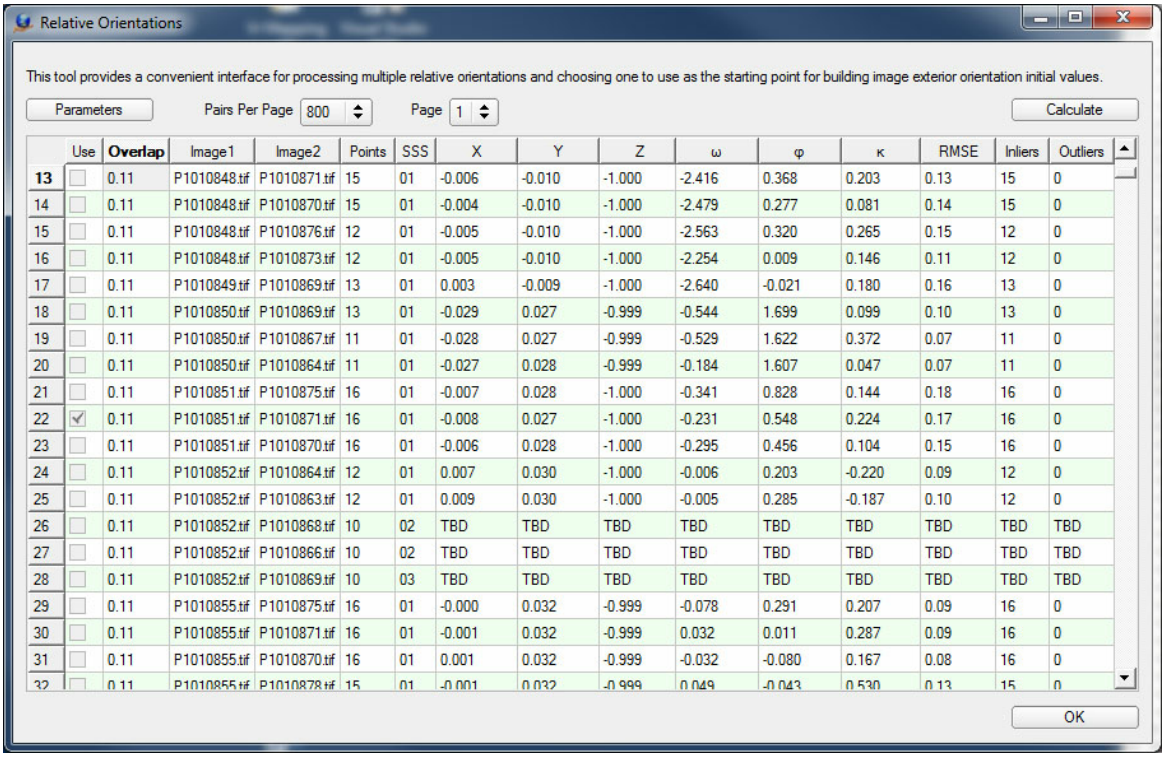

	Use	Overlap	Image1	Image2	Points	SSS	X	Y	Z	ω	φ	κ	RMSE	Inliers	Outliers
13	☐	0.11	P1010848.tif	P1010871.tif	15	01	-0.006	-0.010	-1.000	-2.416	0.368	0.203	0.13	15	0
14	☐	0.11	P1010848.tif	P1010870.tif	15	01	-0.004	-0.010	-1.000	-2.479	0.277	0.081	0.14	15	0
15	☐	0.11	P1010848.tif	P1010876.tif	12	01	-0.005	-0.010	-1.000	-2.563	0.320	0.265	0.15	12	0
16	☐	0.11	P1010848.tif	P1010873.tif	12	01	-0.005	-0.010	-1.000	-2.254	0.009	0.146	0.11	12	0
17	☐	0.11	P1010849.tif	P1010869.tif	13	01	0.003	-0.009	-1.000	-2.640	-0.021	0.180	0.16	13	0
18	☐	0.11	P1010850.tif	P1010869.tif	13	01	-0.029	0.027	-0.999	-0.544	1.699	0.099	0.10	13	0
19	☐	0.11	P1010850.tif	P1010867.tif	11	01	-0.028	0.027	-0.999	-0.529	1.622	0.372	0.07	11	0
20	☐	0.11	P1010850.tif	P1010864.tif	11	01	-0.027	0.028	-0.999	-0.184	1.607	0.047	0.07	11	0
21	☐	0.11	P1010851.tif	P1010875.tif	16	01	-0.007	0.028	-1.000	-0.341	0.828	0.144	0.18	16	0
22	☑	0.11	P1010851.tif	P1010871.tif	16	01	-0.008	0.027	-1.000	-0.231	0.548	0.224	0.17	16	0
23	☐	0.11	P1010851.tif	P1010870.tif	16	01	-0.006	0.028	-1.000	-0.295	0.456	0.104	0.15	16	0
24	☐	0.11	P1010852.tif	P1010864.tif	12	01	0.007	0.030	-1.000	-0.006	0.203	-0.220	0.09	12	0
25	☐	0.11	P1010852.tif	P1010863.tif	12	01	0.009	0.030	-1.000	-0.005	0.285	-0.187	0.10	12	0
26	☐	0.11	P1010852.tif	P1010868.tif	10	02	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
27	☐	0.11	P1010852.tif	P1010866.tif	10	02	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
28	☐	0.11	P1010852.tif	P1010869.tif	10	03	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
29	☐	0.11	P1010855.tif	P1010875.tif	16	01	-0.000	0.032	-0.999	-0.078	0.291	0.207	0.09	16	0
30	☐	0.11	P1010855.tif	P1010871.tif	16	01	-0.001	0.032	-0.999	0.032	0.011	0.287	0.09	16	0
31	☐	0.11	P1010855.tif	P1010870.tif	16	01	0.001	0.032	-0.999	-0.032	-0.080	0.167	0.08	16	0
32	☐	0.11	P1010855.tif	P1010878.tif	15	01	-0.001	0.032	-0.999	0.049	-0.043	0.530	0.13	15	0

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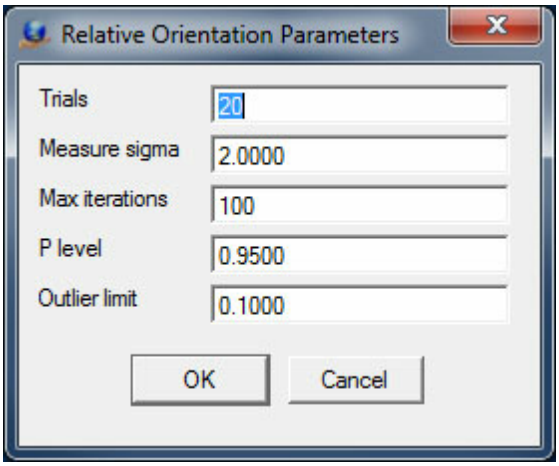
Relative Orientation Parameters

The Relative orientation parameters can be accessed by clicking the "Parameters" button near the top left of the window.



Trials Relative orientation uses a RANSAC method to find robust solutions. This parameters is a limit to how many times the solution will start over. The higher the number the harder the algorithm looks for solutions, but the slower it goes. Typical values range from 5-100 depending on how many outliers are expected in the data.

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Measure sigma Predicted measurement standard error in pixels. Typical values range from 0.5 - 2.0.

Max iterations Limit on the number of iterations for optimizing relative orientations solutions

P Level Searching for solutions includes asking various questions (e.g. is this solution better than that solution?). These questions are statistical and P Level is level at which they must be significant in order to answered a specific way. Typical values range 0.9-0.99.

Outlier limit This is threshold for how much of the data can be classified as outliers in acceptable solutions. If set to 0.1 at most 10% of data can be outliers. Typical values range from 0.0-0.5.

Statistically Similar Solutions (SSS)

When determining relative orientation it is possible to find multiple solutions. Theoretically this indicates that points are near to some critical geometry. However, the shape of those geometries is complex (particularly when modeling them considering measurement noise). In order to detect them the software keeps track of all statistically similar solutions it encounters while search for the optimum solution. If SSS > 1 then the image measurements alone are not enough to definitively choose a single solution (given the current parameters). Users can tell the software which solution to use. To do this double click on a SSS cell > 1. A table that lists the stats of all the similar solutions will be displayed. Clicking on the "Use" check box of a row selects a particular solution. An example of relative orientation with four SSS is given below. In this example the second row was chosen as a solution. In this case the camera motion was expected to be mostly horizontal (it is from a drone flight) which made the solution with the smallest Z component the more probable representation of the true geometry.

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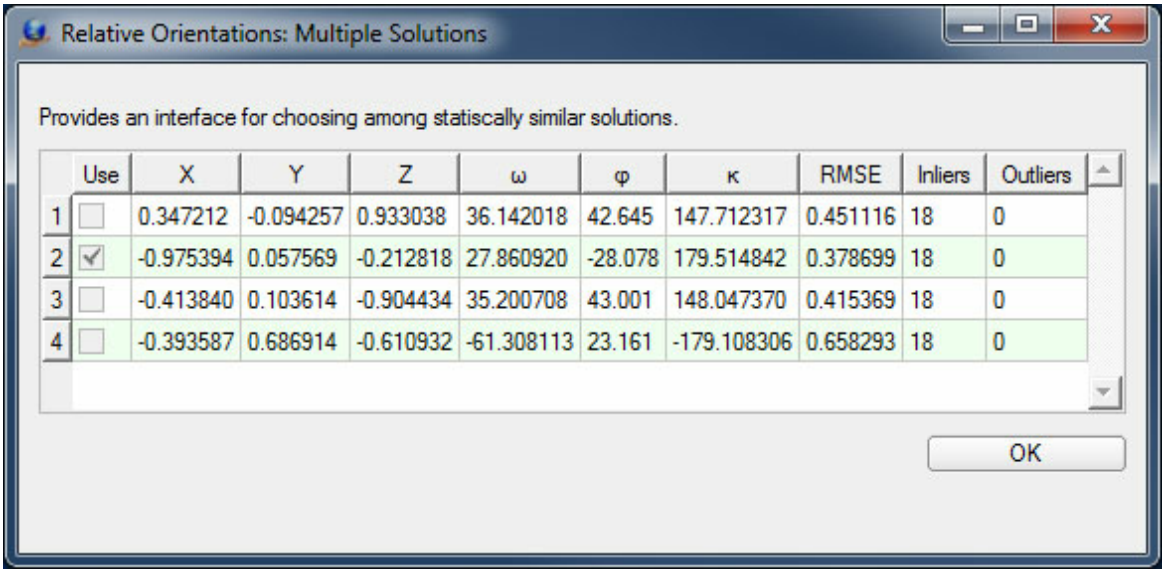

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Free Network Building

After a relative orientation is selected, the free network interface is used to build a block of images in relative space. The interface is shown below. Images that are not yet part of the relative block are shown in the table on the left. Images that have relative EOs are shown on the right. The buttons between the two tables are operations that move images from the left to the right (calculate EOs). The "Top" button calculates an EO for the top images and if successful moves it to the right table. Alternatively, users can make a selection of images in the left table by clicking/dragging the row numbers and use the "Selected" button to calculate EOs for a group of images. The final option if for the software to try to calculate EOs for all of them sequentially, the "Until Fail" button.

The buttons in the right column are divided into groups. The top button runs the optimization. The two buttons grouped below that operated on selections of images in the right table. "Clear EO(s)" moves images back to the left side (excluded them from the current solution). "Redo EO (s)" recalculates the EOs for selected images as if moving them from the left side anew. The reports group of buttons allows access to all the relevant bundle reports. The bottom group of buttons "Backup" images measurements, Clean automatic tie points, and save calibrated cameras.

The "Ok" button at the bottom middle exits the interface.

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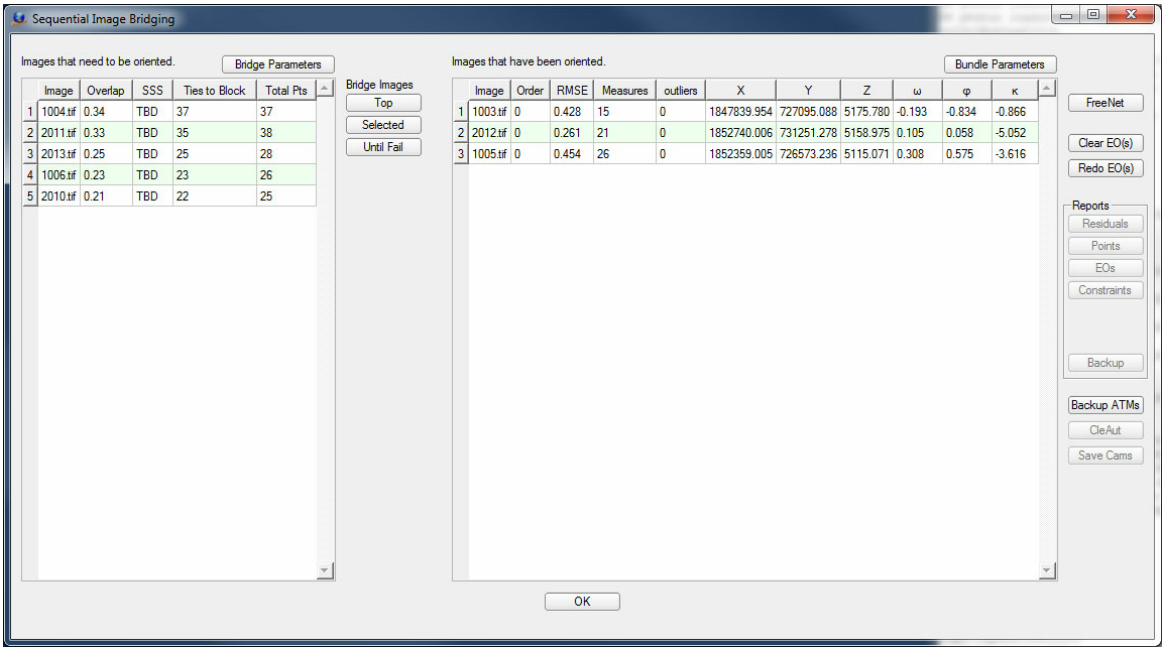

The parameters button above the left table allows access to the following parameters:

Trials — Relative orientation uses a RANSAC method to find robust solutions. This parameters is a limit to how many times the solution will start over. The higher the number the harder the algorithm looks for solutions, but the slower it goes. Typical values range from 5-100 depending on how many outliers are expected in the data.

Measure sigma — Predicted measurement standard error in pixels. Typical values range from 0.5 - 2.0.

Max Iterations — Limit on the number of iterations for optimizing relative orientations solutions

P Level — Searching for solutions includes asking various questions (e.g. is this solution better than that solution?). These questions are statistical and P Level is level at which they must be significant in order to answered a specific way. Typical values range 0.9-0.99.

Outlier Limit — This is threshold for how much of the data can be classified as outliers in acceptable solutions. If set to 0.1 at most 10% of data can be outliers. Typical values range from 0.0-0.5.

Stop at failed bridge — If checked the "Until fail" option will stop at any failed attempt to find an EO for an images. Otherwise it will keeping trying on other images.

Max intermediate bridges — The number of images that are bridged into a solution in between bundle optimizations.

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The bundle adjustment parameters are accessed using the button above the right table.

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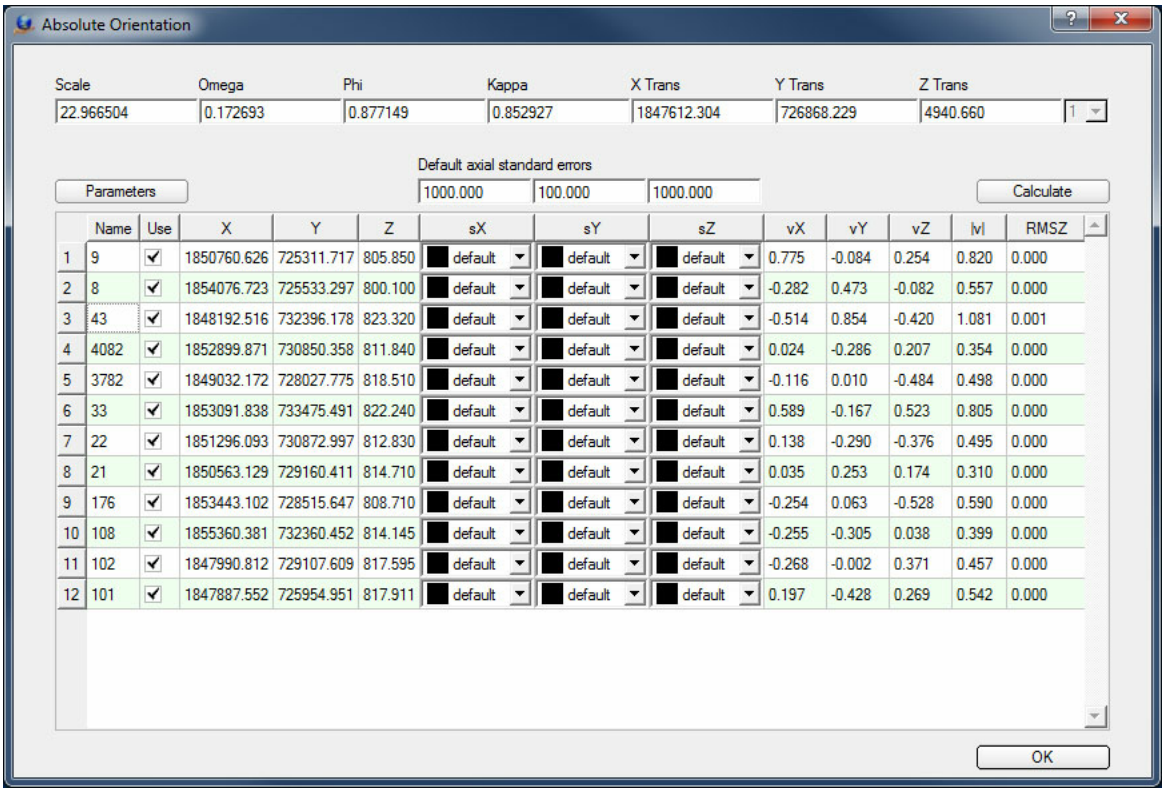
Absolute Orientation

Absolute orientation does a best fit alignment of camera positions and orientations to the control. It must be done before running the bundle adjustment. The absolute orientation button becomes active when there are at least three intersected control points in a free network adjustment. The interfaces is shown below.



	Name	Use	X	Y	Z	sX	sY	sZ	vX	vY	vZ	|v|	RMSZ
1	9	☑	1850760.626	725311.717	805.850	default	default	default	0.775	-0.084	0.254	0.820	0.000
2	8	☑	1854076.723	725533.297	800.100	default	default	default	-0.282	0.473	-0.082	0.557	0.000
3	43	☑	1848192.516	732396.178	823.320	default	default	default	-0.514	0.854	-0.420	1.081	0.001
4	4082	☑	1852899.871	730850.358	811.840	default	default	default	0.024	-0.286	0.207	0.354	0.000
5	3782	☑	1849032.172	728027.775	818.510	default	default	default	-0.116	0.010	-0.484	0.498	0.000
6	33	☑	1853091.838	733475.491	822.240	default	default	default	0.589	-0.167	0.523	0.805	0.000
7	22	☑	1851296.093	730872.997	812.830	default	default	default	0.138	-0.290	-0.376	0.495	0.000
8	21	☑	1850563.129	729160.411	814.710	default	default	default	0.035	0.253	0.174	0.310	0.000
9	176	☑	1853443.102	728515.647	808.710	default	default	default	-0.254	0.063	-0.528	0.590	0.000
10	108	☑	1855360.381	732360.452	814.145	default	default	default	-0.255	-0.305	0.038	0.399	0.000
11	102	☑	1847990.812	729107.609	817.595	default	default	default	-0.268	-0.002	0.371	0.457	0.000
12	101	☑	1847887.552	725954.951	817.911	default	default	default	0.197	-0.428	0.269	0.542	0.000

The seven parameters of the transformation are listed along the top. The "Use" check boxes enable or disable points in the adjustment. The standard errors of each of the control points in this example are set to default. The default setting indicates that the values above each column will be used. The large default values force the inclusion of every point. Smaller values would allow the transformation to exclude data that appeared to be miss measured. If changes are made to the weights or "Use" options the solution text turns pink, and the "Calculate" button must be pressed to update the solution.

Parameters are accessed by clicking the button near the top left of the interface.

Trails — Relative orientation uses a RANSAC method to find robust solutions. This parameters is a limit to how many times the solution will start over. The higher the number the harder the algorithm looks for solutions, but the slower it goes. Typical

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values range from 5-100 depending on how many outliers are expected in the data.

Z Limit — The number of standard error lengths a solution must be in apparent error before it is excluded from the solution.

Max Iterations — Limit on the number of iterations for optimizing relative orientations solutions

P Level — Searching for solutions includes asking various questions (e.g. is this solution better than that solution?). These questions are statistical and P Level is level at which they must be significant in order to answered a specific way. Typical values range 0.9-0.99.

Outlier Limit — This is threshold for how much of the data can be classified as outliers in acceptable solutions. If set to 0.1 at most 10% of data can be outliers. Typical values range from 0.0-0.5.

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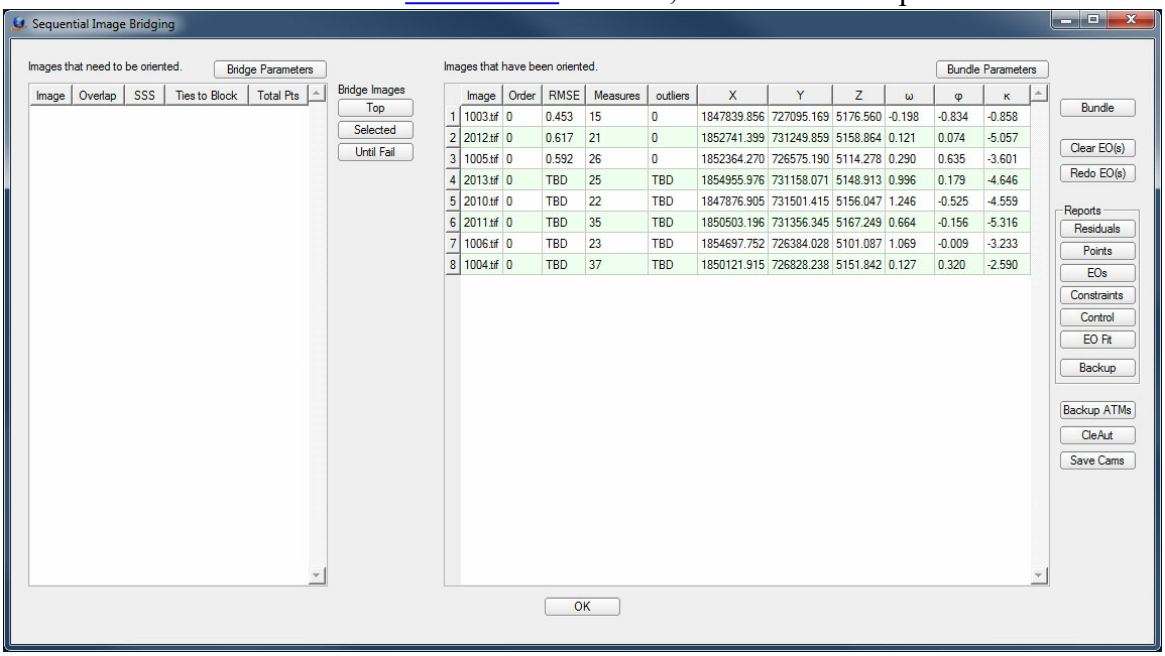
Block Building

The block may continue to be built and bundle adjustments run after absolute orientation. The interface is almost identical to the free network interface, but a few more reports are available.



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2.5.5 Import, Pix4D

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Vr Mapping

Importing a Pix4D Project Into Vr Aerial Triangulation (VrAirTrig)

This document explains the work flow for importing data from Pix4D into VrAirTrig.

There are at least two reasons that users may wish to rerun a Pix4D block in VrAirTrig.
1. The VR Bundle adjustment provides detailed reports and comprehensive weighting parameters.
2. In order to compensate for the imperfect Pix4D camera model export.

Item two requires a bit more explanation. The Pix4D camera distortion model appears to represented internally by an irregular grid, and they do not export enough data to replicate it. The polynomial approximations of the grid that they export are sufficient to set approximate models from their EOs, but not sufficient for mapping. Hence, in order to set models directly from the Pix4D solution users must export distortion corrected images from Pix4D and set models using the distortion corrected images and the imported Pix4D camera file (with the radial distortions disabled). Alternatively, they can follow this procedure to rerun the bundle.

Workflow

1. Open Air Trig and Create a project File.
2. Import a camera file
3. Add the images
4. Setup the control file
4. Import the Pix4D camera position solution
5. Import the measurements
6. Run the bundle adjustment

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Open Air Trig and Create a New Project File

The 'New Project' command is located in the 'Project' window on the main title bar. After choosing a file name and location the project edit/setup wizard will open.

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Import a Camera File

To create a new VR camera file from the Pix4D camera click on the 'New Camera' button on the 'Cameras and Photos' tab of the project wizard. A Camera Edit dialog will open. Click the Import Camera Data button near the top left. Change the file type to Pix4D (using the combo box near the bottom right). Navigate to the file (the file name format is *pix4d_calibrated_internal_camera_parameters.txt). A fully functional camera definition will be imported, but a description can be added for convenience.

To see the imported (and scaled) distortion coefficients click on the 'Edit Radial Distortions' button near the bottom right of the camera edit dialog. You'll notice that the 'Adjustment mode' has been set to 'Polynomial'. The actual polynomials can be seen by clicking on the 'Polynomial Parameters' button.

Upon clicking 'OK' to exit the camera edit window, you'll be prompted to choose a file name for the new camera file.

Full documentation for the camera edit dialog is located here.

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Add the Images

To add images to project click on the name of camera the images will be assigned to in the left table of the 'Cameras and Photos' tab of the project wizard. When a single camera is selected the 'Assign Photos to Camera' button on the bottom left becomes active. Click this button and navigate to choose the images.

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Setup the Control File

On the 'Orientations and Control' tab of the project wizard the 'Control File' button is used to select ground control file. The control file can be file formatted as follows:

```
PtName1 X Y Z
PtName2 X Y Z
PtName3 X Y Z
```

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```
...
```

The Vr Mapping software adds some default header information when it saves the file.

File Example:

```
# Coordinate File
# Layout  - Field Order              Min number of fields
#  0        NAME X Y Z CX CY CZ                3
#  1        NAME Y X Z CY CX CZ                3
#  2        X Y Z NAME CX CY CZ                4
#  3        Y X Z NAME CY CX CZ                4
#  4        NAME X Y Z                         3
#  5        NAME Y X Z                         3
#  6        X Y Z NAME                         4
#  7        Y X Z NAME                         4
#  8        X Y NAME                           3
#  9        Y X NAME                           3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
# Datum   - Datum
# 0         NAD1927
# 1         NAD1983
#
# UtmZone - UTM Zone
# 1-60      Utm zone number
#
# Units   - Coordinate units
#  0        Us Foot
#  1        International Foot
#  2        Meters
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
          5  1862600.861000   724626.555000   807.1600
         14  1862956.537000   726104.024000   810.4900
         27  1862097.709000   729995.080000   793.1600
         29  1865529.981000   731805.394000   808.5700
         30  1861813.412000   731226.056000   794.1000
        103  1875804.906000   722601.108000   894.5390
        104  1876434.487000   726668.853000   899.2450
```

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```
107   1868807.915000   727037.911000   797.9120
110   1873497.612000   726632.340000   912.9600
227   1863885.554000   727376.236000   810.9500
528   1864669.954000   723806.413000   816.2600
```

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Import The Camera Position and Orientation Solution

To import the Pix4D camera positions and orientations (EOs) click on the 'Import EOs' button on the 'Orientations and Control' tab of the project wizard. A windows browse dialog will be opened. Select the Pix4D file type from the combo box on the bottom right of the window and then navigate to the file. A message box will appear that lists how many of the images were correctly read from the input file. The entries in the table under the heading 'Exterior' will also change to 'Yes' indicating that an image has an exterior orientation (EO). See 'Import, Exterior Orientations' for more general EO importing information.

At this point, images have fully defined orientations and it can be determined if control points project into the images. The number of control points that project into each images is listed in the table under the heading 'Ctl Pts'. The entries in the table are sortable by the values in each column. To sort them by the number of control points, click on the 'Ctl Pts' header (It may be necessary to click it twice to sort the image in descending order by the number of control point). Double clicking on non-zero values in the 'Ctl Pts' column will allow you to view thumb nails of the control points in the images that they project into. Viewing some of these thumbnails is a good way to verify that the control, camera definition, and image orientations have been oriented successfully.

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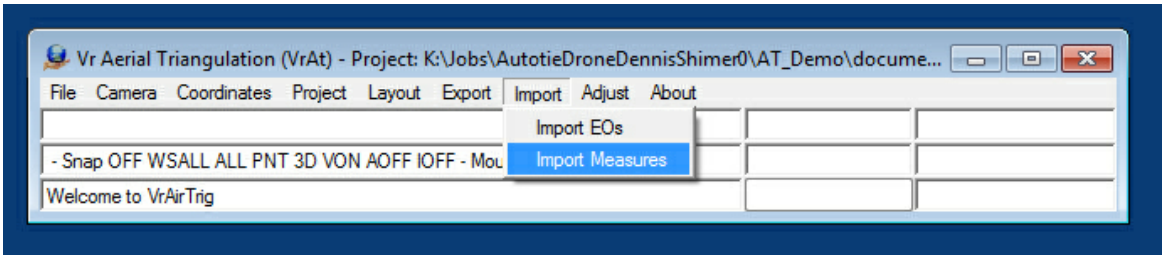
Import the Measurements

The Pix4D image measurements are importing by selecting 'Import Measures' from the import menu on the main command ribbon.



Option 1: It is recommended to export the bingo format tie points from Pix4D because this file has a reasonable number of points. The exported file with be named "*_tp_bingo.txt".

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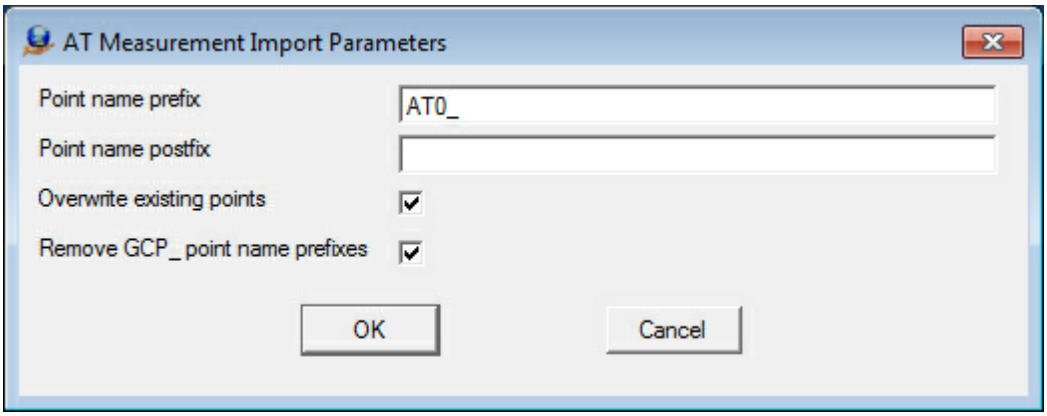
If following option 1 select the Bingo file type from the combo box in the bottom right and navigate to the file (*_tp_bingo.txt).

Option 2: Export the Pix4D format tie points from Pix4D. This file has a huge number of points which makes importing and running the bundle slow. The exported file will named *_tp_pix3d.txt.

If following option 2, select Pix4D as the file type under from the combo box near the bottom right of this window and navigate to the file (*_tp_pix3d.txt).

A dialog will be displayed which allow the setting of the At Measurement Import Parameters.



Point name prefix - Optionally add a prefix to all NON CONTROL point names. For this reason it is essential to define the control point file before running this import. Adding the default "AT0_" to the point names causes the software to see the imported points as automatic tie points. Automatic tie points can be winnowed, deleted, etc. more easily than points that the software believes are manual measurements.

Point name postfix - Optional post fix to all NON CONTROL point names. For this reason it is essential to define the control point file before running this import.

Overwrite existing points - If checked all previous image points will be deleted.

Remove GCP_ point name prefix - Pix4D adds this prefix to control point measurements in its tie point files. It is usually convenient to remove it so that the point names in the tie point file will match those in the control file. This option is only available when importing in Pix4D and Bingo formats.

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Run the Bundle Adjustment

Run the bundle adjustment from the 'Adjust' menu on the main control ribbon. There is no need to open layout, or view images, or anything else.

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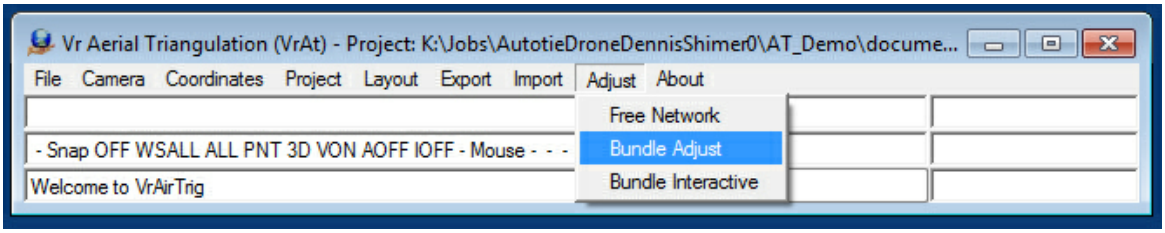

There will be a prompt for user parameters and after iterating the bundle final tweaking window will open.

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2.5.6 Import, Photoscan

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Vr Mapping

Importing a Agisoft Photoscan Project Into Vr Aerial Triangulation (VrAirTrig)

This document explains the work flow for importing data from Pix4D into VrAirTrig.

There are at least two reasons that users may wish to rerun a Photoscan block in VrAirTrig.
1. The VR Bundle adjustment provides detailed reports and comprehensive weighting parameters.
2. In order to compensate for the imperfect Photoscan camera model export.

Workflow

1. Export Camera Exterior Orientations and Image Measurements from Photoscan
2. Open Air Trig and Create a project File.
3. Import the camera file

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4. Add the images

5. Setup the control file

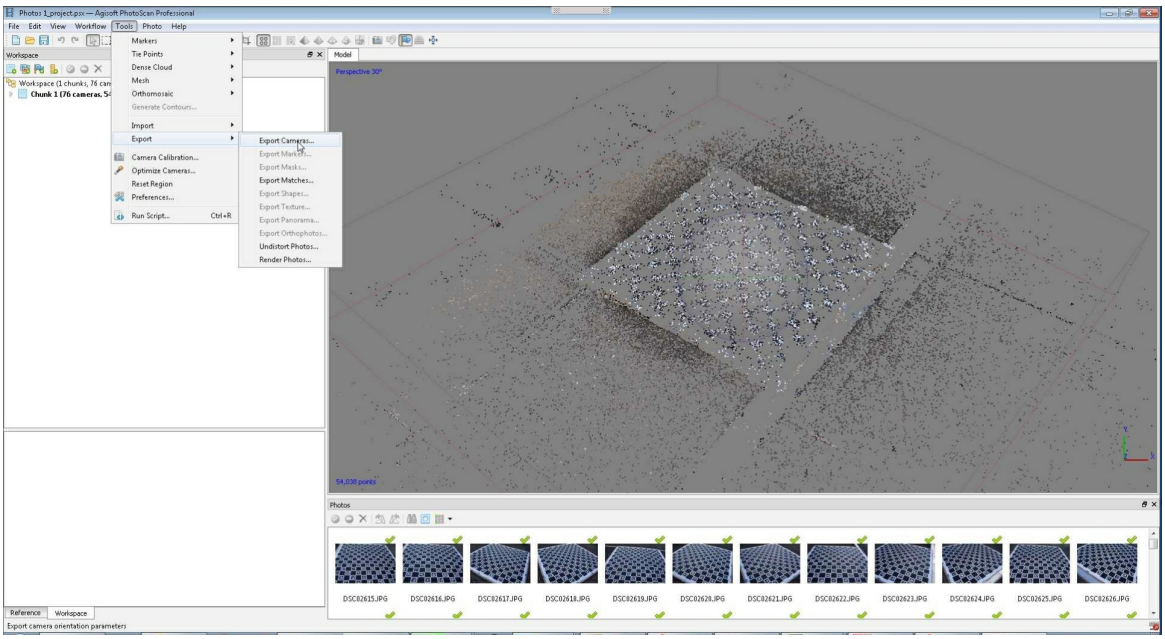
6. Import the Photoscan camera position solution

7. Import the measurements

8. Run the bundle adjustment

Export Camera Exterior Orientations and Image Measurements from Photoscan.

Export the camera exterior orientations, called "Cameras" in Photoscan.



Save the exterior orientations as "Bingo" format.

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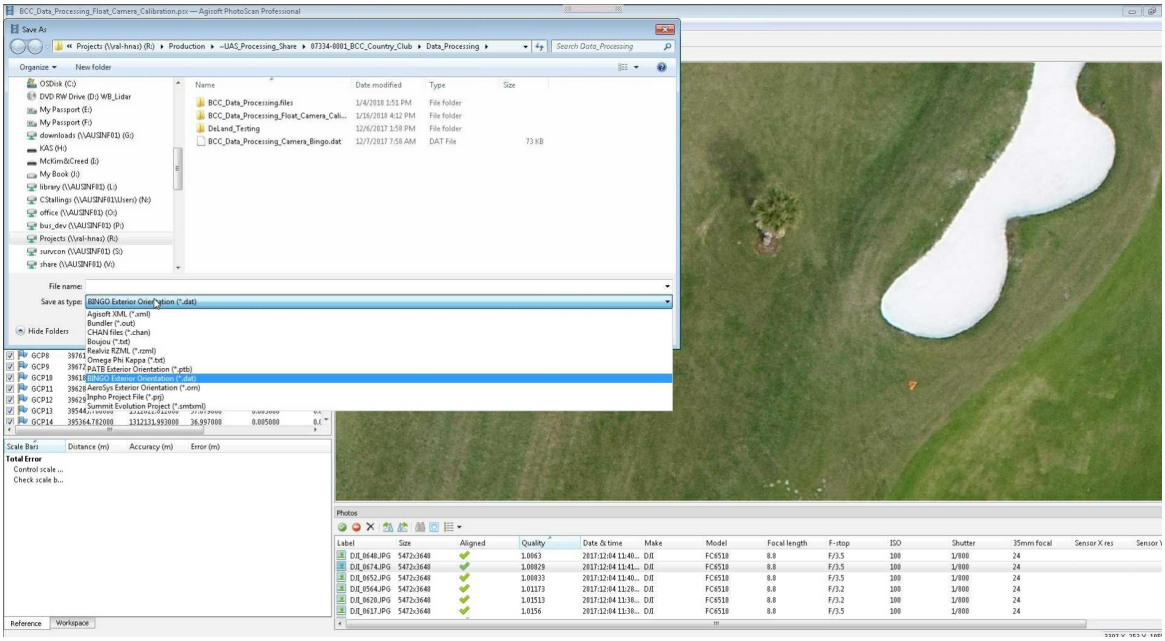
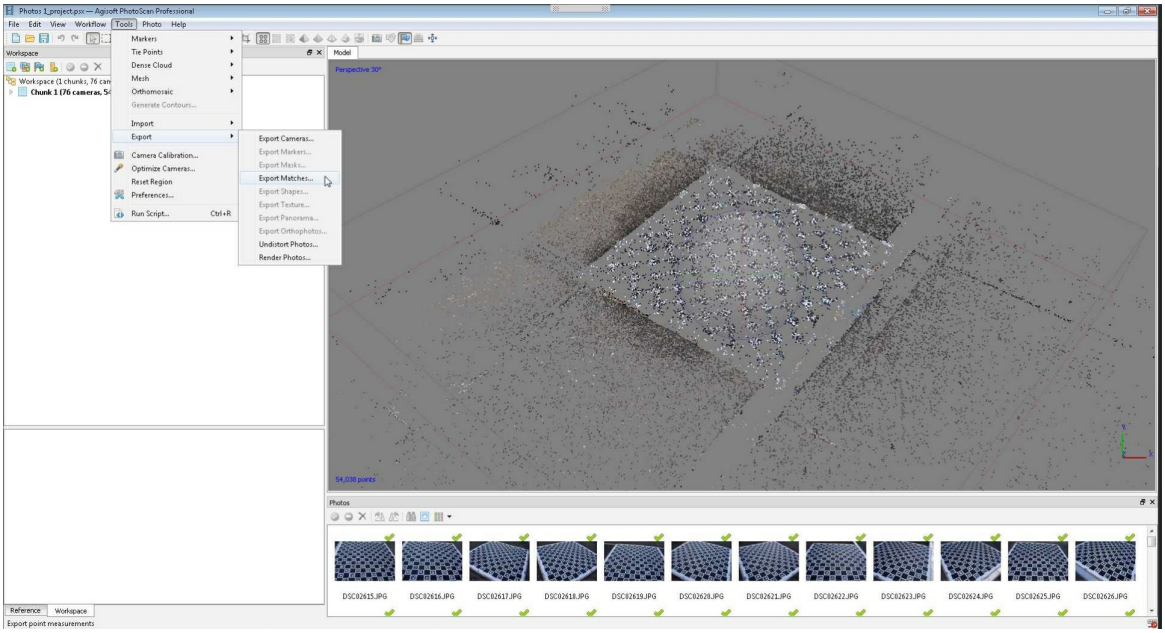


Export the image measurements (called "Matches" in Photoscan) as a "patb" format.



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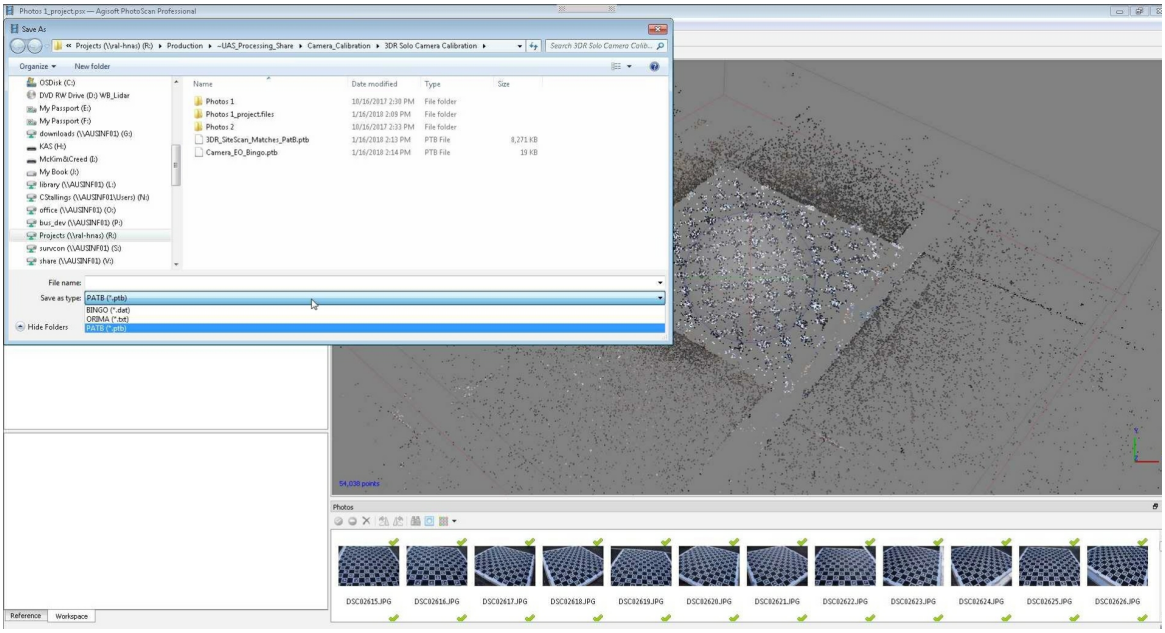

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Open Air Trig and Create a New Project File

The 'New Project' command is located in the 'Project' window on the main title bar. After choosing a file name and location the project edit/setup wizard will open.

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Import the Camera File

To create a new VR camera file from the Photoscan camera click on the 'New Camera' button on the 'Cameras and Photos' tab of the project wizard. A Camera Edit dialog will open. Click the Import Camera Data button near the top left. Change the file type to Agisoft (using the combo box near the bottom right). Navigate to the file (the file name format is *.xml). A fully functional camera definition will be imported, but a description can be added for convenience. Note that in order to import measurements the camera must be converted to millimeters instead of native pixels. To do this conversion you will be prompted for a pixel size in millimeters. It is best to get this number from inside Photoscan.

To see the imported (and scaled) distortion coefficients click on the 'Edit Radial Distortions' button near the bottom right of the camera edit dialog. You'll notice that the 'Adjustment mode' has been set to 'Polynomial'. The actual polynomials can be seen by clicking on the 'Polynomial Parameters' button.

Upon clicking 'OK' to exit the camera edit window, you'll be prompted to choose a file name for the new camera file.

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Full documentation for the camera edit dialog is located here.

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Add the Images

To add images to project click on the name of camera the images will be assigned to in the left table of the 'Cameras and Photos' tab of the project wizard. When a single camera is selected the 'Assign Photos to Camera' button on the bottom left becomes active. Click this button and navigate to choose the images.

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Setup the Control File

On the 'Orientations and Control' tab of the project wizard the 'Control File' button is used to select ground control file. The control file can be file formatted as follows:

```
PtName1 X Y Z
PtName2 X Y Z
PtName3 X Y Z
...
```

The Vr Mapping software adds some default header information when it saves the file.

File Example:

```
# Coordinate File
# Layout  - Field Order              Min number of fields
#  0        NAME X Y Z CX CY CZ                 3
#  1        NAME Y X Z CY CX CZ                 3
#  2        X Y Z NAME CX CY CZ                 4
#  3        Y X Z NAME CY CX CZ                 4
#  4        NAME X Y Z                          3
#  5        NAME Y X Z                          3
#  6        X Y Z NAME                          4
#  7        Y X Z NAME                          4
#  8        X Y NAME                            3
#  9        Y X NAME                            3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
```

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```
# Datum    - Datum
# 0          NAD1927
# 1          NAD1983
#
# UtmZone  - UTM Zone
# 1-60       Utm zone number
#
# Units    - Coordinate units
#  0         Us Foot
#  1         International Foot
#  2         Meters
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
          5  1862600.861000   724626.555000   807.1600
         14  1862956.537000   726104.024000   810.4900
         27  1862097.709000   729995.080000   793.1600
         29  1865529.981000   731805.394000   808.5700
         30  1861813.412000   731226.056000   794.1000
        103  1875804.906000   722601.108000   894.5390
        104  1876434.487000   726668.853000   899.2450
        107  1868807.915000   727037.911000   797.9120
        110  1873497.612000   726632.340000   912.9600
        227  1863885.554000   727376.236000   810.9500
        528  1864669.954000   723806.413000   816.2600
```

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Import the Camera Position and Orientation Solution

To import the Photoscan camera positions and orientations (EOs) click on the 'Import EOs' button on the 'Orientations and Control' tab of the project wizard. A windows browse dialog will be opened. Select the "Bingo" file type from the combo box on the bottom right of the window and then navigate to the EO file saved in step 1. A message box will appear that lists how many of the images were correctly read from the input file. The entries in the table under the heading 'Exterior' will also change to 'Yes' indicating that an image has an exterior orientation (EO). See 'Import, Exterior Orientations' for more general EO importing information.

At this point, images have fully defined orientations and it can be determined if control points project into the images. The number of control points that project into each images is listed in the table under the heading 'Ctl Pts'. The entries in the table are sortable by the values in each column. To sort them by the number of control points, click on the 'Ctl Pts' header (It may be

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necessary to click it twice to sort the image in descending order by the number of control point). Double clicking on non-zero values in the 'Ctl Pts' column will allow you to view thumb nails of the control points in the images that they project into. Viewing some of these thumbnails is a way to verify that the control, camera definition, and image orientations have been oriented successfully.

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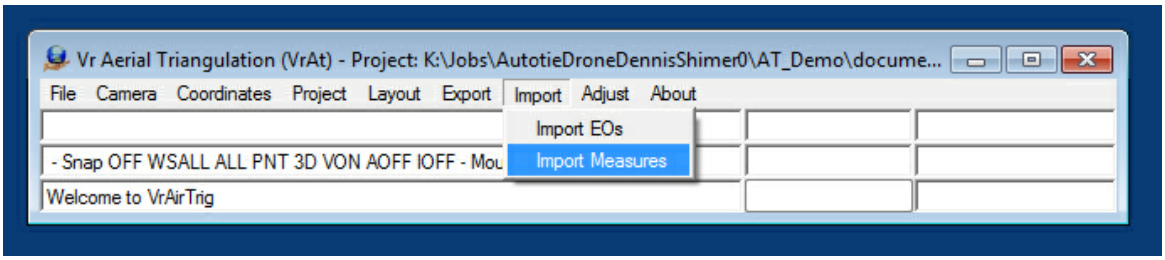
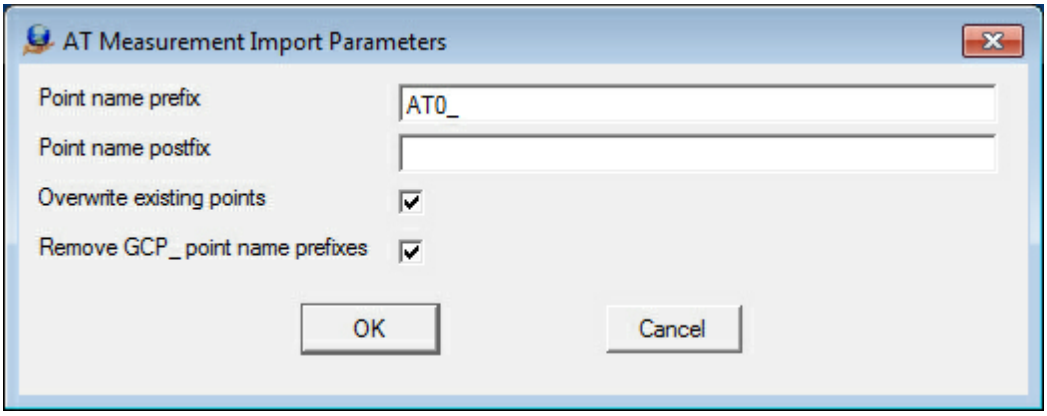
Import the Measurements

The Photoscan image measurements are importing by selecting 'Import Measures' from the import menu on the main command ribbon. Chose the "patb" format and navigate to image measurement file saved in step 1.



A dialog will be displayed which allow the setting of the At Measurement Import Parameters.



Point name prefix - Optionally add a prefix to all NON-CONTROL point names. For this reason it is essential to define the control point file before running this import. Adding the default "AT0_" to the point names causes the software to see the imported points as automatic tie points. Automatic tie points can be winnowed, deleted, etc. more easily than points that the software believes are manual measurements.

Point name postfix - Optional post fix to all NON-CONTROL point names. For this reason it is essential to define the control point file before running this import.

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Overwrite existing points - If checked all previous image points will be deleted.

Remove GCP_ point name prefix - Pix4D adds this prefix to control point measurements in its tie point files. It is usually convenient to remove it so that the point names in the tie point file will match those in the control file. If not importing from Pix4D it is best to uncheck this box.

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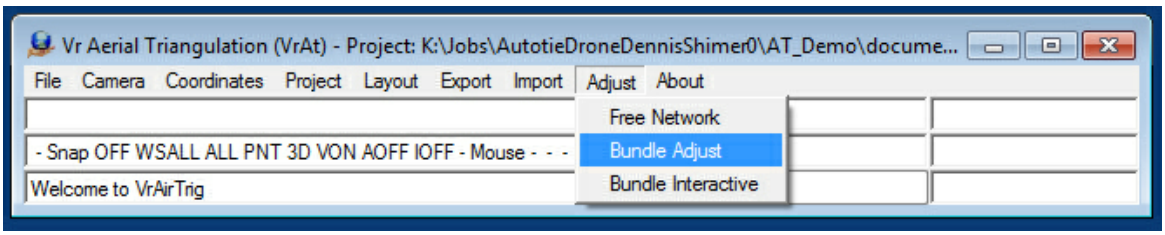
Run the Bundle Adjustment

Run the bundle adjustment from the 'Adjust' menu on the main control ribbon. It is not required to open layout, or view images, or anything else. However, opening layout to verify the point layout, make additional measurements of control point, etc. is advisable.



There will be a prompt for user parameters and after iterating the bundle final tweaking window will open.

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2.5.7 Import, Datumate

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Vr Mapping

Importing a Datumate Project Into Vr Aerial Triangulation

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(VrAirTrig)

This document explains the work flow for importing data from Datumate into VrAirTrig.

This workflow allows the import of the Datumate control point coordinates and associated measured photo coordinates along with the automatically generated tie points to be imported into VrAirTrig. After the import of the data the VrAirTrig bundle adjustment is performed which generates detailed reports and allows for comprehensive weighting parameters. Output from the bundle adjustemnet includes a camera calibration and exterior orientation (EO) parameters for the orientation of stereo models using Vr Model Set (VrModSet) or the generation of orthophotos using Vr Orthophoto (VrOrtho).

Workflow

1. Open VrAirTrig and create a project File.

2. Import a camera file

3. Add the images

4. Setup the control file

4. Import the Datumate camera position solution

5. Import the measurements

6. Run the bundle adjustment

Open Air Trig and Create a New Project File

The 'New Project' command is located in the 'Project' window on the main title bar. After choosing a file name and location the project edit/setup wizard will open.

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Import a Camera File

Importing a camera file is an optional step and is not needed if a camera file already exists. For example, the Vr Camera Calibration (VrCamCal) creates camera files.

A camera file may be imported from the Camera pull-down in the main window or it may be imported from the Project Wizard. To create a new Vr camera file from the Project Wizard click on the 'New Camera' button on the 'Cameras and Photos' tab. A Camera Edit dialog will open. Click the 'Import Camera Data' button near the top left. Change the file type to 'Datumate (.ori)' (using the combo box near the bottom right).

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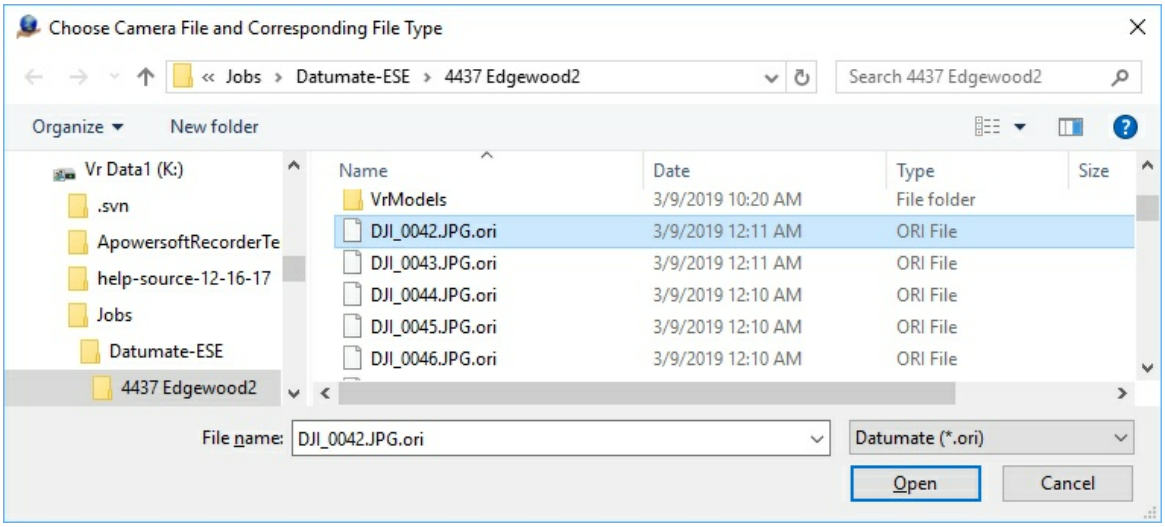
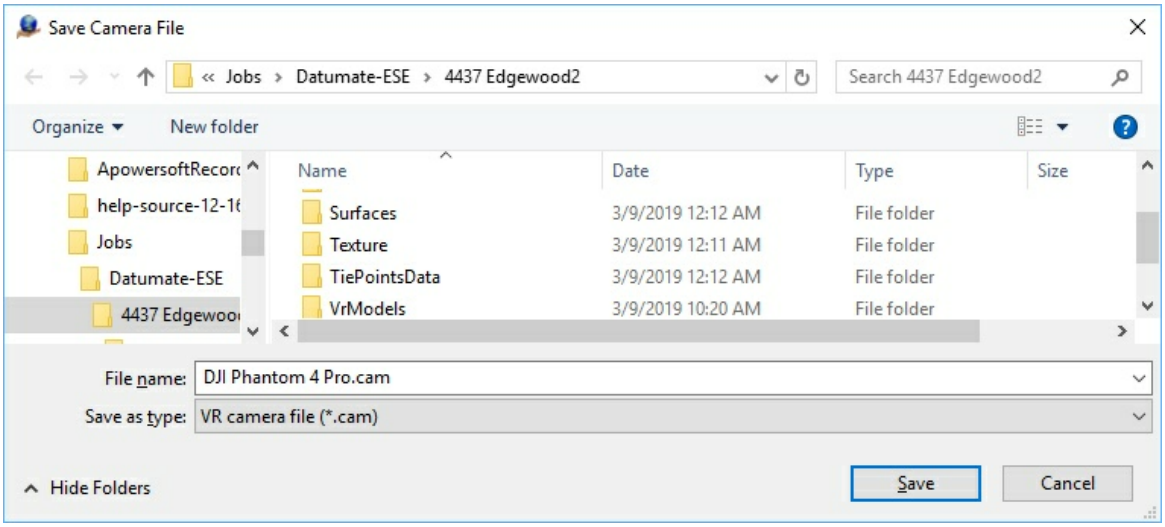


Import Camera File dialog for Datumate

The Datumate camera information is stored in the Datumate .ori files. There is a .ori file for each photo that was used by Datumate. Any .ori file may be selected if a single camera was used for the entire project. If multiple camera were used then this procedure would be repeated for each camera. If multiple cameras were used when the .ori files might need to be viewed to determine a .ori file for each camera. A fully functional camera definition will be imported, but a description can be added for convenience.

The Datumate camera import does not import radial distortions and the resulting camera file has the radial distortions turned off.

Upon clicking 'OK' to exit the camera edit window, a new camera file name may be entered in the Save Camera File and the imported camera data will be saved as a Vr camera file.



Save Camera File dialog

The new camera file name will be entered into the Project Wizard 'Camera and Photos' tab. Full

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documentation for the camera edit dialog is located here.

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Add the Images

To add images to project click on the name of camera the images will be assigned to in the left table of the 'Cameras and Photos' tab of the project wizard. When a single camera is selected the 'Assign Photos to Camera' button on the bottom left becomes active. Click this button and navigate to choose the images.

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Setup the Control File

On the 'Orientations and Control' tab of the project wizard the 'Control File' button is used to select ground control file. The control point data is stored in a .xml file (typically job.xml). When the control data is read and placed in a Vr control file, this file may be saved.

The Vr Mapping software adds some default header information when it saves the file.

File Example:

```
# Coordinate File
# Layout  - Field Order              Min number of fields
#  0        NAME X Y Z CX CY CZ                3
#  1        NAME Y X Z CY CX CZ                3
#  2        X Y Z NAME CX CY CZ                4
#  3        Y X Z NAME CY CX CZ                4
#  4        NAME X Y Z                         3
#  5        NAME Y X Z                         3
#  6        X Y Z NAME                         4
#  7        Y X Z NAME                         4
#  8        X Y NAME                           3
#  9        Y X NAME                           3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
# Datum   - Datum
# 0         NAD1927
# 1         NAD1983
#
# UtmZone - UTM Zone
# 1-60      Utm zone number
```

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```
#
# Units   - Coordinate units
#  0        Us Foot
#  1        International Foot
#  2        Meters
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
         5  1862600.861000   724626.555000   807.1600
        14  1862956.537000   726104.024000   810.4900
        27  1862097.709000   729995.080000   793.1600
        29  1865529.981000   731805.394000   808.5700
        30  1861813.412000   731226.056000   794.1000
       103  1875804.906000   722601.108000   894.5390
       104  1876434.487000   726668.853000   899.2450
       107  1868807.915000   727037.911000   797.9120
       110  1873497.612000   726632.340000   912.9600
       227  1863885.554000   727376.236000   810.9500
       528  1864669.954000   723806.413000   816.2600
```

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Import the Camera Position and Orientation Solution

To import the Datumate camera positions and orientations (EOs) click on the 'Import EOs' button on the 'Orientations and Control' tab of the project wizard. A windows browse dialog will be opened. Select the Datumate file type from the combo box on the bottom right of the window (Dautmate (.ori)). Like the Datumate camera parameters, the EO data is stored in the Datumate .ori files. Since it is expected that all the .ori files are in the same folder a single .ori file is selected and all the .ori files in that folder are read.

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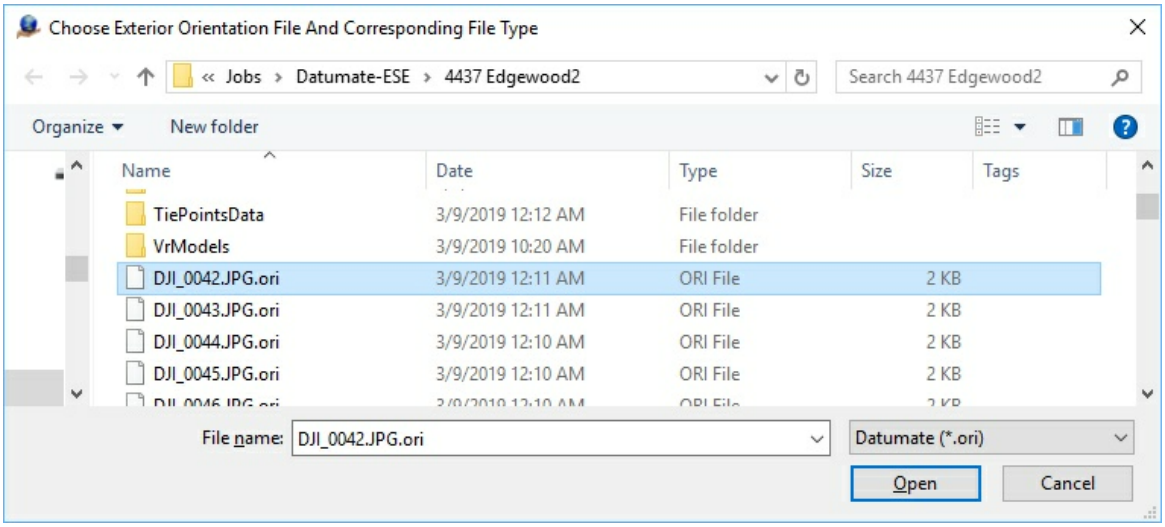

Import Exterior Orientations (EO) dialog

A message box will appear that lists how many of the images were correctly read from the input file. The entries in the table under the heading 'Exterior' will also change to 'Yes' indicating that an image has an exterior orientation (EO). See 'Import, Exterior Orientations' for more general EO importing information.

At this point, images have fully defined orientations and it can be determined if control points project into the images. The number of control points that project into each images is listed in the table under the heading 'Ctl Pts'. The entries in the table are sortable by the values in each column. To sort them by the number of control points, click on the 'Ctl Pts' header (It may be necessary to click it twice to sort the image in descending order by the number of control point). Double clicking on non-zero values in the 'Ctl Pts' column will allow you to view thumb nails of the control points in the images that they project into. Viewing some of these thumbnails is a good way to verify that the control, camera definition, and image orientations have been oriented successfully.

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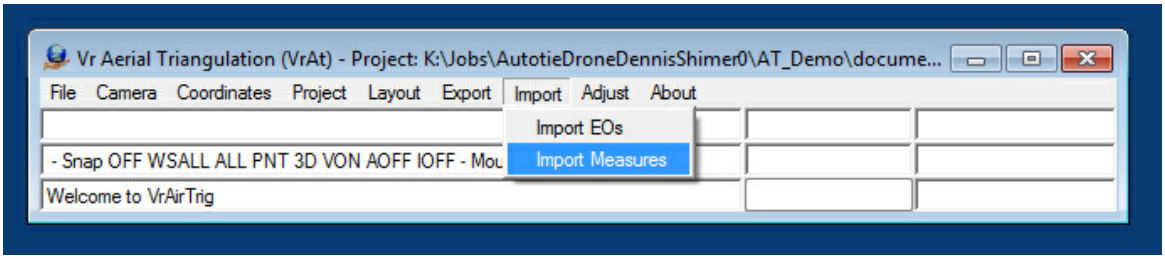
Import the Measurements

The Datumate image measurements are imported by selecting 'Import Measurements from the import menu on the main command ribbon.



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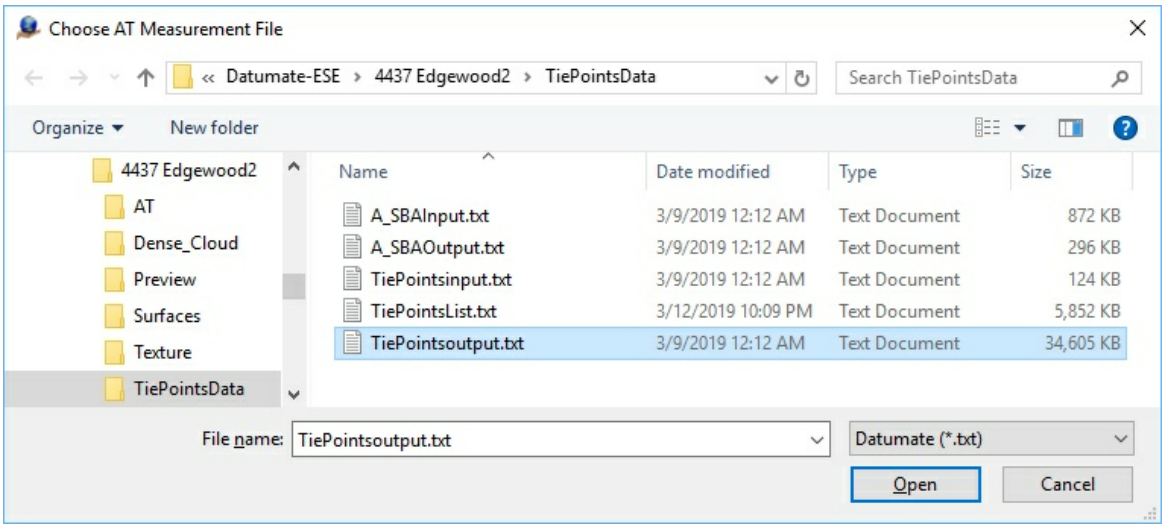
The Datumate measurements are imported from two files which are the Datumate tie points file (.txt) and the Datumate jobs file (.xml) which contains the ground control points.

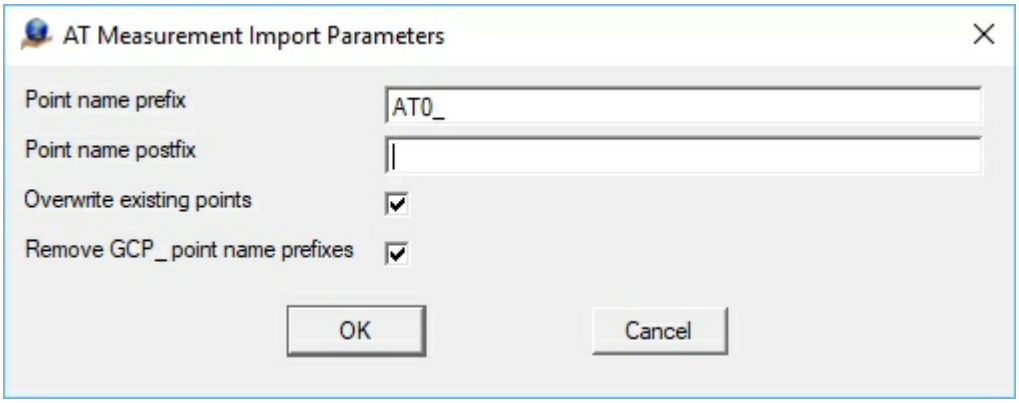
Import the Tie Points



The Choose AT Measurement file dialog

The first file to import is the Datumate tie points file. This file is typically in a separate TiePointsData folder and is named TiePointsoutput.txt. The tie points are in a text file and the file type is 'Datumate (*.txt)'. Navigate to the tie points folder and select the tie points file.

Next, a dialog will be displayed which allow the setting of the At Measurement Import Parameters.



The AT Measurement Import Parameters

Point name prefix - Optionally add a prefix to all NON CONTROL point names. For this reason it is essential to define the control point file before running this import. Adding the default "AT0_" to the point names causes the software to see the imported points as automatic tie points. Automatic tie points can be winnowed, deleted, etc. more easily than points that the software believes are manual measurements.

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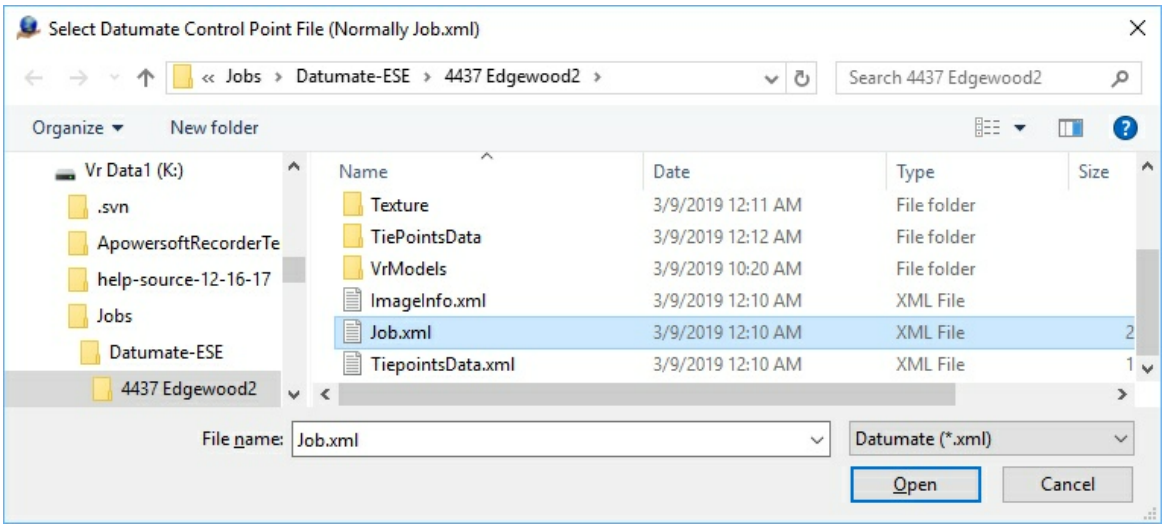
Point name postfix - Optional post fix to all NON CONTROL point names. For this reason it is essential to define the control point file before running this import.

Overwrite existing points - If checked all previous image points will be deleted.

Remove GCP_ point name prefix - Pix4D adds this prefix to control point measurements in its tie point files. It is usually convenient to remove it so that the point names in the tie point file will match those in the control file. This option is only available when importing in Pix4D and Bingo formats.

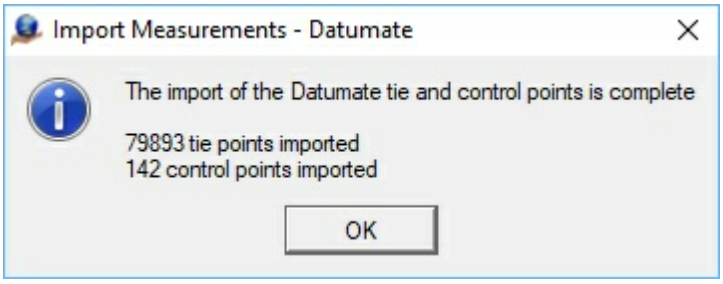
Import the Ground Control Points (GCPs)



The Select Datumate Control Point File

The Datumate control point file is typically the job file. This is a .xml file and is typically named Job.xml.

Once the two input files are read, the following dialog is displayed indicating the import measurements process is complete.



The Import Measurements complete dialog

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Run the Bundle Adjustment

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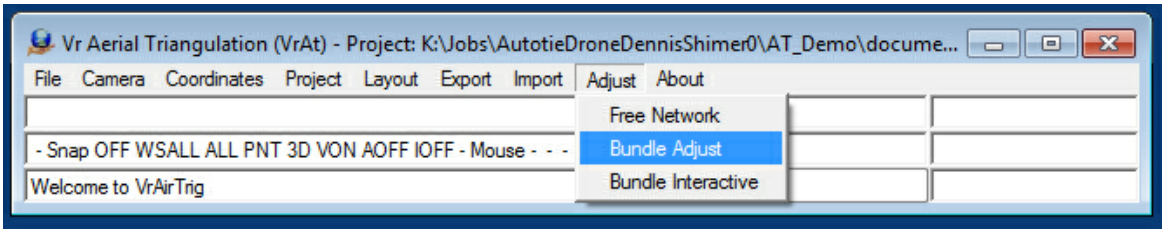
Run the bundle adjustment from the 'Adjust' menu on the main control ribbon. There is no need to open layout, or view images, or anything else.



There will be a prompt for user parameters and after iterating the bundle final tweaking window will open.

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2.5.8 AeroSys Download and Install

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Vr Mapping

AeroSys Download, Install and Password Request

Description

Below are instructions on downloading, installing, and requesting passwords for the AeroSys aerial triangulation adjustment software. The AeroSys software is the adjustment engine for the Vr Aerial Triangulation package VrAirTrig. If you wish to evaluate the AeroSys adjustment software with Vr Aerial Triangulation, the software may be downloaded and installed and will adjust up to eight photographs without a password. With a password, up to 2000 photos may be adjusted in a single block.

Information about configuring AeroSys can be found at AeroSys Settings and Configuration.

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Download the AeroSys Software Disks

1. Got to http://aerogeomatics.com/aerosys/software/.
2. Click the folder with the latest version.

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Index of /aerosys/software

Name	Last modified	Size	Description
Parent Directory		-	
AAA MN 96 VIPERS/	06-Dec-2009 11:56	-	
AZDOT WIN7/	02-Nov-2011 20:39	-	
AeroSysX v8 OEM/	03-Jun-2013 14:47	-	
AeroSys X/	03-Jun-2013 14:29	-	
AeroSys v5.5 OEM/	01-Jun-2005 15:59	-	
AeroSys v6 OEM/	01-Jun-2005 15:44	-	
AeroSys v7 OEM/	06-Feb-2009 17:46	-	
Data/	18-Dec-2007 23:00	-	
DiMAC/	15-Apr-2009 17:27	-	
Fargo Junior Jets in..>	18-Mar-2007 23:45	-	
HCHA 2008 2009 ICE S..>	13-Oct-2008 15:08	-	
HCHA U14/	10-Mar-2012 23:34	-	
ISPRS 2008 Beijing/	13-Jul-2008 07:43	-	
MICRO DEM/	23-Jul-2013 14:57	-	
Misc/	26-May-2005 17:50	-	
Most Recent Updates/	03-Jun-2013 14:39	-	
Socet Set plugin/	26-May-2005 17:52	-	
Training/	27-Jan-2007 03:59	-	
WIN7/	02-Nov-2011 14:16	-	
Womens D1 Hockey/	14-Nov-2011 15:28	-	
asprs/	19-Feb-2008 20:56	-	
doc/	26-May-2005 17:10	-	
mexico/	04-Apr-2008 13:29	-	
orthomapper/	11-May-2006 12:56	-	

aerogeomatics.com/aerosys/software/AeroSys_v7_OEM/

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This walkthrough uses the AeroSys_v7_OEM.

3. Download the files and place them in a temporary folder. Please note that file names will differ based on the software version.

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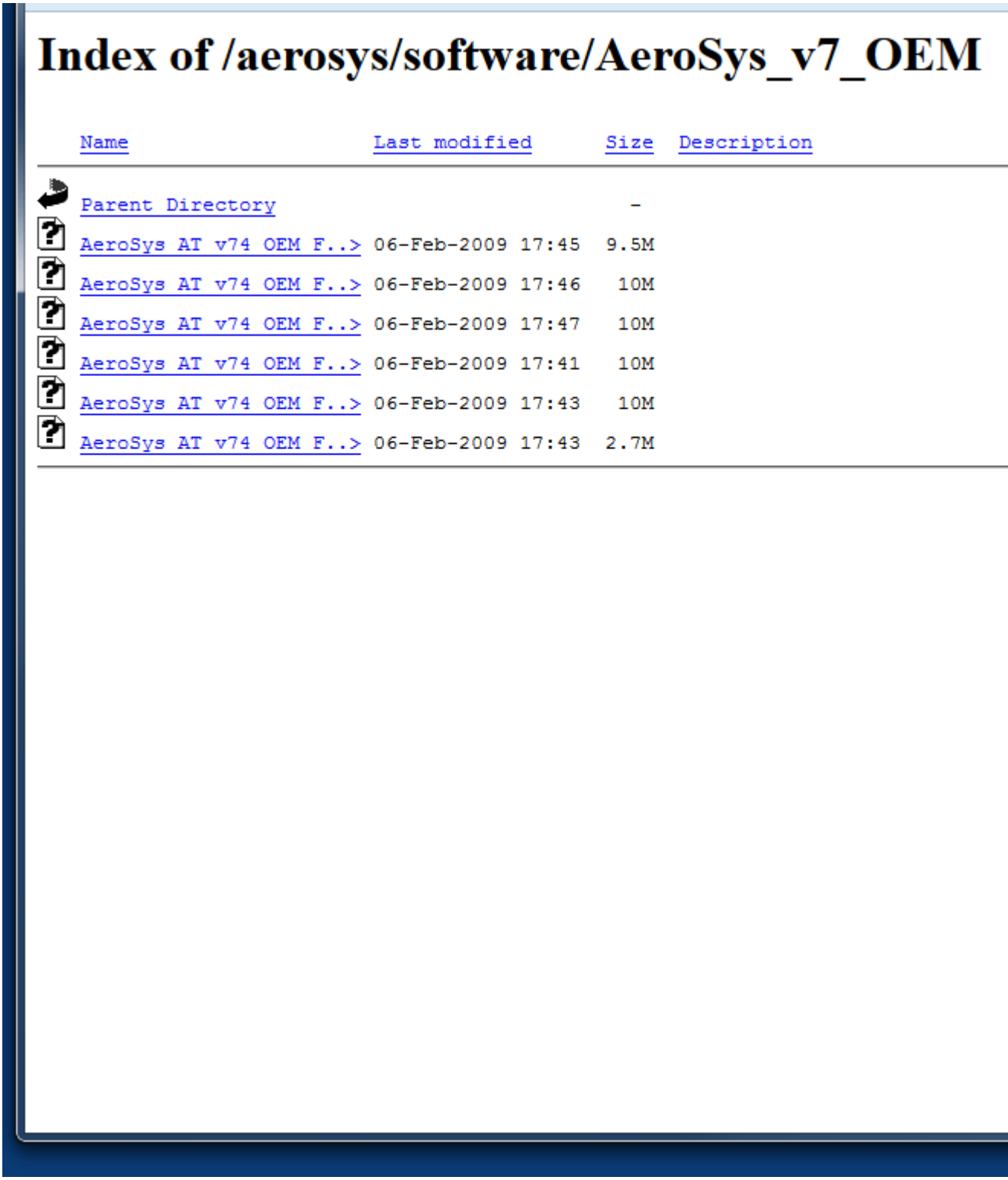

4. Unzip the disk files. Place the extracted file in a separate folder or the same temporary folder as the .zip files.

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5. Run Setup.exe and follow the installation instructions. The folder "AeroSys" will be created containing the necessary files.

6. Once the software is installed, download the VrSoftware/AeroSys patch. This patch may be downloaded from the Cardinal Systems web page under Download Vr Mapping Software. The same username and password used to download the Vr Mapping software is required for the download. The patch is in the vrsoftware/aerosys folder and is named aerosys_patch.zip.

7. Download aerosys_patch.zip into a temporary folder and extract the contents. The three files in the patch are `AeroSysX.exe, dga114.dll and HiResWin.dll`.

8. Place AeroSysX.exe, dga114.dll, and HiResWin.dll in the C:\AeroSys\asw30\bin folder.

Configuration

For configuration information, see "AeroSys Settings and Configuration".

Obtaining Information for a Password Request

Move to the \AeroSys\asw30\bin folder and run AeroSysX.exe. The following dialog box should appear.



Place the mouse cursor in the dialog box and press the right mouse key. Select "Register" from the menu.

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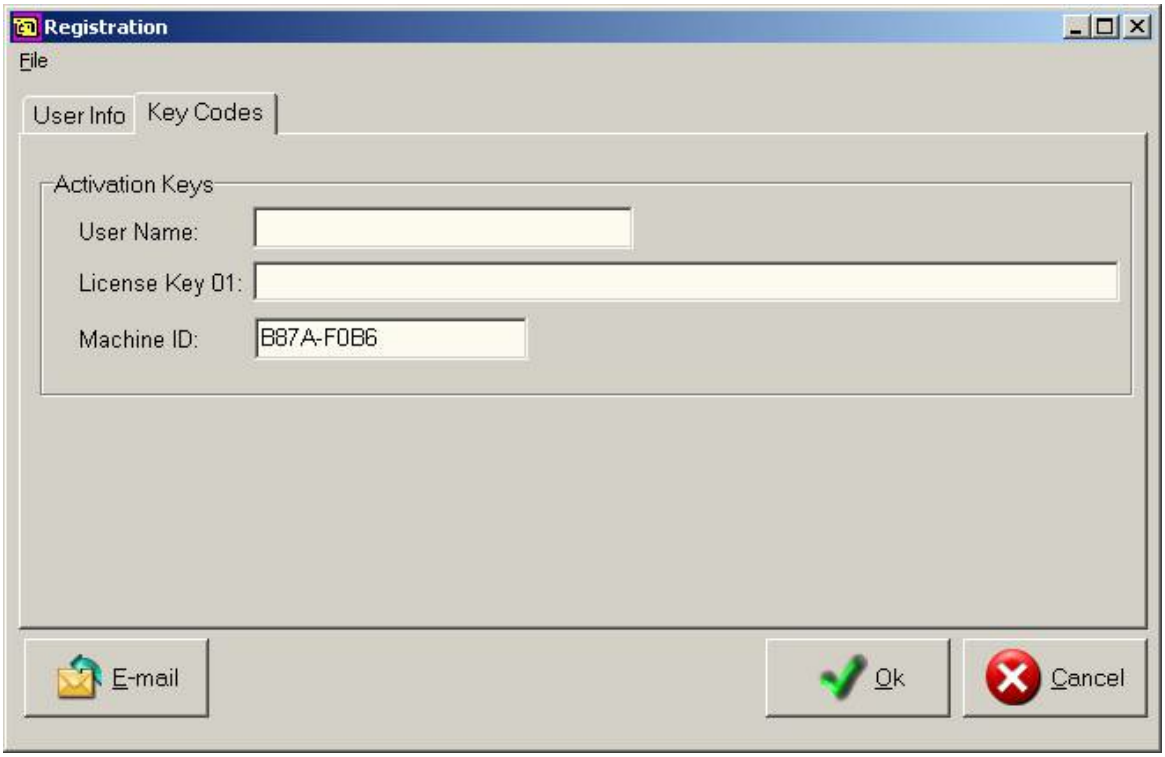

E-mail the Machine ID to Cardinal Systems. The User Name and License Key will be returned to unlock your version of AeroSys. The User Name and License Key must be entered exactly as shown. It is recommended that this information be cut-and-pasted into the dialog box .

To exit AeroSysX, right click and select Quit -> Exit from the menu.

2.5.8.1 AeroSys Settings and Configuration

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Vr Mapping

AeroSys Settings

Description

The following are the general purpose settings for AeroSys. These settings may need

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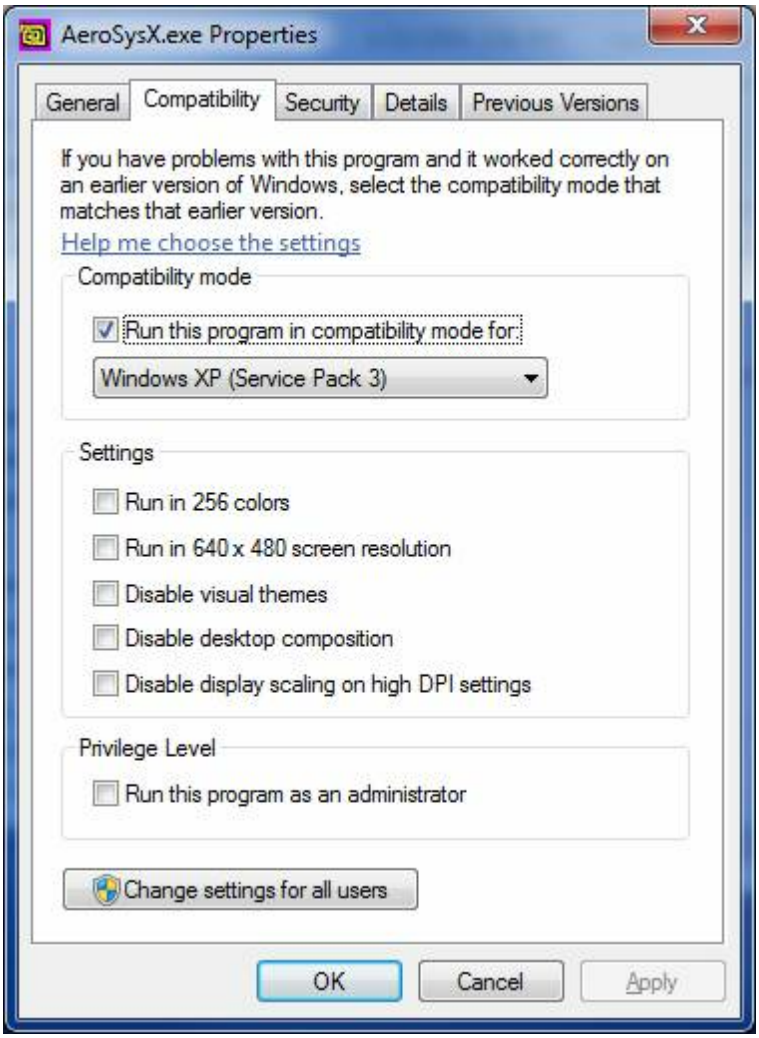
modification for some situations.

For downloading and installation help, see "AeroSys Download and Install".

Windows 7 Settings

1. Move to the \AeroSys\asw30\bin folder.
2. Right click AeroSysX.exe. Select "Properties" from the menu then click the "Compatibility" tab.
3. Set Compatibility mode to "Windows XP (Service Pack 3) as shown below.



The AeroSysX Properties dialog box

In order for Aerosys Version 7.2 to run inside VrAirTrig in Windows 7, the Windows security level must be reduced. "User Account Control Settings" can be accessed from Start -> Control Panel -> System and Security -> Change User Account Control settings. Change the notify setting to "Never notify as shown below". Reboot the computer for the change to take effect.

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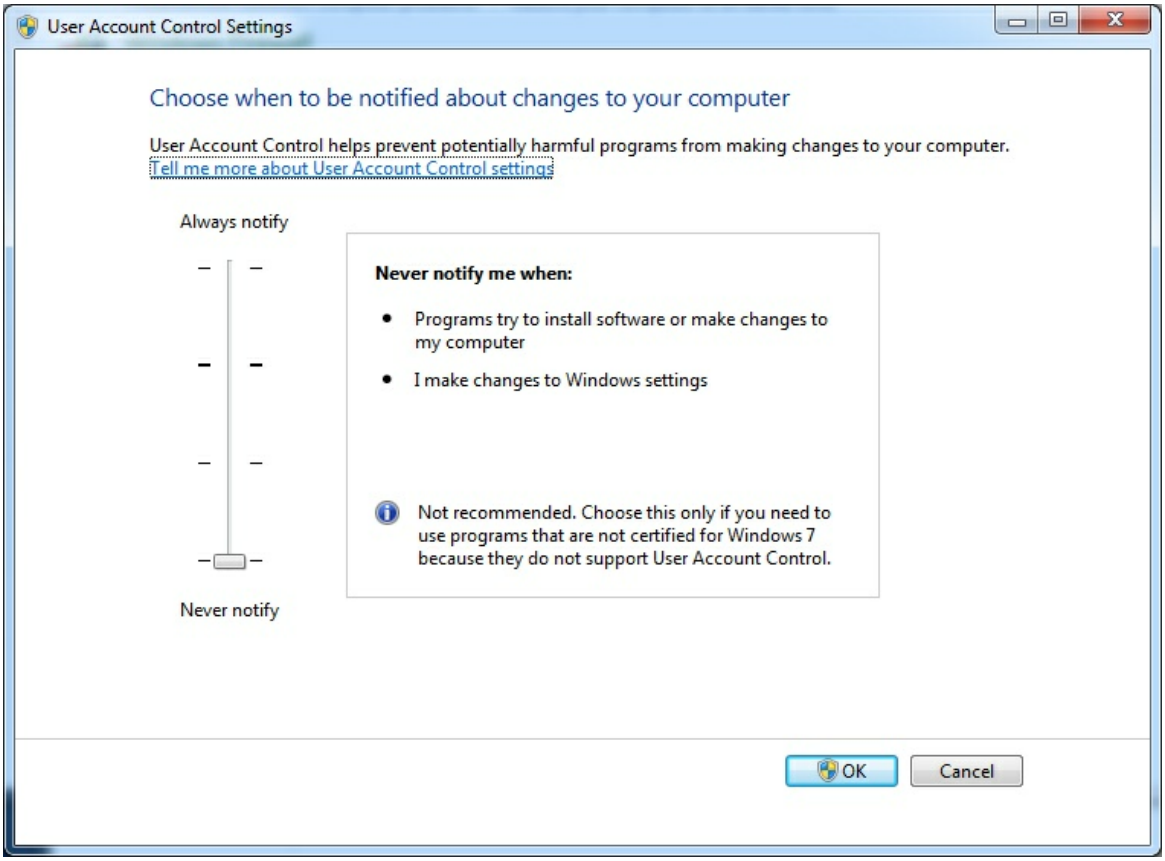

The User Account Control Settings and the lowest setting.

AeroSys Settings

Move to the \AeroSys\asw30\bin folder and run AeroSysX.exe. The following dialog box should appear.



Click the dialog box one time. Press the following key sequences to display the different confirmation menus. These menus may also be accessed by pressing the right mouse button and navigating through the menus to select the desired item. To exit the AeroSysX program press [Ctrl] X.

[Ctrl] [Alt] A - Auto-Sequence Configuration
[Ctrl] [Alt] R - Maximum Residual Limits
[Ctrl] [Alt] S - Default Standard Deviations

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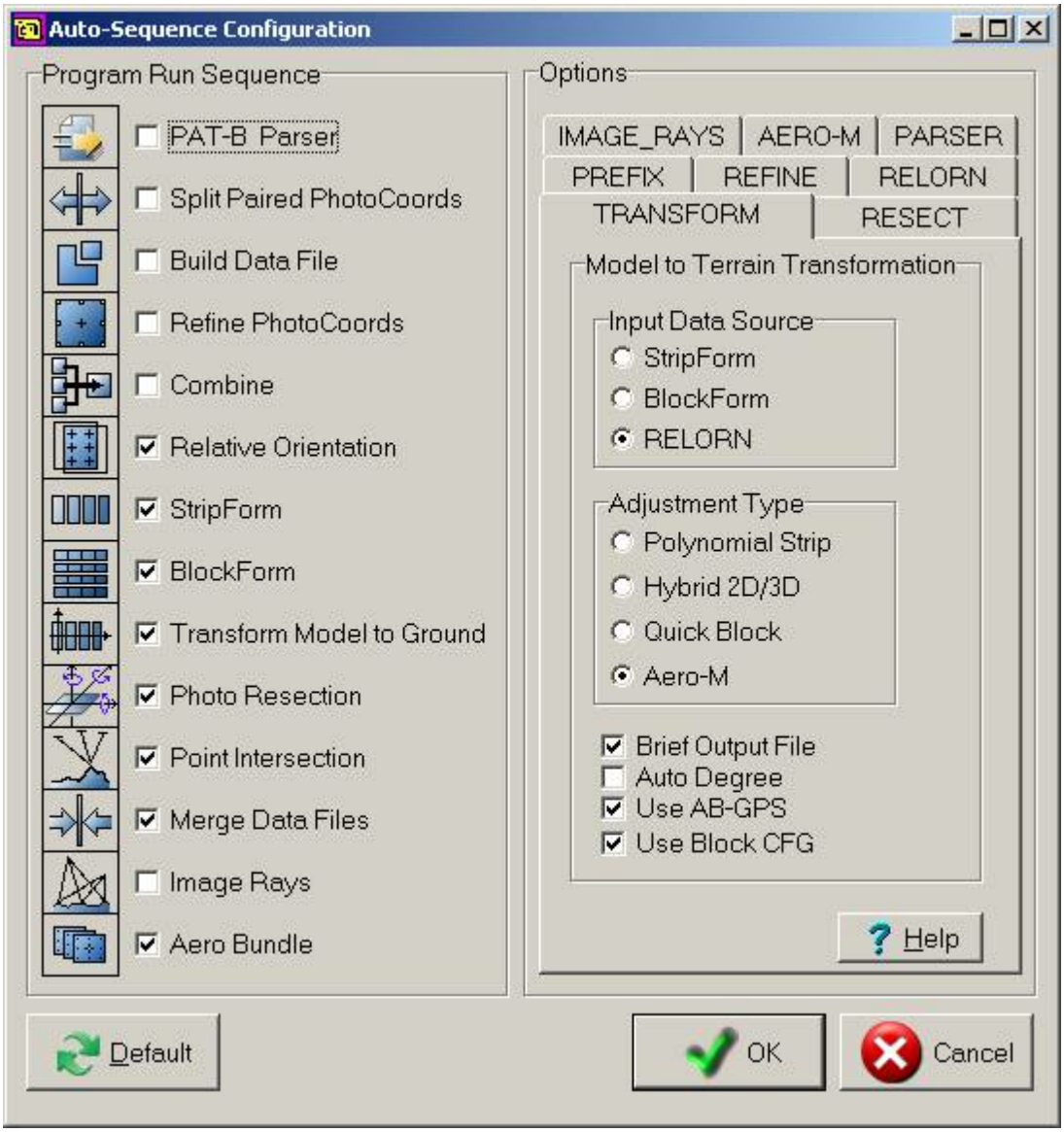
[Ctrl] [Alt] P - Pass Point ID & Position Parameters
[Ctrl] [Alt] T - Set Tie Point Thresholds
[Ctrl] [Alt] O - AeroSys Bundle Adjustment Configurations Options AeroSys-AT v7.2

[Ctrl] [Alt] A - Auto-Sequence Configuration



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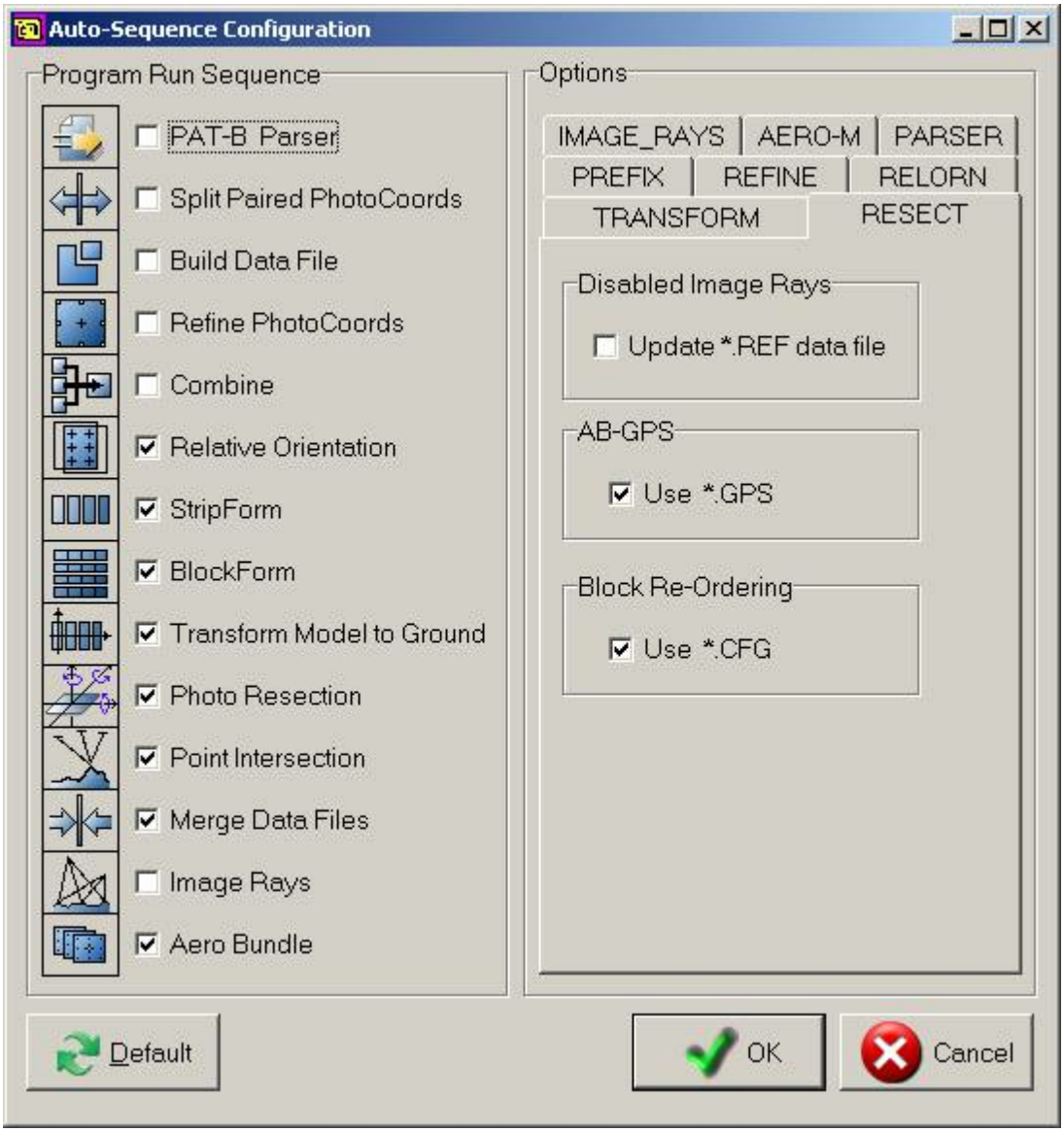

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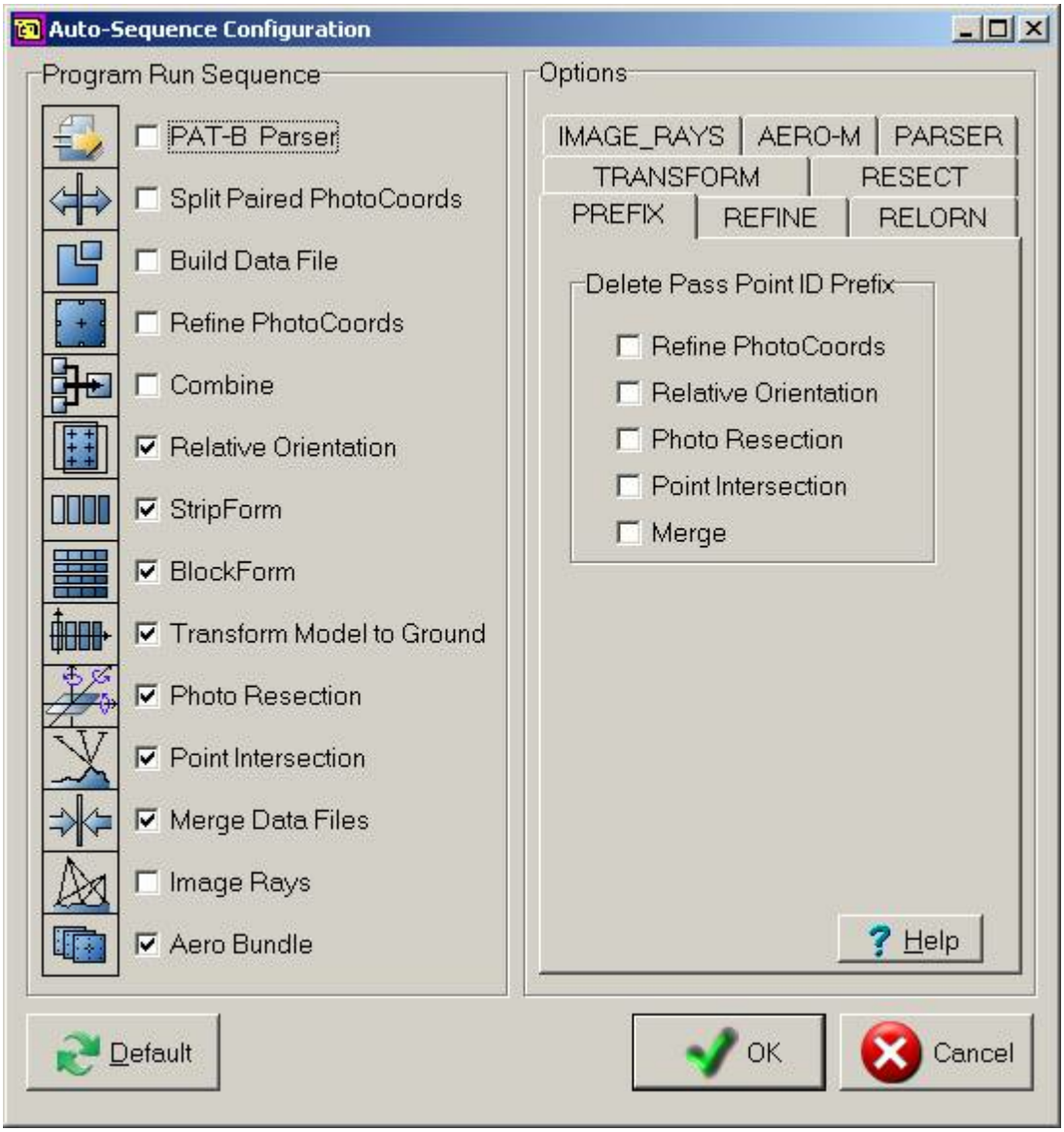

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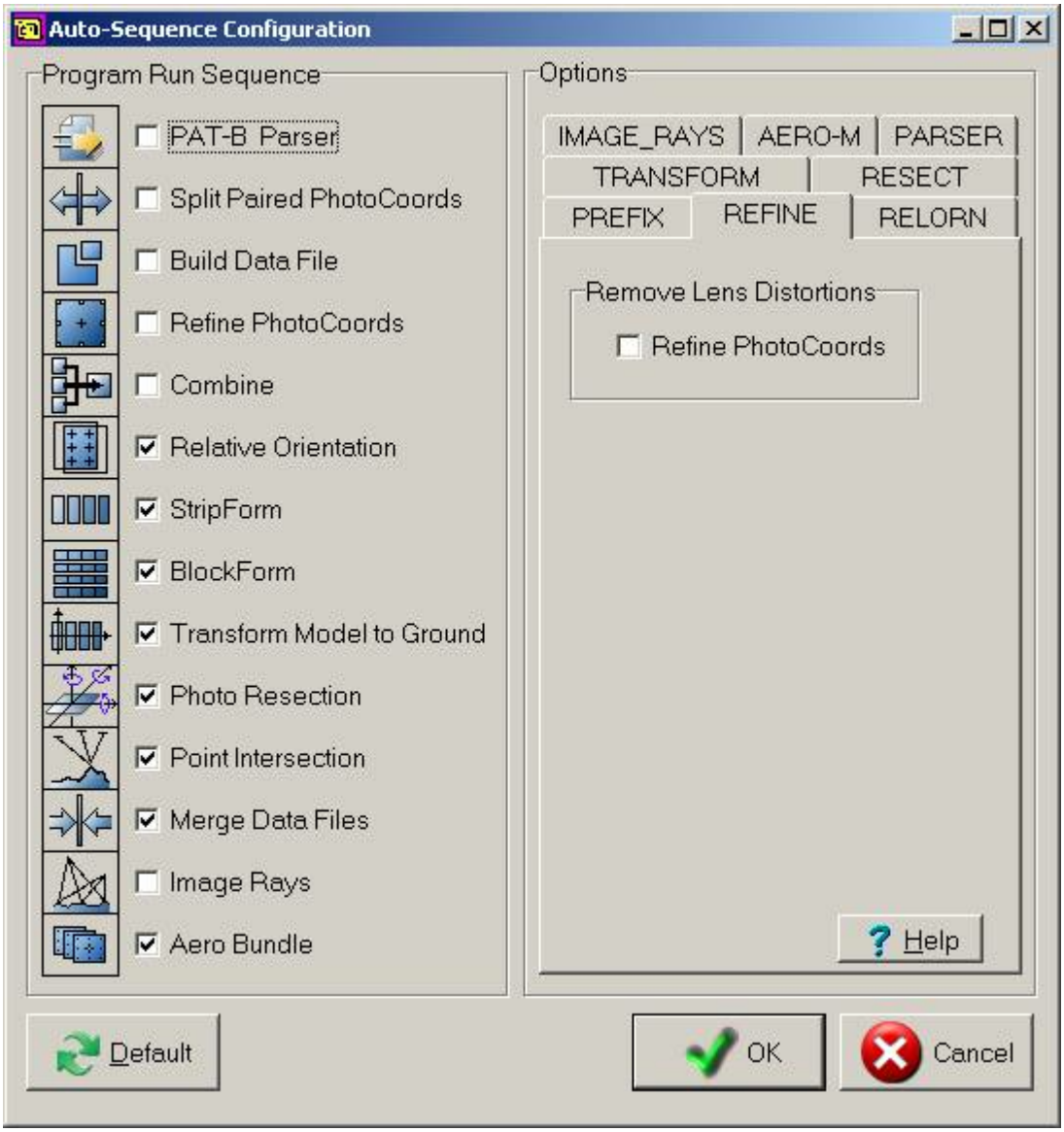

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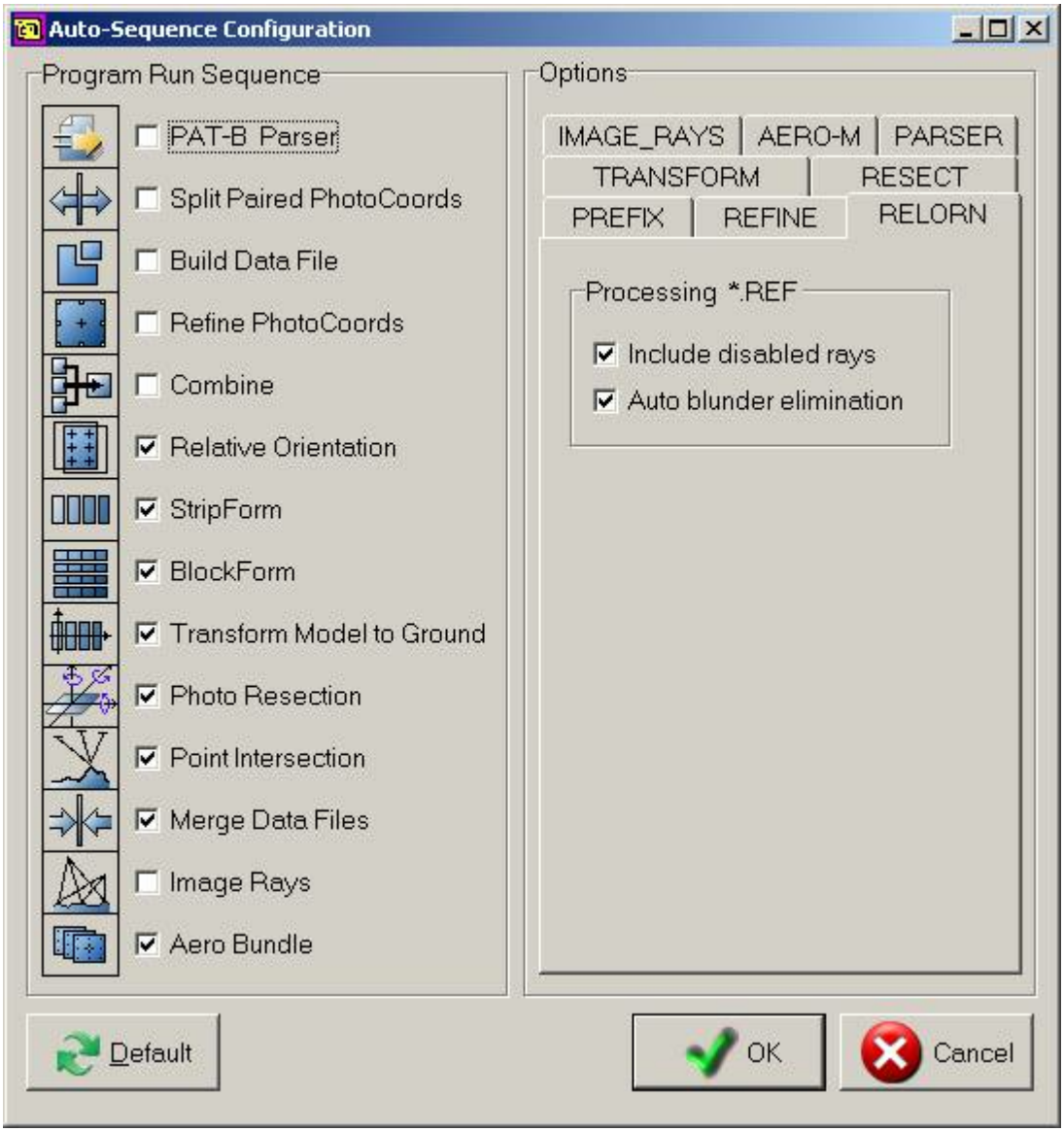

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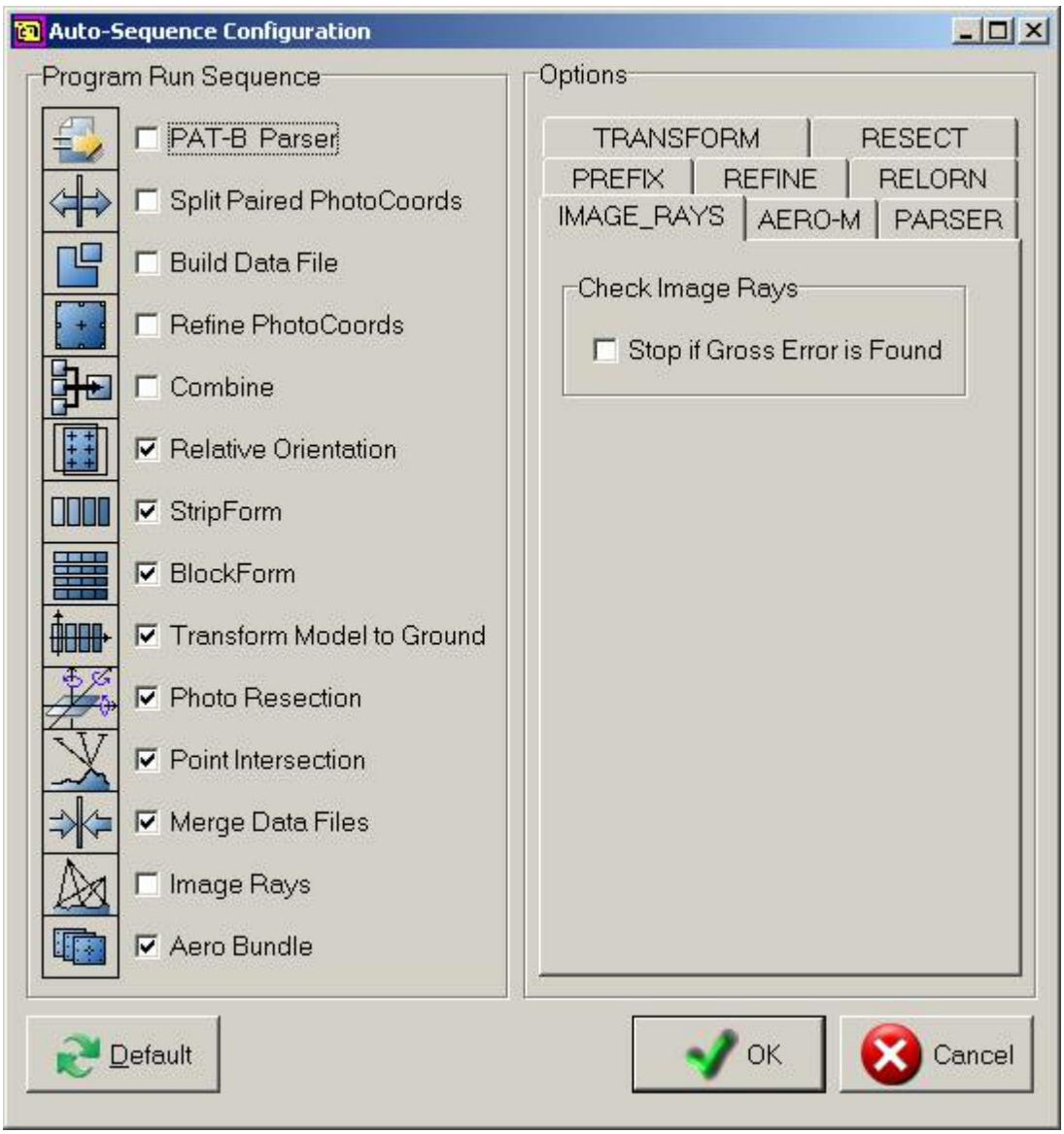

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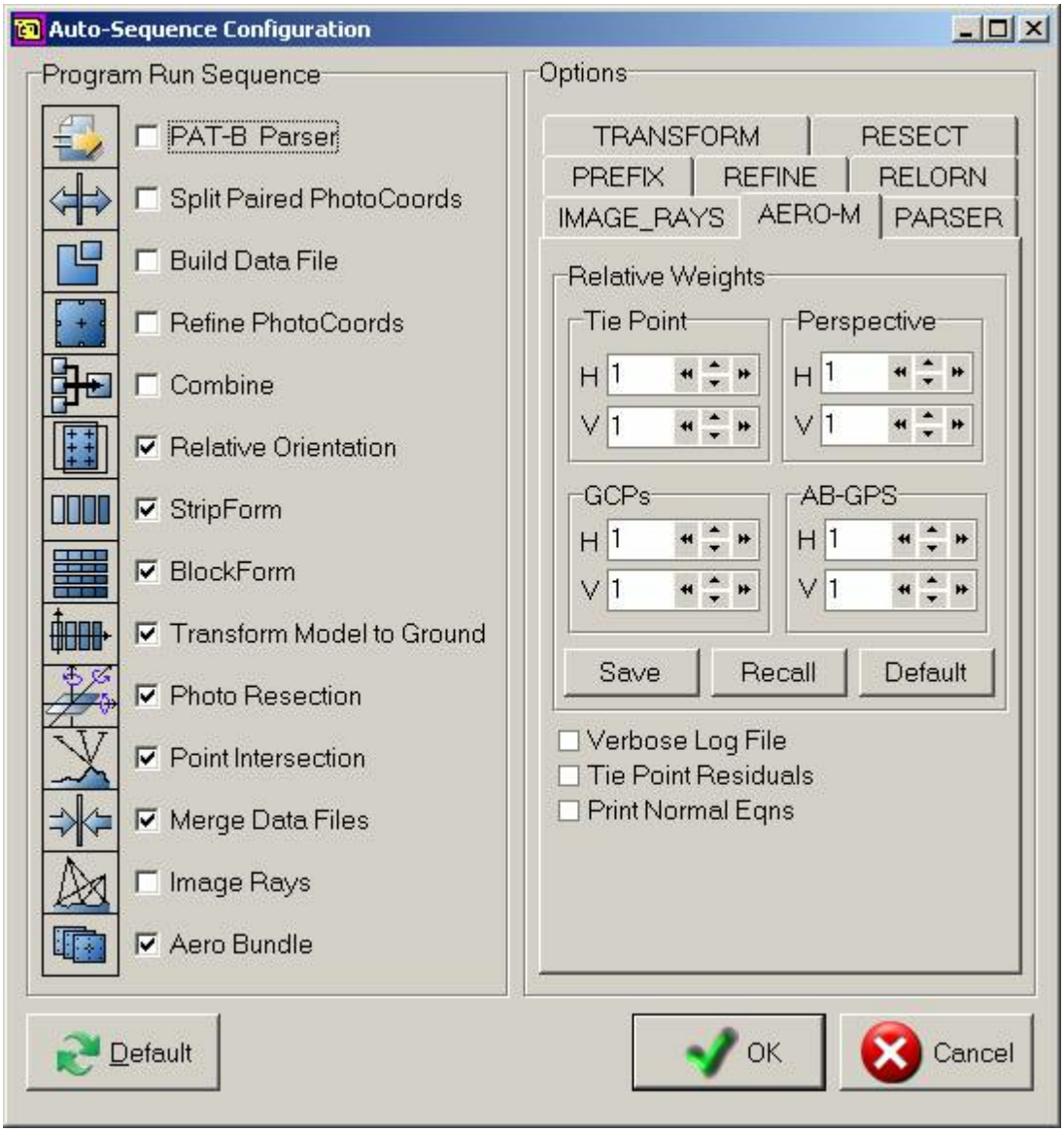

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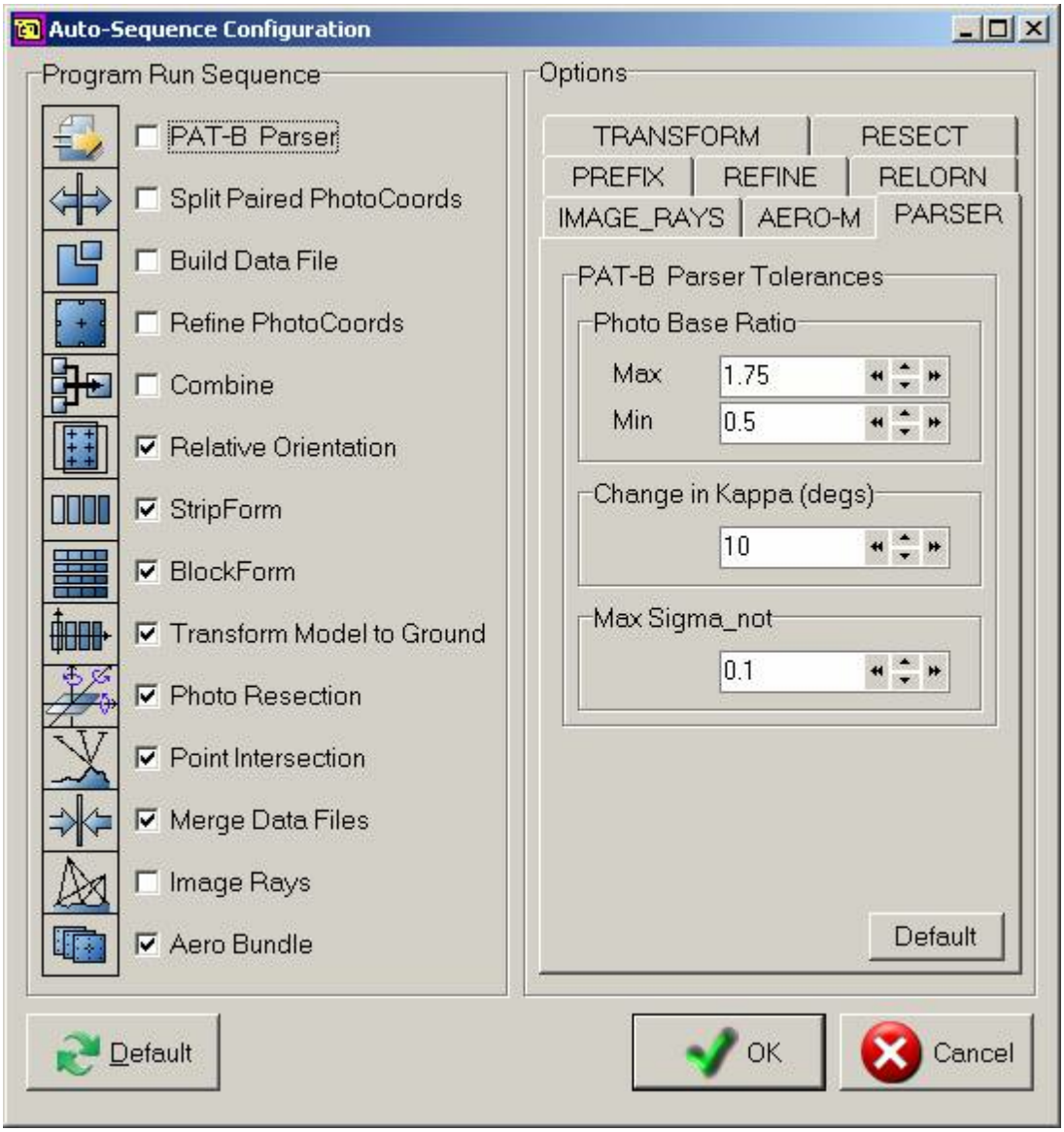

[Ctrl] [Alt] R - Maximum Residual Limits

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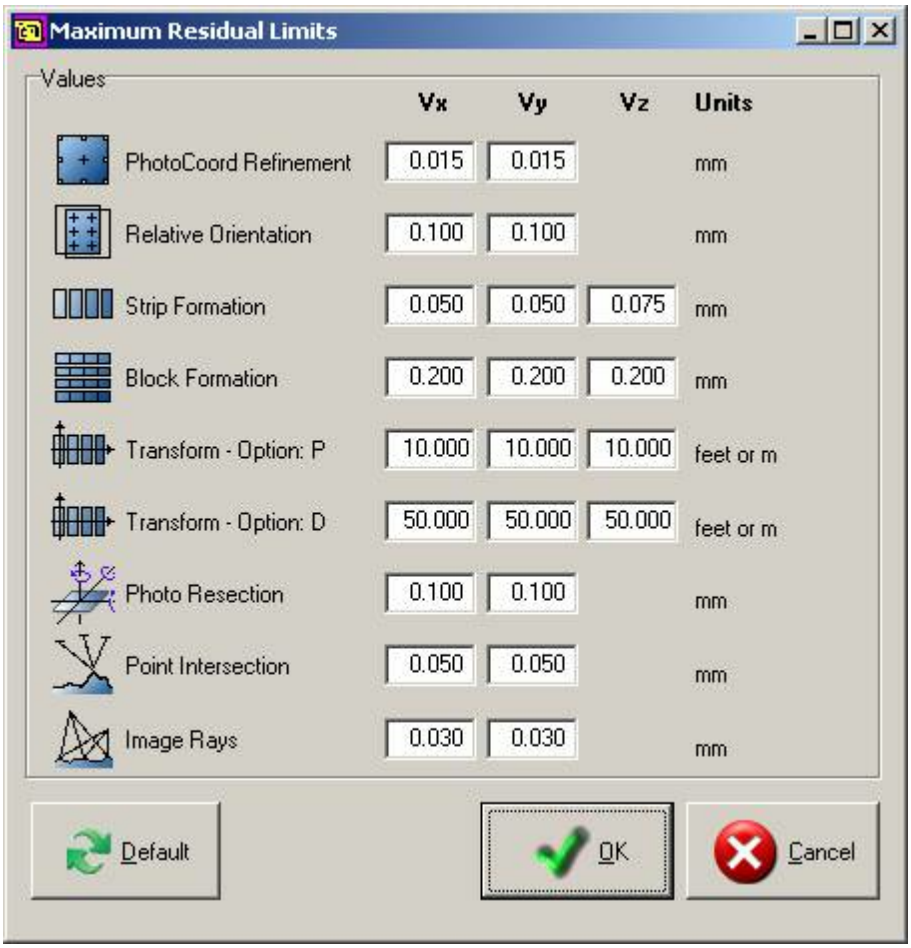

[Ctrl] [Alt] S - Default Standard Deviations

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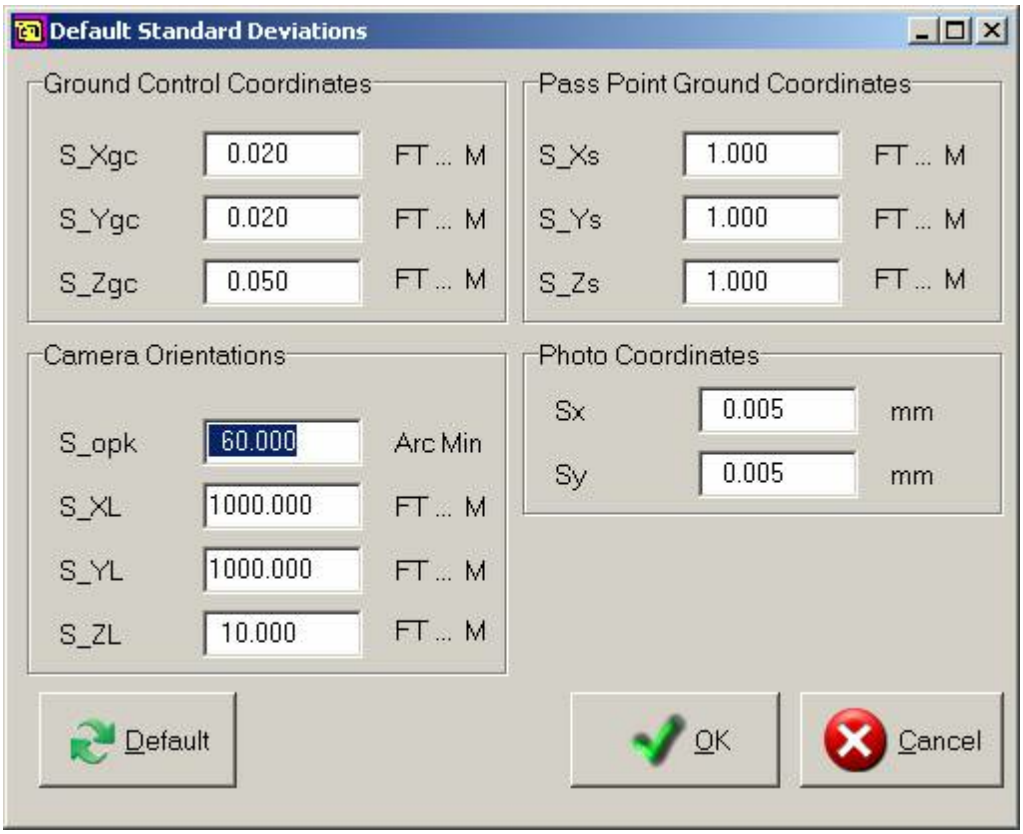

[Ctrl] [Alt] P - Pass Point ID & Position Parameters

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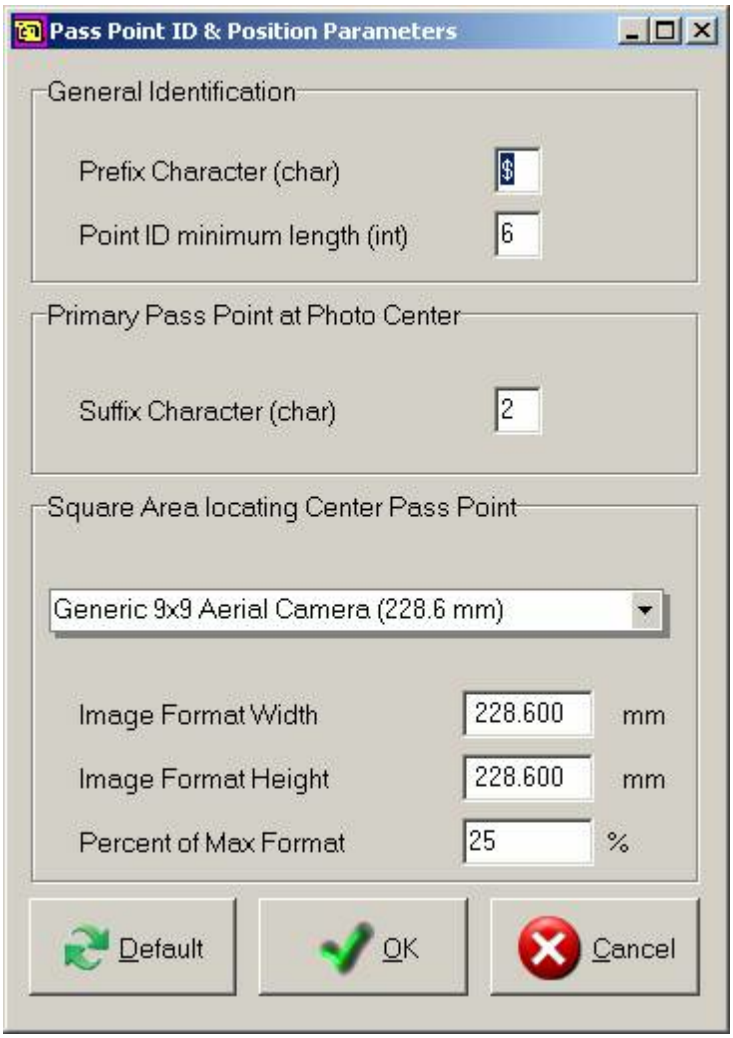

[Ctrl] [Alt] T - Set Tie Point Thresholds

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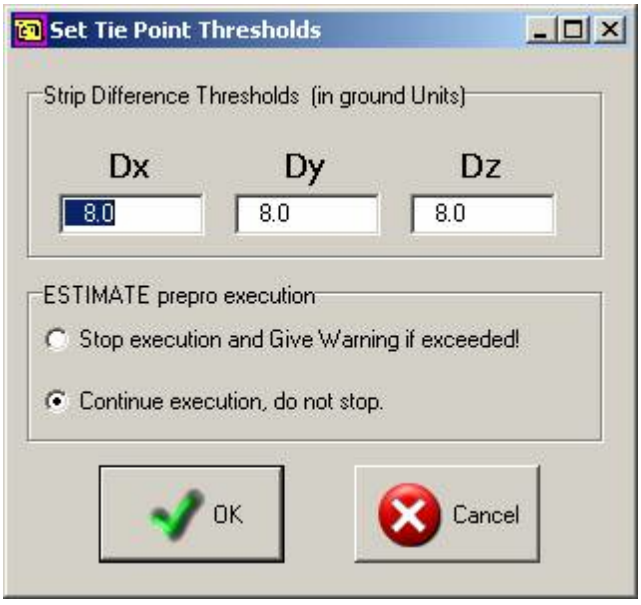
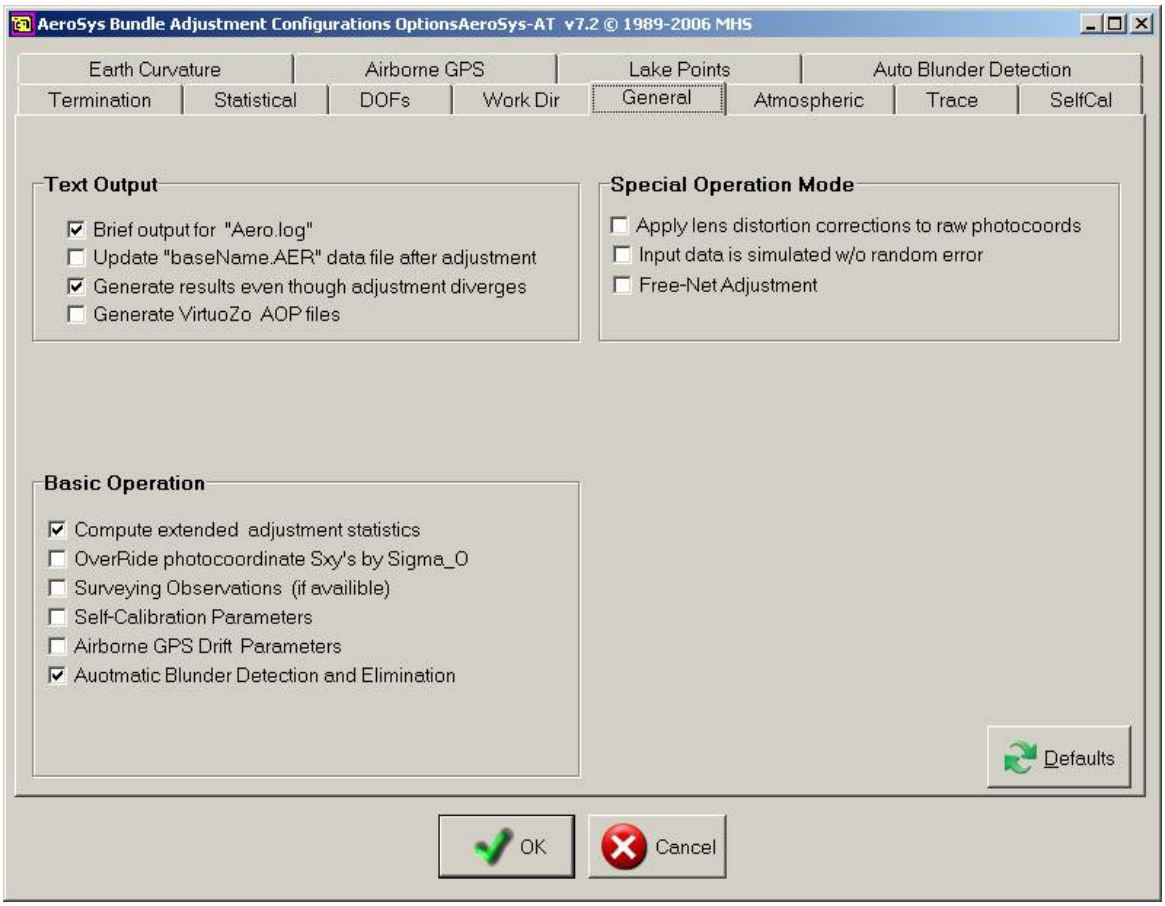


[Ctrl] [Alt] O - AeroSys Bundle Adjustment Configurations OptionsAeroSys-AT v7.2



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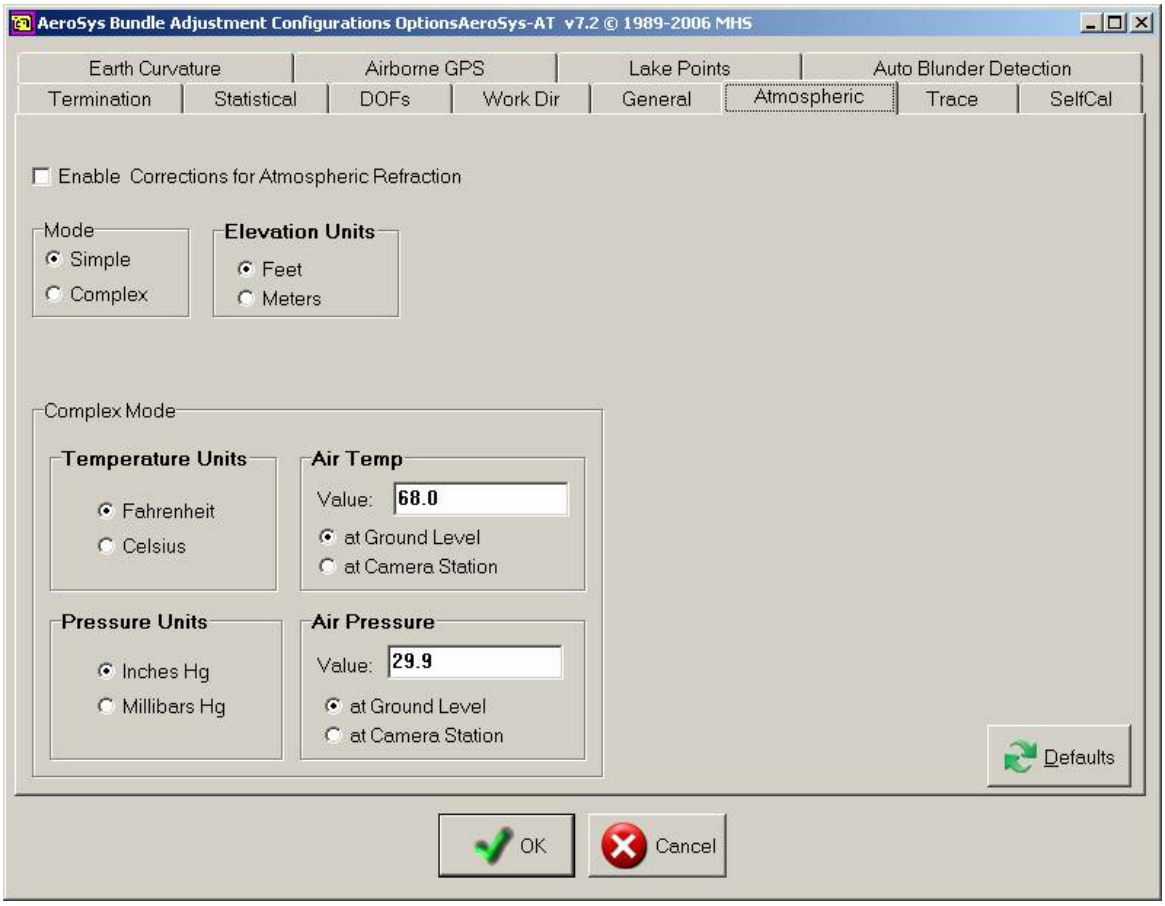

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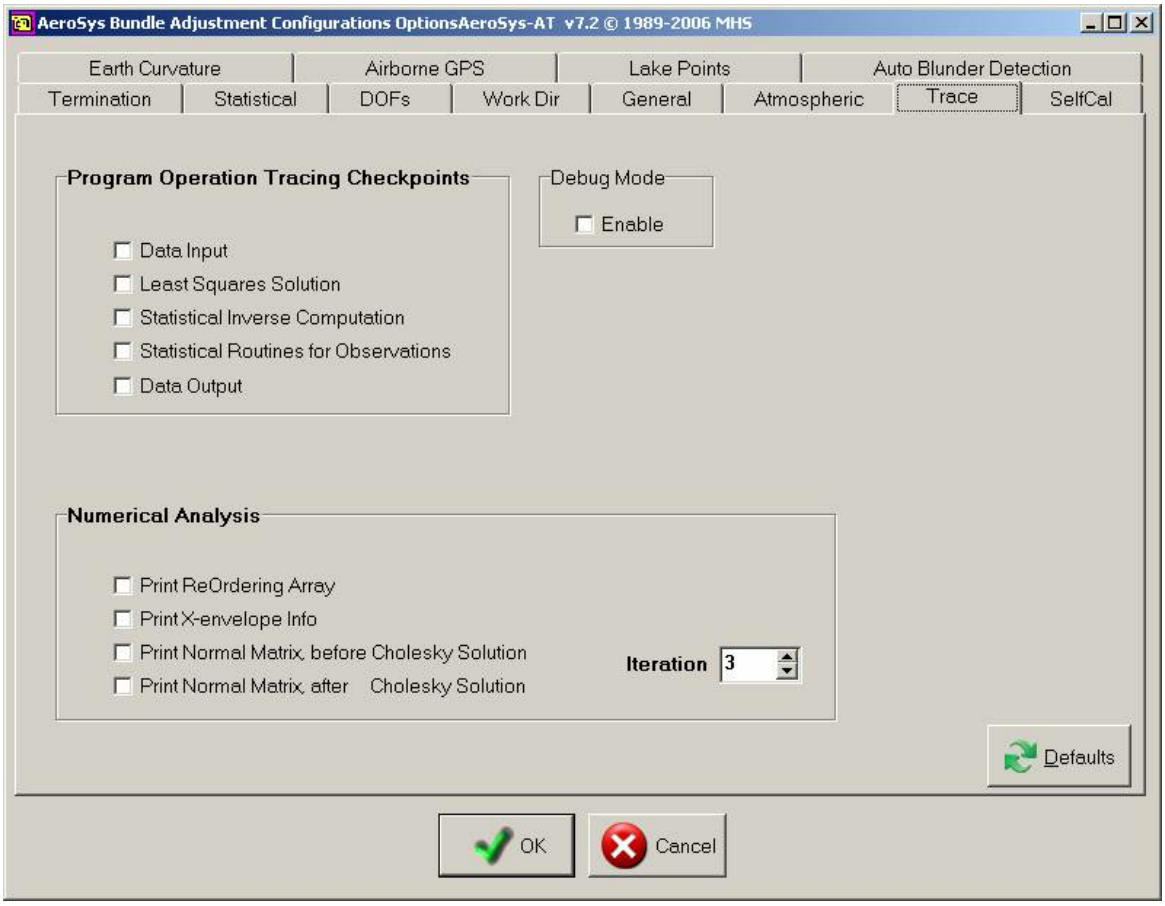

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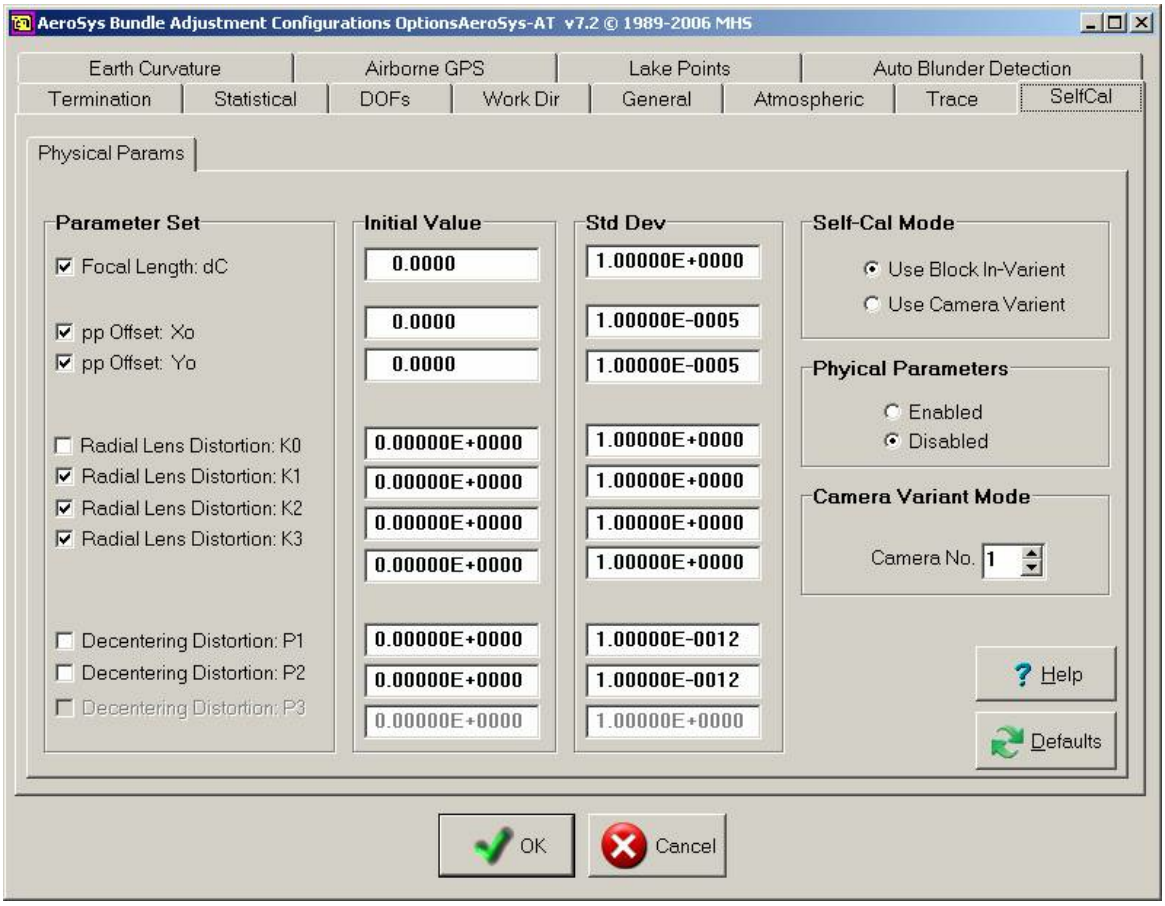

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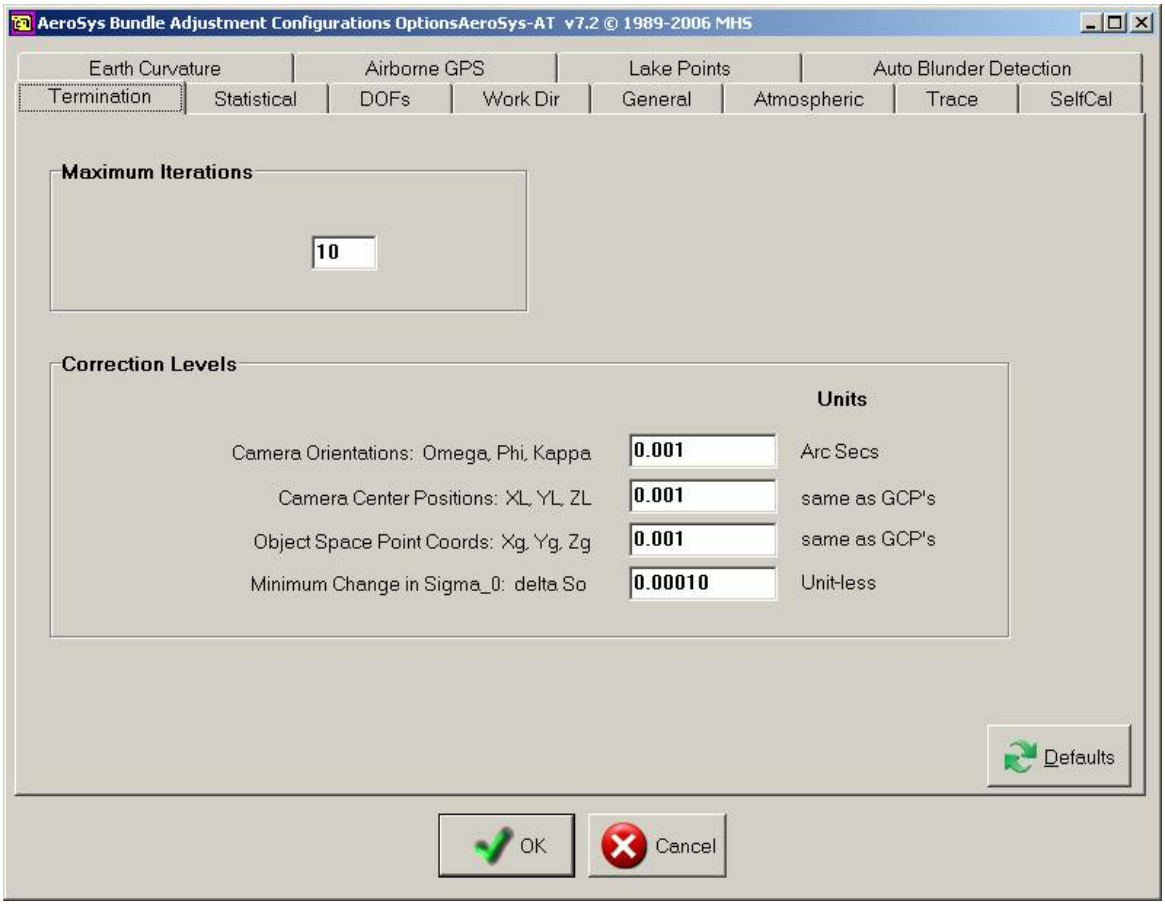

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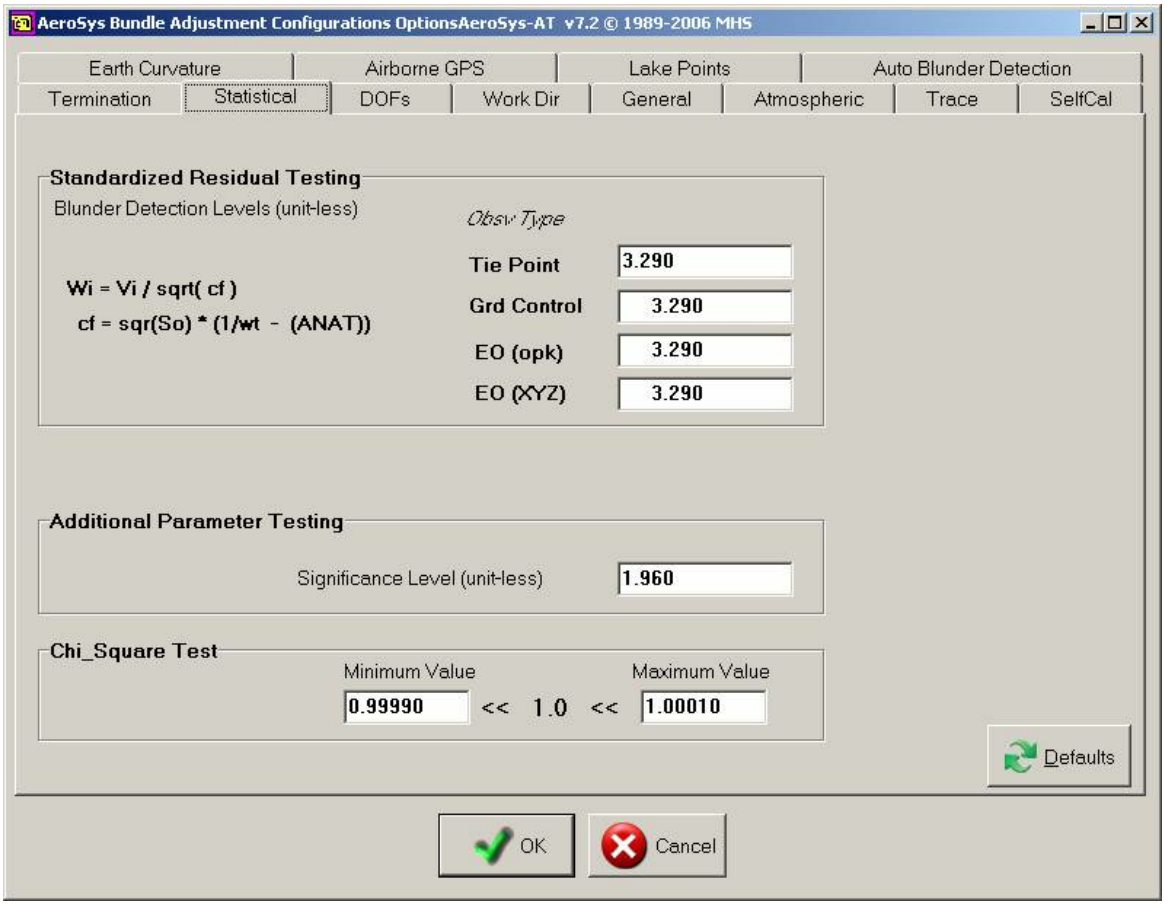

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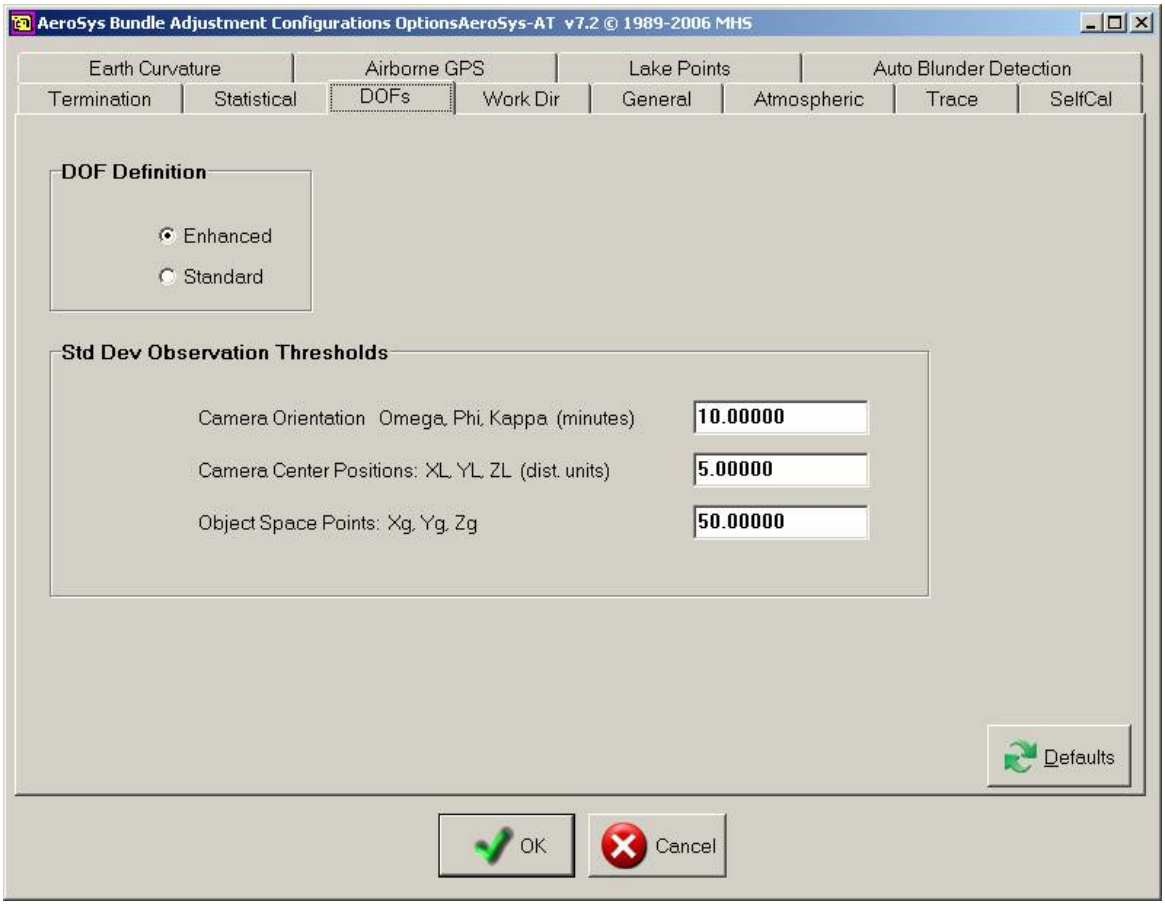

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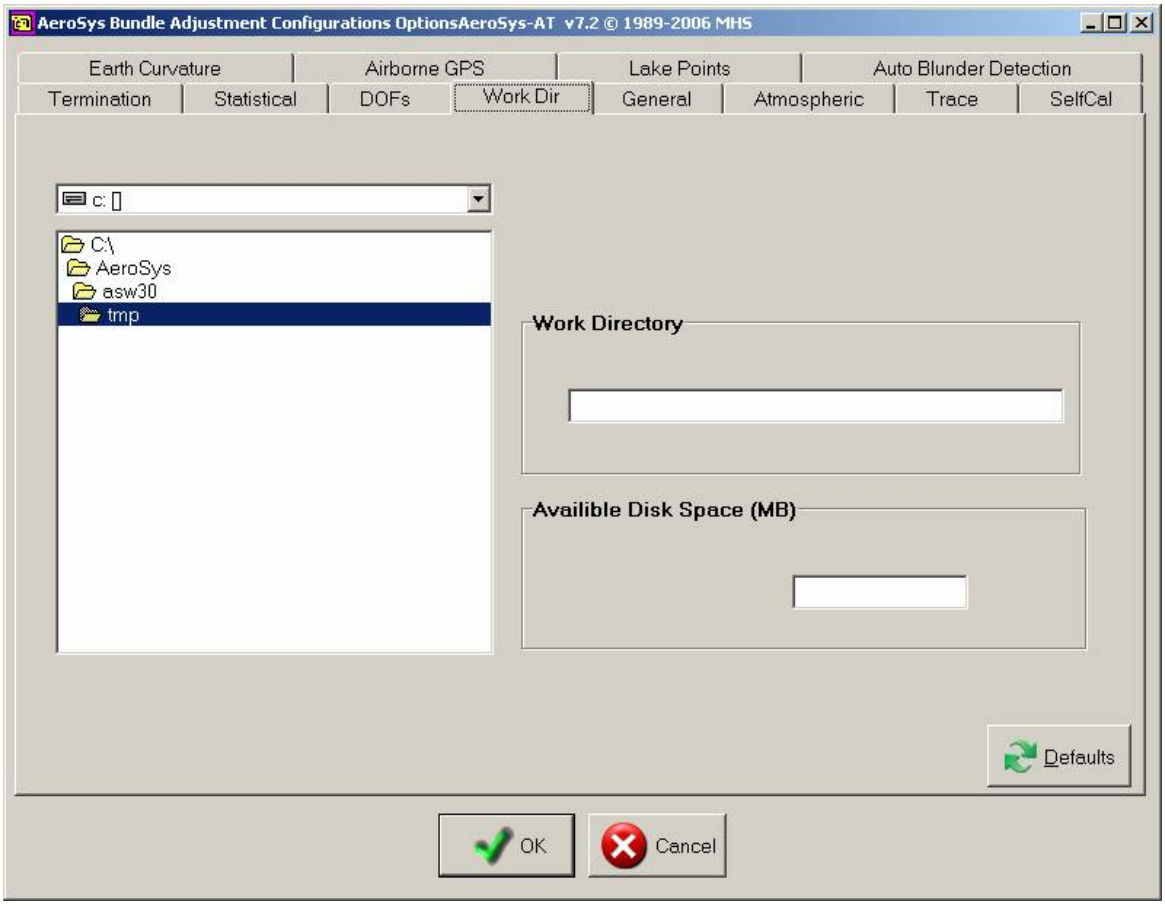

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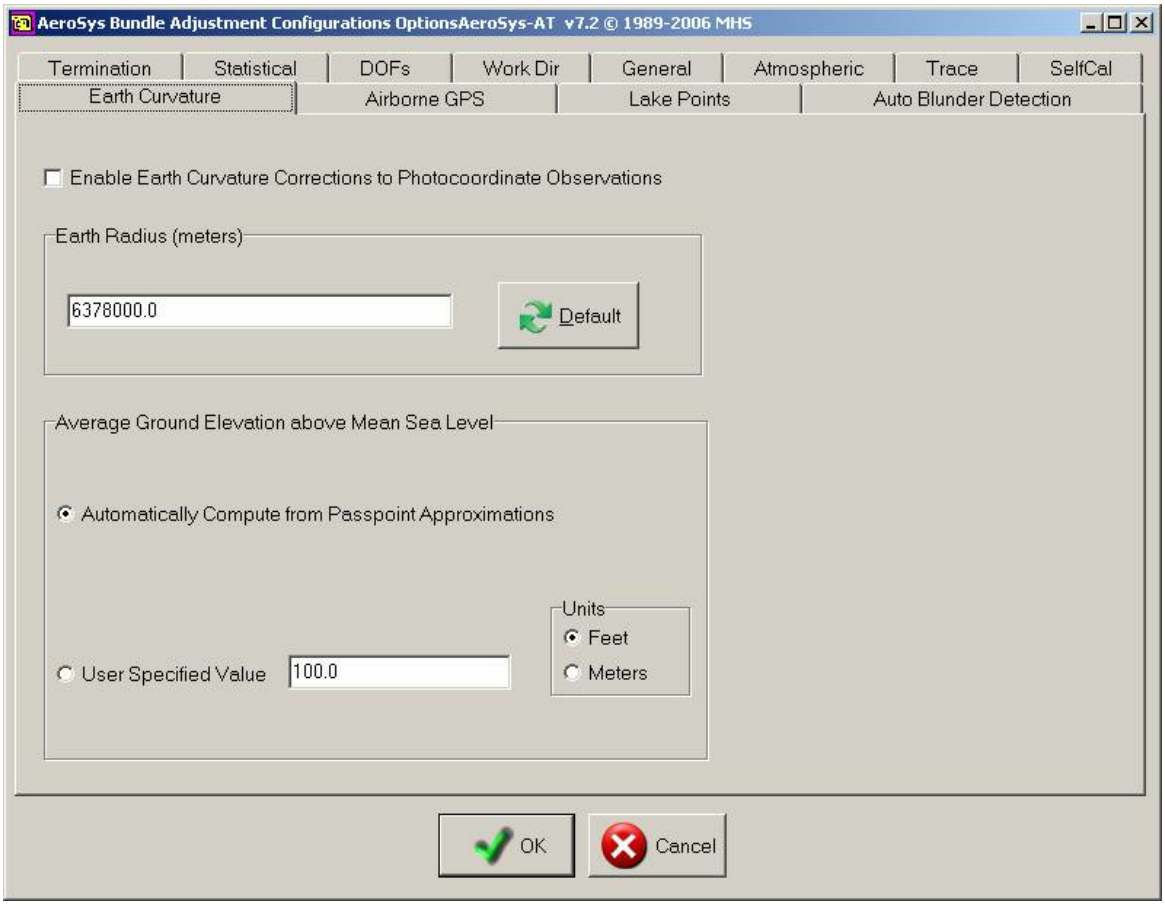

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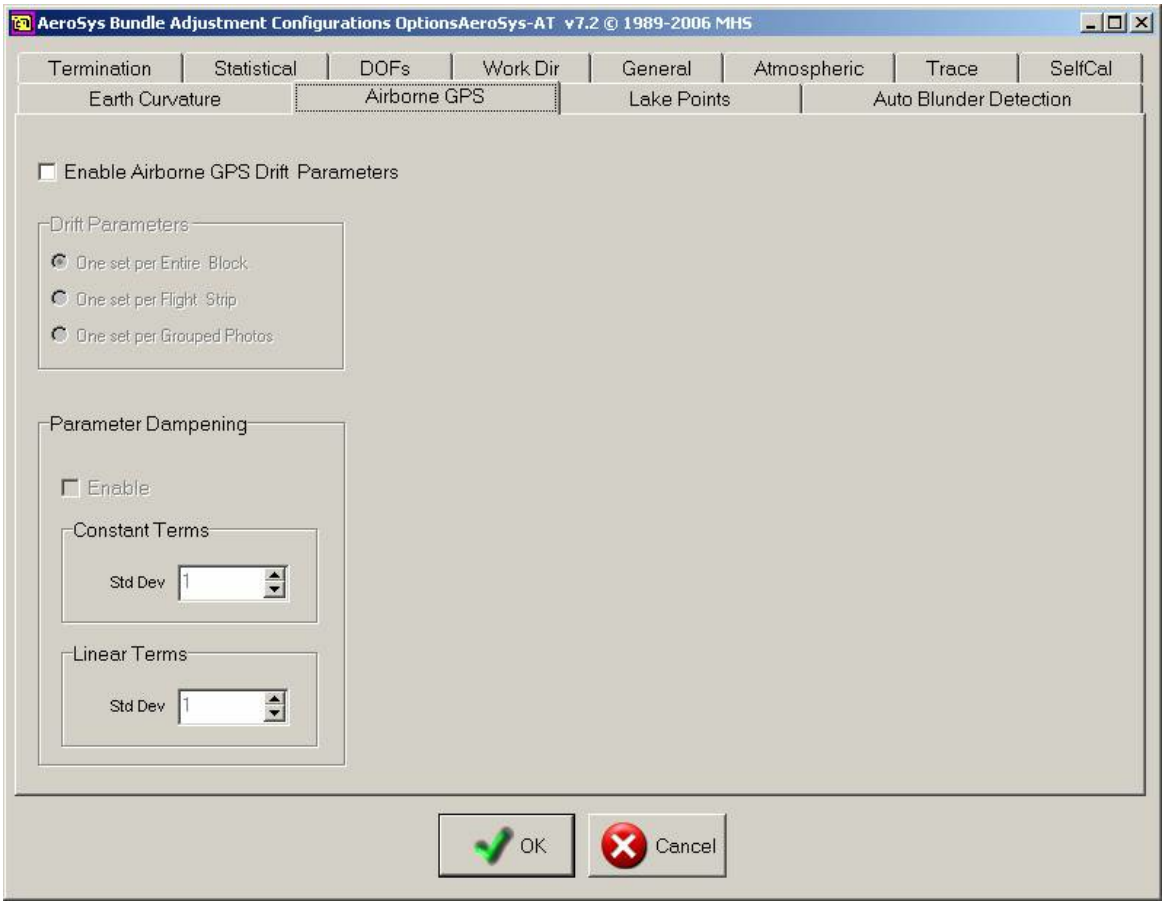

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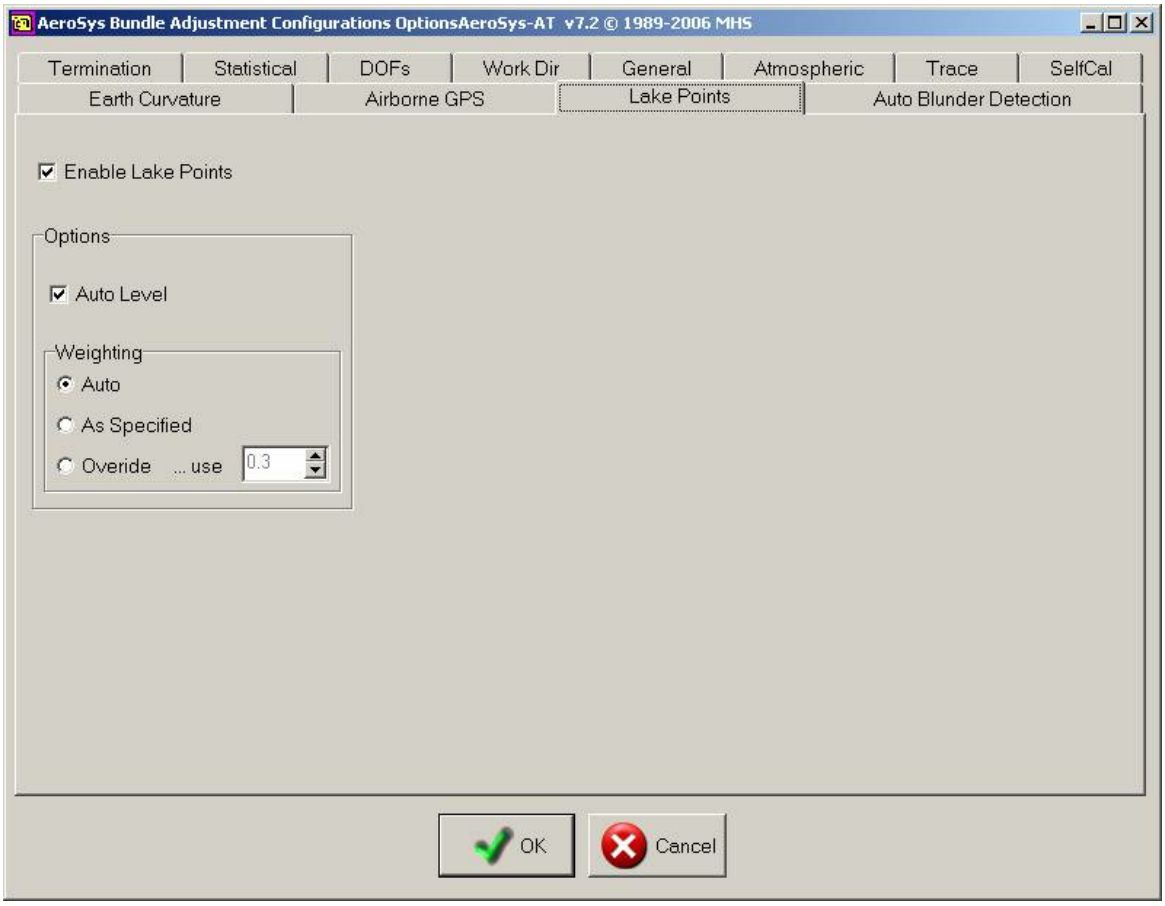

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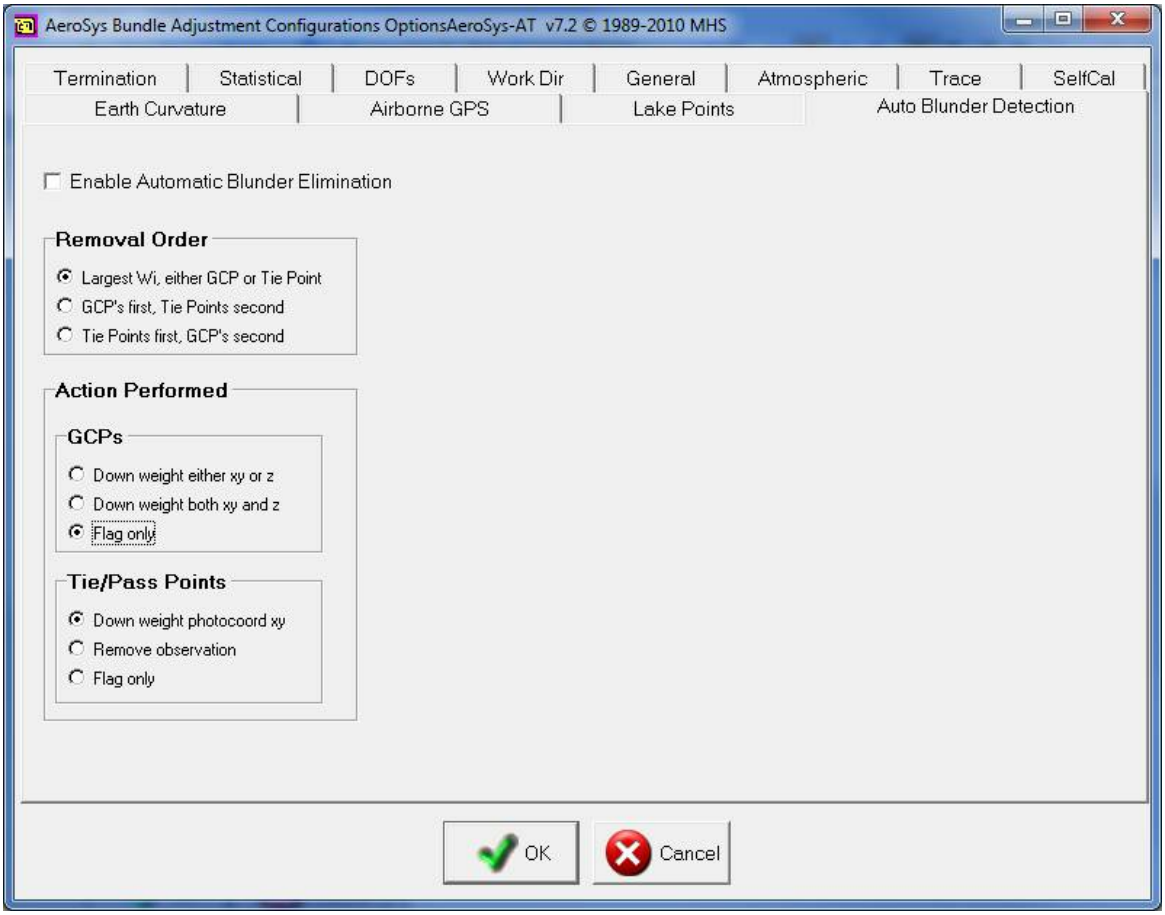

2.6 Vr Balance

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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VrBalance



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VrBalance is an advanced global image balancing solution to correct color and intensity differences between images. VrBalance is integrated seamlessly with VrMosaic.VrBalance will work with raw or ortho rectified images and does not require any image orientation.

It also can serve as a stand-alone program for directly balancing any set of images. When used as a standalone program, VrBalance provides a powerful tool for batch processing a large number of images. The VrBalance standalone program allows any number of images to be selected and then written out as or replaced with corrected images.

The VrBalance advanced color and intensity balancing process analyses all of the images in a project. Using statistical matching techniques, it computes a global correction model to fit all of the images into a common color and intensity range. This results in image color and intensity uniformity throughout the entire project and provides excellent image-to-image matching during the mosaicing process.

All VrBalance computation parameters may be adjusted by the user, giving complete control over the balancing process. Computation parameters provide separate settings for color and intensity adjustment types. Other processing parameters include sampling method, computation level, samples per image, sample size, and standard deviation filter. An image margin may also be specified to eliminate the use of non-image data around the edges of raw images.

Like VrMosaic, VrBalance balances images across an entire project; however, VrBalance works in a batch mode with any set of input images. VrBalance can be operated from the command-line without any user interaction using appropriate input arguments.

Vr Balance Documentation

2.6.1 Documentation

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

VrBalance

Type: Stand-alone Batch Application (vrbalance.exe)

Image Balancing Application

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Un-balanced images

Overview
Using VrBalance
Command-Line options

Overview

This is a stand-alone program that uses the same methods as VrMosaic to balance images across an entire project, but works in a batch mode with any set of input images. VrBalance can be operated from the command-line without any user interaction by using appropriate input arguments. Type VrBalance –h for a list of command-line options. If started without any arguments, VrBalance will prompt for input parameters.

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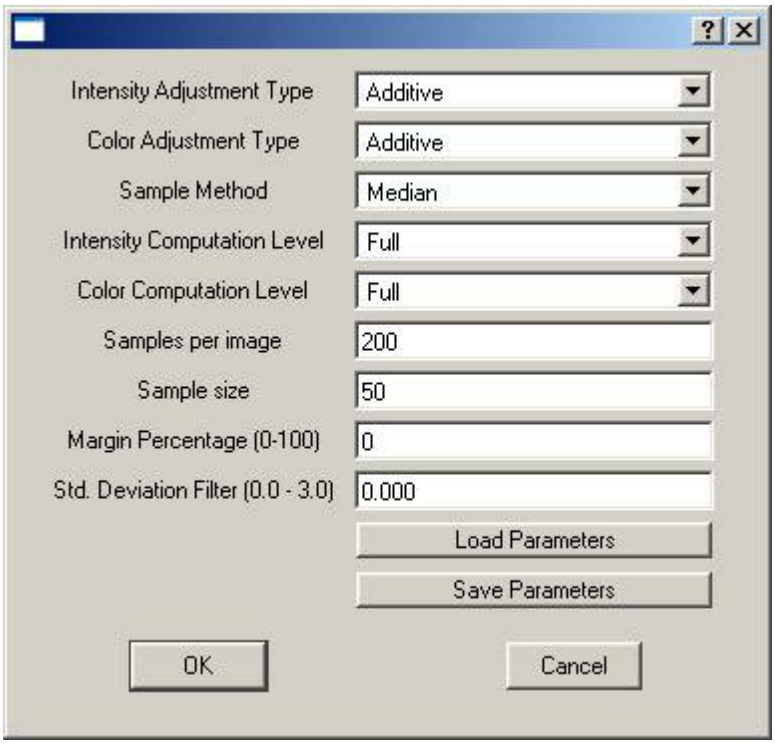
Using VrBalance

Without any parameters passed, VrBalance starts by displaying the following dialog box.



Intensity Adjustment Type

Sets the computation method to use to adjust image intensity.
Additive mode works best on the widest range of images, but there are some cases where multiplicative gives better results. Multiplicative mode tends to increase image contrast. Only try multiplicative if additive yields poor results.

None	Do not apply any intensity adjustment.
Additive	Additive computation mode.
Multiplicative	Multiplicative computation mode.

Color Adjustment Type

Sets the computation method to to use to adjust image color.
Additive mode works best on the widest range of images, but there are some cases where multiplicative gives better results. Multiplicative mode tends to increase image contrast. Only try multiplicative if additive yields poor results.

None	Do not apply any color adjustment.
Additive	Additive computation mode.
Multiplicative	Multiplicative computation mode.

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Sample method

Sets the method to use to sample data from the images

Mean	Use the mean sample method.
Median	Use the median sample method.

Intensity computation level

Sets the computation level to use to compute the intensity adjustment. The medium setting does not fit the data as closely as full. In most cases, full is the best option. For an image with many lakes or other non-matching areas, medium may produce better results.

No adjustment	No adjustment is applied to the intensity.
Medium	A medium computation is used.
Full	A full computation is used.

Color computation level

Sets the computation level to use to compute the color adjustment. The medium setting does not fit the data as closely as full. In most cases, full is the best option. For an image with many lakes or other non-matching areas, medium may produce better results.

No adjustment	No adjustment is applied to the color.
Medium	A medium computation is used.
Full	A full computation is used.

Samples per image

Sets the number of samples to take from each image. The default value is 200. Increasing this value on very large images may produce better results because it will look at a larger percentage of the image. This has a direct relation with computation speed. A value less than 20 will likely yield unreliable results.

Sample size

Sets the square size of the area looked at for each sample. The default value is 50 (a 50x50 pixel sample).

Margin percentage

Sets how much of the outer image is ignored during processing. For images with areas around the edges with invalid image data (like fiducials), this setting can force those areas to be ignored. A value of 10 would result in the outer 10% of the image being ignored; a value of 0 would result in the full image being considered.

Std. Deviation Filter

Limits the pixels to those that fall around the mean of the sample. For example, the sample were normal and the filter set to 1.0, ~68% of the data (1 standard deviation about the mean in either direction) would be used for the computation. This can help filter out undesirable parts of an image.

0.0 = No filter.

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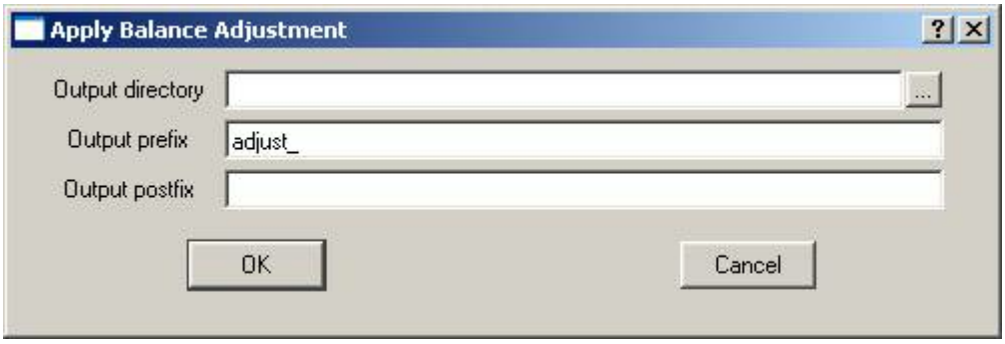
1.0 std = 68% of a normal distribution,

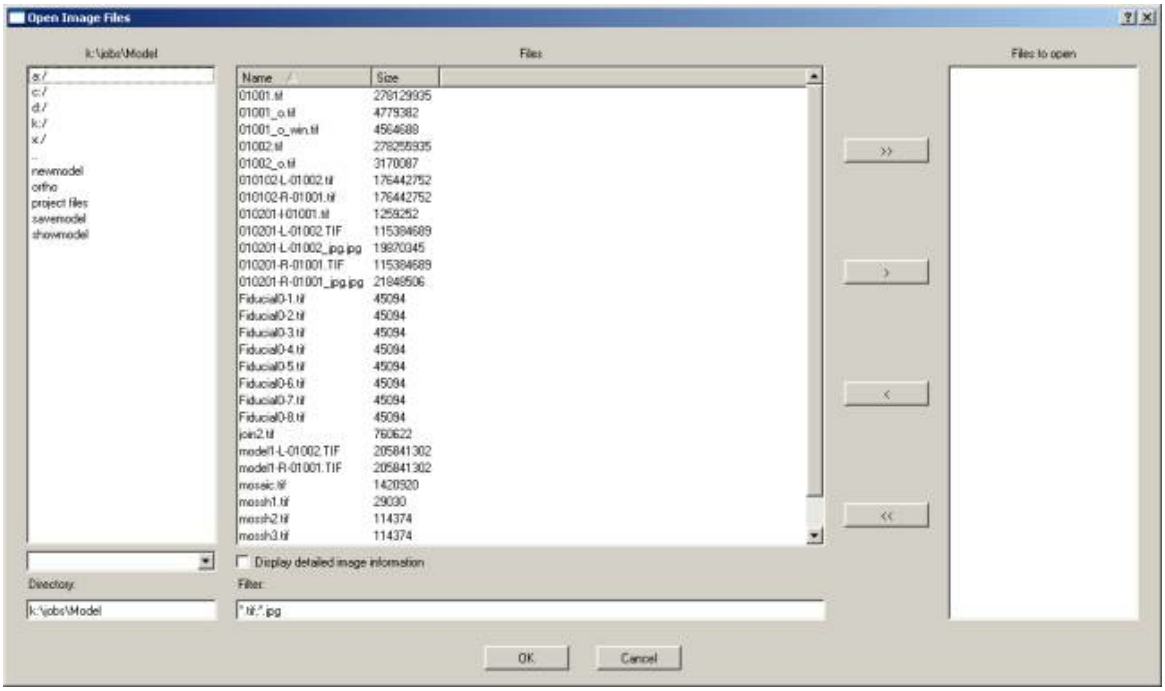
2.0 std = 95% of a normal distribution

3.0 std = 99.7% of a normal distribution)

After selecting "Ok" in the parameters dialog box, the following dialog is displayed to control output filename options.



After selecting "Ok" in the output filenames dialog box, the following dialog is displayed to select input images.



After selecting "Ok", the images are processed and adjusted output images are created.

Command-line options

VrBalance can be run from the command-line for non-interactive image processing. The current command-line options are as follows (typing vrbalance –h displays command-line options).

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```
VRBALANCE [options] [image(s)]

where options are:

 -s                Silent mode. Does not prompt for parameters.
 -l filename       Load balance parameters from file.
 -o directory      Output directory.
 -p postfix        Postfix to add to each output image name.
 -r prefix         Prefix to add to each output image name.
[images]           Optional list of images to process.
                   Will display image selection dialog if left blank.
Example:
vrbalance -l myparams.vba -o c:\balance\out\ -o out_ c:\balance\*.tif
(Balance all TIFF images in the c:\balance directory, using the balance parameters
```

2.7 VrVolumes

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Vr Mapping

VrVolumes

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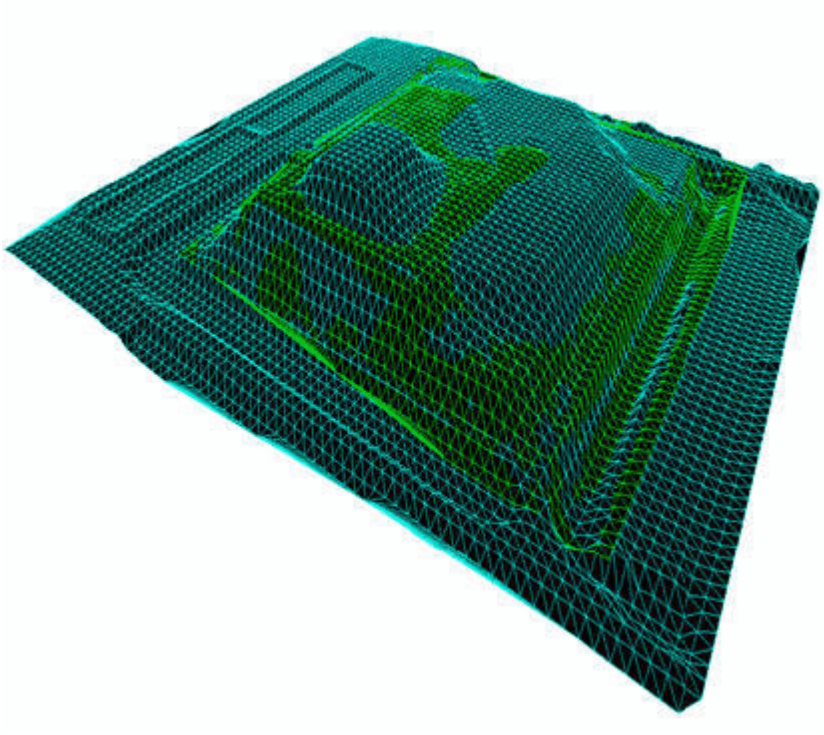

VrVolumes provides fast and flexible volume calculations between surfaces with the ease and power of VrOne. Using a Digital Terrain Model (DTM) based computation method, VrVolumes computes volumes directly from the surface triangles, yielding highly accurate results. It computes cut and fill quantities between a single ground surface and a flat elevation surface or between two ground surfaces.

An arbitrary boundary line may be selected to limit the volume calculations to a predefined area. This ensures that the volume calculations are limited to the specific area of interest. To allow maximum flexibility, the boundary line does not need to be part of the existing surfaces.

The user can save the combined surface triangles and view them for detailed analysis. This feature, in conjunction with VrOne's built-in 3D vector viewing tool, provides a quick and powerful method for analyzing volumetric data.

As part of the new volumes support, VrOne also has the ability to manage multiple surfaces at one time. Several surfaces may be loaded into memory at once, allowing the user to instantly switch between them.

Features include:

- Surface to flat elevation volumes computation;
- Surface to surface volumes computation;
- Flexible reporting with user customizable output formats;
- High accuracy using direct T.I.N. based computation method;

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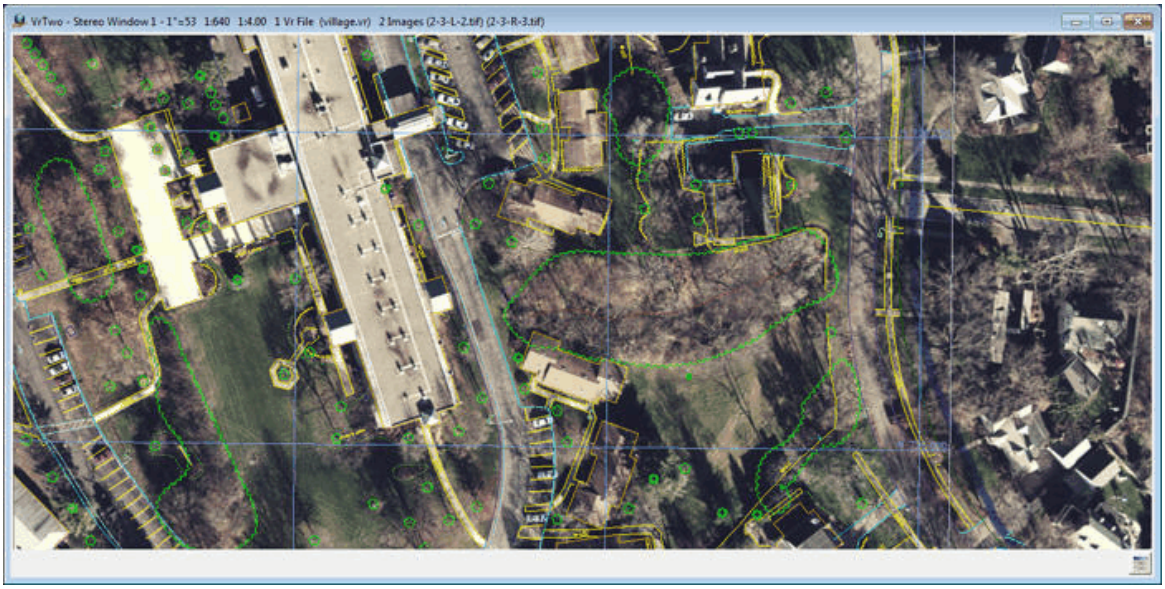
- Volume boundary limits specified using any VrOne line;
- Advanced surface analysis using the 3D viewer in VrOne and VrTwo;
- Runs inside VrOne for seamless job integration.

2.8 VrLite

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrLite



VrLite offers a combined, lighter version of the time-tested VrOne and VrTwo softwares, putting the utility of the VrMapping suite into more hands.

VrOne/VrTwo offers the worlds most extensive and capable mapping software. When mapping tasks arise that do not require the full power of VrOne/VrTwo, VrLite offers a solution. Managers, supervisors, and even clients will benefit from this low-cost, streamlined version. VrLite offers the ability to view project status and quality while offering many key components of VrOne and VrTwo.

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Do more with less with VrLite.

Features include:

- Intuitive, improved user interface;
- Full support for the VrOne data base;
- Core interactive insert applications for lines, symbols and text;
- Core editing applications for lines symbols and text;
- Digital Terrain Model (DTM) support;
- 2D viewing support for vectors and image;
- 3D viewing support of VrTwo models with vectors;
- Full layer and display control;
- Same VrOne/VrTwo look and feel.;
- Runs on Windows 7 and Windows XP.

2.9 Model Orientation

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CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Model Orientations

There are two stand-alone programs available to accomplish the task of 3D model orientations which include VrTwo Orientation and Vr Model Set. Along with the two model orientations, there are several support applications.

- **VrTwo Orientation (Vr2Ori)** - Offers a more hands on approach to orientation with the option to import aerial triangulation measurements and the ability to set a model using the traditional three-step orientation method (interior, relative, absolute ordination). Please see VrTwo Orientation for more information on this program.
- **Vr Model Set (VrModSet)** - Offers a streamlined optimal procedure and imports exterior orientations only. makes creating and choosing models easy. VrModSet picks the best models to orient based on simple user defined overlap parameters which is useful for UAV work. Please see Vr Model Set for more information on this program.

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- **Vr Camera Calibration (VrCamCal)** - Offers is a stand-alone program to perform camera lens calibrations. Please see Vr Camera Calibration for more information on this program.
- **Edit Camera (EdiCam)** - Used by various applications to allow entry/edit of camera calibration parameters. Please see Edit Camera for more information on this application.

2.9.1 Vr Model Set

Vr Mapping

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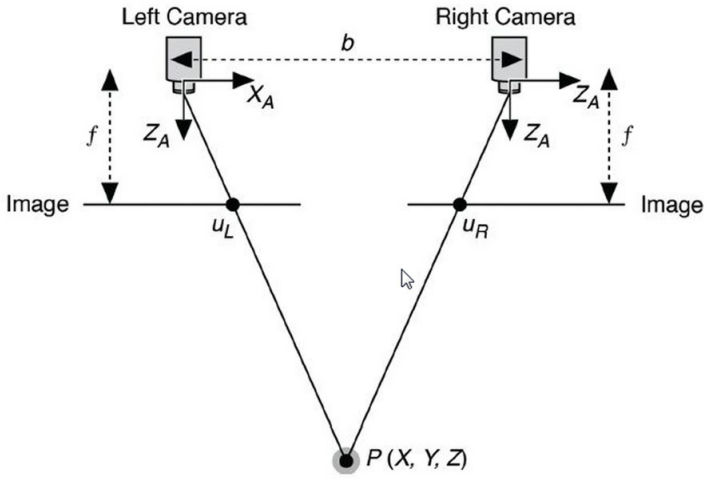
Vr Model Set (VrModSet)

Type: Stand-alone application (VrModSet.exe)



Stereo model diagram

Overview

There are two stand-alone programs for setting up 3D stereo models for the VrTwo soft copy environment: VrTwo Orientation and Vr Model Set (this program). Vr Model Set is a simplified redesign of VrTwo orientation. Aerial triangulation results from various software packages are

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imported directly. Vr Aerial triangulation project files are opened and edited without any conversion needed. The best best models to orient are selected based on simple user defined overlap parameters; this particularly useful for UAV work.

VrTwo Orientation (Vr2Ori) - Offers a more hands on approach to orientation with the option to import aerial triangulation measurements and the ability to set a model using the traditional three-step orientation method (interior, relative, absolute ordination). Please see VrTwo Orientation for more information about this program.

Getting Started

For best results, image orientations should be refined using aerial triangulation. The procedure for setting models from directly georeferenced image orientations is identical, but will have lower quality results. The work flow for the Vr Model Set program is the organization of the following inputs. The first three items are required.

- **Camera Definitions** - Camera definitions are represented by the parameters in the Vr Camera (.cam) files which include items such as focal length, principal point and distortion values. Cameras definitions affect the exterior orientations (EOs). If the focal length, principal point, or distortion values change there will be a shift in the EO values. To replicate the aerial triangulation (At) results, the cameras must be identically defined here as they were when AT was was done.
- **Images** - Tif or jpeg image files (Vr Image Utility can be used to rapidly convert other formats).
- **Orientations** - Interior (IO) and exterior (EO) orientations are required to set stereo models. Much like camera data, the interior orientations (IOs) need to be identical to the those used during AT process. This is automatic for digital images, and can be imported for film imagery in various formats. EOs may be in one of the supported EO formats. Measurement import is not supported (though that is still an option in Vr Two Orientation).
- **Control** - Control, or "ground control", is useful for verifying that all the inputs are correct. If control data is provided, models will also have the ability to drive to the control points to check their residuals.

If prior work was performed in the Vr Aerial Triangulation, VrTwo Orientation or Vr Image Utility program, these project files may be used in Vr Model Set. It is suggested that the project data be checked after import and that the EOs be re imported. This is because GPS or other approximate EOs are frequently imported in VrAirTrig and may need to be overwritten. This can be done in the "Orientations and Control" tab.

If there was no prior work done in VR a new project may be created. The new project command will prompt you to choose a file name and will then open the Edit Project window.

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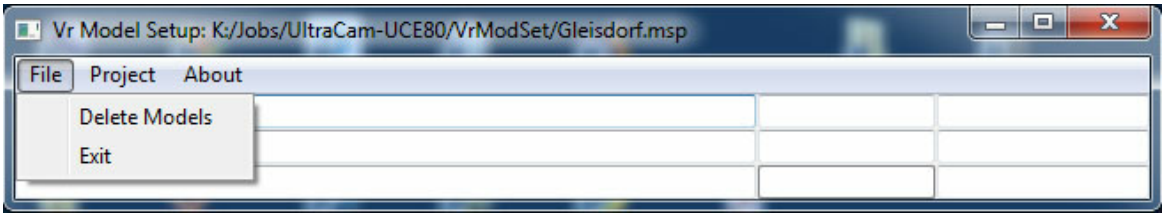
Command Reference

File



Vr Model Set File menu

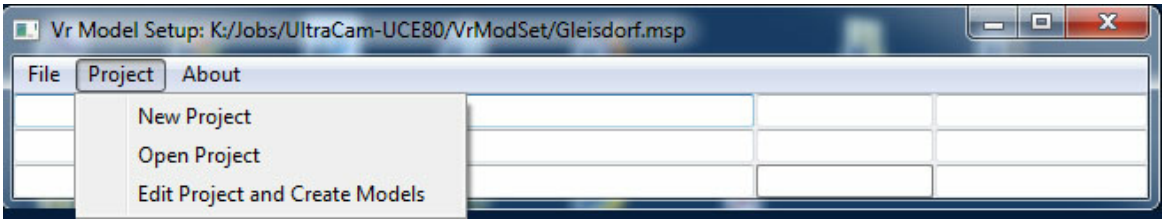
Delete Models

This is a utility for deleting model(s). Models that are not setup for on-the-fly viewing consist of a group of related files, using this utility deletes all related files together. On-the-fly models are only a single file and are easily deleted using this or other means.

Exit

Exits the Vr Model Set program.

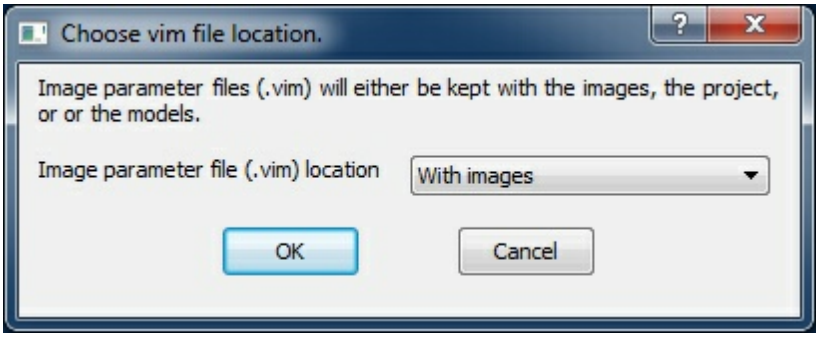
Project



Vr Model Set Project menu

New Project

Creates a new project and prompts for a project file name and the Vr image file (.vim) file location.



Choose vim file location dialog

Image parameter file (.vim) location - Each image that is used by Vr Mapping has a corresponding .vim file which is the same name as the image with with a .vim extension. The .vim file contains information about the image including strip and photo number information, pixel

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size, camera name, GPS time when the image was taken, interior orientation measurements, and exterior orientation parameters.

Options for the .vim file location include.

- With images - The .vim files will be in the same folder that contains the image. This is the recommended setting, there is less potential for confusion because all Vr Projects will reference the same vim file for each image.
- Project folder - The .vim files will be in the project folder. The project folder is defined when the project is created when the project file name (.msp) was entered.
- Model folder - The .vim files will be placed in the folder that is defined to store the resulting stereo model files.

After the project has been created, program execution goes to Edit Project (see below).

Open Project

Opens an existing project. The project may be a Vr Model Set (.msp), Vr Aerial Triangulation (.atp), VrTwo Orientation (.vpr) or a Vr Image Utility (.iup) project.
After the project has been opened, program execution goes to Edit Project (see below)

Edit Project and Create Models

Edits an existing project and creates stereo models. There are four tabs or steps that make up the work flow of defining/editing parameters and creating stereo models. Edit Project is described below.

About



Vr Model Set About menu

About

Displays information about Vr Model Set including the version number and release date.

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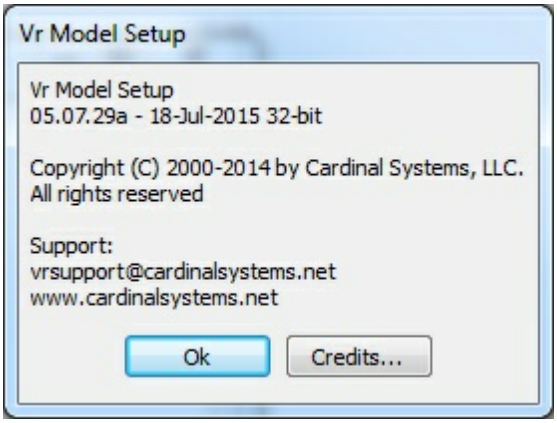

About dialog

Edit Project and Create Models

Cameras and Photos Tab

Camera definitions (.cam) files may be created, added, and (or) edited. Images are assigned to specific cameras.

Image rotations may also be defined. The image rotation tells the software if an image has been rotated from its raw state and allows the camera calibration and interior orientations to be correctly applied. It is strongly recommended that images remain in their original raw state (un-rotated) through the entire process from aerial triangulation to end project. Rotating images is an unnecessary step and doing so complicates the work flow and contributes to confusion and errors.

Add or create cameras to begin. Once a camera is defined, it can be selected in the camera table in order to assign it images (using the 'Assign photos to camera' button). This ensures that no image can be added to the project without knowing its camera. Double clicking on an camera to edit the parameters.

Selecting a camera in the left table will display the images assigned to it in the right table. Selecting images in the right table enables the 'Remove Photo(s)' and 'Set Rotation(s)' buttons--which will only operate on the selected images.

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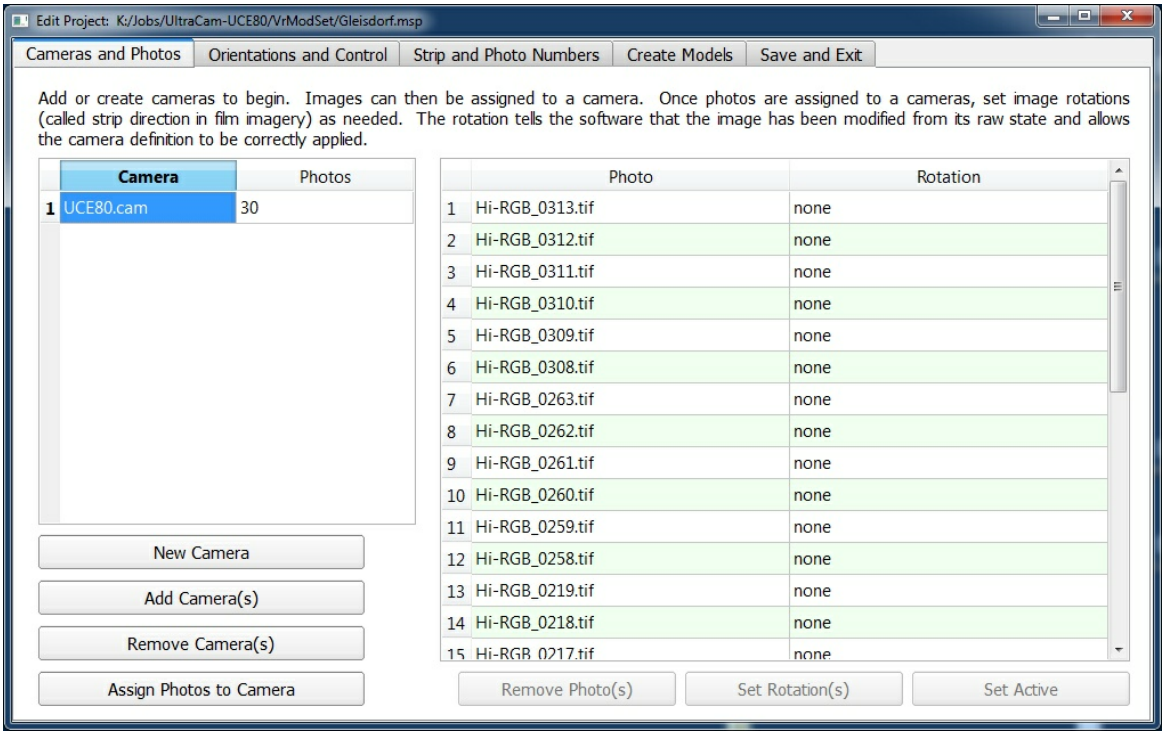

The Cameras and Photos tab in the Edit Project dialog

New Camera

Creates a new camera definition (.cam file). See Edit Camera for information on the entry/ editing of camera parameters.

Add Camera(s)

Adds existing cameras to the project.

Remove Camera(s)

Removes cameras from the project. The cameras to be removed are highlighted in the left pane before pressing this button.

Assign Photos to Camera

Assigns a photo or group of photos to a camera definition. Select a camera from the left pane then press "Assign Photos to Camera".

Remove Photo(s)

Removes selected photos from the project. Select photo(s) in the right table to activate this button.

Set Rotation

Sets the rotation of photo(s) selected in the right pane. A dialog will be displayed which will allow a photo rotation of None, 90 degrees clockwise, 180 degrees or 270 degrees clockwise. These rotations refer to images that have been saved on the disk in rotated positions. Knowing that images have been rotated allows orientation and camera data to be correctly applied. Users are advised to never rotate images, it causes confusion and gains nothing.

Set Active

Images set to inactive are not used for creating models.

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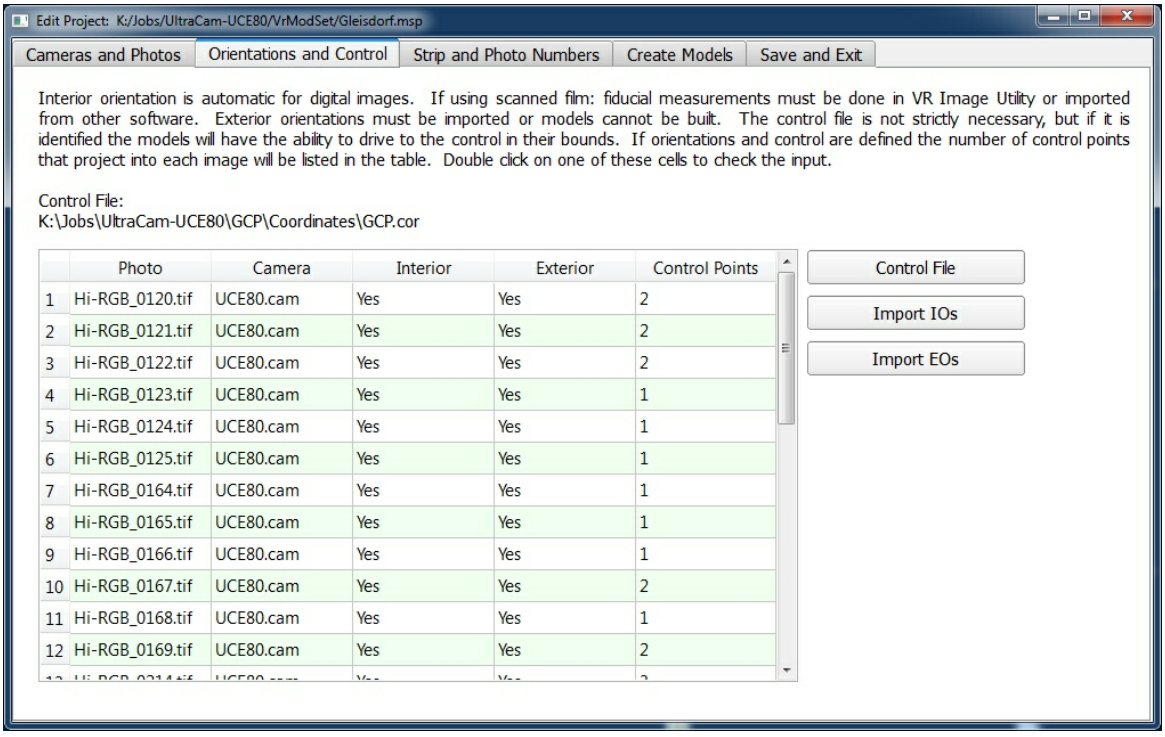
Orientations and Control Tab

On this tab, image orientations are imported and a control (ground) file may be defined. The table lists the name and the status of the interior and exterior orientations for each photo. If the interior and exterior orientations are defined for a photo, the number of control point that projects into the photo is shown in the rightmost column.

If the camera definition for a photo indicates that it is a digital camera then interior orientations are automatic. If the camera definition for a photo specifies a film camera with fiducials, the interior orientation measurements should be imported from the software that was used for aerial triangulation. If Vr Aerial Triangulation (VrAt) was used then this is done automatically when the project if first opened by this program.

Exterior orientations (EOs) must be imported. Supported EO input formats include Albany, Applanix , PATB transpose matrix, PATB, JFK, AeroSys, ISAT EO file, FotoG, BINGO, ISAT 'photo' file, MATCH-AT and Optech LYNX. Is is suggested that the EOs be re-imported during this step to ensure that final aerial triangulation results (not GPS or other initial values) are being used.



The Orientations and Control tab in the Edit Project dialog

Control File

Select a control (ground) file. Supported formats for control files in include the Vr Coordinate file (.cor), text file (.txt) or data file (.dat). Any file with the following format can be used:

```
PtName1 X1 Y1 Z1
PtName2 X2 Y2 Z2
```

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. . .

Import IOs
Interior orientations may be imported from several formats including ISAT (photo), SOCET SET (.iop) or MATCH-AT (.prj)

Import EOs
Exterior orientations may be imported in various formats.

Double-click of Control Points Field
If the number of Control Points value for a photo is greater than zero, the cell may be double clicked to view photo thumbnails of a control point. If the number of control points is greater than one a dialog will allow the selection of which control point to view.



Photo thumbnails displaying the area around a control point

Strip and Photo Numbers Tab

The Strip and Photo Numbers tab allows the assignment of strip and photo numbers. Strip and photo numbers can make job organization and management easier. Although this capability exists for the convenience of project organization, it may be needed for importing some exterior orientation formats such as Aerosys, Albany, ISAT and JFK. Strip and photo numbers allow models to be named in a meaningful way that communicates the individual model's relation to the whole project. It is good practice to take the time to make sure they are assigned correctly.

For most jobs strip and photo, numbers will be calculated automatically based on the image EOs, or obtained from a VrAirTrig or Vr Two Orientation project when first opened in Vr Model Set. Strip and photo numbers that are calculated based on EOs will not match those in EO files or numbers imbedded in image names. In this case, the strip and photo numbers can be overwritten manually or derived from the photo names.

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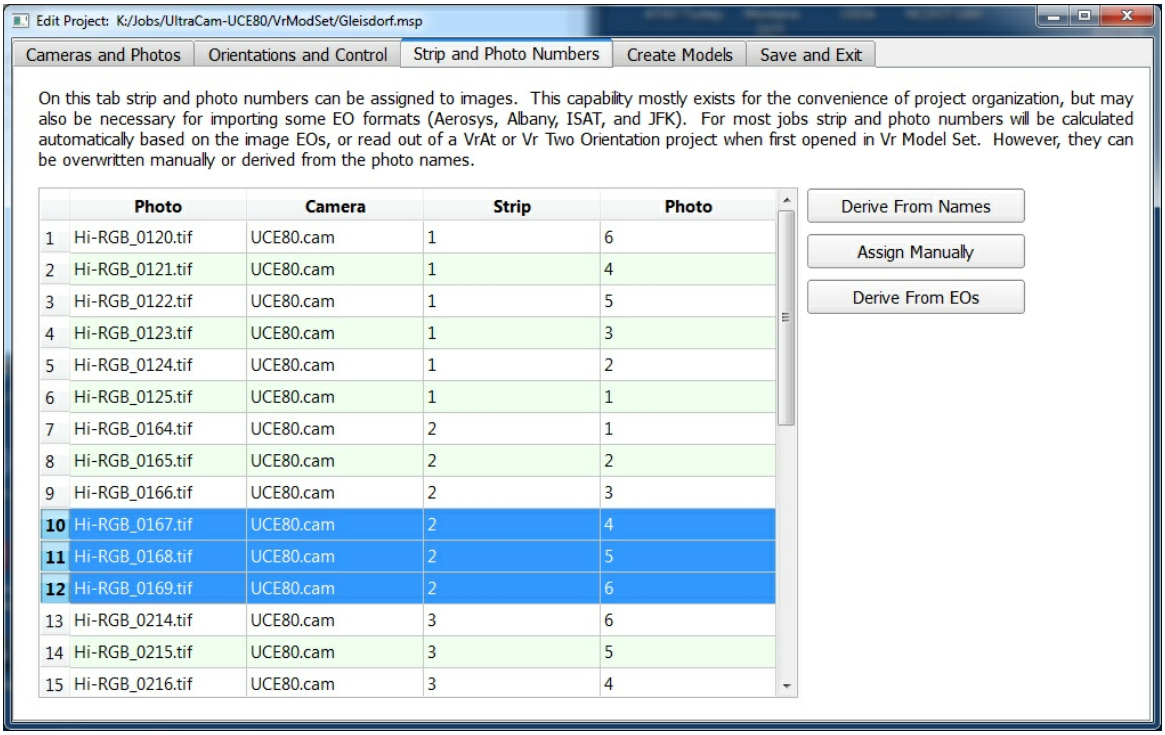
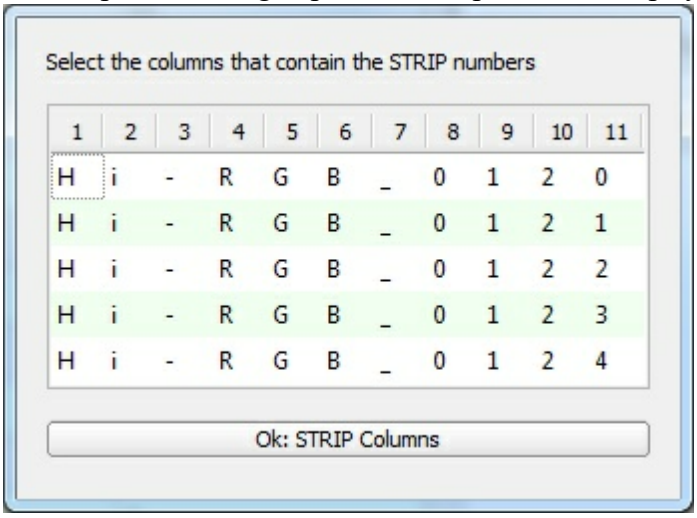


	Photo	Camera	Strip	Photo
1	Hi-RGB_0120.tif	UCE80.cam	1	6
2	Hi-RGB_0121.tif	UCE80.cam	1	4
3	Hi-RGB_0122.tif	UCE80.cam	1	5
4	Hi-RGB_0123.tif	UCE80.cam	1	3
5	Hi-RGB_0124.tif	UCE80.cam	1	2
6	Hi-RGB_0125.tif	UCE80.cam	1	1
7	Hi-RGB_0164.tif	UCE80.cam	2	1
8	Hi-RGB_0165.tif	UCE80.cam	2	2
9	Hi-RGB_0166.tif	UCE80.cam	2	3
10	Hi-RGB_0167.tif	UCE80.cam	2	4
11	Hi-RGB_0168.tif	UCE80.cam	2	5
12	Hi-RGB_0169.tif	UCE80.cam	2	6
13	Hi-RGB_0214.tif	UCE80.cam	3	6
14	Hi-RGB_0215.tif	UCE80.cam	3	5
15	Hi-RGB_0216.tif	UCE80.cam	3	4

The Strip and Photo Numbers tab in the Edit Project dialog

Derive from Names

Derives the strip and photo numbers from the photo file names. The "Derive from Names" button operates on a group of selected photos and displays the following dialog.



1	2	3	4	5	6	7	8	9	10	11
H	i	-	R	G	B	_	0	1	2	0
H	i	-	R	G	B	_	0	1	2	1
H	i	-	R	G	B	_	0	1	2	2
H	i	-	R	G	B	_	0	1	2	3
H	i	-	R	G	B	_	0	1	2	4

Select strip and photo number columns

In the above example the first five photo names are displayed (eg. Hi-RGB_1020.tif). Each character in the image names is separated into columns (1-11).

To assign the strip numbers, the columns that contain the strip numbers are highlighted by clicking or dragging on the column numbers and pressing the Ok button. In this example, the strip columns are 8 and 9, and the images are all assigned to strip 1.

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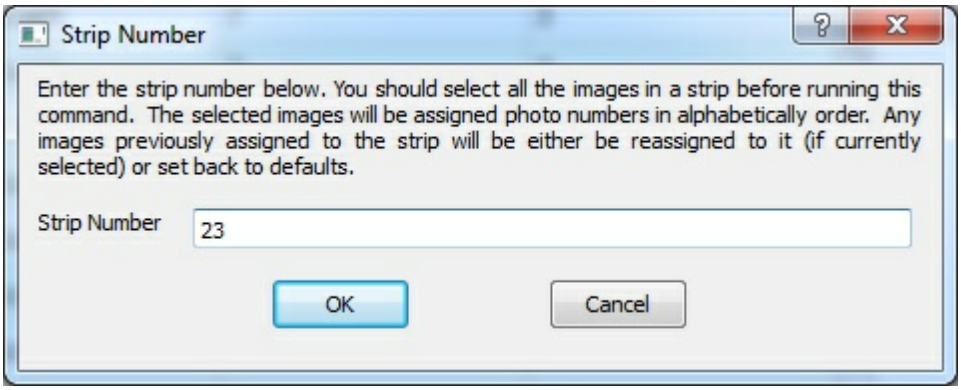
Then, to assign the photo numbers, the columns that contain the photo numbers are highlighted by clicking or dragging on the column numbers and pressing the Ok button. In this example, the photo columns are 9, 10, and 11, and photos are numbered 120-124.

Assign Manually

Manually assign a group of photos to be a strip. Within the selected group the photo numbers will be assigned in alphabetical order starting at photo number 1.



Assign strip numbers manually dialog

Derive from EOs

Obtains the strip and photo numbers from the current exterior orientation file.

Create Models Tab

Once the parameters are entered on the previous tabs, models are created on the Create Models tab.

With some of the new digital camera platforms such as the UltraCam and UAV (drone) imagery, it's possible to obtain a large amount of photos for a job. The Create Models process allows the user to select the desired model overlaps to optimize coverage with the minimal amount of models. It's also possible to set 60% overlapped photos on projects that have 80% or greater photo overlaps to maximize the base to height ratio of the resulting stereo models.

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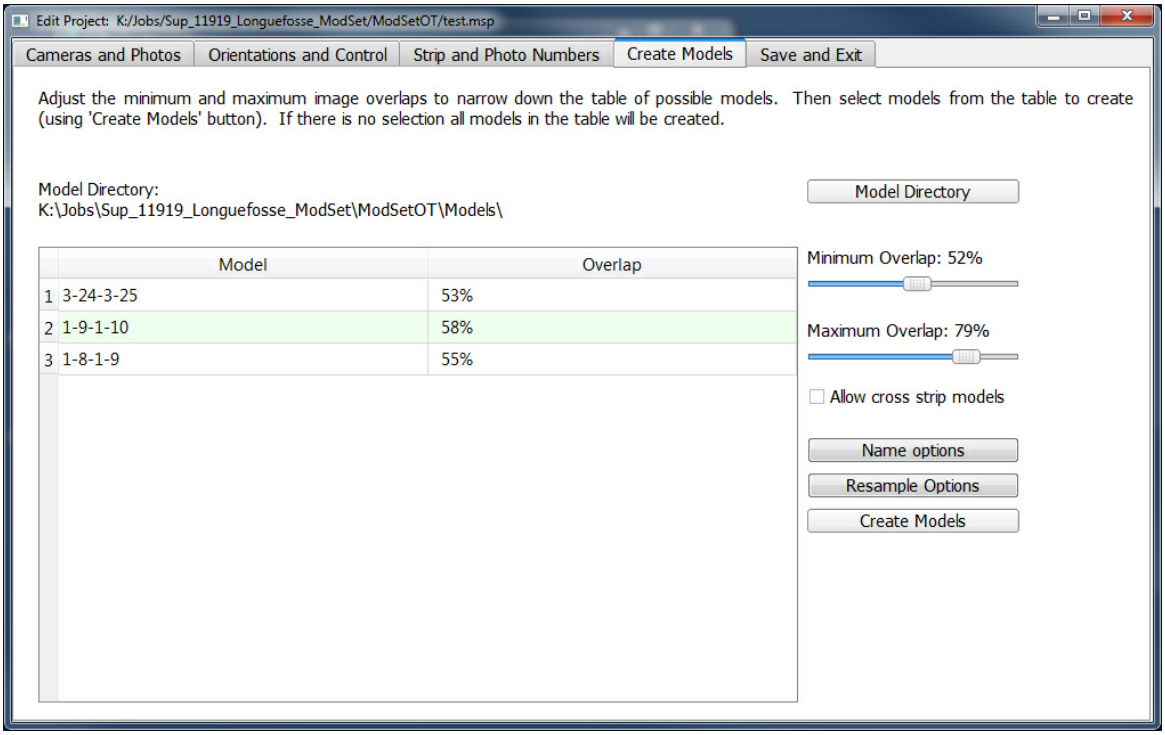

The Create Models tab in the Edit Project dialog

Model Directory
Define the directory (folder) to place the resulting stereo models.

Minimum Overlap
The minimum overlap slider is used to set the lower bounds of the stereo model overlap. The lowest recommended setting is 50%, setting it lower will frequently result in lack of coverage.

Minimum Overlap
The maximum overlap slider is used to set the upper bounds of the stereo model overlap. This parameter must be greater than the Minimum Overlap.

Allow cross strip models
If checked cross strip models with applicable overlaps will also be created.

Name options
Interface to model naming options. After closing the dialog the 'Model' column in the table will update with the new names.

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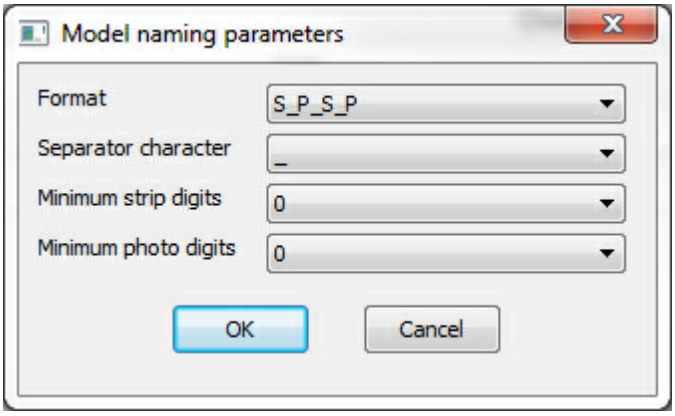
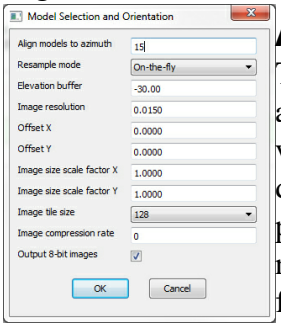


Resample Options

Begins the model creation process, by prompting for resampling parameters.



Model resampling parameters

Align models to azimuth

This parameter is a north azimuth in degrees, and should be set to approximately perpendicular to the flight lines. There are two ways to view a 3D stereo model. The two ways have opposite image Y axis directions. The models will be set to make the Y image axis as close as possible to this azimuth. The choice is binary and alignment, therefore, can not be perfect. However, it does prevent unnecessary 180° perspective flipping.

Resample mode

Images can be resampled using the nearest neighbor, bilinear, bicubic, or on-the-fly algorithms. On-the-fly is recommended because it is the fastest and simplest. On-the-fly models are also the easiest to pass around.

Elevation buffer

The elevation buffer is a percent of the flying height. The larger the number, the larger the area that will be sampled. If models seem too small, try using a great value here. Typical ranges are 0-20%. The default is 2%.

Image resolution

This parameter defaults to maintaining the image native resolution. It is the pixel size of the output image in millimeters. It allows users to super or sub-sample the images, but this is not recommended.

Offset X

This parameter shifts the area of the model that is resampled in the x direction. It is not usually necessary to adjust this parameter.

Offset Y

This parameter shifts the area of the model that is resa

Image size scale factor X

This parameter scales the area of the model that is resampled in the x direction. It is not usually necessary to adjust this parameter.

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Image size scale factor Y
This parameter scales the area of the model that is resampled in the y direction. It is not usually necessary to adjust this parameter.

Image compression rate
Output images can be compressed, but it is not recommended.

Output-8-bit images
If checked resampled images will be 8-bit regardless of the bit depth of the input images.

Create Models
Starts the model creation. Users may be prompted to delete models already in the output directory.

Save and Exit
Saves the currently defined parameters and exits the "Edit Parameters and Create Models dialog" and returns to the main menu.

2.9.1.1 Change On-The-Fly Model Paths

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Change On-The-Fly Image Paths

Type: Utility accessed from VR Model Sets "Misc" menu.

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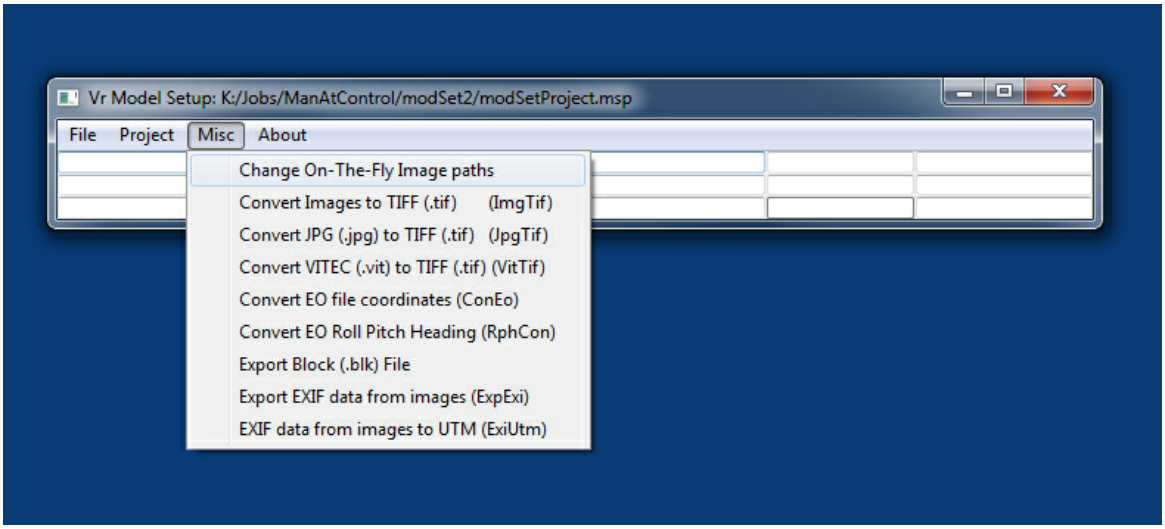
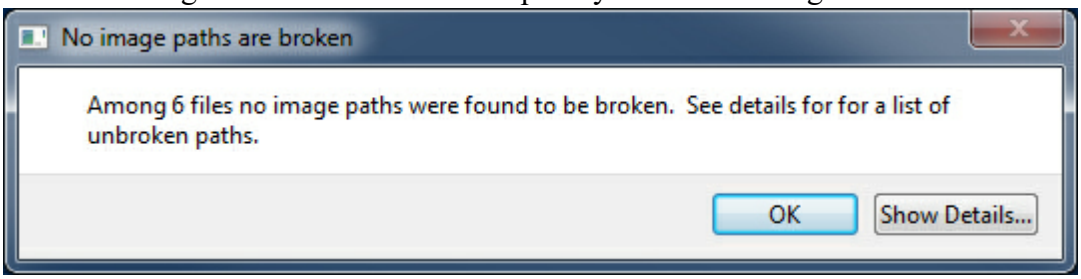


Overview

Frame image on-the-fly model data are saved in VMF files. VMF files are self-contained, they link to no external files except the raw images. Hence, edits to cameras, EO files, vim's, etc. have not effect on models after they are set. This is intended, and makes for easy passing of solutions with minimal support files. To pass models to compilers, you only need to send them the VMFs. However, the raw images path on the compiler machines and AT machines may be different. This utility is used to correct broken image paths in VMF files.

Procedure

When the command is first run from the drop down menu it prompts the user to select the VMF files to be changed. If there are no broken paths you'll see a message similar to:



If broken paths are found you'll see an information box that lists the broken paths and a browse dialog will open prompting you to select the correct location for the images.

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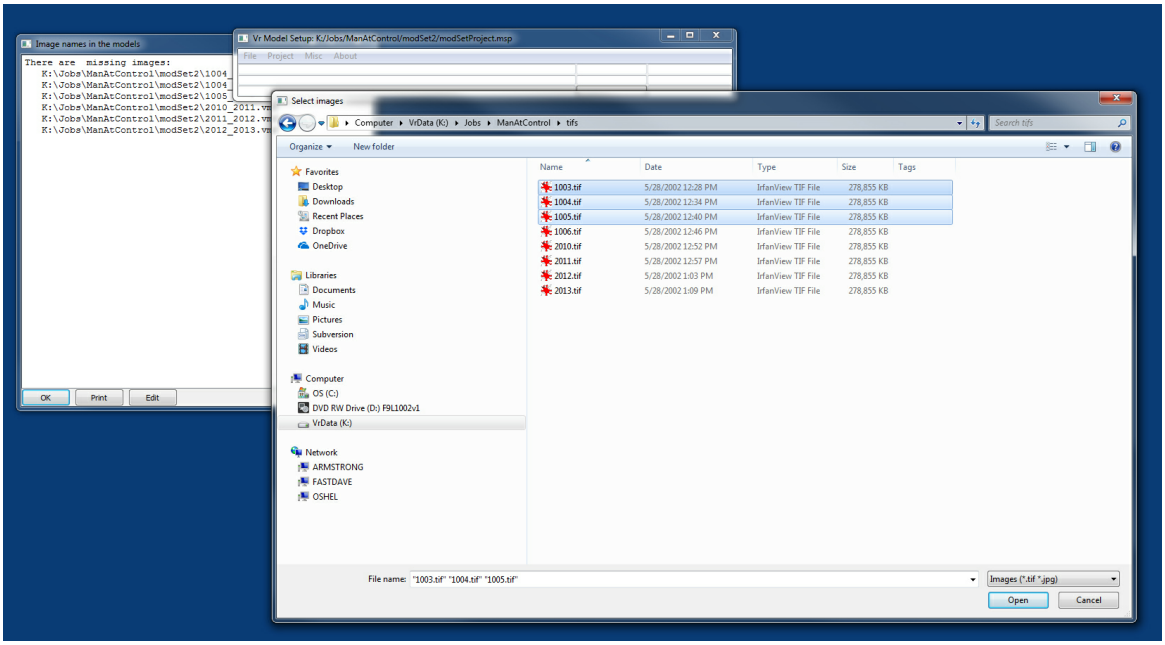
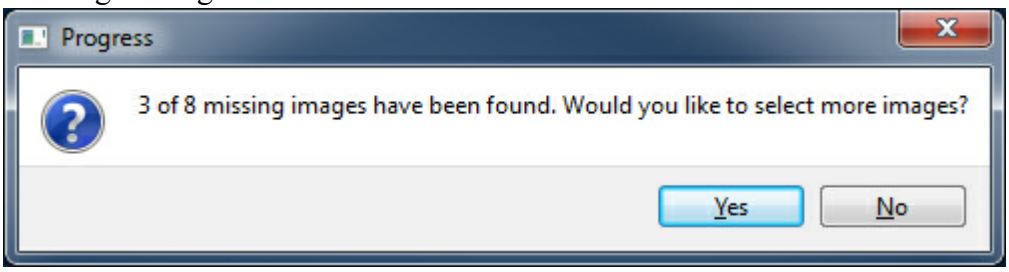
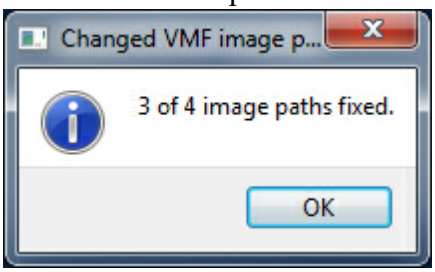


In the example above, only three of the 8 image paths were selected. This resulted in the following warning:



Clicking "Yes" will open another browse dialog so that more images can be selected more images. This permits the images to be in separate folders. Clicking "No" will cause the software to fix the subset of paths that it can:



2.9.2 Camera Calibration

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Mapping

Vr Camera Calibration (CamCal)



Overview
Camera Calibration
Setting Up and Taking Calibration Photos
The Calibration Grid
The Camera Lens
Camera Calibration Photos
Viewing Angles
Filling The Frame

Overview

The Vr Camera Calibration is a stand-alone program to perform camera lens calibrations. The parameters output from this process include the camera's aspect ratio, focal length, principal point, scale factor and lens distortion (pin-cushion effect). The calibration method used by this program uses photographs taken of a calibration grid from different angles. This method is refereed to as Bouguet's Method.

NOTE: The Vr Camera Calibration (CamCal) program is not yet released. At the present time camera calibration photos may be sent to Cardinal Systems for processing. Contact Cardinal

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Systems for more information. (07-Jan-2015)

Camera Calibration

Camera calibration is an important first step when preparing to extract measurements from images. The process of camera calibration is relating the ideal model of that camera to the actual physical device. Information about the camera must be known in order to make accurate measurements. This information includes aspect ratio, focal length, principal point, scale factor and lens distortion (pin-cushion effect).

The U.S. Geological Survey (USGS) has provided high accuracy camera calibration services for aerial cameras for many years and continues to do so today. Over the years the USGS Report of Calibration from the Optical Science Laboratory at USGS has become the defacto requirement of other U.S. Federal agencies, as well as State and local governments. The USGS Report of Calibration defines the math model an an example of how to use the parameters given.

With the increased use of small format and handheld cameras for aerial and non-aerial mapping and measurements the need to calibrate lower cost cameras became necessary. Out of this need came the Vr Camera Calibration (CamCal) program. The calibration method used by this program uses photographs taken of a calibration grid from different angles. This method was made popular by Jean-Yves Bouguet and in his "Camera Calibration Toolbox for Matlab" work and this method, which is used by CamCal, is referred to as Bouguet's Method.

The USGS camera calibration is computed using the Simultaneous Multiframe Analytical Calibration system (SMAC model) and the parameters output by this method are supported by the Vr Camera Calibration program. This allows the output from CamCal to be supported by existing photogrammetric work flows.

In theory, it is possible to define a lens that will have no distortions. In practice, however there is no such lens. All lenses have some amount of distortion and this distortion is classified as either pincushion or barrel distortion.

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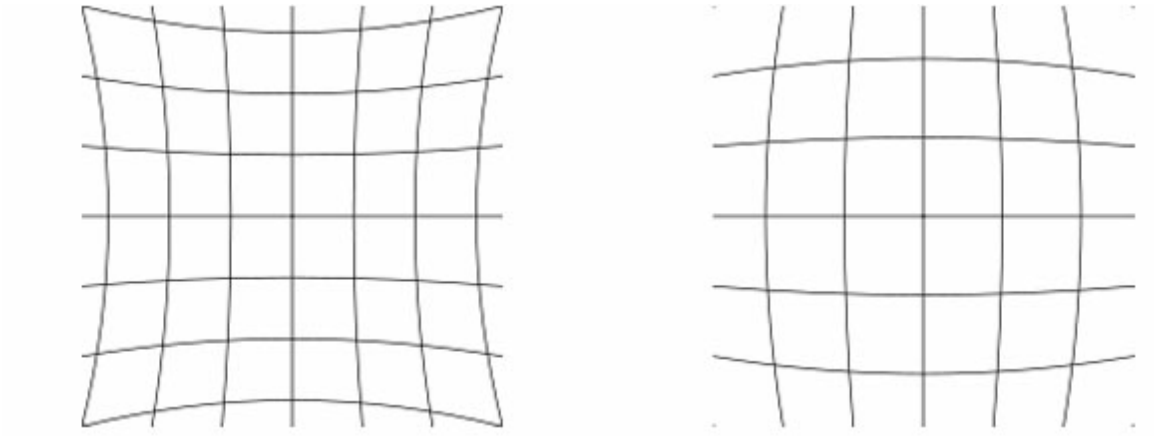
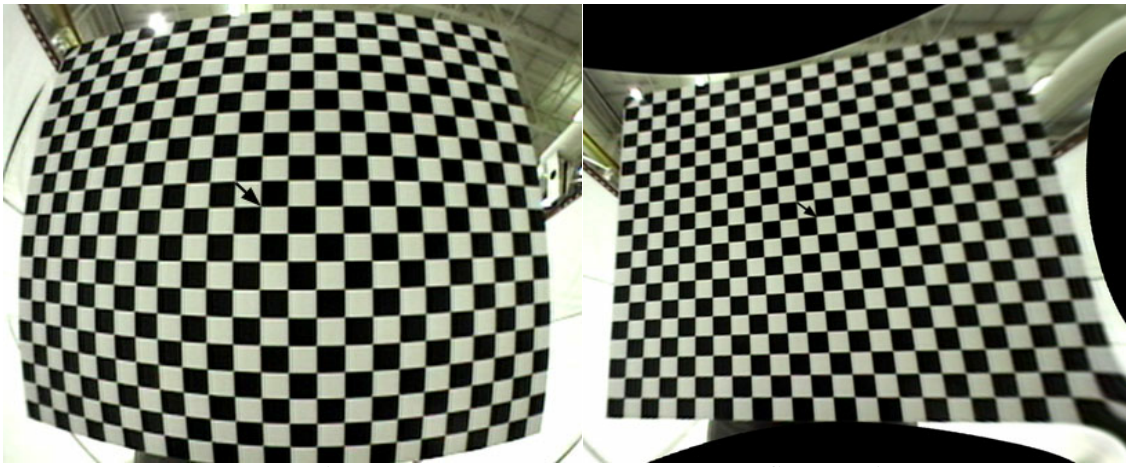


Pincusion and barrel distortion

A simple example of barrel lens distortion is apparent when you take an image of an object with straight vertical or horizontal lines and the lines appear curved in the image. This “barrel” or “fish-eye” effect and is more apparent on lenses with shorter focal lengths. The example below was taken using a fish-eye lens that would not be used for accurate mapping even after calibration but highlights the barrel effect.



Uncorrected image

Corrected image

In a stereo model where both images are uncorrected and a barrel effect lens distortion condition exists, the resulting stereo model will have a 3-dimensional dome distortion resulting in inaccurate measurements. The example below shows two stereo models taken with a GoPro camera with a 3mm fish-eye lens. The blue lines represent a stereo model in which the images were partially corrected in order to obtain stereo and the yellow lines represent a stereo model using a camera calibration from CamCal. The Z has been exaggerated in this example to highlight the effect of lens distortion on a stereo model.

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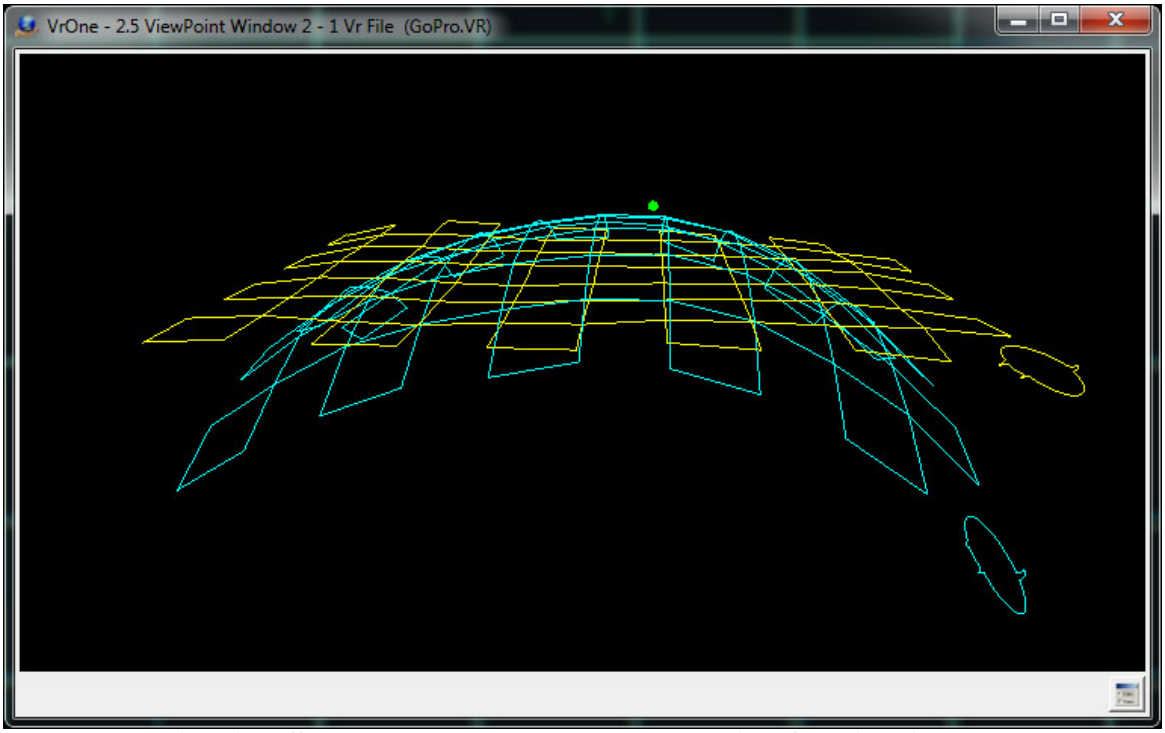

Lens distortion effects on stereo mode (blue) and the correction of the distortions (yellow)

Setting Up and Taking Calibration Photos

The Calibration Grid

The calibration grid (chessboard or checker board) pattern should be asymmetric and consist of even and odd dimensions (i.e. 24x19). Using an even-odd asymmetry yields a calibration grid that has only one symmetry axis, so the calibration grid orientation can always be identified uniquely.

When printing the calibration grid, make sure the printer does not rescale the document which is where the x axis has a different scale than the y axis. Failure to do so will cause intrinsic parameters to be off by a scale-factor. Measure with a ruler to make sure the board has an aspect ratio of 1:1.

The calibration grid needs to be mounted on a flat surface and any warping will decrease calibration accuracy. An ideal surface will be rigid and smooth, for example a table, glass, or marble tile. Cardboard or foam will still work well, but has a tendency to warp over time. It is not necessary, however, to try to make a perfectly smooth surface for the calibration grid.

A calibration grid with more grid squares is advantageous. For example, it's possible to use a calibration grid with dimensions of 9x6 as shown in the examples below but a calibration grid with dimensions such as 23x18 is preferred.

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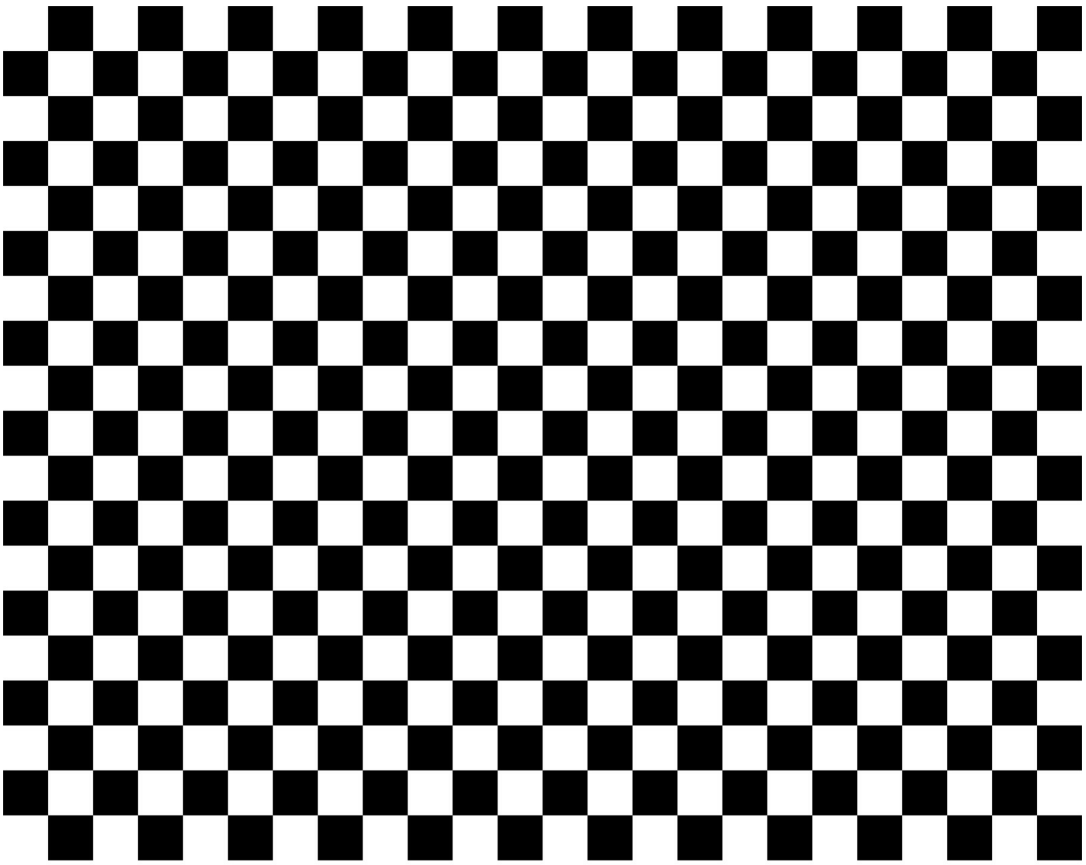

23x18 calibration grid (courtesy of Geomaps International, Inc.)

The calibration grid show above can be downloaded as a PDF file at Camera Calibration Board 23x18.
A lower resolution board may be used if focusing is an issue and can be downloaded at Camera Calibration Board 16x09.

The Camera Lens

The camera should have a fixed focal length and zoom lenses should be avoided. The calibration procedure assumes that every photo taken has the same focal length. Many scientific cameras have a fixed focal length so this is not an issue. Using a tripod to stabilize the camera is also a good idea but not required. Image motion and being out of focus will make it more difficult for the software to find the grid intersections on the calibration grid. To minimize image motion, use a flash if possible or take the photos in a well lighted area. Also select the highest possible lens f-stop to obtain a better depth of field when taking oblique photos. Typical single lens reflex cameras support f-stops up to f/22.

Camera Calibration Photos

Taking a diverse set of in focus photos are essential to calibration. Photos should be taken at various different orientations (or views), distances, and locations in the photo, while filling up as

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much of the photo as possible. The entire board must be in the photos and all the corners must be able to be found by the calibration software.

Be sure that the calibration grid appears along the photo edge and the center. If all the pictures are taken in one region then the results will be biased, even if the residual error is low. The whole calibration grid needs to be visible in the photo and in some cases the calibration grid's border also needs to be visible. Also, even though oblique angle views are required, avoid extreme angles or distances when taking the photos.

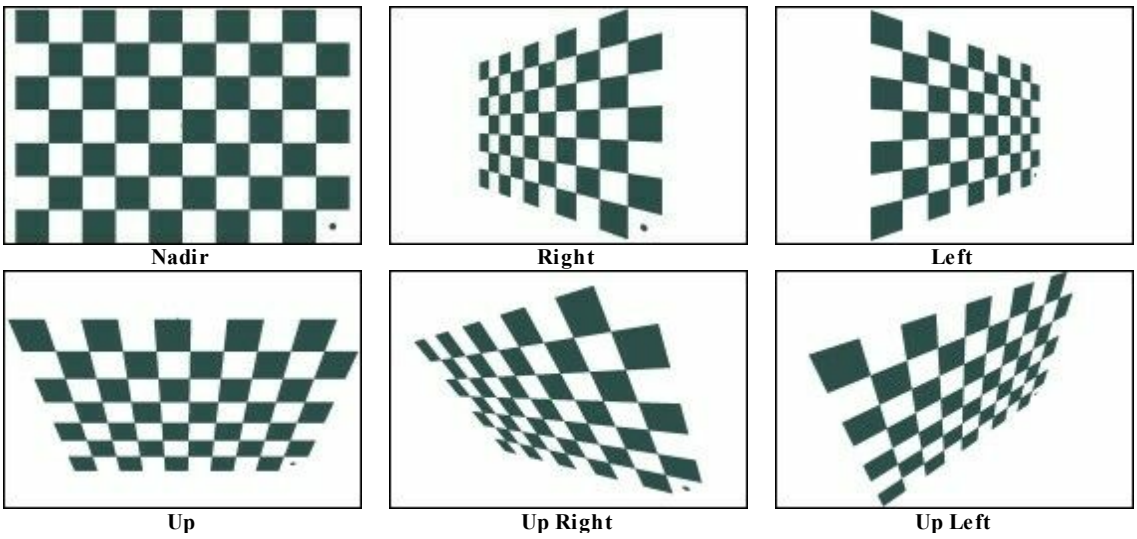
Along with normally orientated camera rotation, photos taken with a 90 degree rotation are required. This cam be accomplished by rotating the camera or the calibration grid sideways.

When taking the camera calibration photos, the following points should be considered.

- The entire calibration grid must be contained within each photo
- Fill the field of view as much as possible.
- Oblique views are more important than nadir views.
- Photos showing the calibration grid at a 90 degree rotation is required.
- Try to fill the photo corners and edges as best as possible.
- Vary the camera distance to the calibration grid.
- It's better to take too many photos rather than too few. 30 to 40 photos are a reasonable amount.

Viewing Angles

Photos should be taken from multiple angles or views. A total of nine views for each camera or calibration grid rotation should be taken as follows. Following are examples showing the nine views from the un-rotated orientation.



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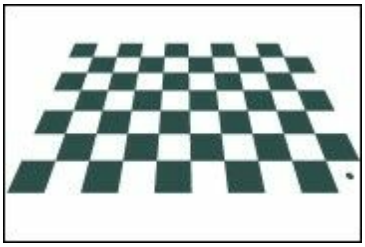
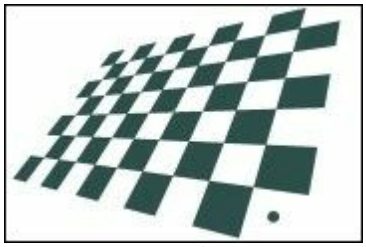
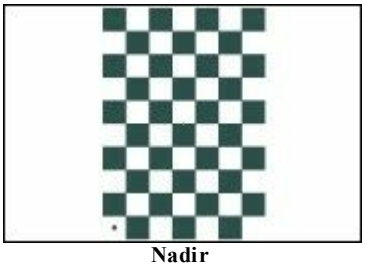
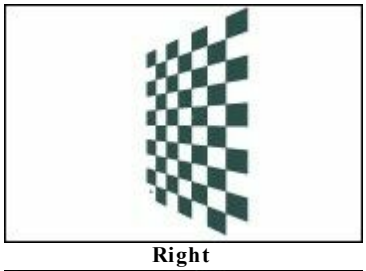

Down

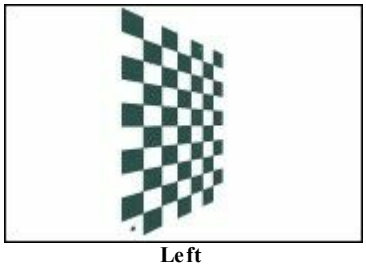

Down Right


Down Left

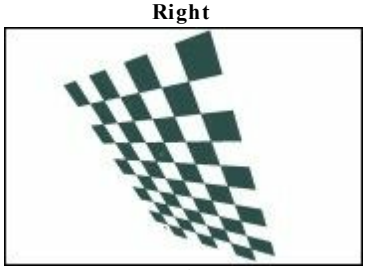
Following are examples showing the nine views from the 90 degree rotation orientation. Either the camera or the calibration grid is rotated 90 degrees clockwise or counterclockwise. In the examples below, the calibration grid was rotated 90 degrees clockwise.


Nadir

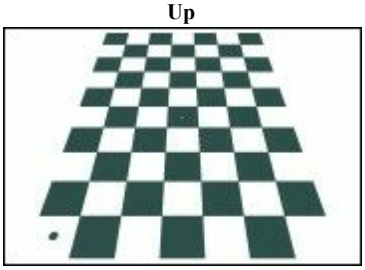

Right

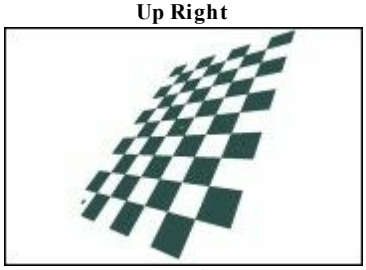

Left

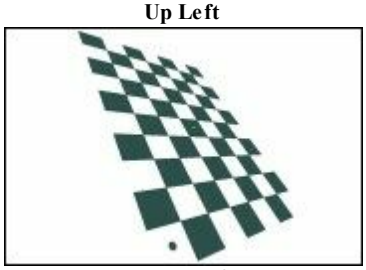

Up


Up Right


Up Left


Down


Down Right


Down Left

Filling The Frame

It's best to fill as much of the photo frame as possible while keeping the entire calibration grid in the frame. The edges and corners are important. Filling the frame and positioning the calibration grid near the corners and edges is easy for the nadir views but becomes more difficult from the oblique views. More than one photo per view might be required to meet this criteria from the oblique views. Following are some examples.

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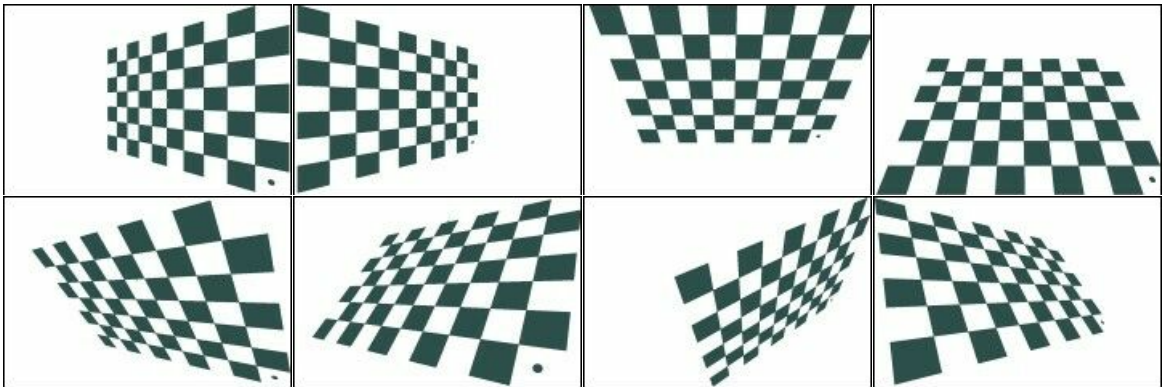
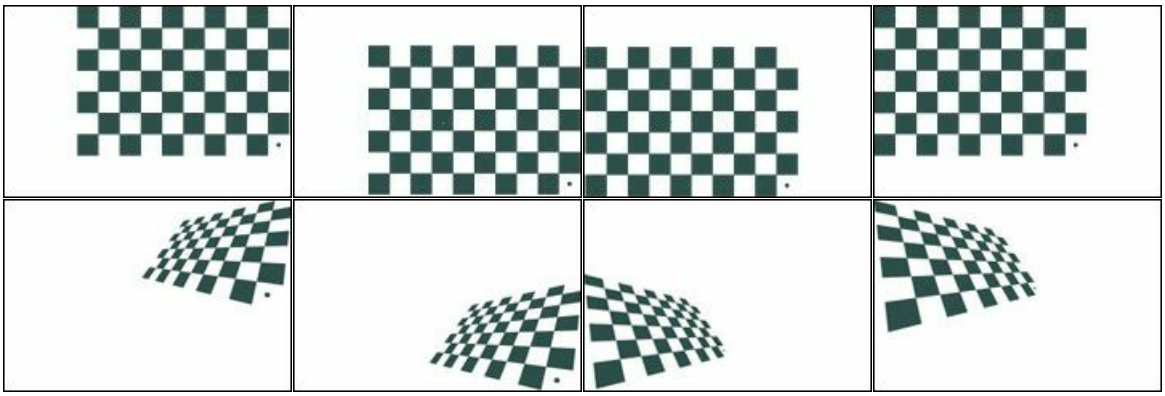


In situations where the scale of the calibration grid does not fill the frame, it is advantageous to take multiple photos of the same view, placing the calibration grid in the corners as best as possible. Following are some examples.



2.9.3 Camera Definition and Editing

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VR Camera Definitions and Editing

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Type: Utility accessed from multiple VR programs.

All VR programs use this interface to define and edit cameras.

Overview

The camera calibration parameters relate the ideal model of a camera to the actual physical device. This information includes focal length, principal points, and lens distortion parameters. Extreme lens distortion is apparent when images of straight lines appear curved (this is common on lenses with short focal lengths). Even in cameras without obvious distortion calibration parameters are important in metric work.

Aerial mapping companies have historically have been spending between 300,000 and 1.5 million dollars on specially built cameras that hold these parameters in check. These metric cameras come with calibration reports. Non-metric cameras can be calibrated using Vr Camera Calibration.

The bundle adjustment also does camera calibration, but it is important to give it reasonable initial values.

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Film Cameras
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- Datumate
- ISAT
- Pix4D
- SocketSet Camera
- SocketSet Support File
- VR Camera File

Digital Cameras

To Setup a digital camera begin by setting the Camera type and setting the camera units as appropriate. Changing the camera units updates the units notations next to all the inputs to clarify what is expected. If editing an existing cameras these two fields will already be set and probably do not need to be changed.

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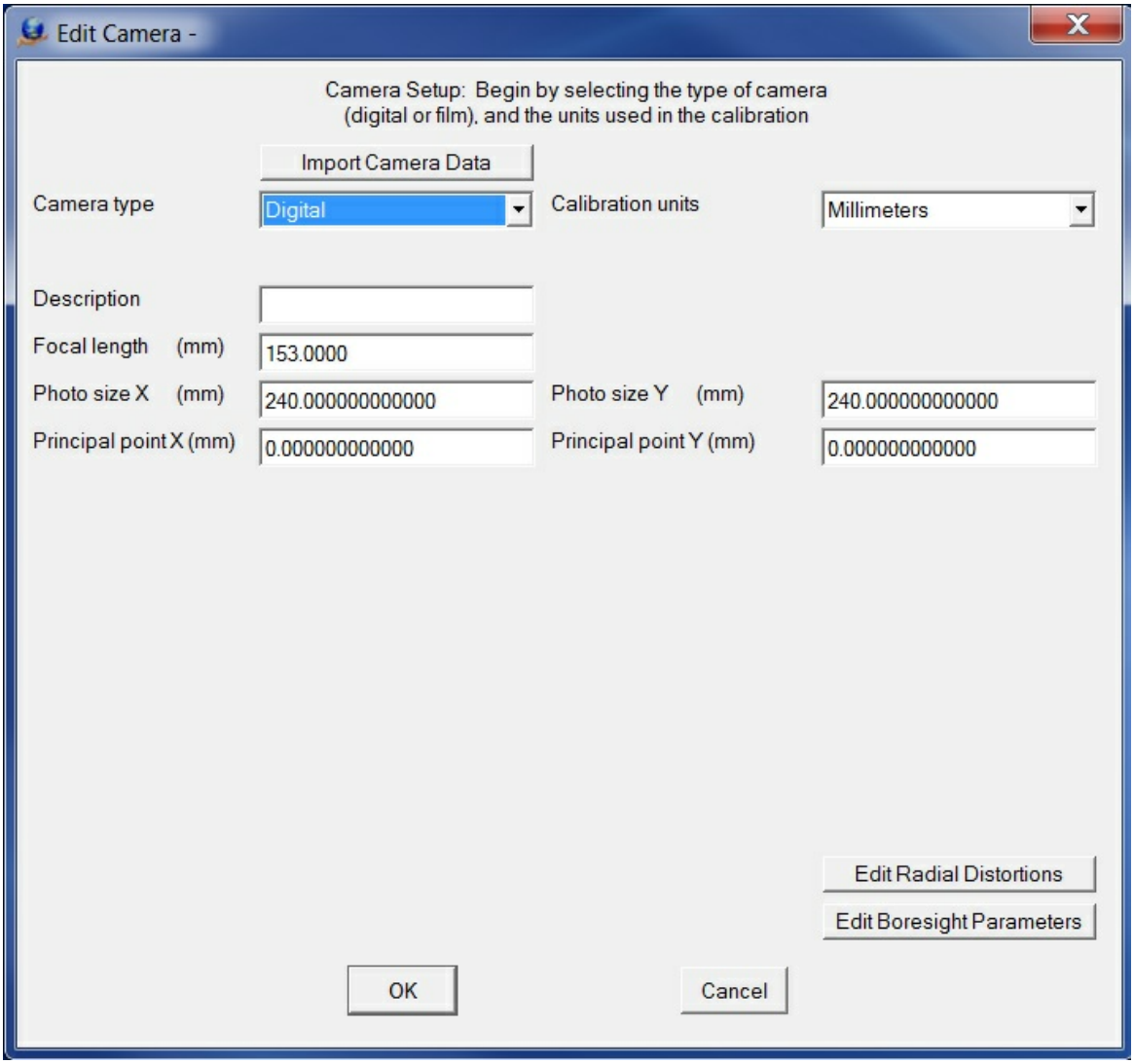

The Digital Camera dialog

Camera type - Defines the type of camera and determines the parameters to display in the dialog.

Calibration units - The coordinate and focal length units are typically defined as Millimeters (mm) or Pixels (px).

Description - A description of the camera may be provided for user convenience and does not affect how the software operates.

Focal length - Defines a fundamental description of the geometry of the bundle of rays captured by image and is usual provided by manufacturers of metric cameras. Non-metric camera users can estimate it from the lens size or use VR Camera Calibration to determine it. This parameter is entered in the calibration units (millimeters or pixels).

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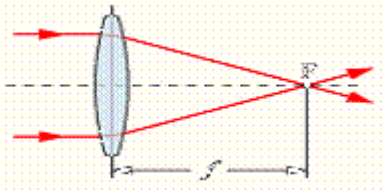

Photo size - The physical dimensions of the image sensor. This parameter is entered in the calibration units (millimeters or pixels).

Principal point - Describe the point of symmetry of the lens distortion. It is often provided by manufacturers of metric cameras, but never by manufacturers of non-metric cameras. In can be estimated to be (0,0) and then determined as part of a bundle adjustment in VR Aerial Triangulation or determined in Vr Camera Calibration. This parameter is entered in the calibration units (millimeters or pixels).

Edit Radial Distortions - Please see Lens distortion

Edit Boresite Parameters - The "boresight" parameters are typically used to describe the differences in the rotations of the sensor (such as camera) rotational axes and the rotational axes of the Inertial Measurement Unit (IMU), which is usually bolted to the camera body. These parameters are set to zero by default.

Note: Even though most of the fields in this dialog indicate millimeters (mm) as the parameter units, the units are entered as specified in the 'Calibration units' field which is Millimeters or Pixels.

Film Cameras

To Setup a film camera begin by setting the camera type to 'Scanned film' and setting the camera units as appropriate, this is probably millimeters. Changing the camera units updates the units notations next to all the inputs to clarify what is expected. If editing an existing cameras these two fields will already be set and probably do not need to be changed.

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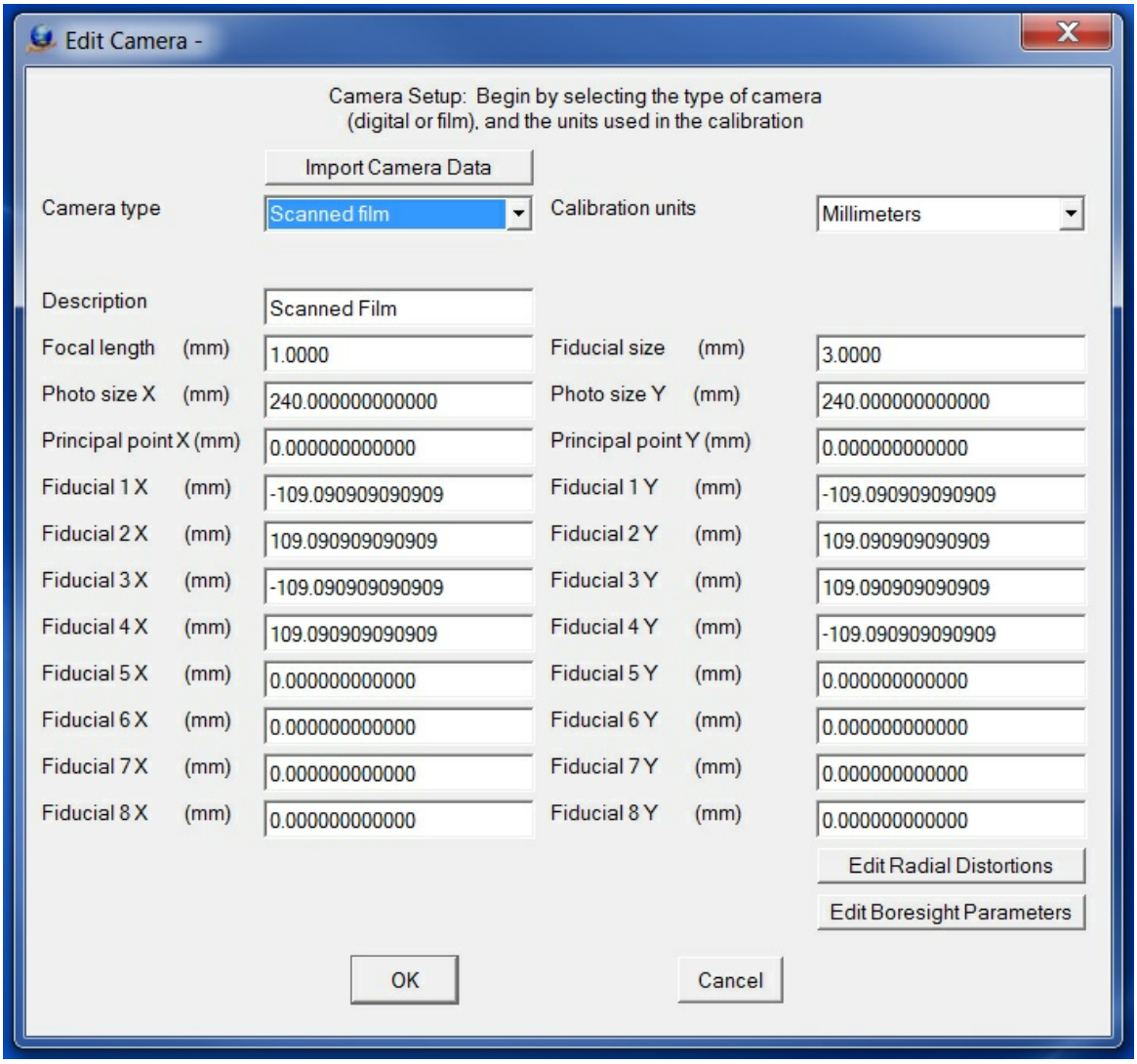

The File Camera dialog

Camera type - Defines the type of camera and determines the parameters to display in the dialog.

Calibration units - The coordinate and focal length units are typically defined as Millimeters (mm) or Pixels (px).

Description - A description of the camera may be provided for user convenience and does not affect how the software operates.

Focal length - Defines a fundamental description of the geometry of the bundle of rays captured by image and is usual provided by manufacturers of metric cameras. Non-metric camera users can estimate it from the lens size or use VR Camera Calibration to determine it. This parameter is entered in the calibration units (millimeters or pixels).

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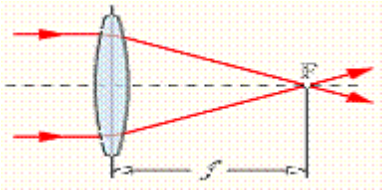

Photo size - The physical dimensions of the image sensor. This parameter is entered in the calibration units (millimeters or pixels).

Principal point - Describe the point of symmetry of the lens distortion. It is often provided by manufacturers of metric cameras, but never by manufacturers of non-metric cameras. In can be estimated to be (0,0) and then determined as part of a bundle adjustment in VR Aerial Triangulation or determined in Vr Camera Calibration. This parameter is entered in the calibration units (millimeters or pixels).

Fiducial n X and Y - Defines the coordinate positions for up to eight fiducial marks. Most aerial cameras have eight fiducial marks, and it is strongly recommended that all fiducial marks be used to compute the interior orientations. If there are less than eight fiducial marks (or you elect to use less) leave the undefined fiducial mark coordinates zeros. These parameters are entered in the calibration units (millimeters or pixels).

Edit Radial Distortions - Please see Lens distortion

Edit Boresite Parameters - The "boresight" parameters are typically used to describe the differences in the rotations of the sensor (such as camera) rotational axes and the rotational axes of the Inertial Measurement Unit (IMU), which is usually bolted to the camera body. These parameters are set to zero by default.

Note: Even though most of the fields in this dialog indicate millimeters (mm) as the parameter units, the units are entered as specified in the 'Calibration units' field which is Millimeters or Pixels.

RPC Cameras

To Setup a RPC camera select the 'Camera type" to RPC

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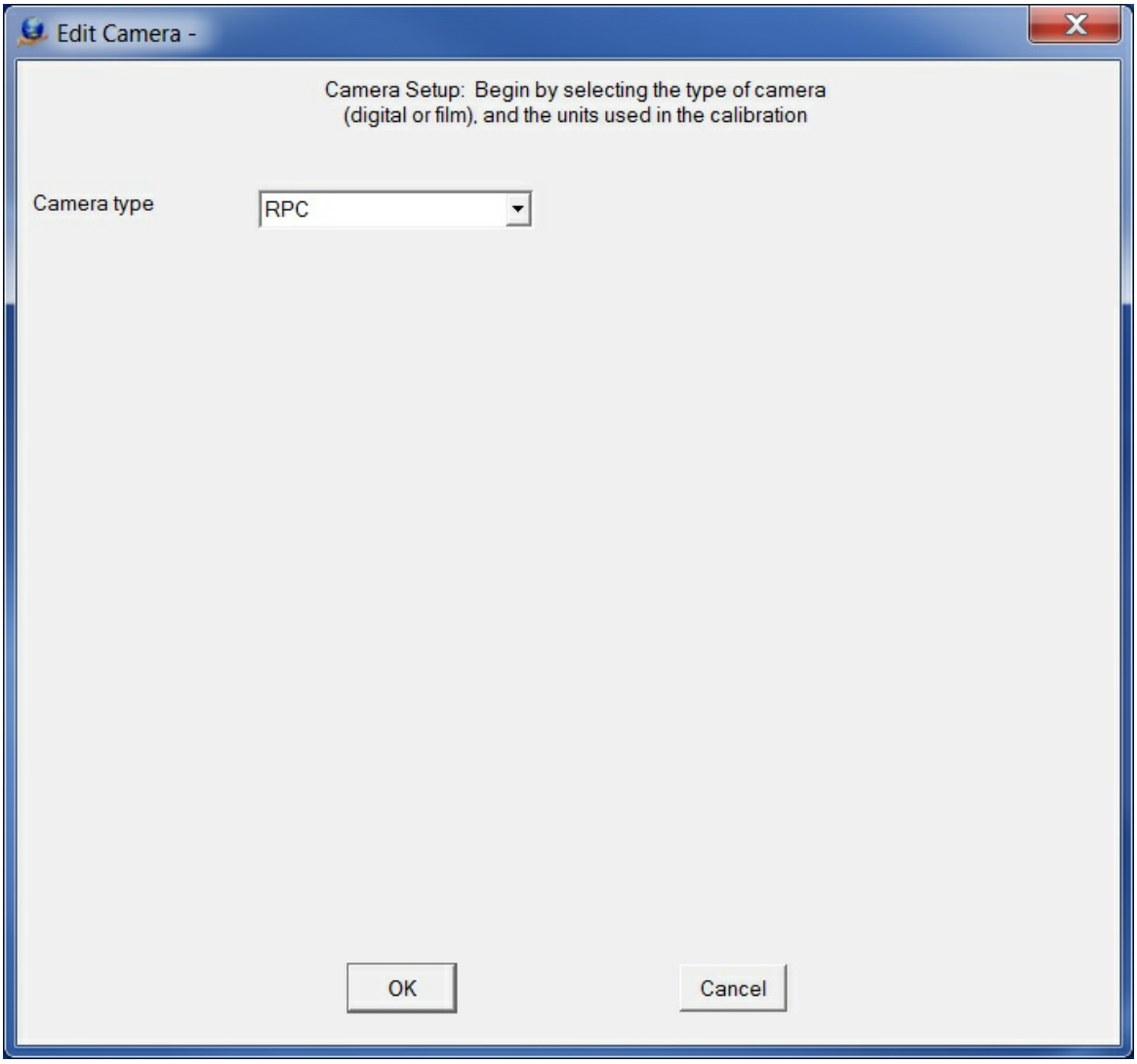

The RPC dialog

Notice that there are no parameters. RPCs (rational polynomial coefficients) encode not only the exterior orientation of images but their interior orientation and camera parameters as well. The only reason a camera is even created is as a place holder. The Vr software requires that images be assigned a camera, so here a dummy camera is used. This serves the purpose of telling the software to expect/require an RPC data file for this image.

Lens Distortion

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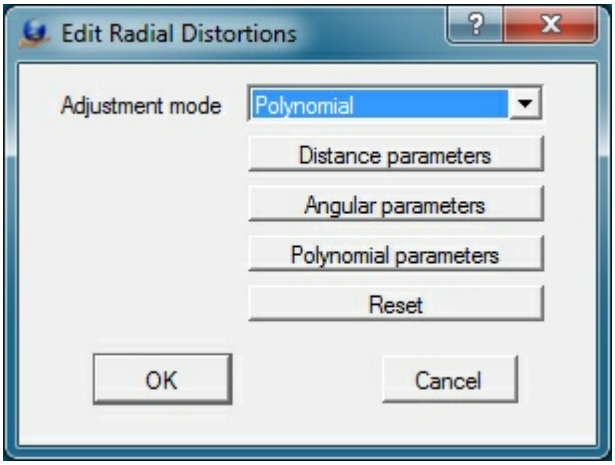

Lens distortion causes imaged positions to be displaced from the ideal or true locations. In aerial cameras these distortions are normally minimal but can still have an effect on accuracy. Some of the digital cameras have large lens distortions and radial distortions must be entered for accurate mapping results.

Adjustment mode - There are two methods of representing radial distortions which are by distance or with polynomial values. Most camera calibration programs output radial distortions values as polynomial parameters. The Angular option is currently not supported.

Distance Parameters

Radial distortions that are represented as concentric rings about the camera lens calibrated principal point may be entered as distance parameters. The radial distortions shown below are from a small format camera.

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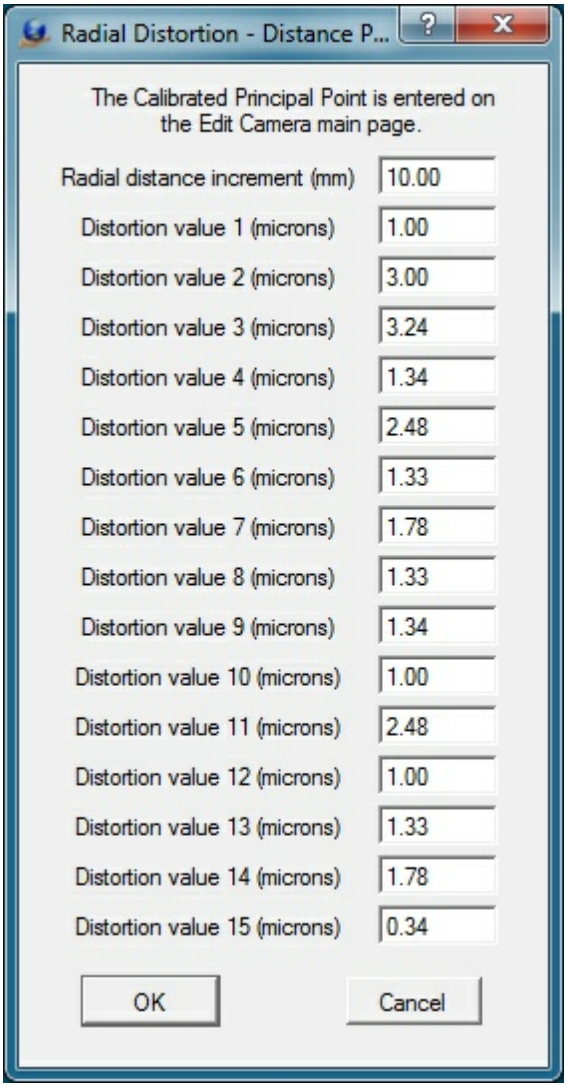

Defining radial distortions by distance

Radial distance increment - Represents the distance between the concentric rings that make up the distance parameters. Radial distance increment units should be the same as those used for Fiducial positions.

Distortion values - Specifies distortion values for each distance. There may be up to 15 values. Distortion value units should be the same as those used for Fiducial positions.

Angular Parameters

The Angular Parameters are currently unsupported.

Polynomial Parameters

The mathematical model used is based on the Simultaneous Multi-camera Analytical Calibration (SMAC) method as defined by the USGS. Care should be taken when entering these parameters, as entry errors cause model orientation errors and distortions which affect model accuracy. For metric cameras these values should be provided in a calibration report. For non-metric cameras they can be determined in VR Camera Calibration or assumed zero and calculate as part of the bundle adjustment.

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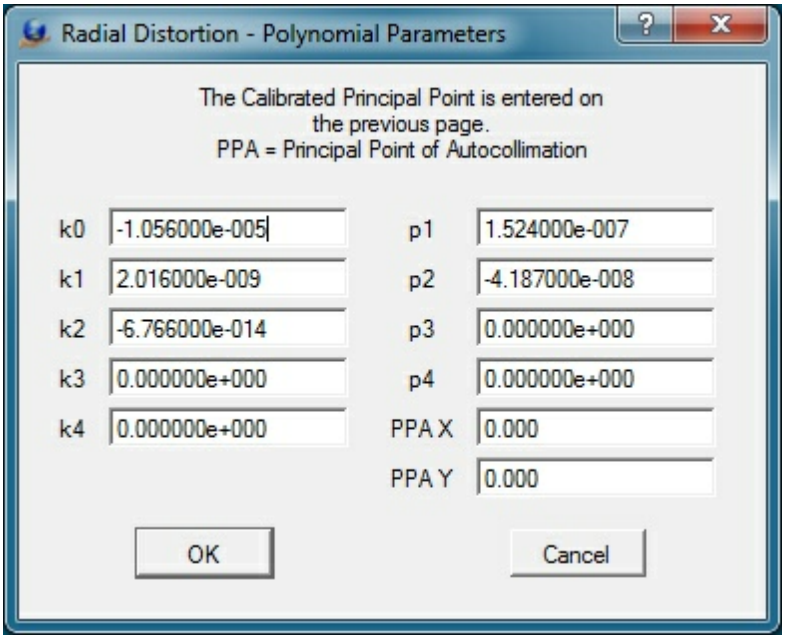
Up to five symmetric radial distortion coefficients (K values) can be defined. Unused (undefined) K values should be left zero.

Up to four decentering coefficient values (P Values) can be defined. Unused (undefined) P values should be left zero.

The K and P values are entered into the Polynomial Parameters dialog box in exponential notation. The values entered from the USGS camera calibration report may have the decimal place moved one position to the left depending on the number entered. For example:

```
USGS value:  0.1403x10-3
Value typed:  .1043e-3
Shown value: 1.403000e-004
```



The Radial Distortions dialog box for entering the polynomial parameters

Importing Camera Data

If supported, a camera file should be imported to avoid transcription errors and other frustrations. Various formats are supported, but several of them have only partial definitions and some values must still be manually entered. Finally, some camera formats cannot be translated into VR exactly. Please read the documentation carefully. Also, file formats from other software do change periodically, if you have an issue please send an email to support@cardinalsystems.net and we will get it fixed.

All camera importing is done using the 'Import Camera Data' located near the top of the camera edit dialog.

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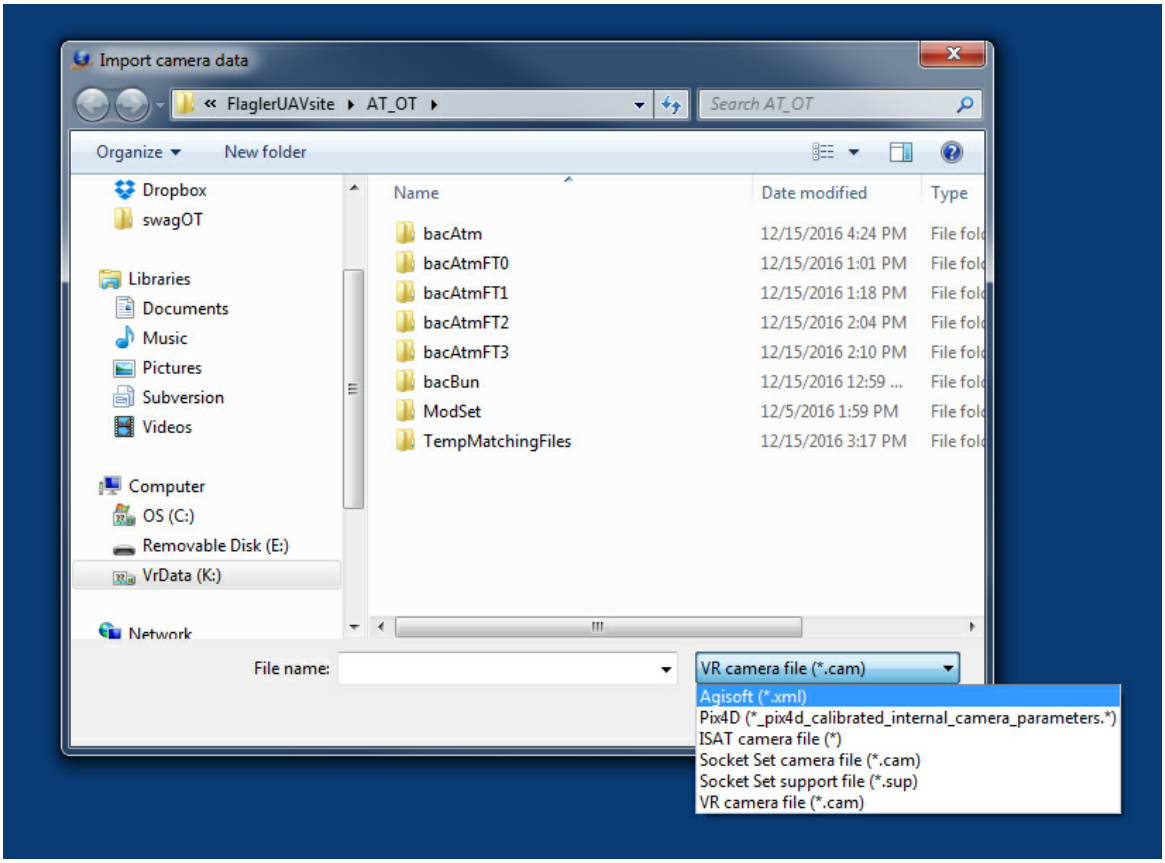

Import Camera dialog

The type of camera is selected from file type combo box near the bottom right of the windows file open dialog.

Agisoft Camera Import

Agisoft camera files are among those that are not translated exactly into VR. The camera definition is complete, but includes multiple focal lengths and skew parameters that are not currently supported. If importing from Agisoft it is recommended that you import the block measurements and run a bundle in VR AT to compensate for this.

File Format:

```
<sensors>
   <sensor id="0" label="ILCE-5100 (20 mm)" type="frame">
   <resolution width="6000" height="4000"/>
   <property name="pixel_width" value="4.0000000000000010e-003"/>
   <property name="pixel_height" value="4.0000000000000010e-003"/>
   <property name="focal_length" value="2.0000000000000000e+001"/>
   <property name="fixed" value="false"/>
   <calibration type="frame" class="adjusted">
      <resolution width="6000" height="4000"/>
      <fx>5.2542324878152913e+003</fx>
```

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```
        <fy>5.2548648186137489e+003</fy>
        <cx>2.9641988929952763e+003</cx>
        <cy>1.9857667758296288e+003</cy>
        <skew>7.0995629195644328e-001</skew>
        <k1>-1.6570203169850198e-001</k1>
        <k2>1.6255130389270986e-001</k2>
        <k3>-1.6184373209953556e-002</k3>
        <p1>2.7834959305479836e-004</p1>
        <p2>-7.6558212510163196e-004</p2>
      </calibration>
      </sensor>
   </sensors>
```

Datumate Camera Import

The Datumate camera information is stored in the Datumate .ori files. There is a .ori file for each photo that was used by Datumate. Any .ori file may be selected if a single camera was used for the entire project. If multiple camera were used then this procedure would be repeated for each camera. If multiple cameras were used when the .ori files might need to be viewed to determine a .ori file for each camera. A fully functional camera definition will be imported, but a description can be added for convenience.

The Datumate camera import does not import radial distortions and the resulting camera file has the radial distortions turned off.

File format:

```
$ImageID_____________________________________________________(ORI_Ver_1.1)
            C:\Users\efusco\Documents\DatuGram3D\Jobs\4437 Edgewood2\DJI_0042.JPG
$IntOri_FocalLength_____________________________________________________[mm]
      3641.03399123682
$IntOri_PixelSize______(x|y)_____________________________________________[mm]
      1.0   1.0
$IntOri_SensorSize_____(x|y)_____________________________________[pixel]
      4864  3648
$IntOri_PrincipalPoint_(x|y)_____________________________________[pixel]
      2430.13821103775  1829.13666785524
$IntOri_CameraMatrix_____________________________(ImageCoordinateSystem)
      3641.03399123682  0.0   2430.13821103775
      0.0   3641.03399123682  1829.13666785524
      0.0   0.0   1.0
$ExtOri_RotationMatrix_____________________(World->ImageCoordinateSystem)
      -0.0221952154000378     -0.99974523079716 0.00410437713666893
      -0.999702089254286      0.0222355802304079      0.010065371946993
      -0.0101540708073241     -0.00387975130017045    -0.999940919442688
$ExtOri_TranslationVector_____________________(WorldCoordinateSystem)
      2499566.78335786  7104704.29847965  1009.9040071593
$IntOri_Distortion_____(Model|ParameterCount|(Parameters))_______________
            BROWN5 5 0.00919791907365037  -0.0261102747197858     0.026805298450978
$Rectification_Method_____________________________________________________
            NONE
```

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Pix4D Camera Import

Pix4D is among those formats that cannot be exactly duplicated. I appears that they use some kind of irregular distortion grid internally, but only export a SMAC like set of polynomial parameters. If importing from Pix4D it is recommended that you import the block measurements and run a bundle in VR AT to compensate for this.

File format:

```
   Pix4D camera calibration file 0
   #Focal Length mm assuming a sensor width of
6.317479999999999976239x4.738109999999999982180mm
   F 3.73320024386105409064
   #Principal Point mm
   Px 3.15119568290642693142
   Py 2.38913699995431461076
   #Symmetrical Lens Distortion Coeffs
   K1 -0.01268751795503417212
   K2 0.00500201292706088565
   K3 0.00883570912425699420
   #Tangential Lens Distortion Coeffs
   T1 0.00006907855258670360
   T2 0.00007440408018383493
```

ISAT Camera Import

SocketSet Camera Import

There are two support flavors of Socket set camera files. Both contain the same data, but their formatting is quite different. Both are missing the camera photo (chip) size, which must be manually added to complete the camera definition.

SocketSet Camera File, Flavor1:

```
   Focal Length (mm)
   -208.205000
   Principal Point Offset xpoff ypoff in mm
   -6.0000000000000001e-003  -2.0000000000000000e-003
   How many fiducial pairs (max 8):
   8
   Fiducial x,y pairs in mm
   106.004000 -106.008000
   -105.999000 -105.998000
   -106.004000 106.005000
   106.002000 106.002000
   0.003000 -109.992000
```

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```
   -109.996000 0.003000
   -0.004000 109.997000
   109.998000 -0.002000
   Symmetrical Lens Distortion Odd-order Poly Coeffs c0,c1,c2,c3
(c0=offset)
   0.000e+00 0.0000000000000000e+000   0.0000000000000000e+000
0.0000000000000000e+000
   Decentering Lens Coeffs p1, p2, p3
   0.0000000000000000e+000   0.0000000000000000e+000
0.0000000000000000e+000
   How many distortion pairs (max 20):
   0
   Distortion Data Units (m=radial dist in mm, d=field angle in deg):
   m
   Distortion Data Pairs, if any (Radius in mm or deg, Distortion in
Microns):
```

Socket Set Camera, Flavor 2:

```
   camera_calibration_file 1

   #Focal Length (mm)
   FOCAL 92.000500

   #Principal Point Offset xpoff ypoff in mm
   XPOFF 3.000000e-003
   YPOFF 2.000000e-003

   #Principal Point symmetry xsoff ysoff in mm
   XSOFF 0.000000e+000
   YSOFF 0.000000e+000

   #How many fiducial pairs (max 8):
   NUM_FIDS 4

   #Fiducials position
   DATA_STRIP_SIDE left

   #Fiducial x,y pairs in mm:
   FID_PAIRS
   -39.603200 -43.545600
   39.603200 43.545600
   -39.603200 43.545600
   39.603200 -43.545600

   #Symmetrical Lens Distortion Odd-order Poly Coeffs:K0,K1,K2,K3
   SYM_DIST 0.000000e+000   0.000000e+000   0.000000e+000
0.000000e+000

   #Decentering Lens Coeffs p1,p2,p3
   DEC_DIST 0.000000e+000   0.000000e+000   0.000000e+000
```

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```
   #How many distortion pairs (max 20):
   NUM_DIST_PAIRS 0

   #Distortion Data Units (m=radial dist im mm, d=field angle in deg):
   DIST_UNITS m

   #Distortion Data Pairs, if any (Radius in mm or deg, Distortion in
Microns)
   DIST_PAIRS
```

SocketSet Support File Camera Import

Socket Set camera data is also found in the support files. The data here is not as complete. There are not fiducial coordinates (for film cameras) or a photo size. However, some software does camera calibration during the bundle adjustment and records the tweaked focal length, etc. in the support files. Importing a support file will update the changed values. If creating a camera from a support file care should be taken to manually set the fiducial coordinates (if a film camera) and the photo size.

Socket Set Support File:

```
   support_file d
   IMAGE_ID "613020_206_115"
   IMAGE_FILE_NAME 1 "d:\stereo_rfp\dataset1_film\scans\613020_206_115.
img"
   LINES 16576
   SAMPLES 16576
   RECTIFICATION_TERMS
   0.00000000000000e+000 0.00000000000000e+000 1.00000000000000e+000
   0.00000000000000e+000 1.00000000000000e+000 0.00000000000000e+000
   GRND_BIAS 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000
   BIAS 0.000000 GAIN 1.000000
   GROUND_ZERO 3.98854531019135e+006 4.35194217455687e+005
2.67353727151535e+003
   LOAD_PT 3.98854531019135e+006 4.35194217455687e+005
2.67353727151535e+003
   COORD_SYSTEM 6
   UNITS 1
   USE_FAST_MATH 0
   MAX_AND_MIN_ELEVATION 0.0 1000.0
   IMAGE_MOTION 0
   INITIALIZED 2
   STATUS 0
   QUALITY 53
   SENSOR_TYPE FRAME
   FOCAL 2.08205000000000e+002
   IOCOEF_LINE -1.56472108149629e+001 7.13940026073314e+001 -
4.37494679097658e-001 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000   0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000
```

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```
   IOCOEF_SAMPLE -1.54474111419888e+001 4.25912380706273e-001
7.13946648078216e+001 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000
   OPK_LSR -8.28834522463146e-003 -2.65238839172880e-002 -
1.53268429353673e+000
   LSR_CAMERA -1.41202811810784e+001 -4.52335264346011e+003
7.62697206937887e+003
   X0Y0Z0_GEO 6.29715707011150e-001 -1.84514880423643e+000
0.00000000000000e+000
   AZIMUTH_LSR 0.00000000000000e+000
   ATMREF 0
   ATMCO 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000
   ABERR 0
   USE_LENS_DISTORTION 0
   LENSCO 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000 0.00000000000000e+000
   XPOFF -6.00000000000000e-003
   YPOFF -2.00000000000000e-003
   ELLIPSOID NAD_83
   VERTICAL_REFERENCE 1
   A_EARTH 6.37813700000000e+006
   E_EARTH 8.18191910434947e-002
   ELLIPSOID_CENTER 0.00000000000000e+000 0.00000000000000e+000
0.00000000000000e+000
   PROJECTION_TYPE UTM_PROJECTION
   ZONE 13
   FALSE_NORTHING_POS 0.0000000000000000e+000
   FALSE_NORTHING_NEG 0.0000000000000000e+000
   FALSE_EASTING_POS 5.0000000000000000e+005
   FALSE_EASTING_NEG 5.0000000000000000e+005
   GRID_NAME UTM_13N
```

VR Camera Import

Importing VR's native camera format is straight forward. The camera definition is complete and no speacial considerations are required.

File Format:

```
   # VrTwo Camera File
   # 14-Jul-2010 00:51:06
   #
   # FILENAME   - Parameter file name
   # DESC       - Camera description
   # FOCALLEN   - Focal length (Fiducial units)
   # FIDSIZE    - Fiducial size (Fiducial units)
   # FIDUNITS   - Fiducial units (0=mm 1=in 2=pixels)
   # FIDCOUNT   - Number of fiducials used (4 | 8)# PHOTOSIZEX - Photo
```

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```
size X (width)  (Fiducial units)
# PHOTOSIZEY - Photo size Y (height) (Fiducial units)
# PPOX       - Calibrated principal Point X (Fiducial units)
# PPOX       - Calibrated principal Point Y (Fiducial units)
# FID        - Fiducial coordinates
# RADDIST    - Radial distortion Angle Distance DistortValue

FILENAME   "K:\Jobs\ManAtControl\man_rc10.cam"
DESC       "man_rc10"
FOCALLEN   152.67300000
FIDSIZE    3.00000000
FIDUNITS   0
FIDCOUNT   4
PHOTOSIZEX 240.00000000
PHOTOSIZEY 240.00000000
PPOX       0.00100000
PPOY       -0.00700000
FID        0 -105.99200000 -105.99300000
FID        1 106.01700000 106.00500000
FID        2 -105.98600000 106.01600000
FID        3 105.99100000 -105.99300000
FID        4 0.00000000 0.00000000
FID        5 0.00000000 0.00000000
FID        6 0.00000000 0.00000000
FID        7 0.00000000 0.00000000
#
# Radial distortion parameters
#
Mode        0
Dis_Incr    10.000
Dis_Distort  0 0.00000
Dis_Distort  1 0.00000
Dis_Distort  2 0.00000
Dis_Distort  3 0.00000
Dis_Distort  4 0.00000
Dis_Distort  5 0.00000
Dis_Distort  6 0.00000
Dis_Distort  7 0.00000
Dis_Distort  8 0.00000
Dis_Distort  9 0.00000
Dis_Distort 10 0.00000
Dis_Distort 11 0.00000
Dis_Distort 12 0.00000
Dis_Distort 13 0.00000
Dis_Distort 14 0.00000
Dis_Distort 15 0.00000
#
Ang_Angle    0 0.00000
Ang_Angle    1 0.13090
Ang_Angle    2 0.26180
Ang_Angle    3 0.39619
Ang_Angle    4 0.52360
Ang_Angle    5 0.61087
```

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```
Ang_Angle    6 0.69813
Ang_Angle    7 0.00000
Ang_Angle    8 0.00000
Ang_Angle    9 0.00000
#
Ang_Distort  0 0.00000
Ang_Distort  1 0.00000
Ang_Distort  2 0.00000
Ang_Distort  3 0.00000
Ang_Distort  4 0.00000
Ang_Distort  5 0.00000
Ang_Distort  6 0.00000
Ang_Distort  7 0.00000
Ang_Distort  8 0.00000
Ang_Distort  9 0.00000
#
k0            0.000000e+000
k1            0.000000e+000
k2            0.000000e+000
k3            0.000000e+000
k4            0.000000e+000
p1            0.000000e+000
p2            0.000000e+000
p3            0.000000e+000
p4            0.000000e+000
xipp               0.000000
yipp               0.000000
```

2.9.4 Import, Interior Orientations

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Import, Interior Orientations

Type: Utility accessed from various models

All images must have interior orientations before the stereo model can be set.

For digital images (including RPC satellite images) Interior Orientation is automatic. In Vr

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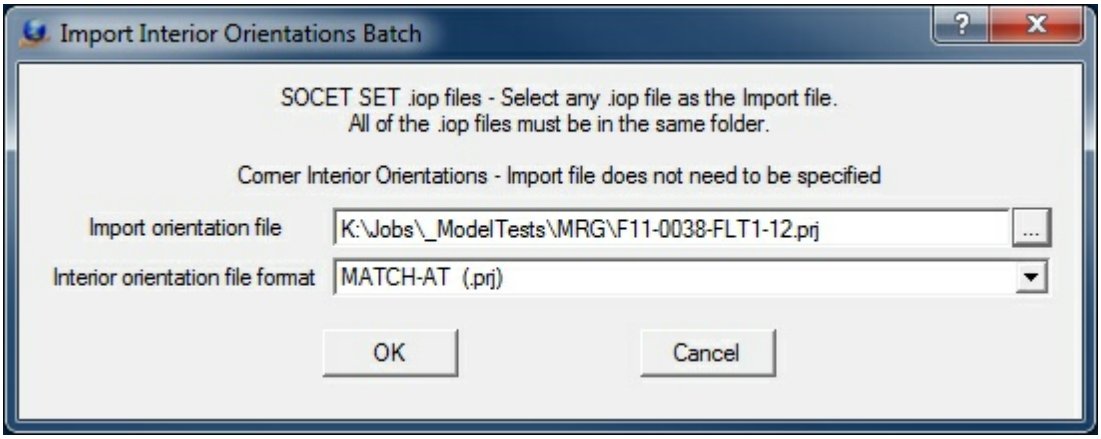
Model Set, Air Trig, and Vr Ortho it is done as soon as an image is added to a project. In Vr Two Orientation (which only exits now for legacy support) it accomplished using the batch import command (immediately below).

Film image interior orientations can be imported following the direction below.

Interior Orientations – Batch (IntBat)



The Import Interior Orientations in Batch dialog box

Import orientation file

Defines the ASCII file that contains the interior orientation measurements. The user must know the correct file for the import format. When importing Socket Set or Orima IOP files any single IOP file may be selected and all IOP files in the same folder will be used.

Interior orientation file format

Specifies the format of the input interior orientation file.

- **ISAT** – The ISAT "photo" file extracts interior orientation measurements.
- **Orima** – The Orima format uses .iop files. Each image must have a corresponding .iop file which uses the same name as the image but with an .iop file name extension.
- **Corner Interior Orientation** – When using images in which the camera has not been calibrated or when using images that do not have fiducials the Corner Interior Orientation to establish a generic interior orientation. When using this format the Import orientation file parameter above does not need to be defined.

Depending on the Interior Orientation File Format selected, one or more additional dialog boxes may appear requesting more information about the input format. One of these dialog boxes may request information about the Photo Name Format. The Photo Name Format dialog box defines the format for decoding the strip number and photo number from and image file name.

If ISAT is selected as the Interior Orientation File Format, the following dialog box will display.

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The ISAT Strip Number Location dialog box. Displayed when importing ISAT exterior orientations.

Strip number location

There are two possible locations for the strip number in the ISAT photo file.

- Embedded with the photo number – The strip number is part of the photo name following the 'photo_parameters' keyword. For example, the record:

  ```
  begin photo_parameters 205    strip_id 2
  ```

  would assume the strip number and photo number are included in the 205 field. The 2 after the strip_id would be ignored. If the number of strip characters were "1" and the number of photo characters were "2", then strip 2, photo 5 would be decoded from the 205 field.

- After the 'strip_id' keyword – The strip number follows the 'strip_id' keyword, which is on the same record as the 'photo_parameters' keyword. For example, the record

  ```
  begin photo_parameters 101    strip_id 3
  ```

  would assume the photo number as 101 and the strip number as 3.

Selecting Images to Orient

The following dialog box is displayed before importing begins, allowing the user to select the images to orient. By default all images are selected.

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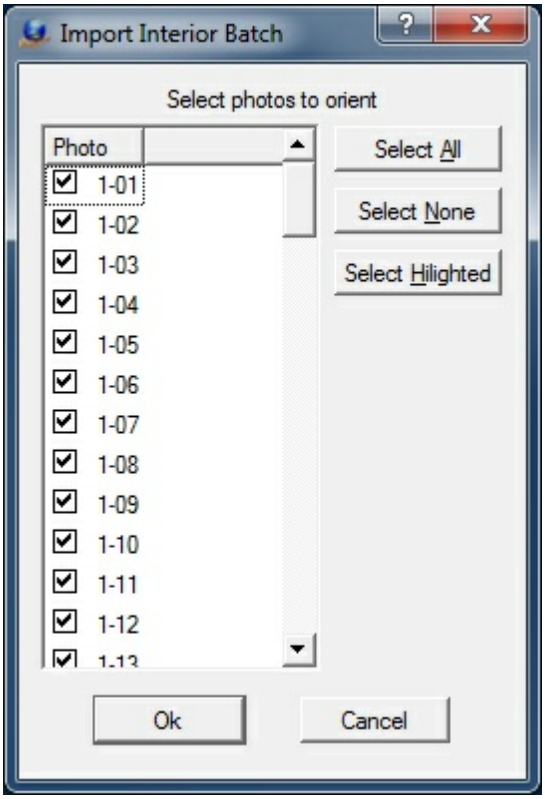

The selection of models for import dialog

After each interior orientation is complete, the results of the import are placed into the information dialog box.

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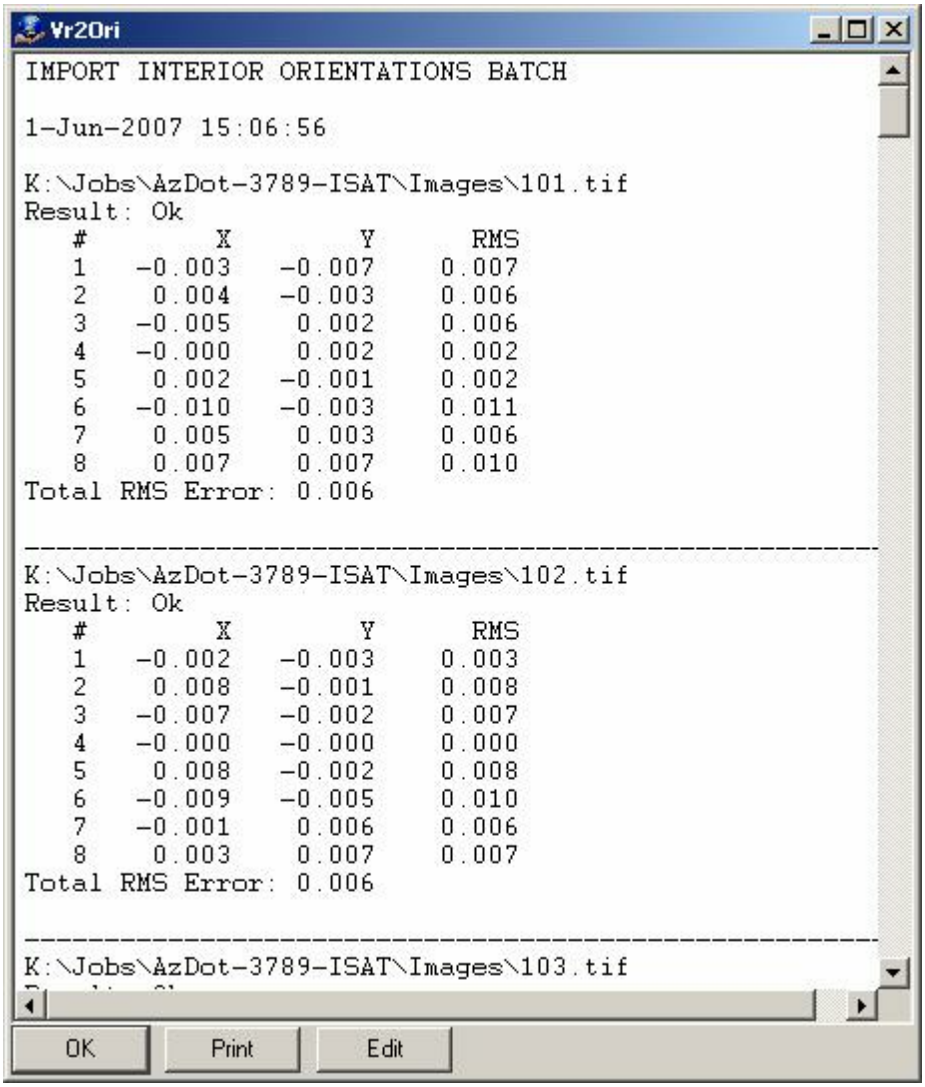

The import exterior orientations information box

2.9.5 Import, Exterior Orientations

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CARDINAL SYSTEMS, LLC
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Vr Mapping

Importing Exterior Orientations

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Description

Requirements
- Requirements for using Measurements
- Requirements for using Exterior Orientations

Measurement File Formats
- ALBANY
- ISBBA
- ISAT
- JFK
- MATCH-AT
- ORIMA
- PATB
- VrAt

Exterior Orientation File Formats
- AeroSys
- ALBANY
- Applanix
- BINGO
- ISAT EO file
- ISAT 'photo' file
- JFK
- MATCH-AT
- PATB
- Pix4D
- Agisoft

Description

There are two methods for model orientation in the VrTwo Orientation Program (Vr2Ori): measurements and exterior orientations. VR Model Set currently only inports exterior orientations. A more detailed description of the two techniques follows:

- **Air Trig Measurements** - Rather than simply importing a solution this method performs a relative and absolute orientation from image ties and ground coordinates. Importing data this way provides numerical feed back on the quality of the results and thus provides a double check of the bundle results. However, the resulting orientation is only an approximation of the bundle result being imported. For this reason is it not the recommend method. It is useful occasionally if there is some issue with or missing input data (usually

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camera definition data). In this case the recalculation tends to smooth over these error or omissions.

The coordinates in measurement files are normally fiducial coordinates in microns or millimeters. Vr2Ori can read various measurement file formats and run the relative and absolute orientations based on these measurements.

- **Exterior Orientations** - Imports the orientation and position of each photograph from an aerial triangulation adjustment (Bundle). There is no recalculation nor approximation. For this reason it is the recommended method. The adjustment values are the rotation angles about the X, Y and Z axis (Omega, Phi, and Kappa) and the position of the photograph in ground units. Borth VR Model set and Vr2Ori can read various exterior orientation files.

Requirements

Requirements for Using Measurements

- **Ground Control File** – Final coordinate file from the aerial triangulation adjustment. It should include the coordinate positions for the original ground control and the xyz coordinate positions for the aerial triangulation pass and tie points. Since we are setting a single model, which requires at least three vertical and two horizontal points, the original ground control file will not have enough points to set the model.
- **Measurements File** – Contains measurements for the points on each photograph for the adjustment. These measurements are X,Y coordinates (expressed in microns or millimeters) for the common and control points. There are several supported formats.

Requirements for Using Exterior Orientations

- **Exterior Orientation File** – Result of the aerial triangulation adjustment. Contains the Omega (x), Phi (y) and Kappa (z) rotation angles and the x, y, z coordinate for each photograph.

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Measurement File Formats

The following are the supported file formats for importing orientations using measurements from aerial triangulation:

- ALBANY
- ISBBA
- ISAT
- JFK
- MATCH-AT
- ORIMA
- PATB

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- VrAt

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JFK Measurement File Format

(ASOP file) – The JFK format is one of the few whose coordinates may not be presented in microns or millimeters. Often, coordinates are in a machine coordinate system. The first four or eight points for each photograph are the fiducial measurements. Upon importing JFK measurements, Vr recomputes the inner orientation so the coordinates in the file may be converted to millimeters. The order that the fiducial points were read in aerial triangulation must be entered and it is suggested that the USGS point number sequence be used when measuring these points in aerial triangulation.

Format example:

```
1  1    1  394005  394013
1  1    2  606000  606008
1  1    3  394000  606011
1  1    4  606004  394013
1  132761  435628  544371
1  132762  415034  522530
1  132763  456432  498834
1  1 1011  500711  602651
1  1 1012  500646  559562
1  1 1013  500501  553826
1  1 1021  586181  544371
1  1 1022  588259  522530
1  1 1023  584832  498834
1  1  374  564371  544390
1  1  375  584965  540962
1  1  801  562101  496860
1  1  802  556680  553263
```

Description:

```
Strip number:  0 -  4   4 chars
Photo number:  4 -  6   3 chars
Point name:    7 - 11   5 chars
X:            12 - 19   8 chars
Y:            20 - 27   8 chars
```

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ISAT Measurement File Format

The coordinates are normally represented in millimeters and there a two pair of measurements for each point.

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The Location of the Strip Number

Strip and photo number may be encoded in the field after the "photo_measurements" keyword. Alternately, the photo number alone may be stored here and the strip number is located after the "strip_id" keyword.

Encoded With the Photo Number - In the following example, the strip and photo numbers are encoded in the same field as the "photo_measurements" keyword, resulting in a strip number of 333 and a photo number of 4.

```
begin photo_measurements 333_04 strip_id 333 version 2.0
```

After the "strip_id" Keyword - In the following example, the photo number is defined after the "photo_measurements" keyword and the strip number is defined after the "strip_id" keyword, resulting in a strip number of 333 and a photo number of 4.

```
begin photo_measurements 04 strip_id 333 version 2.0
```

In any case, the Vr Mapping software prompts the user for the strip number location when needed.

Format example:

```
begin photo_measurements 333_04 strip_id 333 version 2.0
 102  -88.223459  -54.48708   -88.21914   -54.485536  1 0
 202  -88.22346   -54.486643  -88.219141  -54.485099  1 0
 130  -90.547583  88.019566   -90.542839  88.016663   1 0
 103  47.460939   -28.304471  47.46056    -28.30407   1 0
 203  47.459191   -28.306224  47.458812   -28.305823  1 0
 33030 -93.935157 -25.859113  -93.930286  -25.858331  1 0
 33031 -100.47029 69.43473    -100.46501  69.43212    1 0
 33033 -99.97721  69.843071   -99.971954  69.840451   1 0
 33032 -99.925894 -77.858603  -99.921382  -77.857109  1 0
 33034 -104.82956 -80.321189  -104.8249   -80.319784  1 0
 33040 -0.55964746 -8.5576488  -0.55961614 -8.5573221  1 0
 33041 -10.922536 90.767633   -10.92116   90.765257   1 0
 33043 -6.903269  96.243403   -6.9018842  96.241167   1 0
 33042  2.7350342 -69.753146  2.735623    -69.751729  1 0
 33044  4.2095274 -69.864267  4.2100893   -69.86288   1 0
 33050 71.912829  9.8773264   71.913098   9.8771497   1 0
 33051 81.140142  83.422012   81.142934   83.422727   1 0
 33052 81.649493  -76.860884  81.652592   -76.862506  1 0
 6001 53.335374   -22.283994  53.335054   -22.283749  1 0
 6002 60.035923   -19.217072  60.035789   -19.216948  1 0
 6003 88.107365   -18.523815  88.109033   -18.524119  1 0
 6004 93.966025   -18.909729  93.968263   -18.910138  1 0
 6005 95.200412   -13.861172  95.202697   -13.861531  1 0
 6006 83.691161   -13.863357  83.69238    -13.863561  1 0
 6007 68.450912   -14.366451  68.451108   -14.366464  1 0
```

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```
 6008 61.215586   -17.45878   61.215476   -17.458685  1 0
 6009 53.595521   -14.765279  53.595114   -14.765122  1 0
 6010 71.401473   -11.362814  71.401802   -11.362872  1 0
 6011 86.704885   -4.9812579  86.706267   -4.9814476  1 0
 6012 71.737042   5.1825883   71.737305   5.1824424   1 0
 6013 75.166358   -25.993112  75.167144   -25.993234  1 0
 6014 93.554794   -30.308202  93.557233   -30.308791  1 0
 6015 69.879982   -35.217456  69.880641   -35.217514  1 0
end photo_measurements
```

Description:
Field 1 - Point name
Field 2 – X coordinate
Field 3 – Y coordinate
Field 4 – X coordinate
Field 5 – Y coordinate

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PATB Measurement File Format

(.ptb) – The most common file format for point measurements. Most aerial triangulation programs can output this format. The coordinates in a PATB file may be in micros or millimeters. The easiest way to determine units is to look at the focal length in the second field on each photo name record. A focal length of similar magnitude to 153352.0 will indicate microns while a focal length of similar magnitude to 153.352 in indicate millimeters. The coordinates in the example below are in microns.

Format example:

```
01_01     153352.000          0
10010      -6620.441       2659.528         0
10012      -2315.185     -87815.725         0
10011       2189.424      90393.601         0
10022      97584.696     -89972.479         0
10020      95414.200      28553.299         0
HV23A      92335.855      80252.801         0
  -99
01_02     153352.000          0
10010    -101528.830       6362.794         0
10012     -97161.205     -83840.714         0
10011     -92053.394      94683.069         0
10022       2627.953     -85568.158         0
10030      95457.685     -34333.063         0
10031      94577.448      89272.723         0
10032      82389.838    -100853.220         0
10020       1994.823      32149.234         0
HV23A      -1128.292      84051.952         0
  -99
```

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Notes:

- The photo line (precedes list of points) must contain strip-photo name in first field, and a 0 or 1 if the 3rd field must exist.
- The 4th field on the coordinate is optional
- Photo names must match the specified input format
- Point names may be numbers or names NOTE: There is no strip designation in the PATB file
- Each photo is terminated with a point name of –99 (not required)

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ALBANY Measurement File Format

(.icr) – This is another common file format for point measurements. Most aerial triangulation programs can output this format. The coordinates in a ALBANY file may be in microns or millimeters. The easiest way to determine the units is to look at the focal length in the fifth field on first record for each photo. A focal length of magnitude similar to 152673.0 indicates microns while a focal length of magnitude similar to 152.673 indicates millimeters. The coordinates in the example below are in millimeters.

Format example:

```
2  13         0 0     152.673        .000      .000
2  13        33 0     -70.745      72.775      .000
2  13       108 0      11.430      40.554      .000
2  13       176 0     -45.256    -100.547      .000
2  13      1051 0     -67.553     -96.527      .000
2  13      1061 0      15.520    -105.421      .000
2  13      2121 0     -71.696      75.076      .000
2  13      2122 0     -68.741      -7.373      .000
2  13      2123 0     -67.538     -96.541      .000
2  13      2131 0      11.149      98.604      .000
2  13      2132 0      -2.860      27.499      .000
2  13      2133 0      15.510    -105.424      .000
2  13      4082 0     -70.560     -19.258      .000
2  12         0 0     152.673        .000      .000
2  12        21 0     -69.577     -80.242      .000
2  12        33 0       5.606      78.743      .000
2  12       108 0      88.496      46.671      .000
2  12       176 0      33.294     -93.886      .000
2  12      1041 0     -63.319     -73.209      .000
2  12      1051 0      11.074     -90.166      .000
2  12      1061 0      93.484     -98.102      .000
2  12      2111 0     -74.637      83.657      .000
2  12      2112 0     -73.999      -3.280      .000
2  12      2121 0       4.586      81.071      .000
2  12      2122 0       8.614      -1.932      .000
```

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```
2  12      2123 0      11.089     -90.180      .000
2  12      2131 0      87.788     105.447      .000
2  12      2132 0      74.303      33.448      .000
2  12      2133 0      93.474     -98.105      .000
2  12      4082 0       7.016     -13.799      .000
```

Definition:
Field 1 – Strip number
Field 2 – Photo number
Field 3 – Point Number (0 Means the focal length is in the X field)
Field 4 – Not used
Field 5 – X coordinate
Field 6 – Y coordinate
Field 7 – Not used

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ISBBA Measurement File Format

This format is commonly used by SoftPlotter.

Fromat example:

```
** ISBBA image coordinate data ***
***
*** file name D:/12762-1grant//block/12762-1.ISBBA/IMAGE.DAT
***
*** data source SoftPlotter 4.0
***
1
1-1c
1012         3.075      -23.137
58         -24.894      -56.993
1021       -95.234      -46.531
1011        -0.870      -73.799
53        -105.578      -39.682
59         -16.912       -4.766
1022       -96.304        5.440
51         -77.204       37.841
57         -72.808      -40.258
1013         0.552       38.587
1023       -94.155       51.627
-99
1-2c
58          67.540      -53.370
1022        -5.451       10.793
1023        -3.503       58.069
57          18.059      -35.766
1021        -5.013      -41.768
```

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```
52          -34.854        -7.483
1013         95.717        44.240
1012         97.223       -19.365
1032        -91.183        -1.213
53          -15.630       -34.736
1011         92.172       -70.744
51           13.978        43.814
1031        -83.426       -45.247
50          -34.060        40.378
1033        -83.017        54.921
59           76.639        -0.355
-99
1-3c
1023         93.011        62.148
1022         91.285        13.377
52           59.645        -5.671
1021         91.032       -40.537
53           79.846       -33.432
51          111.354        47.565
1033          8.644        58.189
1032          0.153         0.268
1031          9.797       -44.792
50           60.523        43.597
-99
-999
```

Definition
Field 1 – Photo name or point name (-99 = End of photo -999 = End of job)
Field 2 – X coordinate
Field 3 – Y coordinate

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ORIMA Measurement File Format

Format example:

```
  1_3   2_2_11    19.5207   -64.5603   0   N
  1_3   2_3_13    34.4873  -119.0402   0   N
  1_3    2_1_8    10.6301   -37.6484   0   M
  1_3   2_1_14   -20.0428   -46.0351   0   M
  1_3    2_1_5   -94.9184   -13.1161   0   N
  1_3   2_1_17  -105.2247  -112.9695   0   N
  1_4    1_3-3   -71.7986   -88.6343   0   M
  1_4    1_4-3     2.6107   -86.6616   0   M
  1_4    1_5-3    87.4736   -87.6902   0   M
  1_4     4326    -7.5582    27.0686   0   M
  1_4     4327    24.3368   -63.3050   0   M
  1_4     4329   -51.9367   -56.5482   0   M
  1_4     4335  -104.6063   -69.5853   0   M
```

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```
1_4     1_2_4  -105.4197   117.1721   0   N
1_4     1_2_5   -67.8985   100.3433   0   M
1_4     1_2_6   -74.6294   107.7340   0   M
```

Field Descriptions:
1 - Photo name
2 - Point name
3 - X coordinate
4 - Y coordinate
5 - ??
6 - Measure flag M=Measured N=Not Measured D=Disregard

Notes:
This format is commonly used by SOCET SET

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MATCH-AT Measurement File Format

(.prj) – This file is written from the MATCH-AT aerial triangulation program. Typically, this single file contains information to import interior orientations, orientations from measurements, and orientations from exterior orientations. The following is an example of the format for the measurement area of the project file. Each photograph in the project file contains a $PHOTO record which indicates the start of photograph parameters. The measurement section of each $PHOTO starts with the $PHOTO POINTS : record.

Format example:

```
$PHOTO_POINTS :
  101           7.26132        70.06186   1.00  1 { * }
  104           1.35889       -63.66409   1.00  1 { * }
  9001         -0.26552       -80.54105   1.00  2 { * }
  9002          3.64609        -0.74474   1.00  2 { * }
  9003         -1.46410        81.74808   1.00  2 { * }
  9004         87.16268        81.69672   1.00  2 { * }
  9005         87.91409        -3.76749   1.00  2 { * }
  9006         89.27521       -81.72300   1.00  2 { * }
$END_POINTS
```

Field Descriptions:
1 – Point name
2 – X photo coordinate
3 – Y photo coordinate

Notes:
The MATCH-AT project also contains the measurements for interior orientations.

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VrAt Measurement File Format

(.vat) – This file may be written from the Cardinal Systems Vr Air Trig program (VrAt). Coordinates may be in microns or millimeters. Point names may be output as names or numbers.

Format example:

```
# VrTwo Air Trig Measurement Export File
# FileName: E:\Jobs\ManAtControl\ManAt.vat
# Units   : Millimeters
# Date    : 30-Jul-2004 20:00:54
#
Pho          2013     152.6730
Pnt         02131      11.1487      98.6042
Pnt         02132      -2.8599      27.4994
Pnt         02133      15.5102    -105.4237
Pnt         02121     -71.6956      75.0761
Pnt         02122     -68.7412      -7.3727
Pnt         02123     -67.5377     -96.5406
Pnt            33     -70.7452      72.7753
Pnt          4082     -70.5599     -19.2580
Pnt           108      11.4295      40.5537
Pnt         01061      15.5199    -105.4212
Pnt         01051     -67.5527     -96.5268
Pnt           176     -45.2563    -100.5470
End
Pho          2012     152.6730
Pnt         02121       4.5857      81.0707
Pnt         02122       8.6144      -1.9320
Pnt         02123      11.0894     -90.1799
Pnt         02111     -74.6367      83.6569
Pnt         02112     -73.9989      -3.2800
Pnt         02131      87.7877     105.4474
Pnt         02132      74.3027      33.4480
Pnt         02133      93.4742     -98.1047
Pnt            33       5.6058      78.7429
Pnt          4082       7.0155     -13.7986
Pnt           108      88.4956      46.6711
Pnt         01041     -63.3187     -73.2092
Pnt         01051      11.0745     -90.1661
Pnt            21     -69.5766     -80.2417
Pnt         01061      93.4839     -98.1022
Pnt           176      33.2945     -93.8862
End
```

Description:
Field 1 – Keyword
Pho – Photo name record

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Pnt – Point record
End – End of photo record
Field 2 – Photo number/name or Point number/name
Field 3 – X coordinate or focal length
Filed 4 – Y coordinate

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Exterior Orientation File Formats

The following are the supported file formats for importing orientations using exterior orientations from aerial triangulation:

- AeroSys
- Agisoft
- ALBANY
- Applanix
- BINGO
- ISAT EO file
- ISAT 'photo' file
- JFK
- MATCH-AT
- Pix4D
- PATB

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ALBANY Exterior Orientation File Format

(.opm) – Each photo consists of two records.

Format example:

```
1   3         1   1847839.844  727097.439  5176.269 .152673E+03
1   3         1        -.2471      -.9274    -.9588
2  10         1   1847877.219  731502.554  5155.066 .152673E+03
2  10         1        1.3715      -.5810   -5.0702
1   4         1   1850122.336  726831.159  5151.653 .152673E+03
1   4         1         .1069       .3669   -2.8769
2  11         1   1850502.820  731357.482  5167.058 .152673E+03
2  11         1         .7268      -.1776   -5.9014
1   5         1   1852361.929  726573.614  5114.480 .152673E+03
1   5         1         .3401       .6811   -4.0090
2  12         1   1852741.687  731250.353  5158.552 .152673E+03
```

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```
 2  12         1          .1342        .0886   -5.6188
 1   6         1    1854698.052   726385.497   5100.644 .152673E+03
 1   6         1         1.1706        .0001   -3.5862
 2  13         1    1854955.754   731158.172   5148.728 .152673E+03
 2  13         1         1.1115        .1982   -5.1572
```

Description:
Record 1: StripNumber PhotoNumber CameraNumber X Y Z FocalLength
Record 2: StripNumber PhotoNumber CameraNumber Omega Phi Kappa Focal Length

Notes:
Angular units are in gons (400 gons in a circle).

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APPLANIX Exterior Orientation File Format

(.txt) – This data is normally generated by the Applanix POS AV, which is designed for direct georeferencing of airborne sensor data.

Format example:

```
V04-0002
1-4 44  316874.922102 1362855.429  384127.781 3709.728    0.94063   -0.23136  143.2
1-3 45  316882.731476 1364562.264  382832.892 3750.831    0.23227   -0.38762  142.4
1-2 46  316890.538878 1366292.052  381515.545 3718.110    1.16006    0.18896  142.3
1-1 47  316898.346788 1368056.631  380175.348 3726.714    0.52973    0.13071  143.4
```

Description:
Id# Event Time Easting Northing OrthometricHeight Omega Phi Kappa Lat Long

Notes:
Positions are in US Survey Feet
Angular units are in Degrees
Latitude and longitude are in degrees
There are 11 fields

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PATB Exterior Orientation File Format

(.ptb) – Most common file format for exterior orientations. X, Y and Z rotations are expressed as a 2x3 matrix. It is the duty of the importing application to apply these as Omega, Phi and Kappa. In some applications, these need to be computed differently. There are two forms of this rotation matrix: Normal and Transposed. Care most be taken to determine to form to be

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used when importing.

Format example:

```
           624               1    536576.24017    351204.09808      1825.68406
0.999936589007  0.002767531961 -0.010915985152 -0.002541494792  0.999783188939
0.020666782968  0.010970814428 -0.020637729547  0.999726825363
```

Description:
Record 1: PhotoName Number X Y Z
Record 2: Matrix00 Matrix01 Matrix02 Matrix10 Matrix11
Record 3: Matrix12 Matrix20 Matrix21 Matrix22

Notes:
On record 1 the PhotoName field may include the strip number and the photo number.

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JFK Exterior Orientation File Format

(ASOP) – Each photograph consists of two records.

Format example:

```
7   17  -153.672
.0110250     .0019448     .5957646  674222.6243  157773.6886    3567.8489
7   18  -153.672
.0043957     .0055597     .6030570  676023.9183  158952.3540    3560.7434
7   19  -153.672
.0161876     .0102126     .6075526  677847.2048  160154.7148    3553.8859
7   20  -153.672
.0012838     .0043296     .5857654  679688.1069  161333.1414    3545.1678
7   21  -153.672
.0115458     .0102823     .5996792  681493.1207  162501.6403    3537.0296
-9999-9999      .000
.0000000     .0000000     .0000000        .0000        .0000        .0000
```

Description:
Record 1: Strip# Photo# FocalLength
Record 2: Omega Phi Kappa X Y Z (Omega, Phi and Kappa are in radians)

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AeroSys Exterior Orientation File Format

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(.orn) – A straightforward exterior orientation format from the AeroSys aerial triangulation program. Each photograph is represented by a single record and consists of seven fields.

Format example:

```
      7_7      -2.6597385       1.6103960     357.7080606     2125691.498      3183
      7_8      -3.0342212       1.1245021       0.5449938     2133020.447      3184
      7_9      -4.8047193       0.8845449     358.2169991     2140224.146      3185
```

Description:
PhotoName Omega Phi Kappa X Y Z (Omega, Phi and Kappa are in degrees)

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ISAT Exterior Orientation (EO) File Format

(.txt) – A straightforward exterior orientation format from the Zi ISAT aerial triangulation program. Each photograph is represented by a single record and consists of seven or eight fields. There are two formats supported. In the first format the image name is the first field. In t he second format allows the strip number and photo numbers are separate fields.

Format example 1: – The first field is the image name.

```
031_0001   5667886.688208  3579941.997080   7159.144314      0.285997      0.728775
031_0002   5667844.561584  3581335.968222   7163.901070      0.298336      0.408295
031_0003   5667799.305835  3582724.728548   7161.813480      0.238260      0.485285
031_0004   5667756.411109  3584089.983826   7160.137499      0.171293      0.479130
031_0005   5667700.712945  3585487.054886   7160.211317      0.168707      0.839874
031_0006   5667640.201801  3586888.124670   7163.379174      0.122775      0.590436
031_0007   5667578.982333  3588241.886039   7157.674675      0.291043      0.615208
```

Description:
PhotoName X Y Z Omega Phi Kappa

Notes:
Omega, Phi and Kappa are in Degrees.

Formate example 2: – The strip number and photo number are the first two fields and are separate fields.

```
1        01  633705.956334 1017713.325913   3541.001341     -0.702746     -0.000747
1        02  633496.207135 1018781.760240   3538.289389     -0.894707      0.495368
1        03  633304.373459 1019850.278542   3532.097127     -1.088651      0.897845
1        04  633117.825673 1020921.151394   3523.881157     -1.231190      0.642604
1        05  632925.579523 1021991.113322   3524.220192     -1.255064      0.768036
2        01  633468.547313 1020918.384979   3549.197971     -1.224473     -0.268553
2        02  633165.820739 1021965.957745   3539.301372     -1.149814     -0.751714
```

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```
2       03  632851.492305 1023006.306754   3521.964589     -1.193166     -0.430256
2       04  632527.832675 1024042.597472   3515.093004     -1.156498     -0.188606
2       05  632210.803841 1025078.541290   3516.157405     -1.076264      0.333229
2       06  631900.424338 1026119.587659   3519.847944     -0.929761      0.595129
2       07  631588.675331 1027162.319801   3519.625081     -0.924996      0.529891
2       08  631275.629956 1028201.401227   3521.137015     -0.770315      0.640636
2       09  630968.182960 1029245.315282   3516.320396     -0.853725      0.934265
2       10  630675.032675 1030294.244445   3529.544602     -0.767745      1.037869
2       11  630368.161149 1031336.989654   3542.560870     -0.527731      0.712043
```

Description:
Strip# Photo# X Y Z Omega Phi Kappa

Notes:
Omega, Phi and Kappa are in Degrees.

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BINGO Exterior Orientation File Format

(.dat) – A straightforward exterior orientation format. The strip and photo number are encoded into the second field on each record.

Format example:

```
*   <___Photo_No.__><___Easting__><__Northing__><__Height_><___Phi__><__Omega

ORIA             1_1    852893.468    684552.371   7067.864    0.3494    1.05
ORIA             1_2    850824.533    684530.943   7071.312    0.7187   -1.41
ORIA             1_3    848733.011    684566.042   7074.635    0.1749    0.24
ORIA             1_4    846485.544    684602.141   7080.482    0.3974   -0.31
ORIA             1_5    844278.048    684627.307   7085.428    0.2825    0.64
ORIA             1_6    841901.398    684609.550   7079.849    0.2207    1.34
ORIA             1_7    839541.496    684565.046   7071.032    0.1814   -0.00
ORIA             1_8    837231.334    684558.243   7052.136    0.9195    0.46
ORIA             1_9    834982.746    684585.240   7068.398    0.7520    0.25
ORIA             2_1    811577.608    680691.395   6979.592    0.2341   -0.49
ORIA             2_2    813918.739    680656.320   6992.619    0.7454    0.50
ORIA             2_3    816279.883    680619.385   6981.092    0.2130   -1.19
ORIA             2_4    818576.202    680646.701   6976.845   -0.1283   -1.31
ORIA             2_5    820853.737    680713.271   6974.089    0.5515    1.56
ORIA             2_6    823139.581    680702.804   6964.884   -0.7140    0.52
ORIA             2_7    825410.346    680666.215   6976.134   -0.2926   -0.32
ORIA             2_8    827776.013    680649.544   6980.163   -0.4536   -0.17
ORIA             2_9    830128.589    680653.406   6984.985   -0.3665    0.06
```

Notes:
The Bingo EO file is commonly named itera.dat.
The angular units of the rotation angles are gons (0-400)

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ISAT 'photo' File Exterior Orientation File Format

(photo) – This file is normally called 'photo' and contains most parameters from the aerial triangulation process. The exterior orientations for each photo are stored in the photo_parameters and the EO_parameters keyword contains the six photo transformation values. Strip and the photo numbers are encoded in the field after the "begin_photo_parameters" keyword. Alternately, the photo number alone may be stored in this location and the strip number be defined after the "strip_id" keyword. In any case the Vr Mapping software will prompt the user for the strip number location when using this format.

Format example:

```
begin photo_parameters 3_7  strip_id 3
camera_name:   Dimac55mm
camera_orientation:  1
image_id: X:\P0702310_Goochland_County_VA\2_IMAGES\CIR\3_7.tif
GPS_TimeStamp: 136970.85
view_geometry: nadir
std_dev: 0.005000
EO_parameters: 11655866.98965532 3820131.645322843 11830.78862899709 -2.87777064
GIVEN_parameters:    11655867.13035697 3820131.743683286 11830.79926086803 -2.87
GIVEN_std_devs: 150              150              50               0.5
footprint: 11652984.831401 3825616.884040 11660094.406308 3822977.702328 116566
active_elevation: 346.533960
DRIVE_type: collinearity
image_size:    7228 5428
sensor_id:     -1
end photo_parameters
```

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MATCH-AT Exterior Orientation File Format

(.prj) – This file is written from the MATCH-AT aerial triangulation program. Typically, this single file contains information to import Interior Orientations, orientations from measurements, and orientations from exterior orientations. The following is an example of the format for the exterior orientation area of the project file. Each photograph in the project file contains a $PHOTO record which indicates the start of photograph parameters. The exterior orientation section of each $PHOTO starts with the $EXT_ORI : record.

NOTE: The MATCH-AT project also contains the measurements for interior orientations.

Format example:

```
$EXT_ORI : 08:09:13 04/09/2007
```

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```
 153.81000    314469.26800    200635.63600      7759.94900
 0.999041307739       0.043313766030      -0.006354770206
-0.043402462035       0.998951636657      -0.014555202183
 0.005717667476       0.014817060896       0.999873873539
```

Field Descriptions:
Record 1 – Field 1 – Focal length
Record 1 – Field 2 – X coordinate
Record 1 – Field 3 – Y coordinate
Record 1 – Field 4 – Z coordinate
Records 2-4 – 3x3 non-transposed exterior orientation transformation matrix.

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Pix4D Exterior Orientation File Format

This file is typically named *calibrated_external_camera_parameters.txt. The formatting is actually functional identical to ISAT (the first seven columns are identical) and could also be imported as flat file. It is lists separately in the utility and on this help page to avoid confusion.

Format Example:

```
imageName X Y Z Omega Phi Kappa X_sigma Y_sigma Z_sigma Omega_sigma Phi_sigma Kappa
DJI_0002.JPG 1601886.053562 699584.147880 1326.397055 -1.605578 -0.462960 -3.821322
DJI_0003.JPG 1601889.741588 699647.303941 1325.953421 -0.814899 -0.694407 -3.312492
DJI_0004.JPG 1601895.390787 699709.494654 1326.550973 -0.335060 -0.838878 -2.794116
DJI_0005.JPG 1601899.938886 699774.992118 1328.756499 -0.025726 -0.975937 -2.580833
DJI_0006.JPG 1601904.266747 699834.768904 1330.098277 0.306142 -1.319610 -2.414182
DJI_0007.JPG 1601909.181113 699898.074241 1329.351964 0.495125 -1.495394 -1.970121
DJI_0008.JPG 1601914.370060 699961.468493 1328.254365 0.465419 -1.705420 -1.367907
DJI_0009.JPG 1601920.018127 700025.537496 1326.348990 0.339293 -2.062385 -0.503207
DJI_0010.JPG 1601925.843783 700089.273644 1325.046337 0.268445 -2.279582 0.033360 0
DJI_0011.JPG 1601930.238091 700154.536503 1326.451264 0.292907 -2.649587 0.712547 0
DJI_0012.JPG 1601933.754677 700217.910766 1327.980674 0.443966 -3.160493 2.039419 0
DJI_0013.JPG 1601940.806730 700281.496621 1327.744621 0.320311 -2.772126 2.785600 0
DJI_0014.JPG 1601947.348924 700344.680769 1327.271734 0.220593 -2.064149 2.242675 0
DJI_0015.JPG 1601951.768430 700407.307158 1326.123770 0.166306 -1.623274 1.174368 0
DJI_0016.JPG 1601957.426504 700469.981477 1325.374132 0.130986 -1.335922 0.380733 0
DJI_0017.JPG 1601963.468861 700532.881857 1325.741258 0.092435 -1.057470 -0.435225
DJI_0018.JPG 1601969.192215 700596.505770 1328.043061 0.055427 -0.843369 -1.099082
DJI_0019.JPG 1601973.589395 700663.085870 1329.508171 0.045825 -0.876641 -1.538249
DJI_0020.JPG 1601979.254916 700726.847739 1328.356795 -0.002665 -0.891037 -1.610981
DJI_0021.JPG 1601985.771284 700792.059263 1325.580294 -0.084989 -0.934159 -1.939107
```

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Agisoft Exterior Orientation File Format

Agisoft exports a Bingo formatted exterior orientation (EO) file that can be imported. The file name

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will be similar to "Camera Positions 2258-2265_2323-2330 (Bingo).dat".

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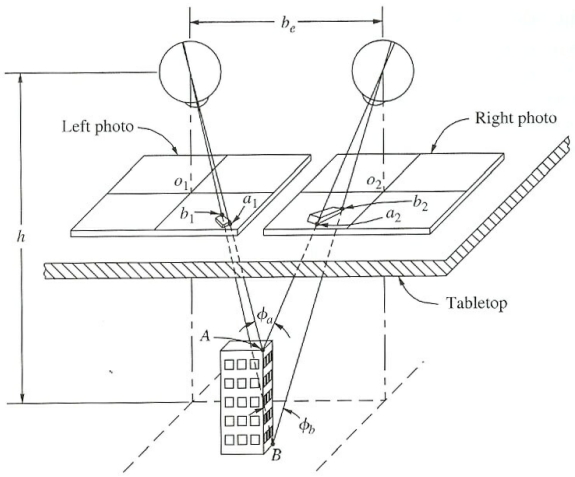
2.9.6 VrTwo Orientation

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VrTwo Orientation (Vr2Ori)



VrTwo Orientation creates stereo image pairs or models to be viewed in VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model, or multiple models may be oriented in a batch mode. Models may be imported from aerial triangulation by their exterior orientations or from the measurements used to tie the images and strips together.

VrTwo Orientation Documentation
Single Model Orientation Tutorial
Single Model Orientation from ISAT Measurements Tutorial
Single Model Orientation from ISAT Exterior Orientations Tutorial
Batch Model Orientations from ISAT Measurements Tutorial
Batch Model Orientations from ISAT Exterior Orientations Tutorial

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Importing Orientations
Camera Calibration

There are two stand-alone programs available to accomplish the task of 3D model orientations which include VrTwo Orientation (this program) and Vr Model Set.

Vr Model Set (VrModSet) - Offers a streamlined optimal procedure and imports exterior orientations only. makes creating and choosing models easy. VrModSet picks the best models to orient based on simple user defined overlap parameters which is useful for UAV work. Please see Vr Model Set for more information about this program.

2.9.6.1 Documentation

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VrTwo Orientation

Type: Stand-alone application (vr2ori.exe)

Photogrammetric stereo model orientation program for Vr Mapping's VrTwo softcopy environment

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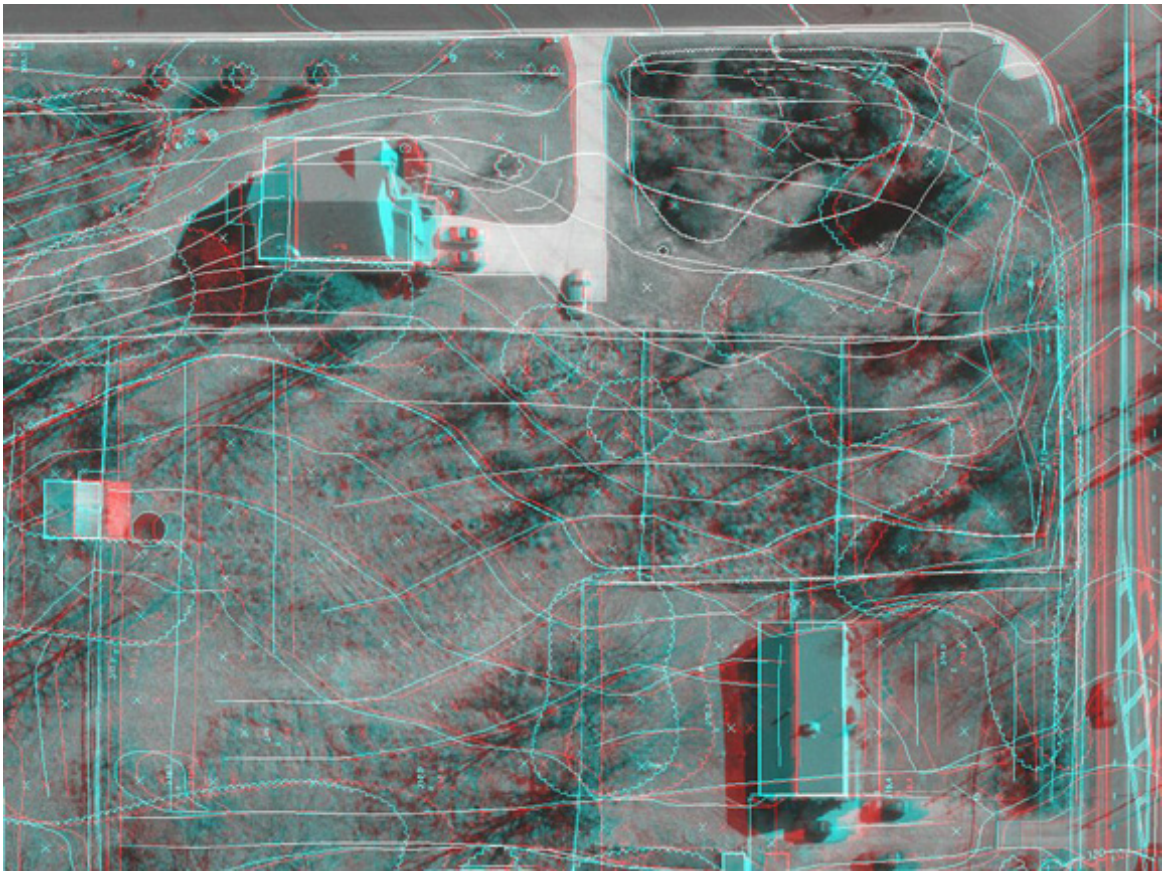

A stereo model (Anaglyph)

Overview

- VrTwo Orientation Basics
- Starting an Application
- The Main Window
- Using VrTwo Orientation

Command Reference

File

- Preferences (Pre)
- Exit (Exi)

Camera

- New Camera (NewCam)
- Edit Camera (EdiCam)
- Import Camera (ImpCam)

Coordinates

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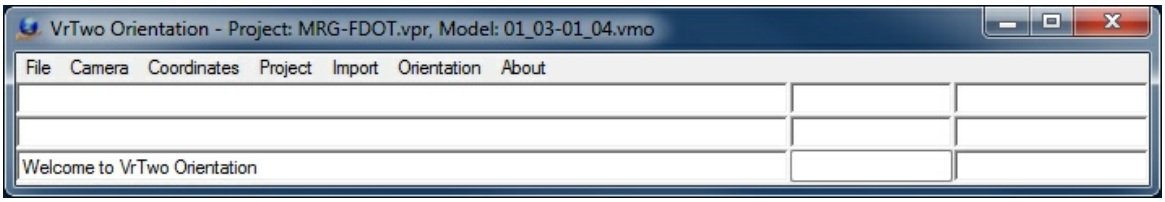
Vr Mapping Coordinate File Format
Photo Name Format

Overview

VrTwo Orientation creates stereo image pairs or models to be viewed in VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model, or multiple models may be oriented in a batch mode. Models may be imported from aerial triangulation by their exterior orientations or from the measurements used to tie the images and strips together.

VrTwo Orientation Basics

VrTwo Orientation will start by opening the Main Window.



The VrTwo Orientation Main Window

Starting an Application (Command)

Start commands by selecting an item from a dropdown menu. Alternatively, start commands with a key-in using the command name.

The Main Window

The Main Window in VrTwo Orientation contains the command pull down menus, a key-in area, two information areas, a progress bar, and the coordinate display. Command names may be entered in the key-in area. The active project name is displayed in the border of the Main Window.

Using VrTwo Orientation

VrTwo Orientation's main purpose is to create stereo models containing left and right image pairs that can be used by VrTwo. These models consist of left and right epipolar images and an orientation parameter file. The parameter file has the extension .orp and contains the orientation parameters required for VrTwo to work with stereo images. VrTwo Orientation is project based and requires a project to be created before any processing can be done. A project in VrTwo Orientation comprises a list of images, camera files, and model definitions. Each project in VrTwo Orientation is divided into models. Each model contains one left image and one right image, resulting in a stereo image pair.

The following files are needed to set a stereo model.

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- Images with overlap suitable for stereo viewing. This overlap is normally 60%.
- A camera calibration. This will be used to create a Vr Mapping camera (.cam) file
- A ground coordinate file.
- An exterior orientation or measurement file from aerial triangulation if importing orientations.

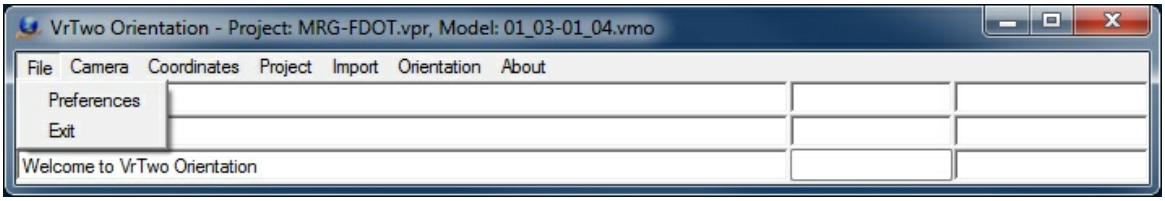
The following is a typical workflow for VrTwo orientations.

1. Create the camera calibration (.cam) file.
2. Create the VrTwo orientation project.
3. Create or import interior orientations.
4. Perform relative and absolute orientations manually, or import them from aerial triangulation exterior orientations or image measurements.

The Vr Image Utility program may be used to prepare the images for the project by attaching the strip location, image pixel size, and camera to each image. It can also be used to perform automatic interior orientations. The VrTwo orientation program also can set up the images for the project. If several programs (such as VrTwo Orientation, Vr Orthophoto, and Vr Aerial Triangulation) will use the same images, Vr Image Utility should be used to set up the images so the other programs may import the project file.

Command Reference

File



The File Menu

Preferences (Pre)

Sets operating parameters for the VrTwo Orientation Program.

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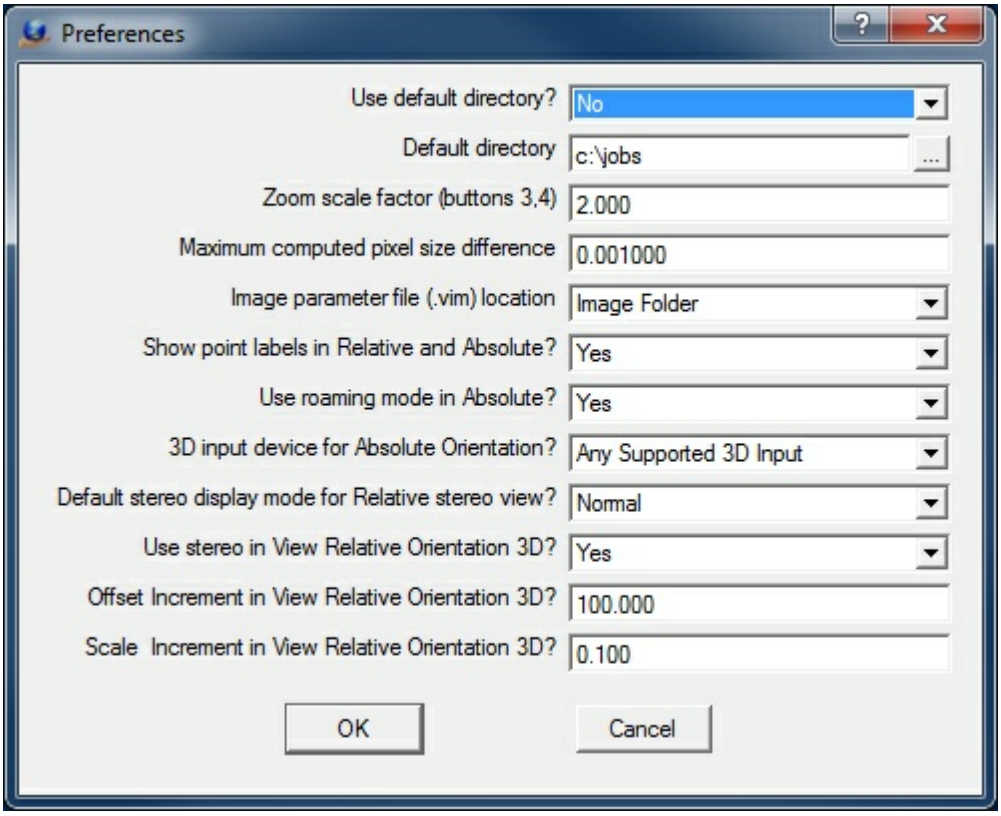

The VrTwo Orientation Preference dialog box

Use default directory?

Specifies whether to use the default directory. The default directory is used as the start directory for items like dialog boxes where files may be selected.

Default directory

Defines the default directory to use provided that “Use default directory” is set to "Yes".

Zoom scale factor (buttons 3,4)

Sets the scale factor to use when zooming in and out with the mouse center button.

Maximum computed pixel size difference

Defines the maximum difference that computed pixel sizes can be from entered pixel size before a warning will be displayed when exiting inner orientation. 0.0 = Don't check pixel size difference.

Image parameter file (.vim) location

Each image used in the VrTwo orientation program has an associated parameter (.vim) file. This file contains the interior orientation values and other image parameters. The image parameter file has the same name as the image but with a .vim file extension. These parameter files may be stored in the same directory (folder) as the images or they may be stored in the project folder. The two options for this value are Image Folder and Project Folder.

Show point labels in Relative and Absolute?

When making observations in relative and absolute orientations point labels that show the point sequence number follow the measuring mark. These labels may be turned off if needed. Some

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graphics cards a slow when updating these labels and turning off the labels is necessary.

Use roaming mode in Absolute?
If set to "Yes", then roaming stereo graphics will be used in Absolute Orientation. If set to "No", then static stereo graphics will be used for Absolute Orientation.

3D input device for Absolute Orientation?
Sets what type of 3D input device to use for Absolute Orientation. Choices are "Mouse Only" or "Any Supported Input 3D Input". If set to "Any Supported Input 3D Input", the the current "XYZ Digitizer" configured for VrTwo will be used.

Default stereo display mode for Relative stereo view?
Sets stereo mode to "Anaglyph" or "Normal" by default when using the Relative orientation stereo view.

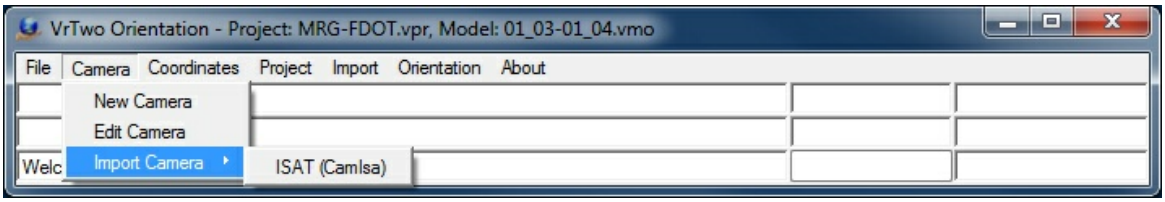
Use stereo in View Relative Orientation 3D
When using the view relative orientation 3D function from the Orientation pull-down it is possible to view the model configuration in true 3D. This is possible if the computer has the necessary 3D hardware.

Offset Increment in View Relative Orientation 3D
The view relative orientation 3D function allows the interactive placement of the model view point offsets. This parameter is used as the increment when adjusting the offsets.

Scale Increment in View Relative Orientation 3D
The view relative orientation 3D function allows the interactive modification of the image size scale factors. This parameter is used as the increment when adjusting these scale factors.

Exit (Exi)
Exits VrTwo Orientation.

Camera



The Camera menu

The camera menu is used to create, edit and import camera calibration parameters.

New Camera (NewCam)
The New Camera allows the user to create and edit a new camera calibration file. The user will be prompted for the file name for the new camera. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file.

Edit Camera (EdiCam)
Edit Camera allows the user to edit an existing camera calibration file. The camera edited does not need to be one of the current cameras and any existing camera file may be edited. When edit

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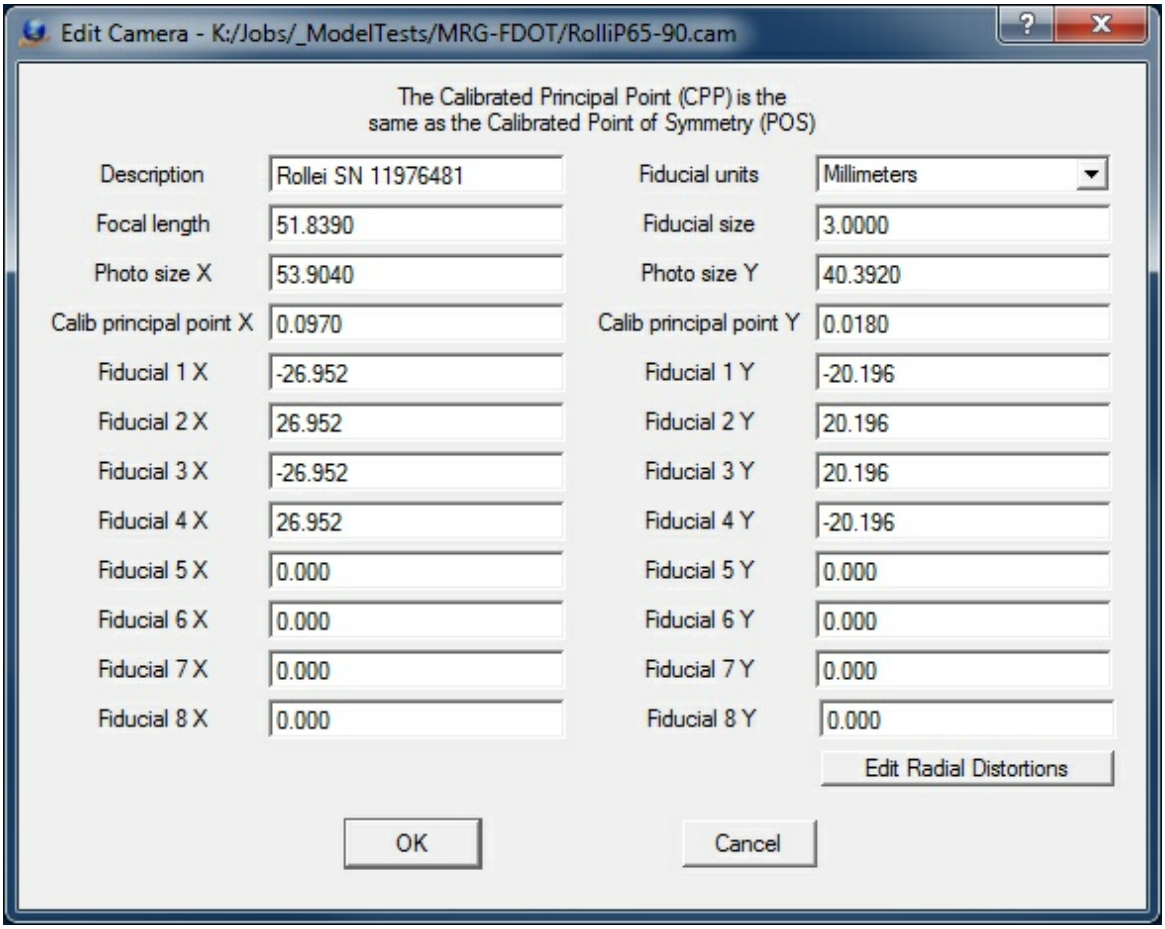
camera is started the user will be prompted for a camera file name and when exiting the user will have the opportunity to save the modified camera calibration parameters.

NOTE: The camera calibration values for the photo size and Calibrated Principal Point should be entered from the calibration report using a strip location of left or zero rotation. One camera calibration (.cam) file is used for all image rotations during model orientation. Please refer to the project camera calibration report to determine the zero rotation (strip location left) orientation of the images for your project. Please see Left and Right Image Rotations for more information on model image rotations.

NOTE: If Corner Interior Orientations are used then the photo size is automatically set by using the photo pixel size defined in Project -> Edit Project -> Define Images.



Description

Describes the camera for user reference. This description is for information only and is not used in model orientation.

Fiducial units

Specifies the units of the coordinate positions (millimeters, inches, or pixels). Many programs used to calibrate handheld cameras output the focal length of the camera in pixels. The

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coordinates entered to represent the fiducial positions must be in the same units as those specified here.

Focal length
Defines the camera lens' focal length, the distance from the focal point to the center of the lens. This value is provided by the camera calibration report. Focal length units should be the same as those used for the fiducial positions.

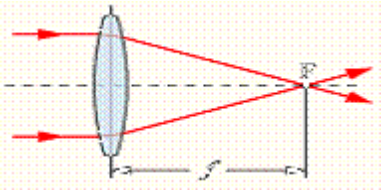
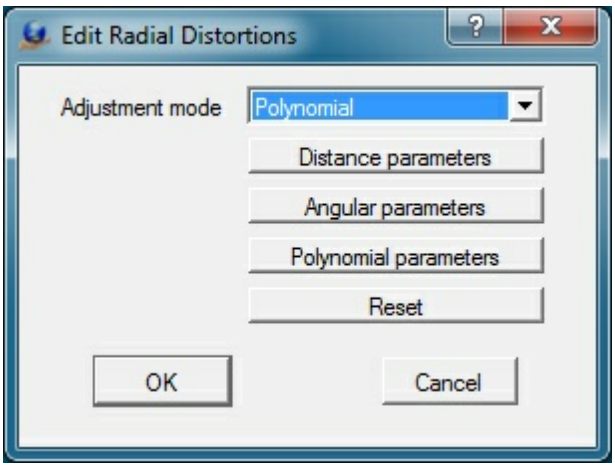


Photo size X Y
Specifies image dimensions. Photo size dimensions should be the same as those used for the fiducial positions.

Calib principal point X Y
Specifies the calibrated principal point (also known as the point of best symmetry). This coordinate position is available from the camera calibration report. Calibrated principal point coordinate units should be the same as those used for the fiducial positions.

Fiducial X Y
Defines coordinate positions for up to eight fiducials in the user-specified Fiducial units. Most aerial cameras have eight fiducials. It is strongly recommended that all eight be entered and used to compute interior orientation. If only four fiducials are used, errors may occur and make residuals useless in determining if the wrong camera calibration was selected.

Edit Radial Distortions



Lens distortion causes image positions to be displaced from their ideal or true locations. In aerial cameras, these distortions are normally minimal but they can still have an effect on accuracy.

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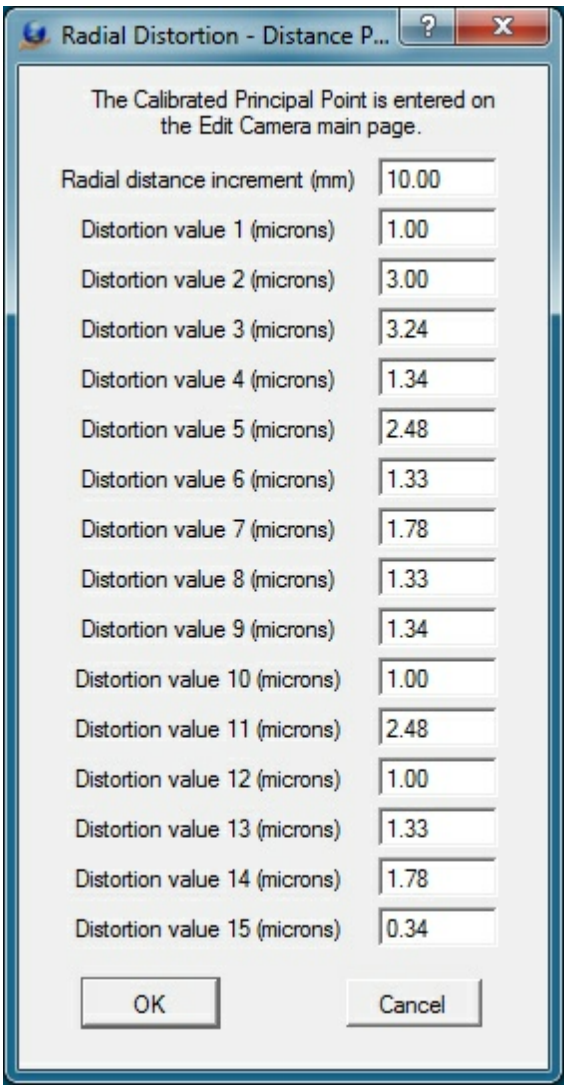
Some digital cameras have large lens distortions and radial distortions must be entered for accurate mapping results.

Adjustment mode

Most camera calibration programs output radial distortion values as polynomial parameters. Though angular parameters are listed, this output type is currently unsupported.

Distance Parameters

Radial distortions, represented by concentric rings about the camera lens' calibrated principal point, may be entered as distance parameters. The radial distortions shown below are from a small format camera and show high radial distortion values.



Defining radial distortions by distance

Radial distance increment

Represents the distance between the concentric rings that make up the distance parameters. Radial distance increment units should be the same as those used for Fiducial positions.

Distortion value n

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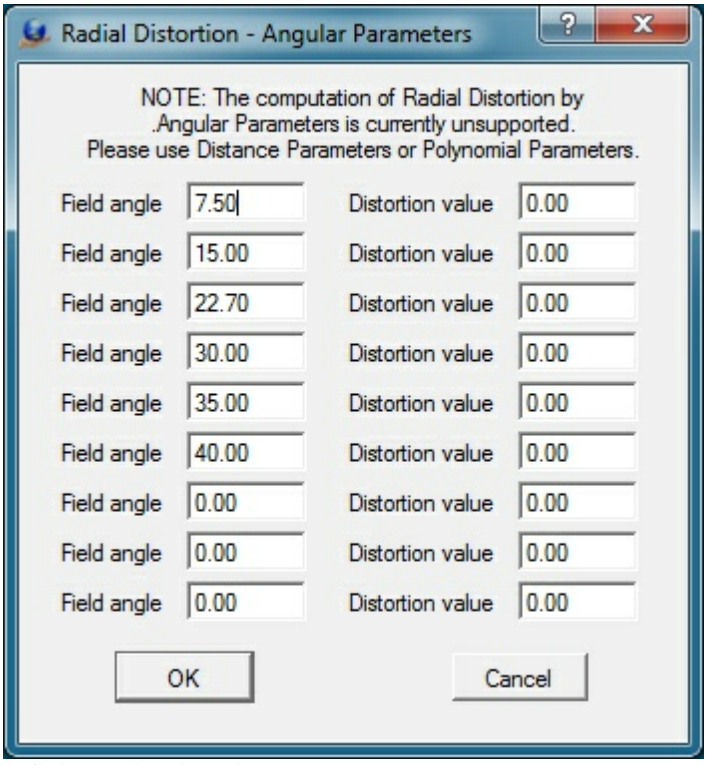
Specifies distortion values for each distance. There may be up to 15 values. Distortion value units should be the same as those used for Fiducial positions.

Angular Parameters

Computation of radial distortions by angular parameters is currently unsupported. Please use distance or polynomial parameters.



Defining radial distortions by angle

Polynomial Parameters

The polynomial values and principal point or autocollimation are provided by the camera calibration report. The mathematical model used is based on the Simultaneous Multi-camera Analytical Calibration (SMAC) method. Care should be taken when entering these parameters, as entry errors cause model orientation errors and distortions which affect model accuracy.

Entry of Exponential Notation

The k0-k4 values and the p1-p4 values are entered into the Polynomial Parameters dialog box in exponential notation. The values entered from the USGS camera calibration report may have the decimal place moved one position to the left depending on the number entered. For example:

```
USGS value:  0.1403x10-3
Value typed:  .1043e-3
Shown value: 1.403000e-004
```

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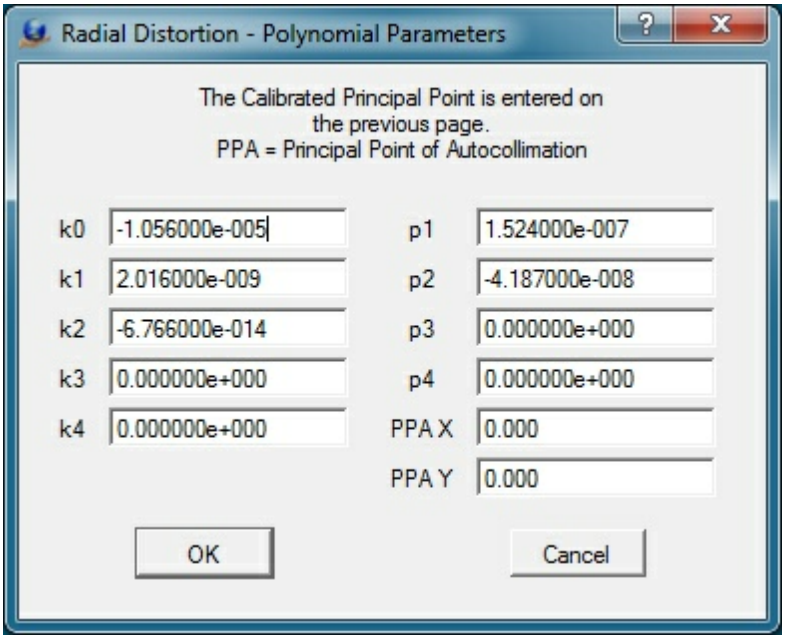

The Radial Distortions dialog box for entering the polynomial parameters

K0-K4

Defines up to five K coefficient values. These are coefficients of symmetric radial lens distortion from the camera calibration report. These values are entered in exponent form.

P1-P4

Defines to four P coefficient values. These are the coefficients of de-centering distortion from the camera calibration report. These values are entered in exponent form.

Import Camera

ISAT (CamIsa)

Imports camera calibrations from an ISAT file. The ISAT file can contain several camera definitions.

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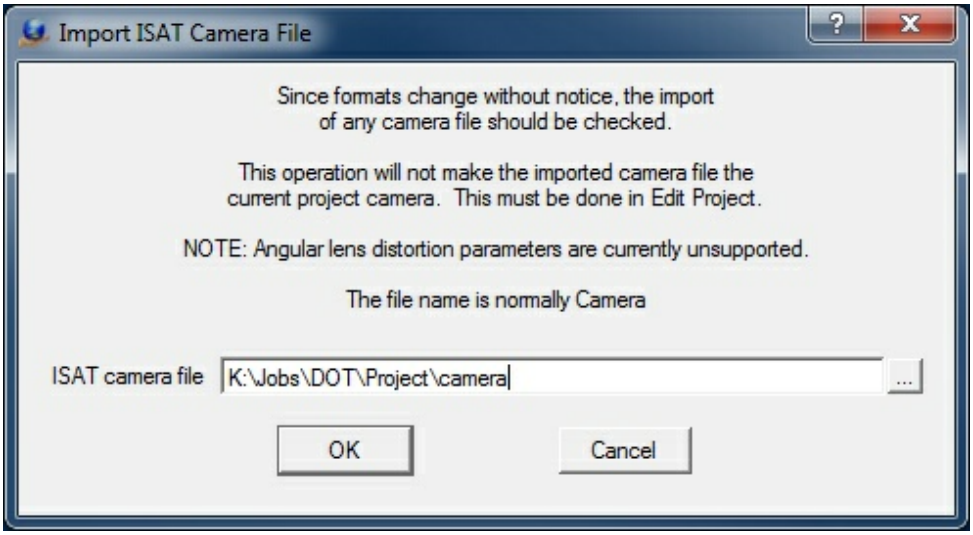
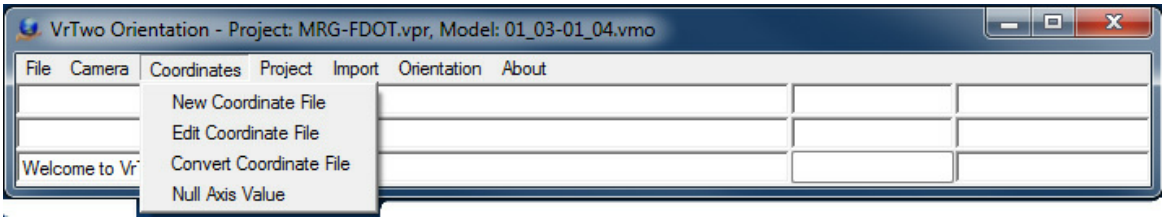


Import ISAT camera file dialog box

ISAT camera file

Defines the ISAT camera file. Normally named "camera".

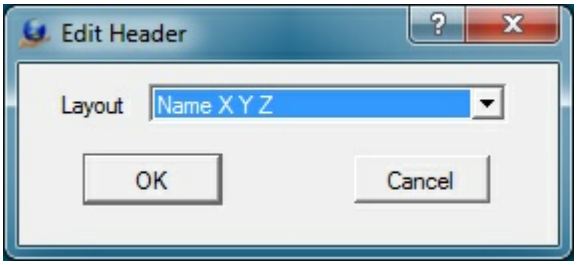
Coordinates



The Coordinates menu provides functions to create and edit coordinate files. It is possible to import existing coordinate files with a simple name change. Please refer to Vr Mapping Coordinate File Format for information on the format and layout of the coordinate files used in VrTwo.

New Coordinate File (NewCoo)

Creates a new coordinate file. The Format, State Plane Zone, Datum, UTM Zone and Units in the Edit Header dialog box are for user reference only. Prompts the user for a coordinate file name and coordinate file parameters.



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The New Coordinate dialog box

Layout

Specifies the fields to be placed in the coordinate file and their order. Options are:

```
Name X Y Z Cx Cy, Cz
Name Y X Z Cy Cx, Cz
X Y Z Name Cx Cy, Cz
Y X Z Name Cy Cx, Cz
Name X Y Z
Name Y X Z
X Y Z Name
Y X Z Name
X Y Name
Y X Name
```

Where:
Name – Point name
X Y Z – Coordinates
Cx Cy Cz – X Y Z point weights

Edit Coordinate File (EdiCoo)

Edits coordinates in an existing coordinate file. Editing options include Add, Change, and Delete. When this command is started, the user can open any coordinate (.cor) file and the edited file may be saved upon exiting the application.

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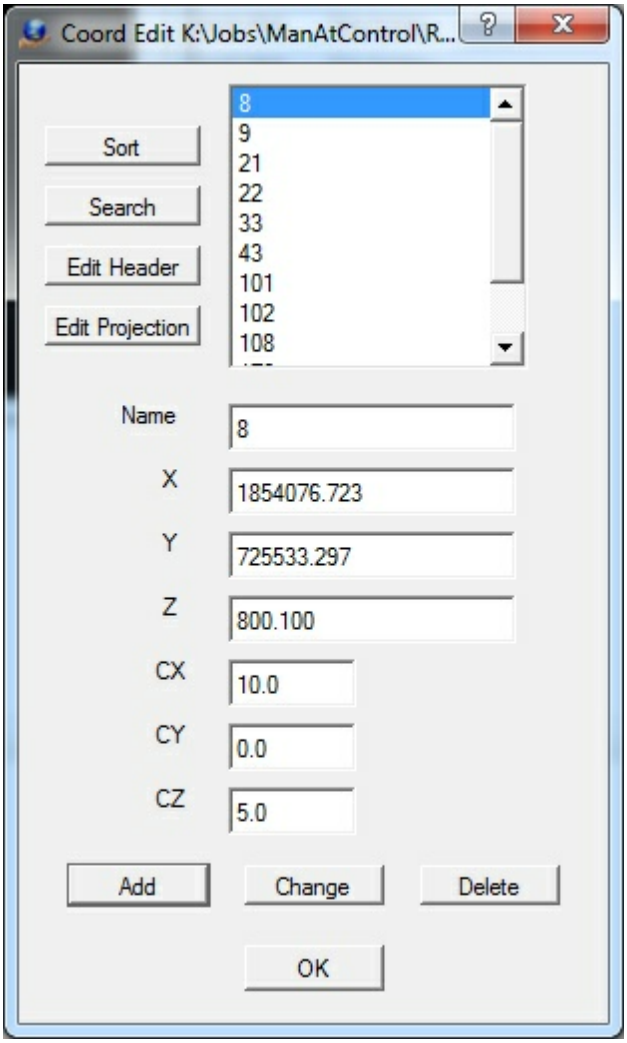

The Edit Coordinates dialog box

Sort
Sorts the coordinate file based on the point name.

Search
Searches for a coordinate point by name. If the point name is found, it becomes the current point.

Edit Header
Edits the coordinate file header.

Name
Defines the point name. It must be alphanumeric and may be up to 32 characters in length.

X Y Z
Defines coordinate values for the point.

CX CY CZ
Defines point weights. These may be used in the coordinate file depending on the File Layout. Normally, point weights are expressed in ground units.

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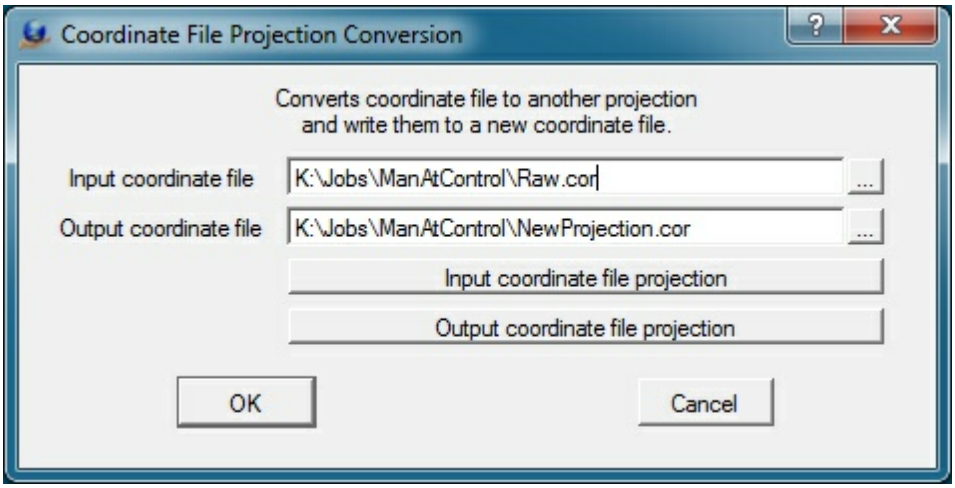
Add
Adds the current point to the coordinate file

Change
Updates the current point with the current Name, X, Y, Z, CX, CY and CZ values.

Delete
Deletes the current point.

Convert Coordinate File (ConCoo)

Converts an existing coordinate file from its current coordinate projection to a different one. Reads an existing VrOne coordinate file, re-projects it, and writes a new coordinate file. See Coordinate Projections for more information.



The Coordinate File Project Conversion dialog box

Input coordinate file
Defines the name of the existing coordinate (.cor) file.

Output coordinate file
Defines the name of the output coordinate file.

Input coordinate file projection
Defines or edits the input coordinate file projection. See Coordinate Projections for more information.

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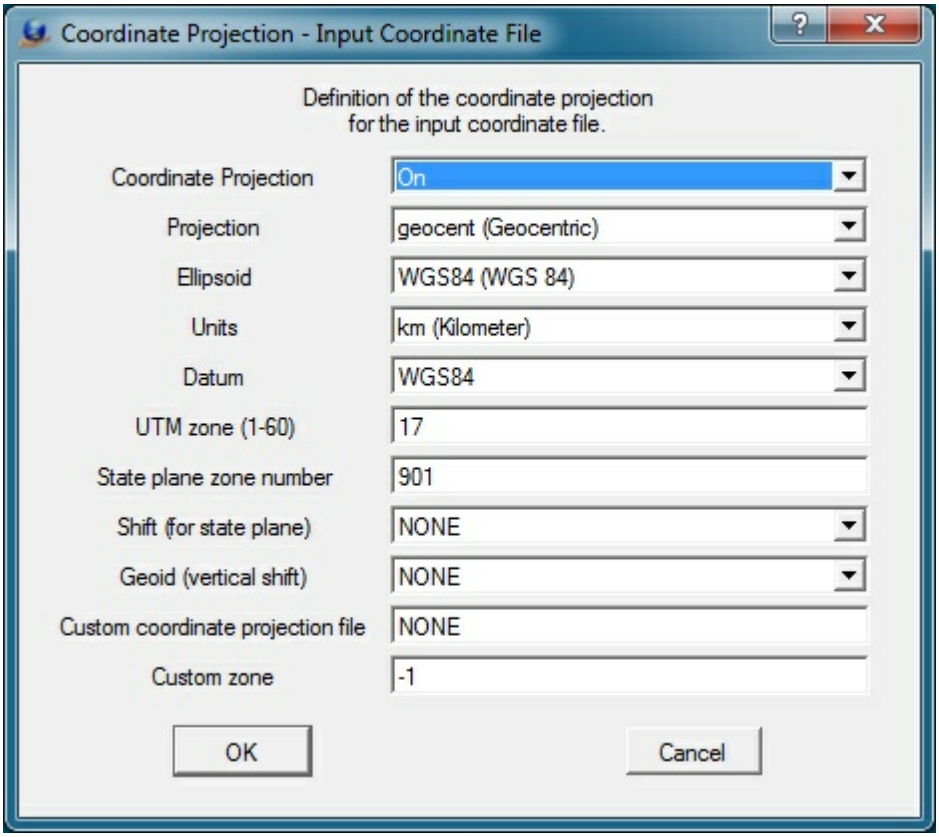

The input coordinate projection definition dialog box

Output coordinate file projection

Defines or edits the output coordinate file projection. See Coordinate Projections for more information.

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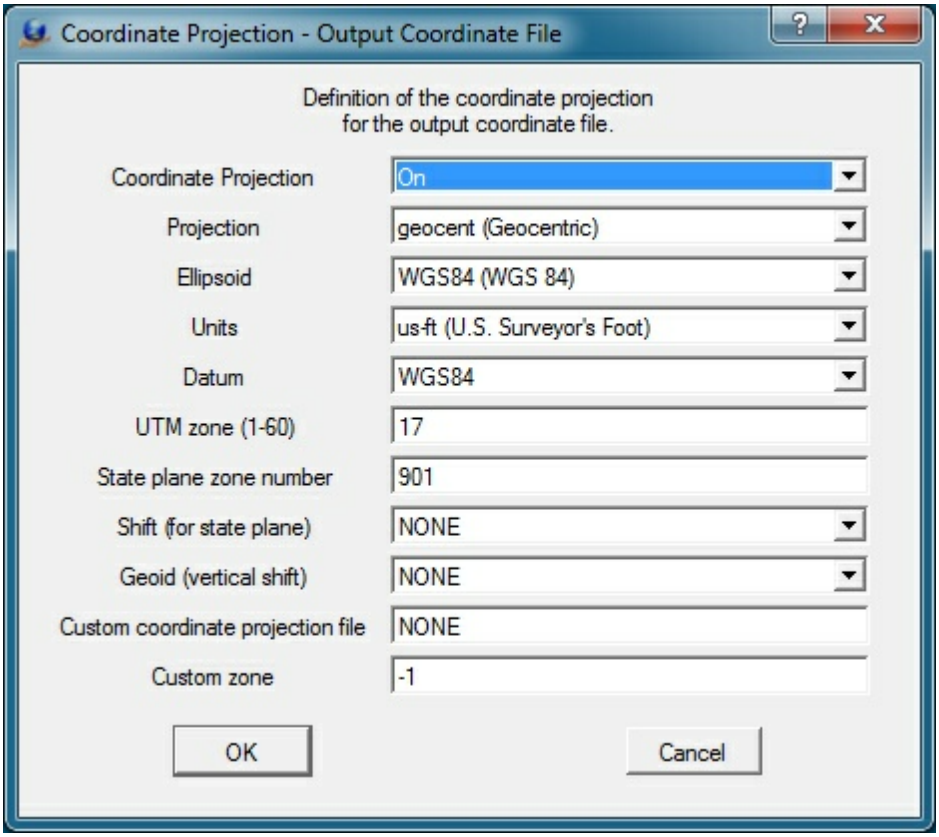

The output coordinate projection definition dialog box

Null Axis Value (NulAxi)

Some points do not have values for all three coordinate axes. The Null Axis Value is an arbitrary figure to which one of a point's 3 coordinate values can be assigned to indicate that it is lacking that value. This value is typically zero, but in cases where zero is a valid coordinate value in the map data, an extreme value like -999 should be used. For example, an elevation-less point could be assigned the coordinates (10, 10, -999) to indicate that it lacks a Z coordinate.

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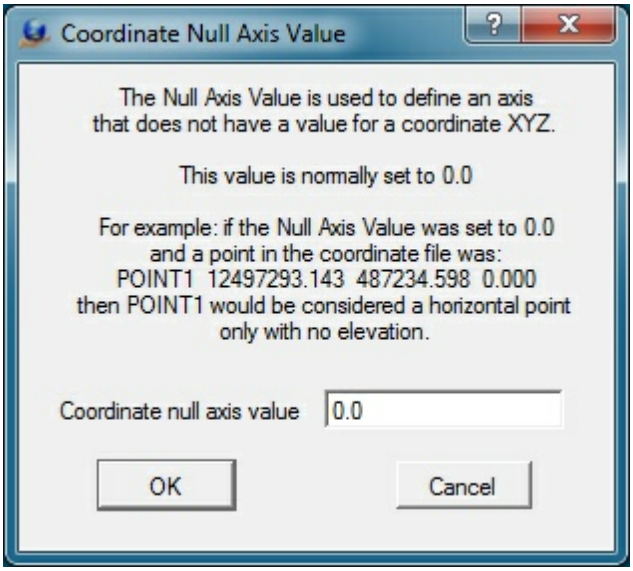
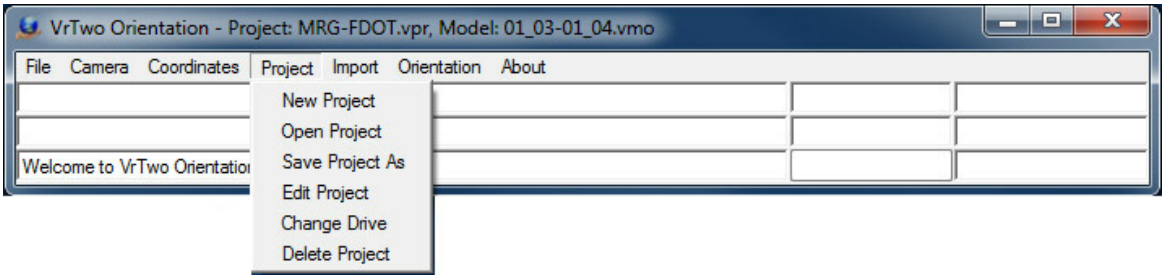


The Null Axis definition dialog box

Project



The Project Menu

Manages VrTwo Orientation projects and has the ability to create, open, save, edit and delete projects. Change Drive allows projects to be moved between different drives and folders. The Vr Two Orientation project file name has a .vpr file name extension.

New Project (NewPro)

Creates a new project and starts Edit Project.

Open Project (OpePro)

Opens an existing project. It is not necessary to close the current project before opening another. All current project parameters are saved automatically before another is opened.

Save Project As (SavPro)

Saves the current project with a different file name

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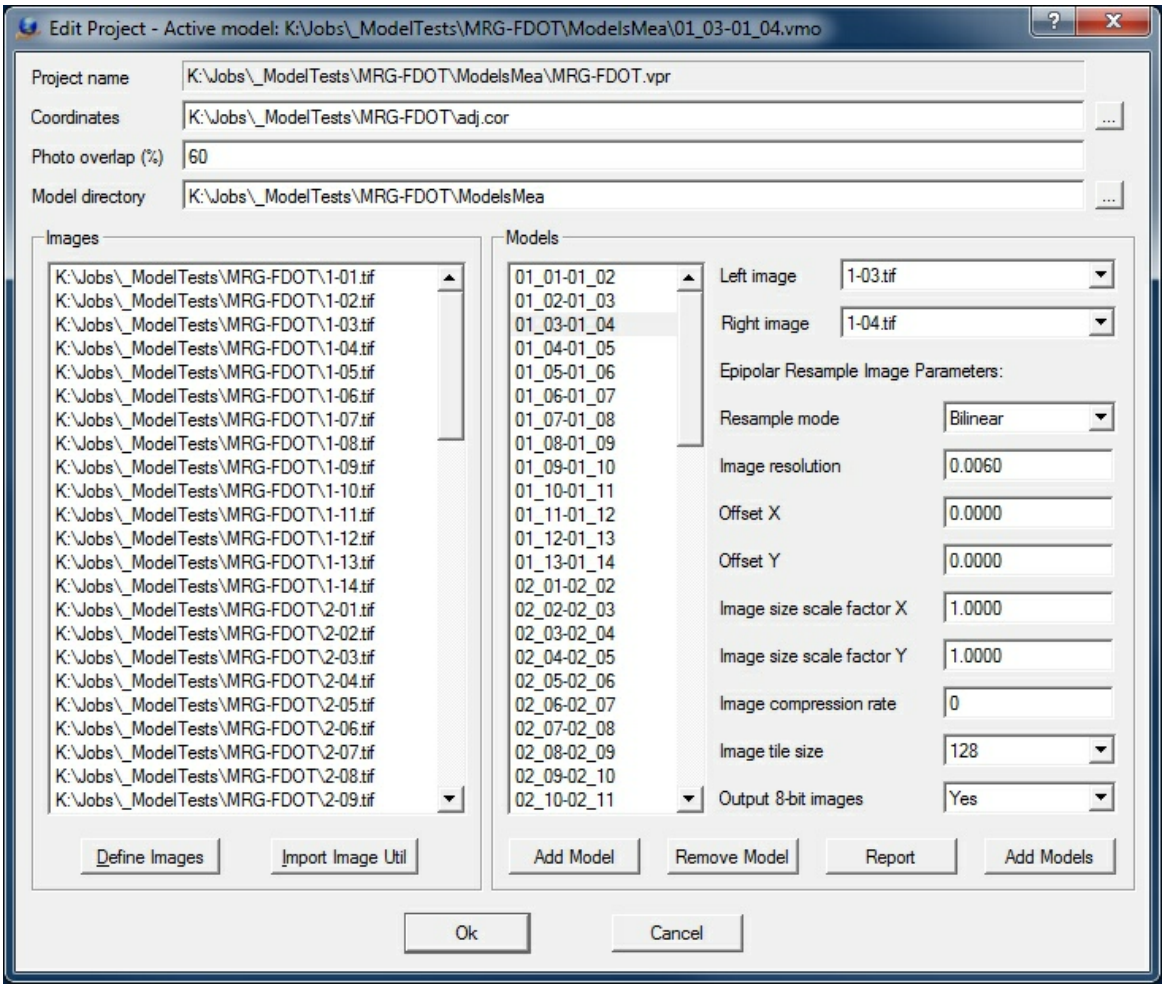
Edit Project (EdiPro)

Allows editing the current project.



The Edit Project dialog box

Project name

Displays the current project file. This file was created when the project was created in Project -> New Project. The field is for display only and cannot be modified.

Coordinates

The project ground coordinate file may be set in this field by pressing the […] button at the end of the field. When importing orientations from aerial triangulation, this file should contain the coordinates for the pass, tie, and ground control points. A coordinate file of this type is always produced from an aerial triangulation adjustment.

Photo overlap

Defines the approximate photo forward overlap as a percentage. Typical aerial mapping jobs use 60% photo overlap.

Model directory

The model orientation process produces parameter and image files required for stereo display.

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The Model Directory field defines the target directory (folder) for these files. The files placed in the directory are the epipolar images, the orientation parameter (.orp) files, and the model definition (.vmo) files. Leaving this field blank places these files in the project directory.

Images
Lists the images that are currently in the project and the "Define Images" and "Import Image Util" buttons.

Define Images
Starts the "Define Images" dialog (see below).

Import Image Util
Transfers parameters previously defined in the Vr Image Utility program to this program. The Vr Image Utility project file has a file name extension of .iup.

Models
Displays the currently defined models with model parameters and the Add Model, Remove Model, and Report and Add Models buttons. The active model's name is highlighted in the list of models. Any model may become active by clicking its model name.

Left image
Displays the current model's left image name. May be changed changed by clicking on the field and selecting a new image from the list.

Right image
Displays the current model's right image name. May be changed changed by clicking on the field and selecting a new image from the list.

Resample mode
Sets the resampling mode to create epipolar images: Nearest Neighbor, Bilinear, or Bicubic. These re-sampling modes affect the quality of the output image and the time it takes to create the epipolar images as follows.

- **Nearest Neighbor** - Fast re-sampling, lowest image quality. High contrast edges appear more jagged.
- **Bilinear** – Medium re-sampling speed, medium image quality. The image quality is softer than nearest neighbor and is normally acceptable for stereo viewing.
- **Bicubic** – Slow re-sampling, highest image quality. The image quality is the softest of the three methods. Commonly used to create orthophotos.

Image resolution
This field specifies the resolution of the epipolar images in millimeters, inches, or pixels as set in the Fiducial Units field in Edit Camera. For example, 12 microns would be entered as 0.012 millimeters. The resolutions of the epipolar images do need to be the same as the original images, though it is recommended. In cases where debugging a stereo model orientation and re-sampling is done multiple times while testing orientation parameters, it is useful to re-sample at a higher resolution such as 30 microns (0.030 millimeters) to obtain a stereo model quickly. "Over sampling" is a process to using a higher image resolution for the epipolar images. This results in a softer image but does not increase the model's accuracy and increases the size of the epipolar

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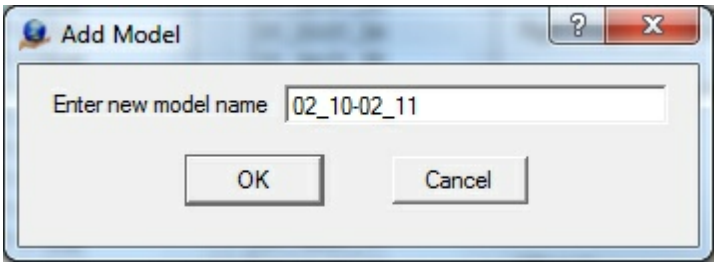
images.

Offset X, Offset Y
Specifies offset to apply to the stereo model viewing center. Offsets are needed in close range photogrammetry when there are high camera angles to the object being photographed. For aerial photogrammetry these values are normally set to zero. See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Image size scale factor X, Image size scale factor Y
Specifies scale factors to adjust the size of the area covered by the epipolar images. The area re-sampled is based on the Photo Overlap setting. These values are normally set to 1.0 (no scale factor). See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Add Model
Adds a single model to the list of models. After the model is added, the left and right images must be selected and the epipolar re-sampling image parameters must be set. To check the orientation of the left and right images, go to Orientation -> Relative Orientation to view the left and right images.



The Add Model dialog box

Delete Model
Deletes the current model from the model list.

Report
Produces a report in a text window about the current file. This report includes project name, image names, and parameters. The contents of this window may be cut and pasted into another document.

Add Models
Forms and adds models in a batch mode based on the images defined in Define Images. The format of the model names is defined in the Model Name Format dialog box. The strip number, left and right numbers and separator characters in the model name can be included. The Update button shows the current format in the upper part of the dialog box based on a strip number of 1 and left and right photo numbers of 2 and 3.

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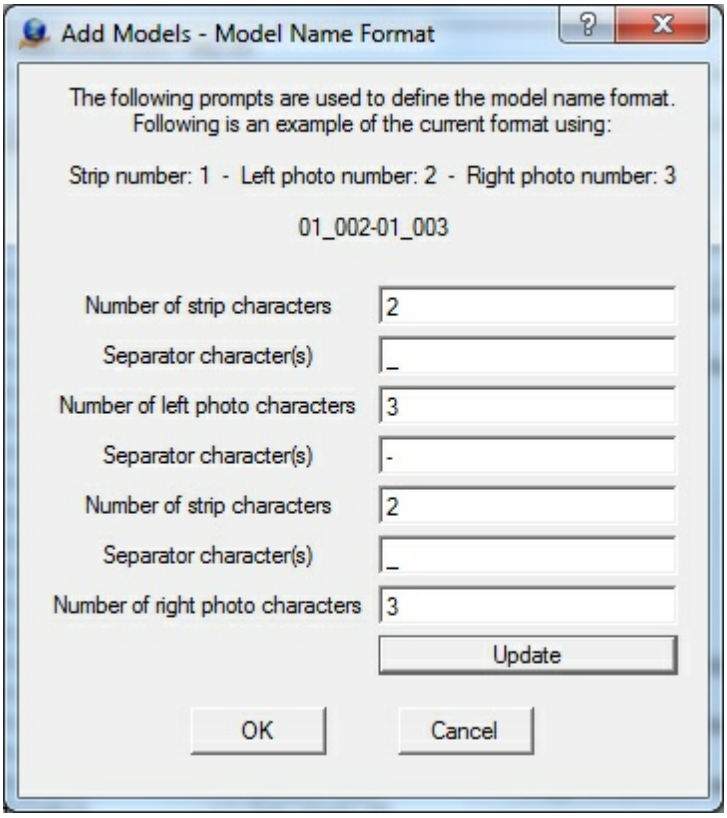

The Model Name Format dialog box for Add Models

Number of strip characters
Defines the number of characters to use for the strip number at the beginning of the model name. Set to blank to disable the output of this field.

Separator character(s)
Sets characters to separate the strip number from the next field. Set to blank to disable output of this field.

Number of left photo characters
Defines the number of characters to use for the left photo number. Set to blank to disable output of this field.

Separator character(s)
Sets characters to separate the left photo characters from the next field.. Set to blank to disable output of this field.

Number of strip characters
Defines the number of characters to use for the strip number. Strip number can be included before the left and right photo numbers. Set to blank to disable output of this field.

Separator character(s)
Sets characters to separate strip characters from the next field. Set to blank to disable output of this field.

Number of right photo characters
Defines the number of characters to use for the right photo number. Set to blank to disable

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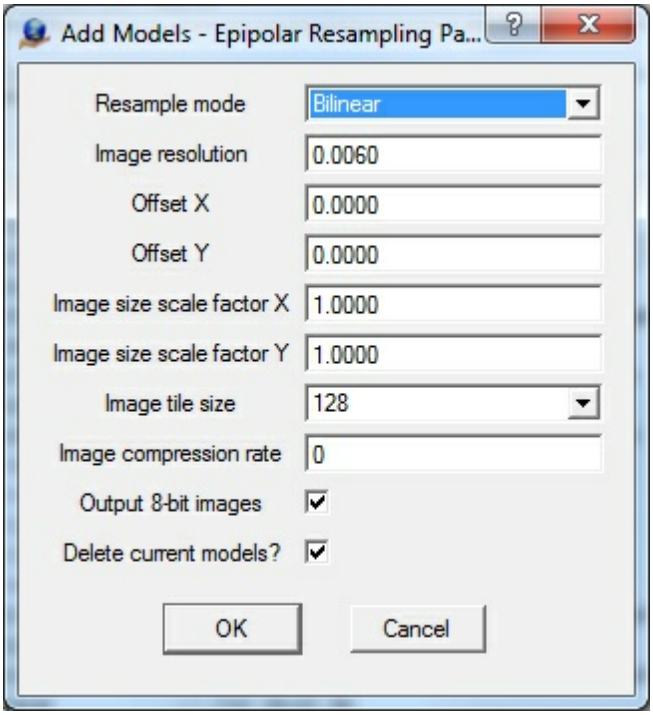
output of this field.

Update

Displays the current format in the upper part of the dialog box based on a strip number of 1 and respective left and right photo numbers of 2 and 3.

The Add Model – Epipolar Re-sampling Parameters

Defines the parameters for creation of epipolar images for stereo viewing.



The Epipolar Re-sampling parameters dialog box

Resample mode

Sets the resampling mode to create epipolar images: Nearest Neighbor, Bilinear, or Bicubic. These re-sampling modes affect the quality of the output image and the time it takes to create the epipolar images as follows.

- **Nearest Neighbor** - Fast re-sampling, lowest image quality. High contrast edges appear more jagged.
- **Bilinear** – Medium re-sampling speed, medium image quality. The image quality is softer than nearest neighbor and is normally acceptable for stereo viewing.
- **Bicubic** – Slow re-sampling, highest image quality. The image quality is the softest of the three methods. Commonly used to create orthophotos.

Image resolution

This field specifies the resolution of the epipolar images in millimeters, inches or pixels as set in the Fiducial Units field in Edit Camera. For example, 12 microns would be entered as 0.012 millimeters. The resolutions of the epipolar images do not need to be the same as those of the original images, though using the same resolution is recommended. When debugging a stereo

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model orientation and re-sampling multiple times while testing orientation parameters, it is useful to re-sample at a higher resolution such as 30 microns (0.030 millimeters) to obtain a stereo model quickly. "Over sampling" is a process which yields a higher image resolution for the epipolar images. This results in a softer image but does not increase the model's accuracy and increases the size of the epipolar images.

Offset X, Offset Y
Specifies offset values to move the viewing center for the stereo model. These are needed in close range photogrammetry when there are high camera angles to the object being photographed. For aerial photogrammetry, these values are normally set to zero. See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Image size scale factor X, Image size scale factor Y
Sets scale factors to adjust the size of the area covered by the epipolar images. The area re-sampled is based on the Photo Overlap setting. These values are normally set to 1.0 (no scale factor). See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Image tile size
Sets the image tile size. Options are "Do Not Tile", 64, 128, 256, 512 and 1024. "Do Not Tile" specifies non-tiled output files. 128 is typically used.

Image compression rate
Defines the JPEG compression rate from 1 to 100. Higher compression ratio values lead to better quality and larger file sizes. Lower compression ratio values mean higher compression, lower quality, and smaller files. A value of 0 indicates no compression.

Output 8-bit images
Specifies whether output epipolar images should use eight bits per sample. If disabled, the bits per sample of the original image will be used.

Delete current models?
Specifies whether to delete the current models. **WARNING**: Deleting a model will delete its model orientations.

Define Images

The Define Images or Import ImageUtil options identify the images in the project and assign image parameters like photo name format, camera name, strip location, and pixel size to each image. If a project is already set up in Image Utility and interior orientations have already been performed, use the Import ImageUtil option. This reads the list of images from the Image Utility project, and automatically recognizes the image settings and interior orientation.

Selecting Define Image displays a new dialog box, allowing images to be added to the project. Each image has a camera file, strip location, and pixel size. Use this dialog to assign the correct parameters to all images in the project. A camera file must be added to the project from this dialog before any photos can be added to the dialog. It is important that the Strip and Photo

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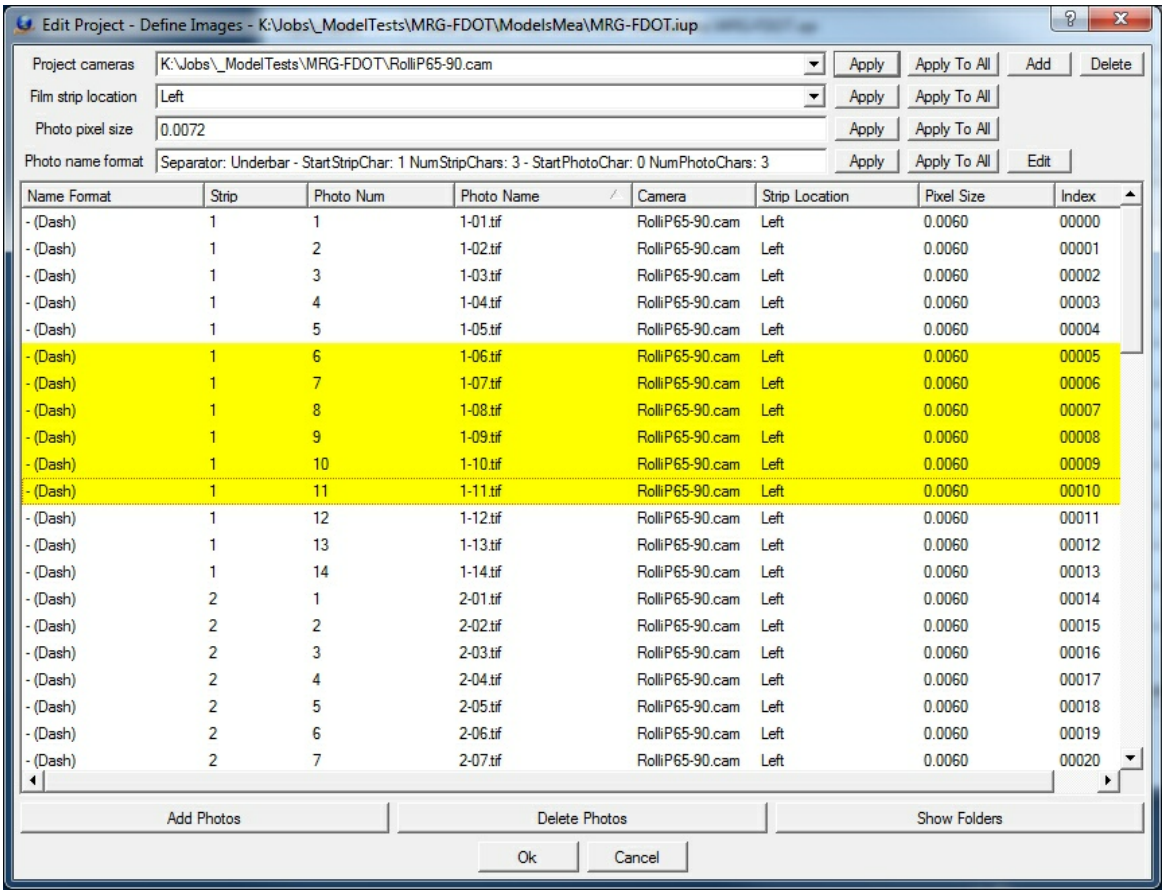
Num display correctly beside each image. This is controlled by setting the proper Name Format for the images.

Images may be highlighted in the dialog box by placing the mouse pointer on an image and dragging. Holding shift key and clicking the mouse highlights a range of images. Holding control (Ctrl) key and clicking the mouse highlights additional images.



The Edit Project - Define Images dialog box

The first four rows of the dialog box serve as a template to be applied to a group of highlighted images or all images. These first four rows contain the project cameras, film strip location, photo pixel size, and photo name format.

Project cameras

Defines up to 10 project cameras.

Film strip location

Sets the location of the film strip in reference to the image rotation. Supported film strip locations are Left, Top, Right and Bottom. This parameter is not dependent on the direction of flight, but rather on the orientation of the image as viewed by the user. The following are examples of strip locations

The data strip is to the left, which represents a rotation value of zero. Please see Left and Right

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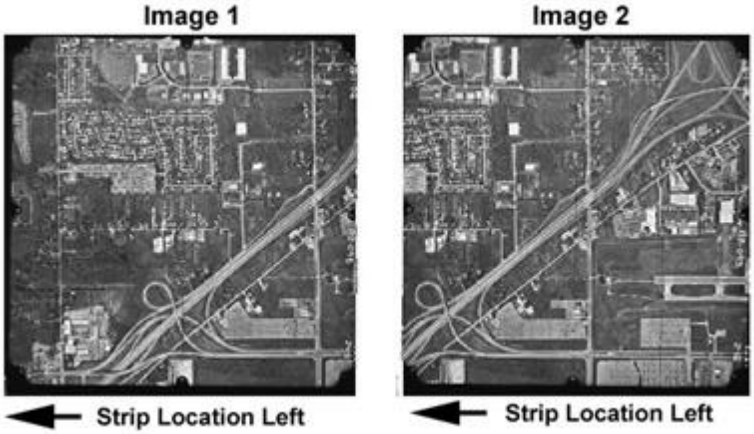
Image Rotations for more information.



The model above has been rotated 180 degrees. The strip location is rotated with the images.

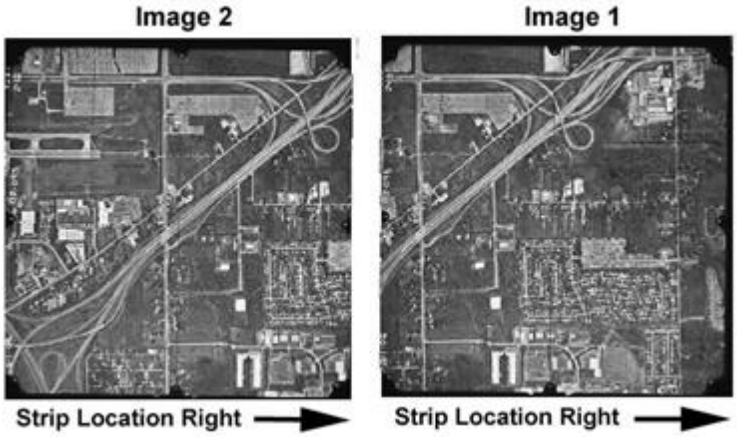


Photo pixel size

Specifies the size of a pixel based on the fiducial coordinate units (millimeteres, inches, or pixels). If the fiducial coordinates are in "pixels", the photo pixel size is always 1.

Photo name format

Describes the method by which to extract image strip and photo number. Please see Photo Name Format for more information.

Change Drive (ChaDri)

Defines the new locations for model orientation parameter files when a project is moved to another directory (folder). When this command starts, the user is prompted for an existing VrTwo Orientation parameter (.vpr) file. The new locations for the various model orientation parameter files may be defined in the dialog box shown below.

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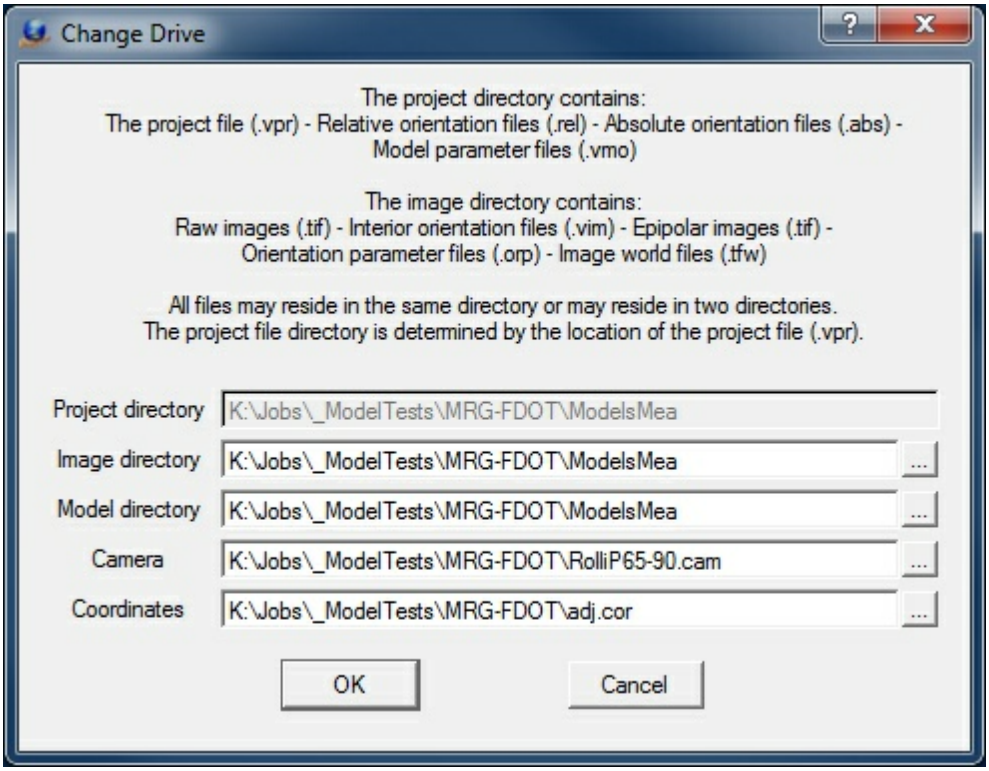
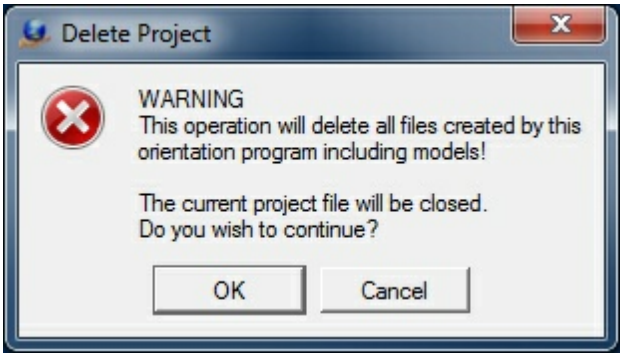


The Change Drive dialog box

Delete Project (DelPro)

Deletes the current project. Before the project is deleted, a warning dialog box is displayed and the user must confirm the delete.



The Delete Project warning dialog box

Import

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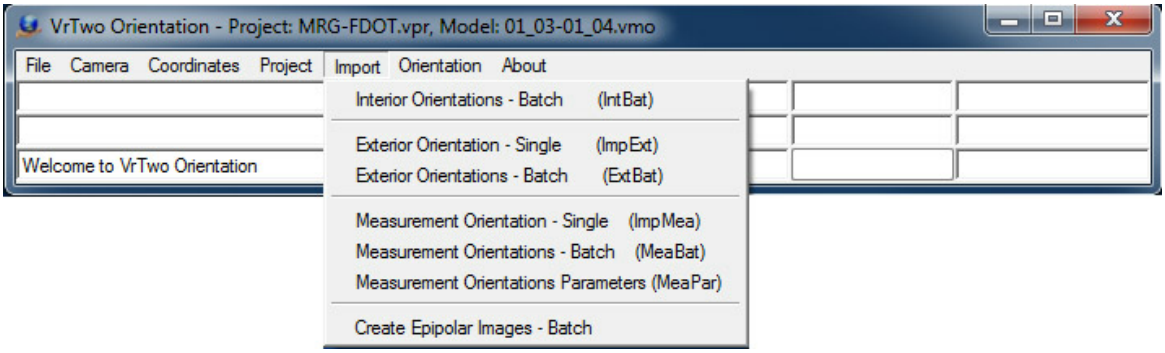

The Import Menu

Import provides methods to orient stereo models from the results of aerial triangulation programs. Interior Orientations can be imported in batch mode. Exterior orientations or measurements can be imported in single model mode or batch.

There are two methods to perform relative and absolute orientations using Import.

Exterior Orientation
Six independent parameters, called the elements of exterior orientation, express the spatial position and angular orientation of a tilted image. The process of aerial triangulation determines these six parameters for each photograph and the availability of these exterior orientations for two overlapping images allows a model setup. The values that make up an exterior orientation are Omega, Phi, Kappa, X, Y, and Z. The Omega, Phi and Kappa are rotations about the x, y, and z axes of the image. X, Y and Z represent the nodal point of the camera lens (where the light rays appear to cross in the camera lens).

Measurements
During aerial triangulation, overlapping and sidelapping images are joined together using pass points (for overlapping images) and tie points (for sidelapping images). Each of these points is placed at a common ground location in the photographs. These points are read for the left and the right images; relative and absolute orientations are performed. Common point names that have an entry in the coordinate file are used during the absolute orientation computations.

Please see Importing Orientations for more information about these two methods and the input formats.

Prerequisites:
The user is expected to know details of the format being imported. The Importing Orientations document should be read before any attempts are made to import model orientations.

Exterior Orientation – Single (ImpExt)

The single model exterior orientation input orients a pair of images into a single model by using the six exterior orientation parameters from the two images.

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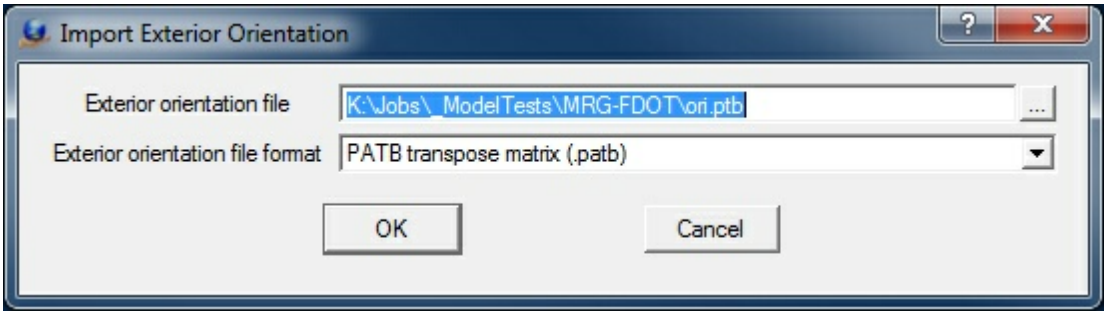


The Import Exterior Orientation initial dialog defining input file and format

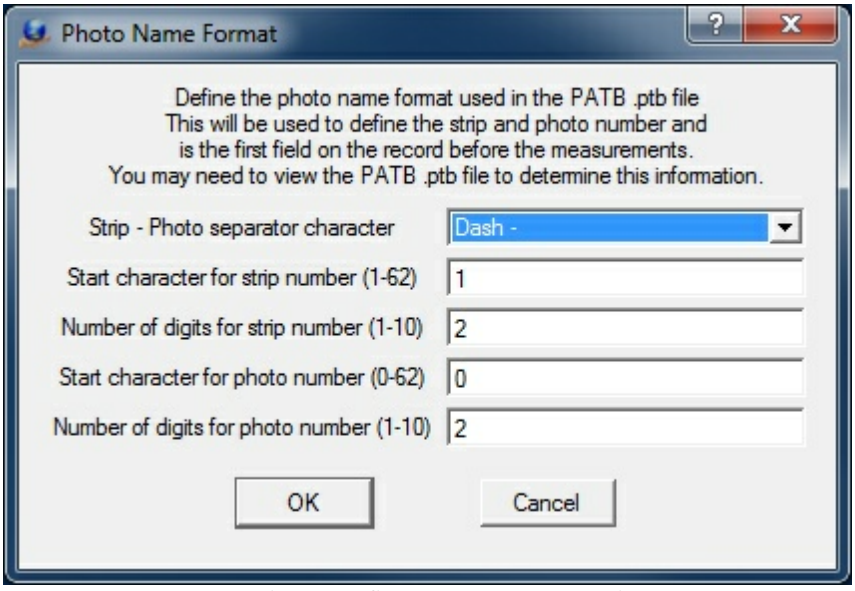
Exterior orientation file

Defines the file containing the exterior orientation parameters. This file normally contains the parameters for multiple images, which consist of an entire job or a single aerial triangulation bundle adjustment. Please refer to the document Importing Orientations for more information on the various formats.

Exterior orientation file format

Specifies the format of the file selected in the Exterior orientation file field.

Many of the orientation file formats require additional information about the strip and photo numbers. This information defines the conversion of photo names to strip and photo numbers.



The Photo Name Format dialog. Defines photo names to strip and photo number conversion parameters.

The Photo Name Format dialog box defines the format for decoding the strip number and photo number from and image file name. Please see Photo Name Format for more information about these parameters.

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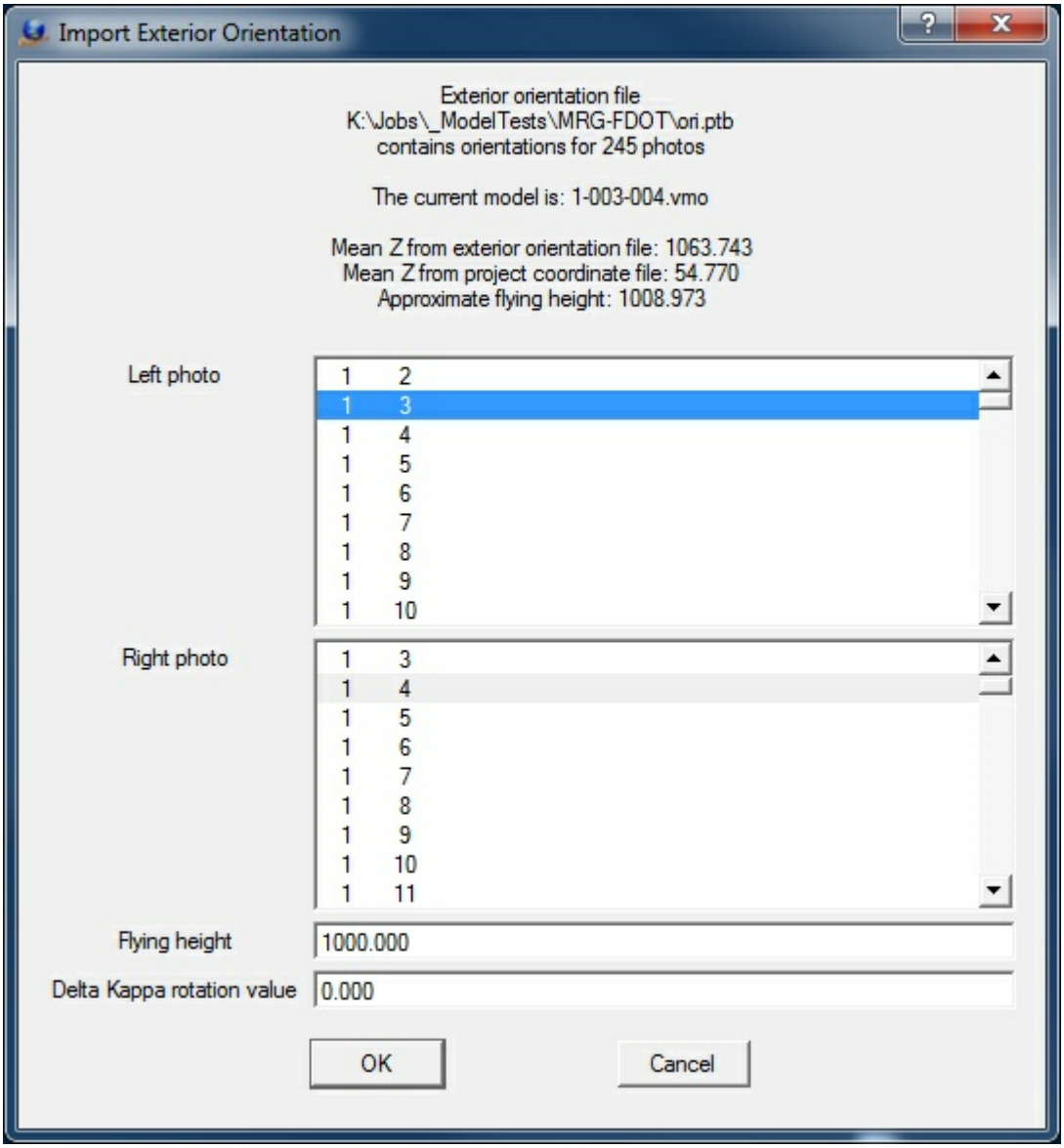

The Import Exterior Orientation left and right photo definition dialog

Select the two images to orient in the Left photo and Right photo menus. The exterior orientation file and number of images read is shown along with the current model at the top of the dialog box.

Flying Height

Specifies in ground units the flying height, the approximate distance between the ground/object and the camera. An approximate value, computed from the mean camera elevations of the exterior orientation file and the mean ground elevation from the active ground control file, is displayed in the information area of the dialog box.

Delta Kappa Rotation Value

Specifies a Kappa rotation angle (about the Z axis) in the exterior orientation file. This is required if the images were rotated from the positions that were used in the aerial triangulation program.

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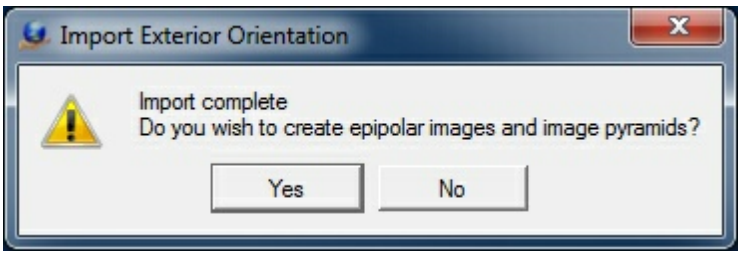
It is suggested that an angle of zero is first attempted. If the import does not produce a viewable stereo model, a rotation value of 180 should be entered. The possible rotation values are 0, 90, 180, and 270 degrees.



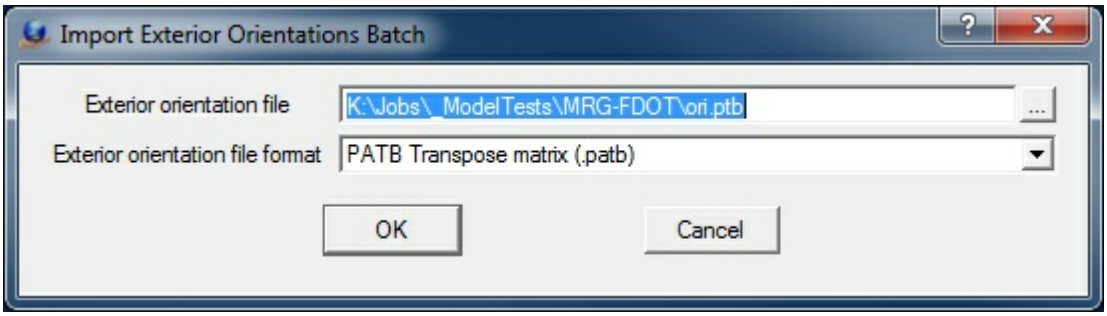
Creation of epipolar images and image pyramids conformation dialog.

When the import is complete, a dialog box will display asking if epipolar images should be created. Press "Yes" to start generating epipolar images for stereo viewing. Press "No" to skip generation of epipolar images.s

When the import of a model using exterior orientation is complete, the VrTwo Orientation program may be exited and VrTwo started to view the model.

Exterior Orientations – Batch (ExtBat)

Many stereo models can be oriented using exterior orientations with Exterior Orientations Batch. Before Exterior Orientations Batch can run, the project must be set, the models must be defined, and interior orientations must be complete.



The Import Exterior Orientations initial dialog defining input file and format

Exterior Orientation File

Defines the file that contains the exterior orientation parameters. This file normally contains the parameters for multiple images, be they an entire job or a single aerial triangulation bundle adjustment. Please refer to the document Importing Orientations for more information.

Exterior Orientation File Format

Specifies the format of the file defined above in "Exterior orientation file".

Depending on the Interior Orientation File Format selected, one or more additional dialog boxes

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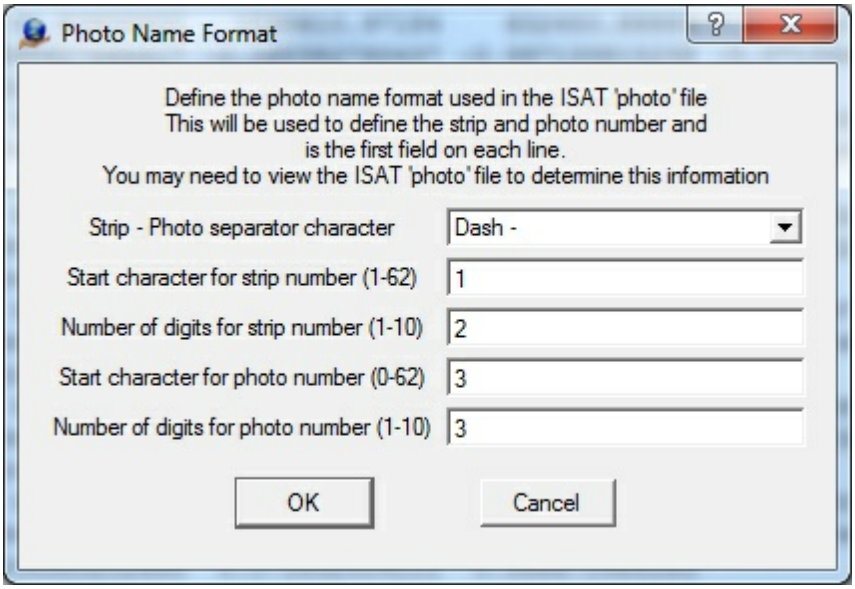
may appear to request more information about the input format. One of these dialog boxes may request information about the Photo Name Format. The "Photo Name Format" dialog box determines how to decode the strip and photo numbers from the image file name.

If ISAT is selected as the Interior Orientation File Format, the following dialog box will be displayed.

If the Strip Number Location for the ISAT 'photo' file was specified as "Embedded with the photo number" then the following dialog box will be displayed.



The Photo Name Format dialog. Defines photo names to strip and photo number conversion parameters.

The Photo Name Format dialog box determines how to decode the strip and photo numbers from the image file name. Please see Photo Name Format for more information a

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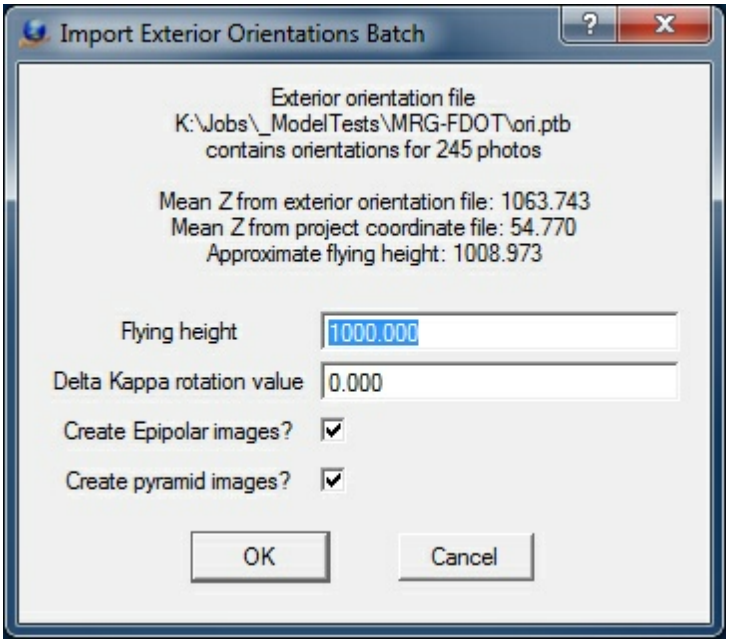

Import Exterior Orientations parameters dialog

Flying Height

Specifies in ground units the flying height, the approximate distance between the ground/object and the camera. An approximate value, computed from the mean camera elevations of the exterior orientation file and the mean ground elevation from the active ground control file, is displayed in the information area of the dialog box.

Delta Kappa Rotation Value

Specifies a Kappa rotation angle (about the Z axis) in the exterior orientation file. This is required if the images were rotated from the positions that were used in the aerial triangulation program. It is suggested that an angle of zero is first attempted. If the import does not produce a viewable stereo model, a rotation value of 180 should be entered. The possible rotation values are 0, 90, 180, and 270 degrees.

Create Epipolar Images?

Specifies whether to create epipolar images after each model has been set up.

Create pyramid images?

Specifies whether to create image pyramids of the epipolar images after each model has been set up.

A list of models available for orientation is displayed.

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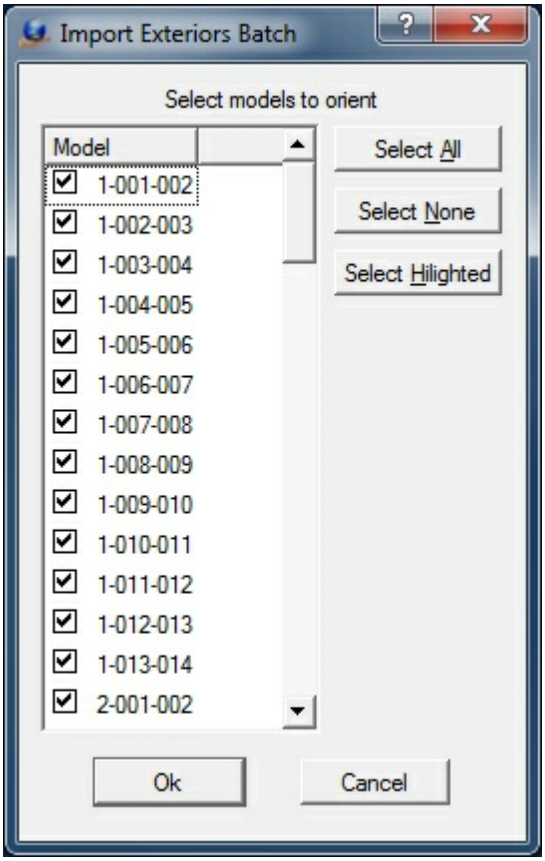

The selection of models for import dialog

Afterhe import completes, its results are placed in the information dialog box.

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The import exterior orientations batch information box

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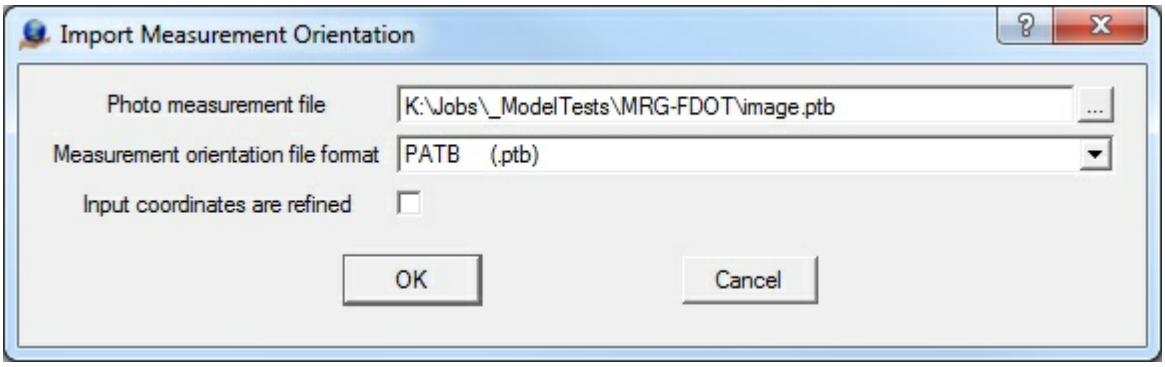
Measurement Orientation – Single

The single model measurement orientation orients a pair of images into a single model using common measured points from the two images. These points are typically measured in an aerial triangulation program.



The Import Measurement Orientations initial dialog defining input file and format

Photo measurement file

Defines the file that contains the photo measurements. This file normally contains the parameters for multiple images, whether they consist of an entire job or a single aerial triangulation bundle adjustment. Please refer to the document Importing Orientations for more information.

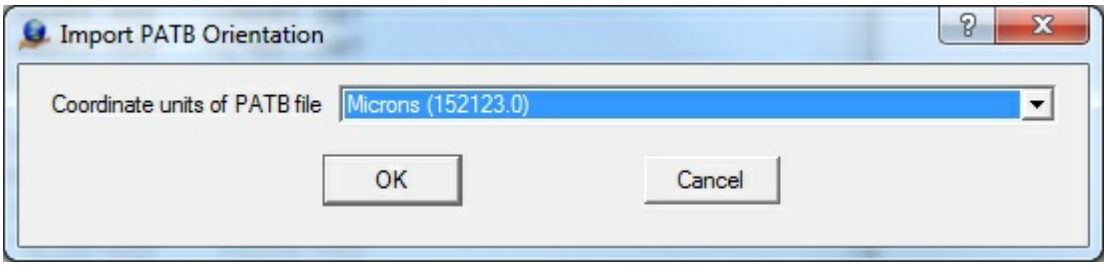
Measurement orientation file format

Specifies the format of the file selected in the "Exterior orientation file" field.

Input coordinates are refined

When measurements are imported, they typically are unrefined coordinates; they do not have the camera distortion corrections applied. If this option is checked, it is assumed that input coordinates are refined and will be converted to unrefined coordinates before passing them to the relative orientation solution. (default = unchecked)

Once a measurement input format is selected, a dialog box prompts for additional file format parameters. These parameters include the photo measurement file name and the coordinate units.



The definition of coordinate units as microns or millimeters dialog

Coordinate units of input file

Specifies coordinate units for the input file (millimeters or microns). The user may need to view

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the input file in a text editor to determine the value for this parameter. Most photo coordinate systems are in millimeters so an x, y coordinate of `-26.499567, 2.2979591` would indicate millimeters while an x, y coordinate of `-26499567.0, 22979591.0` would indicate microns.

Some formats require more information.



Definition of the JFK fiducial read order dialog

JFK fiducial read order

When reading the interior orientations using the JFK aerial triangulation software, the operator may read the fiducials in any order. The order used by the aerial triangulation operator must be known and entered in the field. If only four fiducials were observed (not recommended)n the unused fiducials are entered with a value of zero. For example: 12340000.

The left and right image names are selected in the next step.

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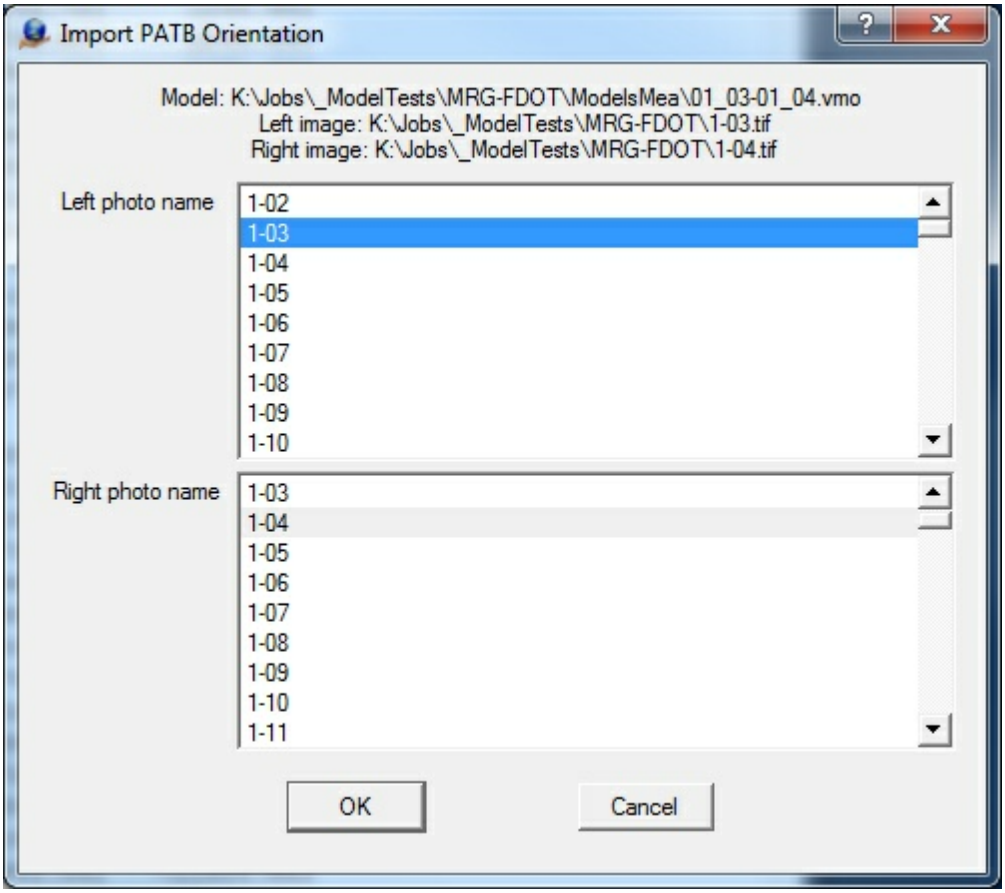

The Import Measurements Orientation left and right photo definition dialog

After the left and right images are selectedn the measurements are imported and the relative and absolute orientations are computed. The results are shown in the information dialog box.

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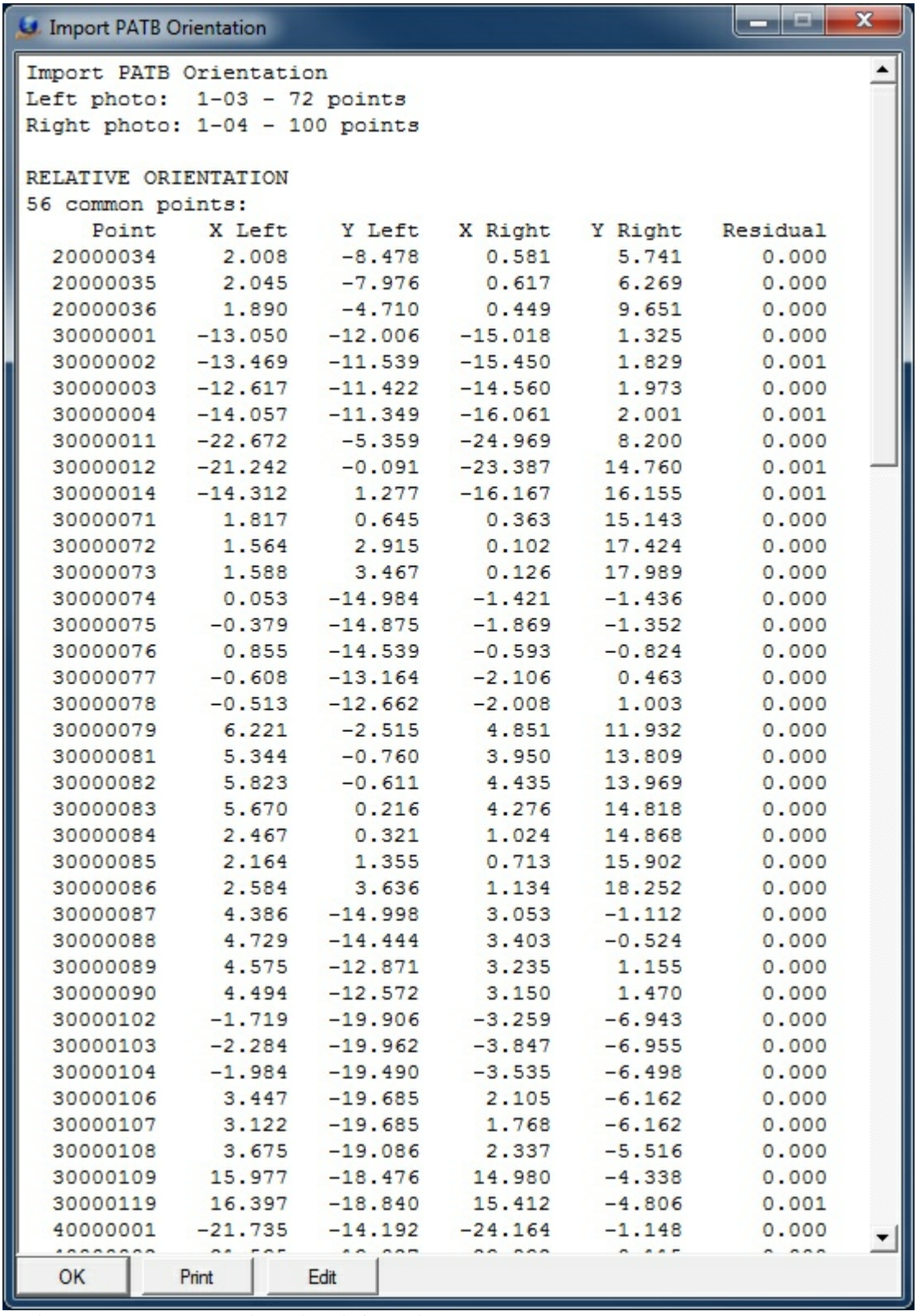

Point	X Left	Y Left	X Right	Y Right	Residual
20000034	2.008	-8.478	0.581	5.741	0.000
20000035	2.045	-7.976	0.617	6.269	0.000
20000036	1.890	-4.710	0.449	9.651	0.000
30000001	-13.050	-12.006	-15.018	1.325	0.000
30000002	-13.469	-11.539	-15.450	1.829	0.001
30000003	-12.617	-11.422	-14.560	1.973	0.000
30000004	-14.057	-11.349	-16.061	2.001	0.001
30000011	-22.672	-5.359	-24.969	8.200	0.000
30000012	-21.242	-0.091	-23.387	14.760	0.001
30000014	-14.312	1.277	-16.167	16.155	0.001
30000071	1.817	0.645	0.363	15.143	0.000
30000072	1.564	2.915	0.102	17.424	0.000
30000073	1.588	3.467	0.126	17.989	0.000
30000074	0.053	-14.984	-1.421	-1.436	0.000
30000075	-0.379	-14.875	-1.869	-1.352	0.000
30000076	0.855	-14.539	-0.593	-0.824	0.000
30000077	-0.608	-13.164	-2.106	0.463	0.000
30000078	-0.513	-12.662	-2.008	1.003	0.000
30000079	6.221	-2.515	4.851	11.932	0.000
30000081	5.344	-0.760	3.950	13.809	0.000
30000082	5.823	-0.611	4.435	13.969	0.000
30000083	5.670	0.216	4.276	14.818	0.000
30000084	2.467	0.321	1.024	14.868	0.000
30000085	2.164	1.355	0.713	15.902	0.000
30000086	2.584	3.636	1.134	18.252	0.000
30000087	4.386	-14.998	3.053	-1.112	0.000
30000088	4.729	-14.444	3.403	-0.524	0.000
30000089	4.575	-12.871	3.235	1.155	0.000
30000090	4.494	-12.572	3.150	1.470	0.000
30000102	-1.719	-19.906	-3.259	-6.943	0.000
30000103	-2.284	-19.962	-3.847	-6.955	0.000
30000104	-1.984	-19.490	-3.535	-6.498	0.000
30000106	3.447	-19.685	2.105	-6.162	0.000
30000107	3.122	-19.685	1.768	-6.162	0.000
30000108	3.675	-19.086	2.337	-5.516	0.000
30000109	15.977	-18.476	14.980	-4.338	0.000
30000119	16.397	-18.840	15.412	-4.806	0.001
40000001	-21.735	-14.192	-24.164	-1.148	0.000

The import measurements orientations information box

When the model import is complete, the results of the import may be viewed in Orientation ->

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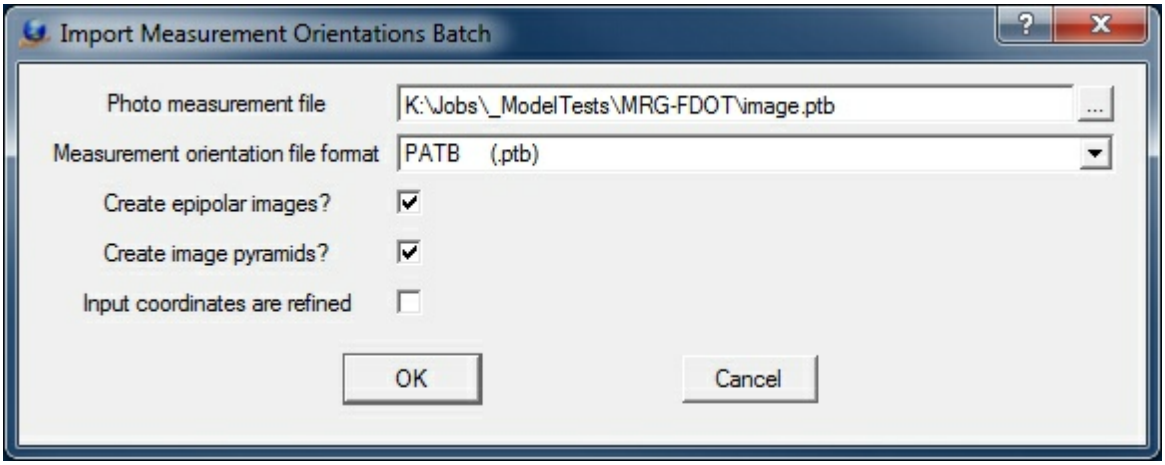
Relative Orientation and Orientation -> Absolute Orientation.

Measurement Orientations – Batch (MeaBat)

It is possible to orientate many stereo models using measurement orientations with Measurement Orientations Batch. Before Measurement Orientations Batch can be run, the project must be set, the models must be defined and interior orientations must be complete.



The Import Measurement Orientations initial dialog defining input file and format

Photo measurement file

Defines the measurement parameter file name. It is typical for the measurements for many images to be in a single input file.

Measurement orientation file format

Specifies the format of the file selected in the "Photo measurement file" field.

Create Epipolar Images?

Specifies whether to create epipolar images after each model has been set up.

Create pyramid images?

Specifies whether to create image pyramids of the epipolar images after each model has been set up.

Input coordinates are refined

When measurements are imported, they typically are unrefined coordinates; they do not have the camera distortion corrections applied. If this option is checked, it is assumed the input coordinates are refined and will be converted to unrefined coordinates before passing them to the relative orientation solution. (default = unchecked)

Depending on the orientation file format selected, one of the following dialog boxes may appear to request more information about the input format:

ISAT

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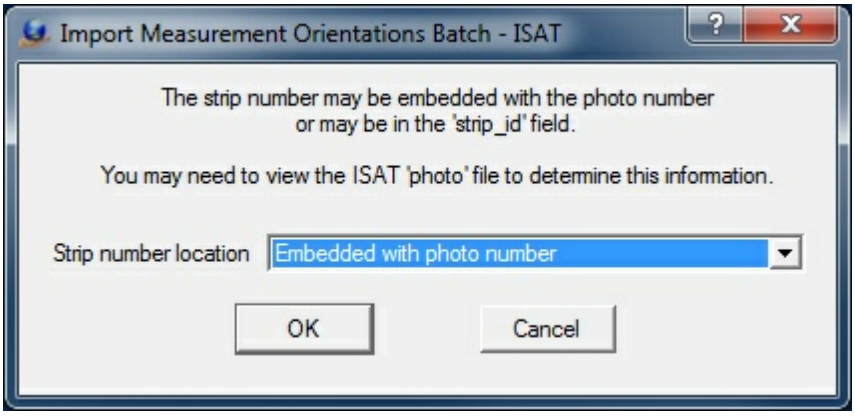

The ISAT Strip Number Location dialog box. Displayed when importing ISAT measurement orientations.

Strip number location

In the ISAT photo file there are two possible locations in which the strip number may be stored. These locations are:

- **Embedded with the photo number** – The strip number is part of the photo name following the 'photo_parameters' keyword. For example, the record:

```
begin photo_parameters 205    strip_id 2
```

would assume the strip number and photo number to be included in the 205 field and the 2 after the strip_id would be ignored. If the number of strip characters was 1 and the number of photo characters was 2 then strip 2, photo 5 would be decoded from the 205 field.

- **After the 'strip_id' keyword** – The strip number follows the 'strip_id' keyword which is on the same record as the 'photo_parameters' keyword. For example, the record

```
begin photo_parameters 101    strip_id 3
```

would assume the photo number as 101 and the strip number as 3.

ATLAS, ISSBA, ORIMA, PATB, VRAT

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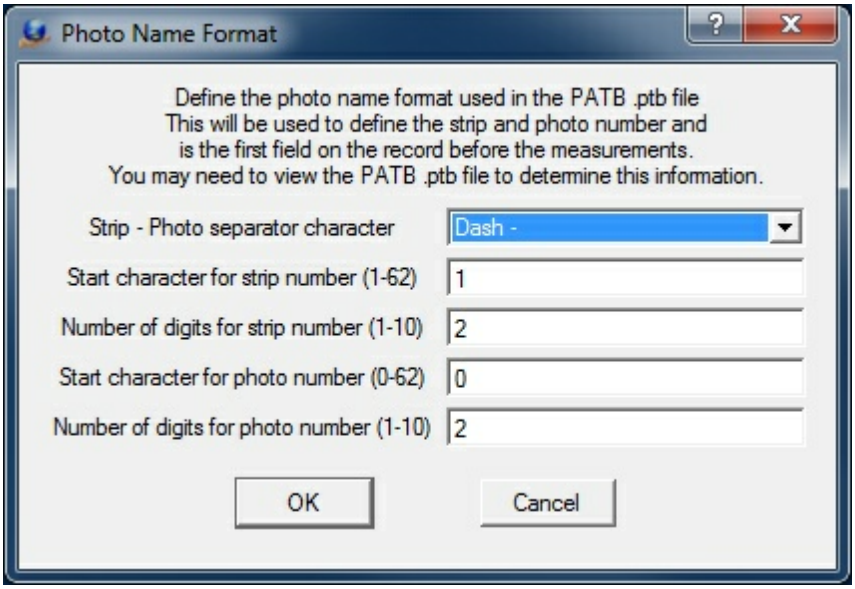
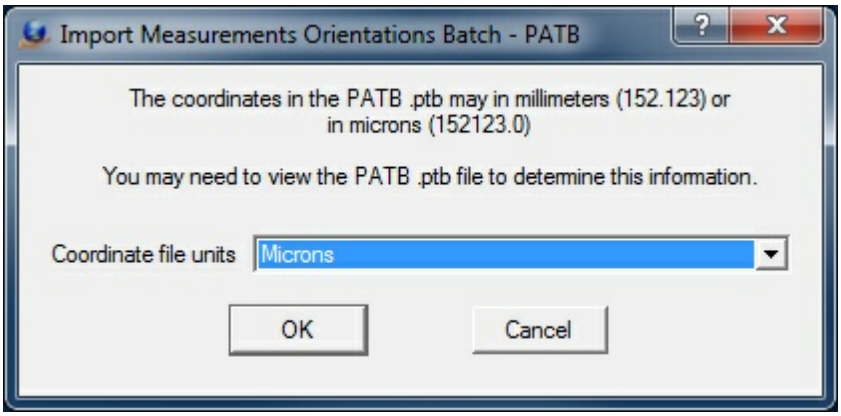


The Photo Name Format dialog. Defines photo names to strip and photo number conversion parameters.

The Photo Name Format dialog box defines the format for decoding the strip number and photo number from and image file name. Please see Photo Name Format for more information about these parameters.

PATB



The definition of coordinate units as microns or millimeters dialog

Coordinate file units

The coordinates that represent the photo measurements in the input file may expressed in millimeters or microns. The user may need to view the input file in a text editor to determine the value for this parameter. Most photo coordinate systems are in millimeters so an x, y coordinate of `-26.499567, 2.2979591` would indicate millimeters while an x, y coordinate of `-26499567.0, 22979591.0` would indicate microns.

A list of model available for orientation is displayed and all models or selected models may be chosen for setup.

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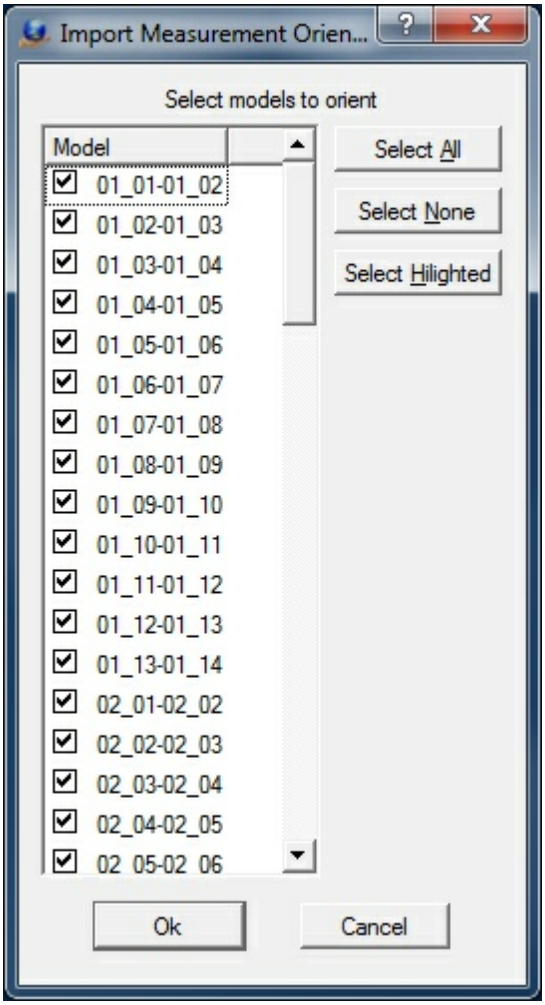

The selection of models for import dialog

After completion of import the results of the import are placed into the information dialog box.

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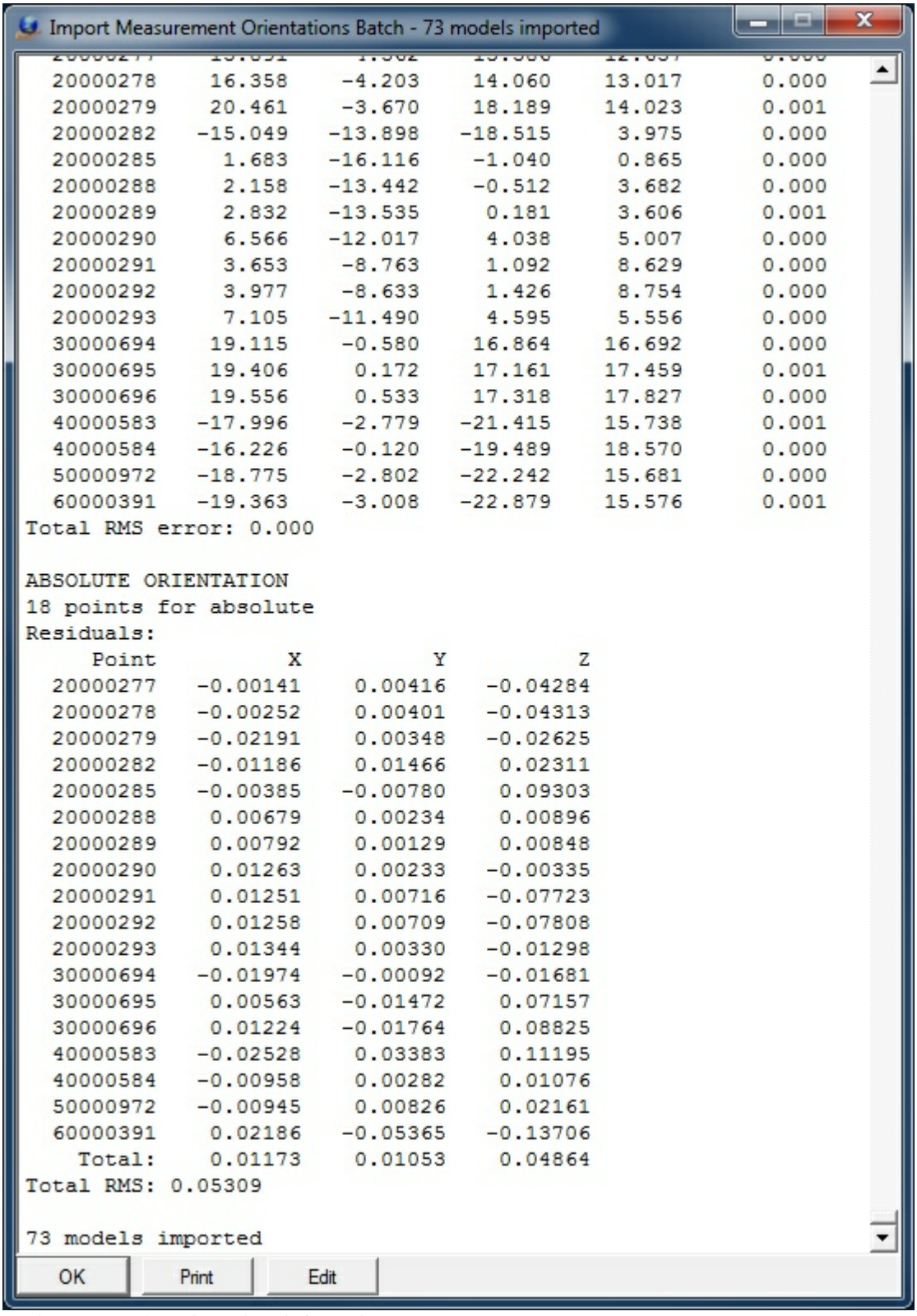

The import exterior orientations information box

When the model import is complete and epipolar images have been created the results of the

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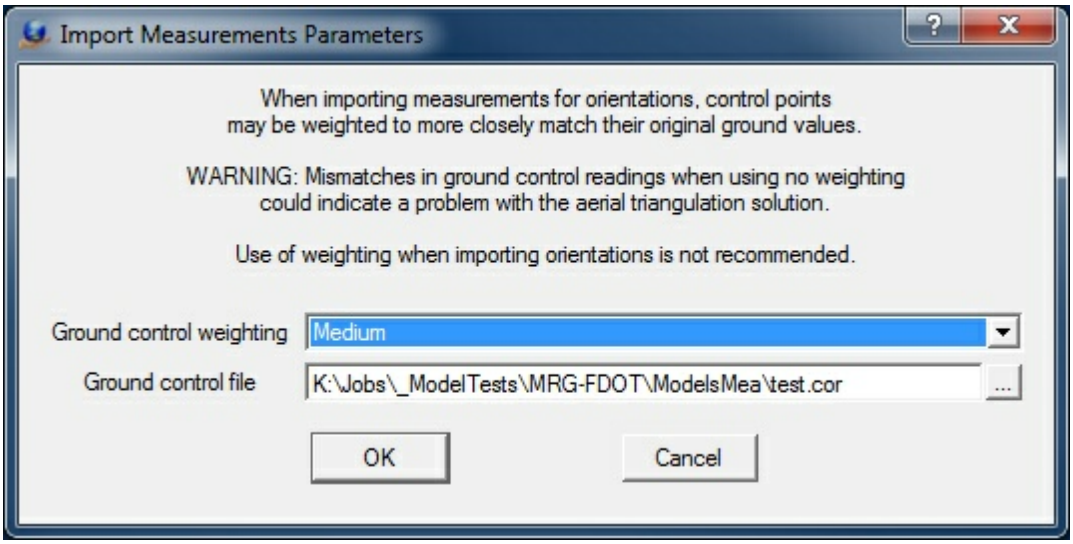
import may be viewed in Orientation -> Relative Orientation and Orientation -> Absolute Orientation.

Measurement Orientation Parameters (MeaPar)



Measurement Orientation Parameters Dialog

When importing measurements for orientations, control points may be weighted to more closely match their original ground values.
WARNING: Mismatches in ground control readings when using no weighting could indicate a problem with the aerial triangulation solution or the ground control used in the aerial triangulation solution. The use of weighting when importing orientations is not recommended.

Ground control weighting
Specifies the amount of ground control point weighting. Options include None, Low, Medium or High. The recommended setting for this parameter is None.

Ground control file
The ground control file that is specified in Coordinates field in Edit Project typically contains the original ground control (field surveyed) and pass a tie points from the aerial triangulation solution. A second ground control file is requited so the original ground control (field surveyed) points can be identified in the weighting process. The file specified should contain only the original ground control points without the pass and tie points.

Create Epipolar Images – Batch (CreEpi)

In many of the orientation methods the creation of epipolar images may be skipped. Create Epipolar Images creates these images in a batch mode.

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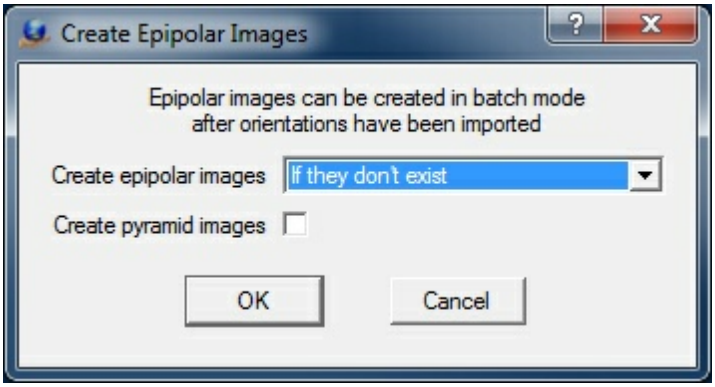


Create Epipolar Images dialog

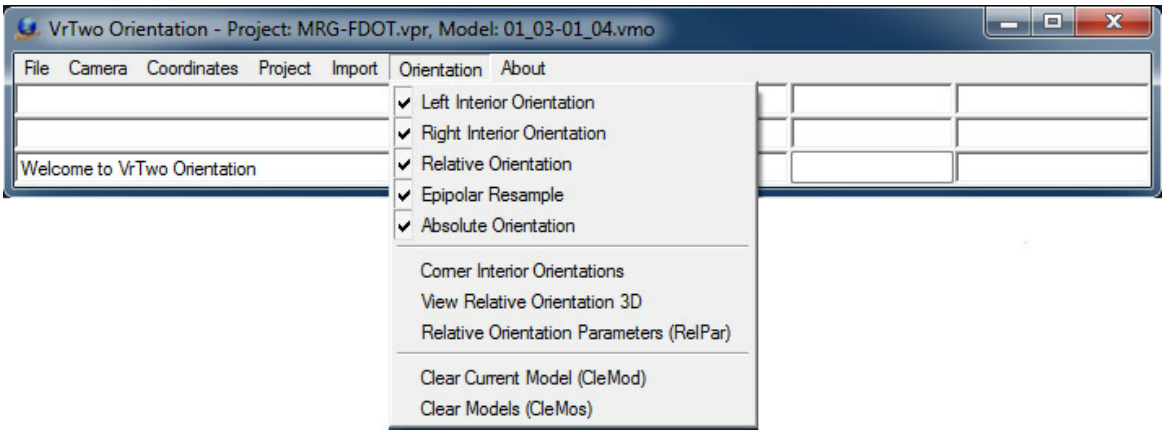
Create epipolar images

This parameter sets the creation mode for the epipolar images. Options are "If they don't exist" and "Create all epipolar images".

Create pyramid images?

Checking this parameter will create image pyramids of the epipolar images after the epipolar images have been created.

Orientation



The Orientation Menu

Left, Right Interior Orientation (LefInt) (RigInt)

There are four methods of performing interior orientations in Vr Mapping. The auto correlated automatic interior orientation process is available in the Vr Image Utility (imageutill.exe) program, importing interior orientations or manually reading the fiducials and Corner Interior Orientations for images that do not contain fiducial markings. The Left / Right Interior Orientation is the manual method. A project must be set up and the camera calibration file must be defined before starting this command.

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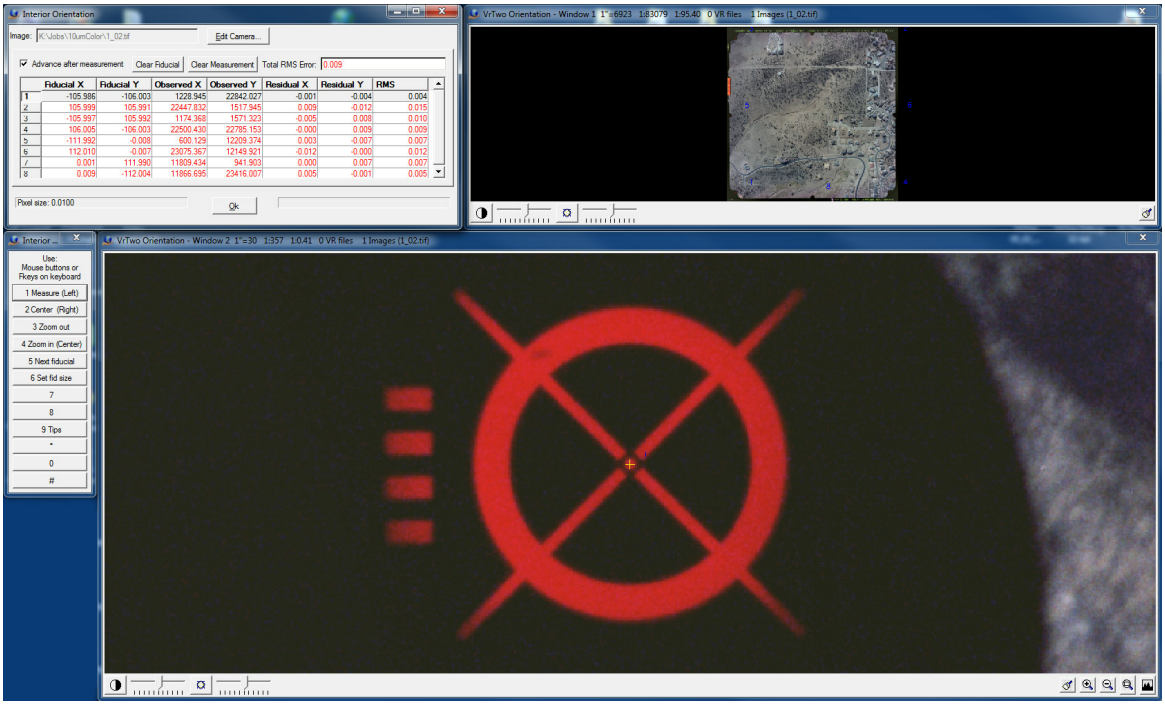
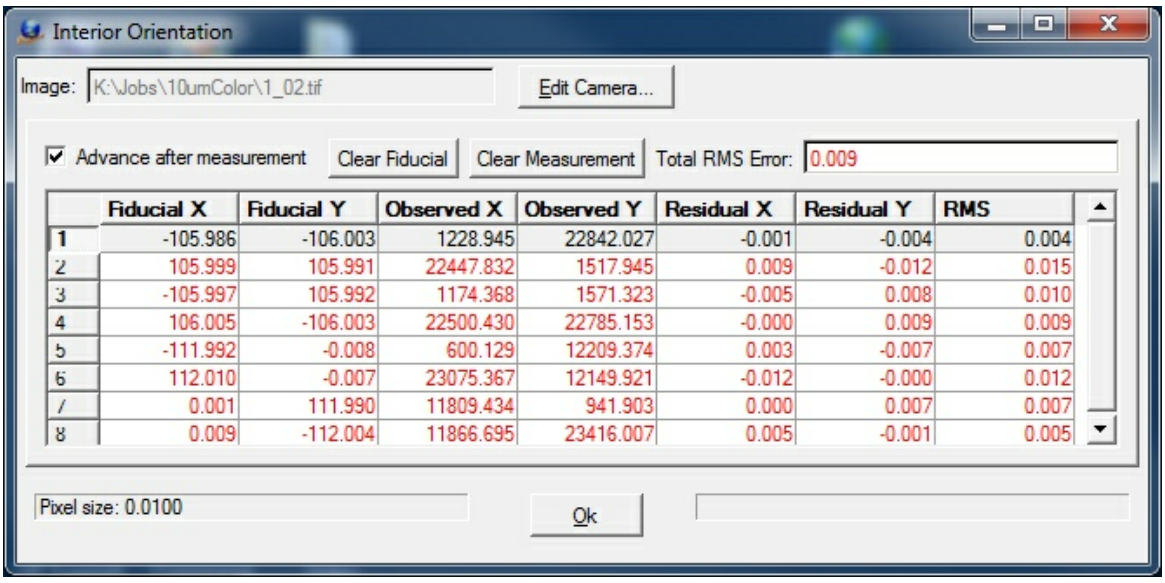


Interior Orientation Interactive Dialog

There are four windows or dialog boxes that make up the interior orientation application.

Residuals – This is the dialog box in the upper left corner of the screen. The Residuals dialog box shows the current residuals of the adjustment. After the third fiducial is read the image pixel size is shown in the lower left corner of this dialog.



	Fiducial X	Fiducial Y	Observed X	Observed Y	Residual X	Residual Y	RMS
1	-105.986	-106.003	1228.945	22842.027	-0.001	-0.004	0.004
2	105.999	105.991	22447.832	1517.945	0.009	-0.012	0.015
3	-105.997	105.992	1174.368	1571.323	-0.005	0.008	0.010
4	106.005	-106.003	22500.430	22785.153	-0.000	0.009	0.009
5	-111.992	-0.008	600.129	12209.374	0.003	-0.007	0.007
6	112.010	-0.007	23075.367	12149.921	-0.012	-0.000	0.012
7	0.001	111.990	11809.434	941.903	0.000	0.007	0.007
8	0.009	-112.004	11866.695	23416.007	0.005	-0.001	0.005

The Interior Orientation results dialog

To drive to a fiducial point the point number may be selected with the mouse.

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Overview – The overview window is in the upper right corner of the screen and shows the entire image. If the cursor is moved into this window the shape of the cursor will change to a square and a press of the left mouse button will display that portion of the image in the measurement window below.



The Interior Orientation overview window

The fiducial numbers are displayed in the overview window.

Measurement – This window displays an enlarged area of the image and allows the observations of fiducials. The controls for the measurement window are displayed in the Menu Keys dialog box to the left.

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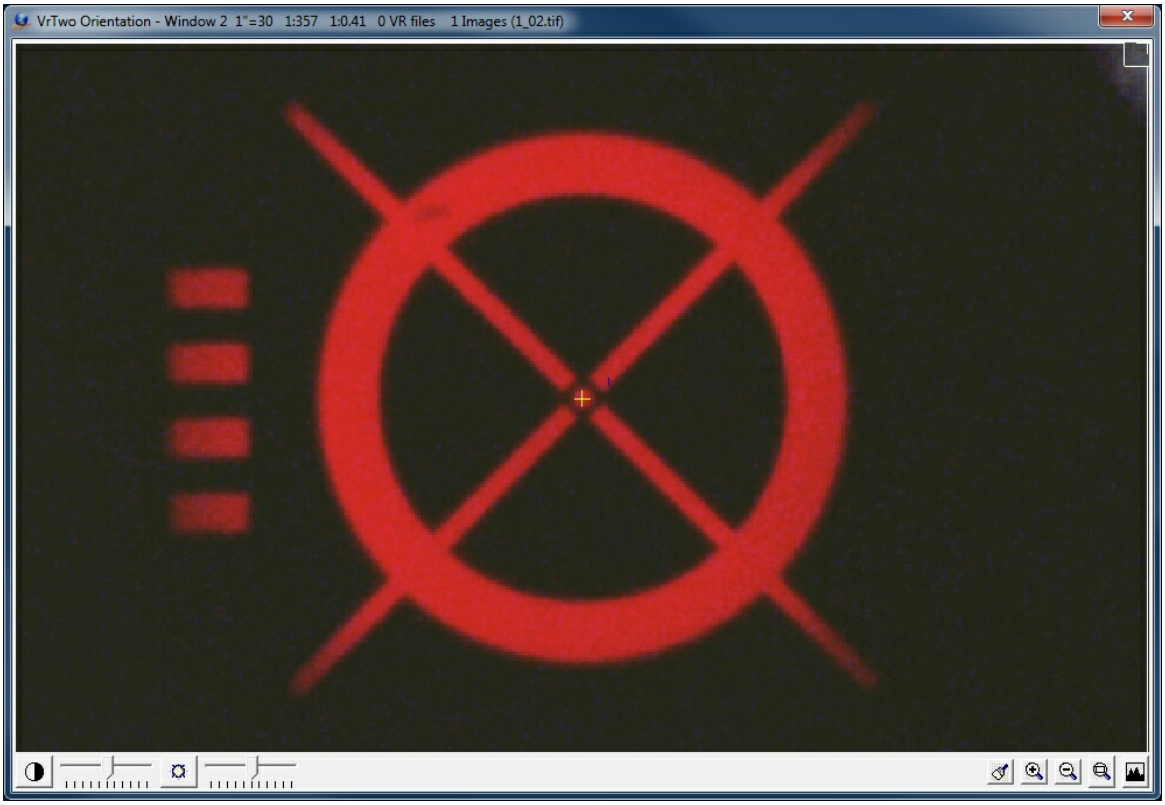

The Interior Orientation measurement window

Fiducials are measured by pressing the left mouse button. See Menu Keys below for all the display controls.

Menu Keys – The display and measurement controls for the measurement window are displayed in the Menu Keys dialog box. Several buttons on the menu keys are mapped onto the mouse and all buttons may be used by pressing the corresponding Fkeys on the system keyboard. For example; to zoom out the F3 key on the system keyboard may be pressed. Note that the buttons cannot be pressed with mouse clicks.

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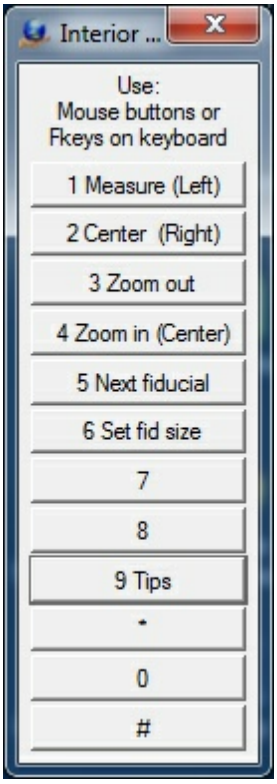

The Interior Orientation Menu Keys dialog

1 Measure (Left)
Measurement button for fiducial observations. This is mapped to the left mouse button.

2 Center (Right)
Centers the screen at the current cursor location. This is mapped to the right mouse button.

3 Zoom out
Zoom out using the zoom scale factor specified in Preferences.

4 Zoom in (Center)
Zooms in using the zoom scale factor specified in Preferences. This is mapped to the center wheel button on the mouse.

5 Next fiducial
Advances to the next fiducial.

6 Set fid size
Sets the fiducial size by digitizing lower left and upper right points around the fiducial. The value is used to set the Fiducial size in the camera calibration which is used for Automatic Interior Orientations in the Vr Image Utility (imageutil.exe) program.

9 Tips
Displays several helpful tips.

Relative Orientation (RelOri)

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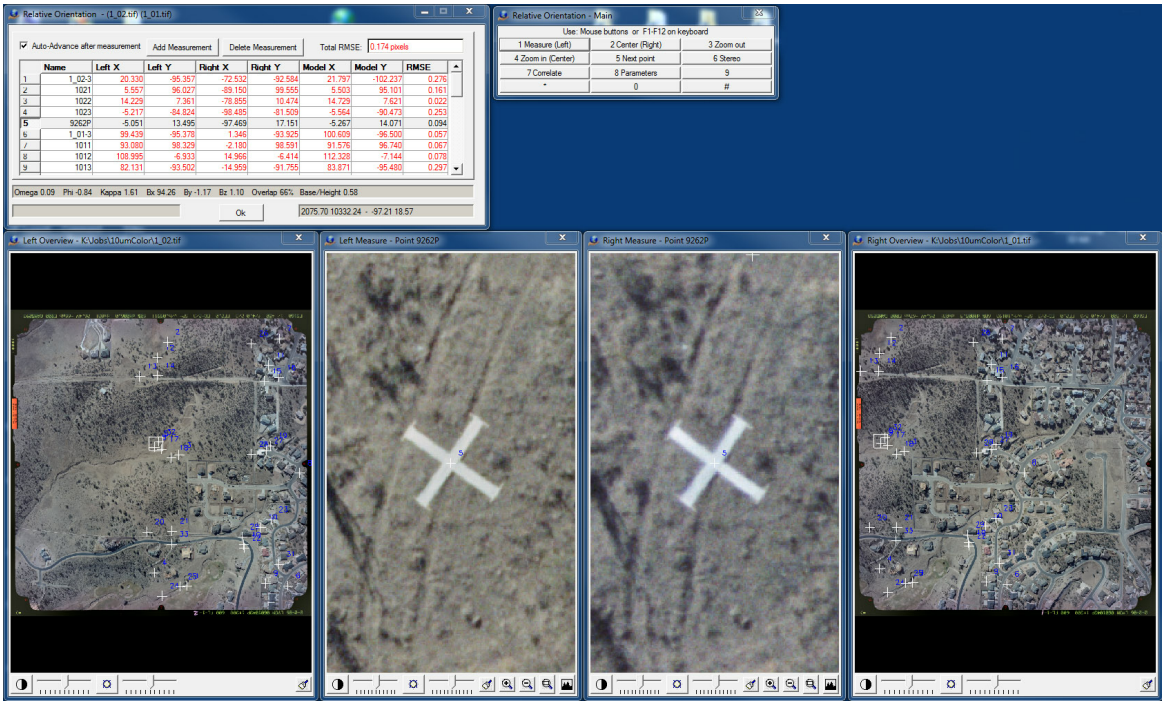
The relative orientation command performs manual relative orientations with one of three options when reading points.

- **Mono-comparator mode** – A common point is read in the left image and the right image. This is useful when reading photo identifiable items such control point panels.
- **Autocorrelation assist** – The cursor is positioned on one image and the common location is found on the other. The cursor may be positioned in the left or right image.
- **Stereo** – The two images may be displayed in stereo and parallax may be cleared using a method similar to clearing parallax on analytical instruments.

After completion of relative orientation, epipolar images may be created which will produce a viewable stereo model.



The Relative Orientation interactive measurement environment

There are six windows or dialog boxes that are displayed during relative orientation.

Residuals – This is the dialog box in the upper left corner of the screen. The Residuals dialog box shows the current residuals of the adjustment.

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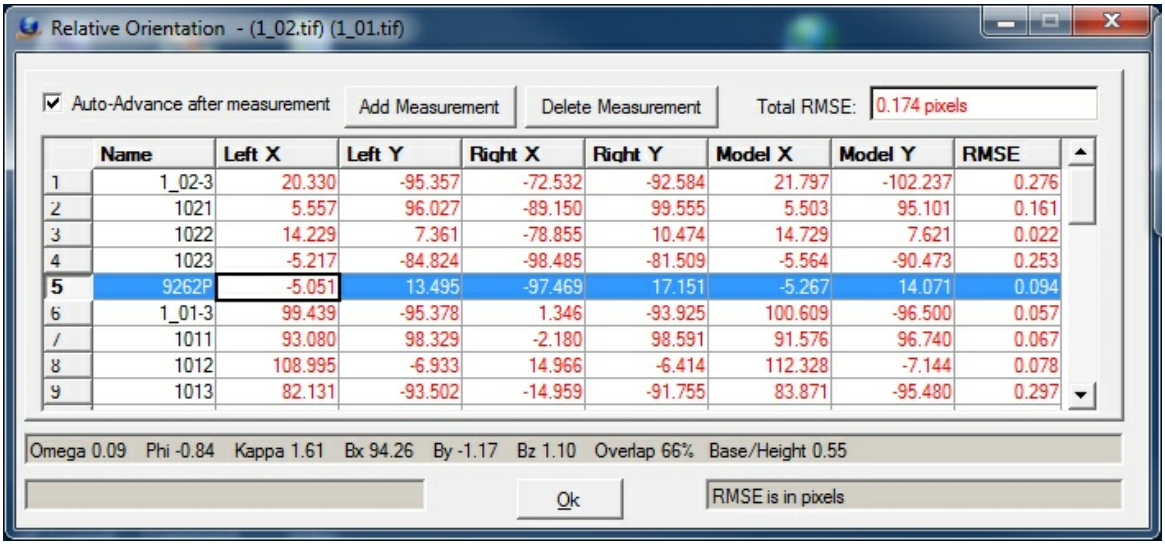
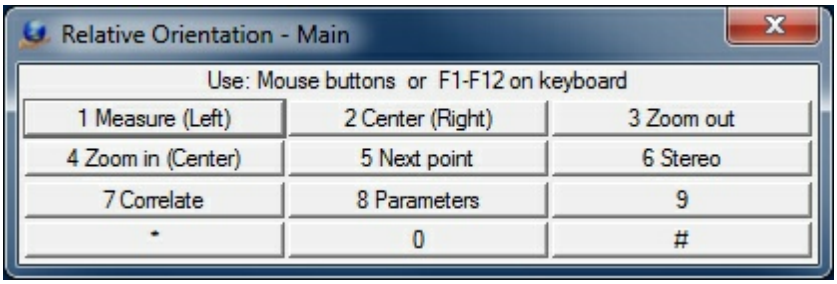


The Relative Orientation interactive measurement control and results dialog

Any point may be driven to by clicking on its sequence number. A least six points must be read before a solution will be computed. To add a measurement the Add Measurement button should be pressed first then the points should be located on the images.

Menu Keys – The display and measurement controls for the measurement window are displayed in the Menu Keys dialog box. Several buttons on the menu keys are mapped onto the mouse and all buttons may be used by pressing the corresponding Fkeys on the system keyboard. For example; to zoom out the F3 key on the system keyboard may be pressed. Note that the buttons cannot be pressed with mouse clicks.



The Relative Orientation interactive measurement Menu Keys dialog

1 Measure (Left)
Measurement button for fiducial observations. This is mapped to the left mouse button.

2 Center (Right)
Centers the screen at the current cursor location. This is mapped to the right mouse button.

3 Zoom out
Zooms out using the zoom scale factor specified in Preferences.

4 Zoom in (Center)
Zooms in using the zoom scale factor specified in Preferences. This is mapped to the center

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wheel button on the mouse.

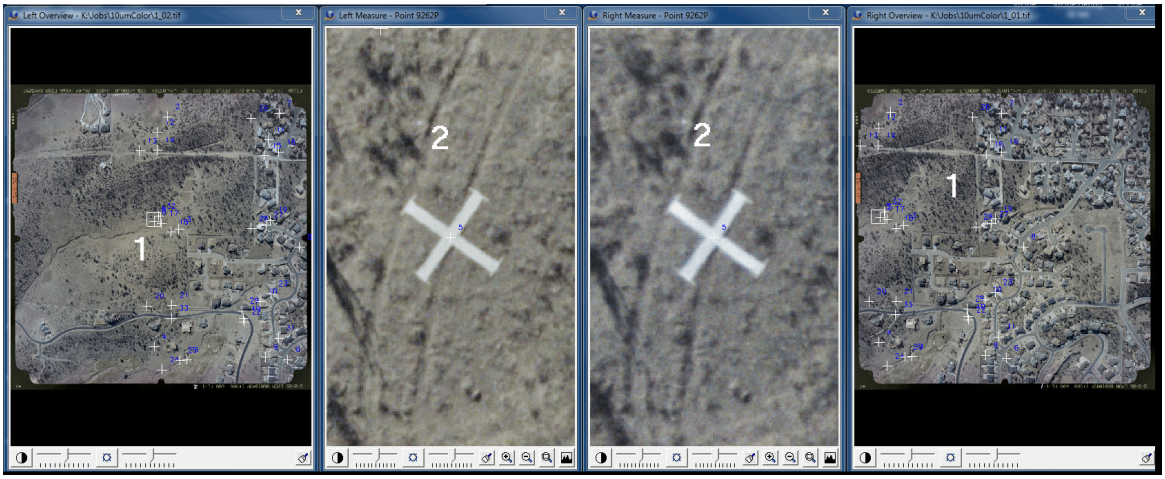
5 Next fiducial
Advances to the next fiducial.

6 Stereo
Changes the measurement mode to stereo. See Relative Orientation Stereo Window.

7 Correlate
Finds the common point in the other image based on cursor position in the left or right measurement window. The result of the correlation is displayed in the Residual and Menu Keys dialog boxes. This result may be rejected or accepted. Point correlation is relayed as a number from 0-1. Guidelines for correlation interpretation are as follow

- 0.9 to 1.0 - Very good
- 0.8 to 0.9 - Good
- 0.7 to 0.8 - Fair
- 0.7 and below - Poor (result should be rejected).

Overview and Measurement Windows – The four windows along the bottom of the screen are the overview (1) and measurement (2) windows. If the cursor moves into one of the overview windows, the cursor changes to a square. Pressing the right mouse button in one of the overview windows copies an enlarged area of the image to the corresponding measurement window.



The Relative Orientation interactive measurement left and right overview and measurement windows

Relative Orientation Stereo Window

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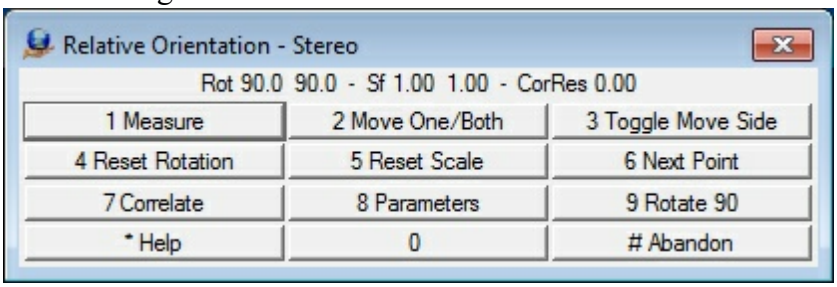
The Relative Orientation stereo window

Pressing MenuKeys button 6 in relative orientation switches measurement mode to stereo and clears the parallax at the point of interest.

The following controls are available in stereo:



The Relative Orientation stereo Menu Keys

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1 Measure
Measures the point in stereo and records the position on both images.

2 Move One/Both
Toggles the movement of the images from both moving to one moving. When the mode is set to one image moving then parallax can be cleared at that location.

3 Toggle Move Side
Toggles the image side while clearing the parallax.

4 Reset Rotation
Resets the current image rotation. See Rotating One Image below.

5 Reset Scale
Resets the current image scale to 1.0. See Scaling One Image below.

6 Next Point
Advances to the next point in relative orientation

7 Correlate
Locates a common point in the images.

8 Parameters
Allows setting stereo parameters.

9 Rotate 90
Rotates both images 90 degrees. This is useful to view stereo between strips because side by side overlap does not produce viewable stereo in this situation.

*** Help**
Displays help on additional key sequences for viewing features. The * keys is F10 on the system keyboard.

 # Abandon
Quits stereo mode and returns to the previous relative orientation layout.

Additional Features and Controls When in Stereo Mode

- **Changing the Cursor Color** – Roll the mouse wheel to change between cursor colors (green, red, black, white, yellow or blue).

- **Changing the Cursor Size** – Press and hold "Alt" and roll the mouse wheel.

- **Rotating One Image** – Press and hold "Shift" and move the mouse in the Y plane. This is useful when viewing images with high rotation angles (as occurs in images from two different strips/flight lines). This adjustment makes stereo viewing more comfortable in these situations. This motion is similar to the “Squint knob” or “Dove prisms” on analytical stereo plotters.

- **Scaling One Image** – Press and hold "Ctrl" and move the mouse in the Y plane. This is

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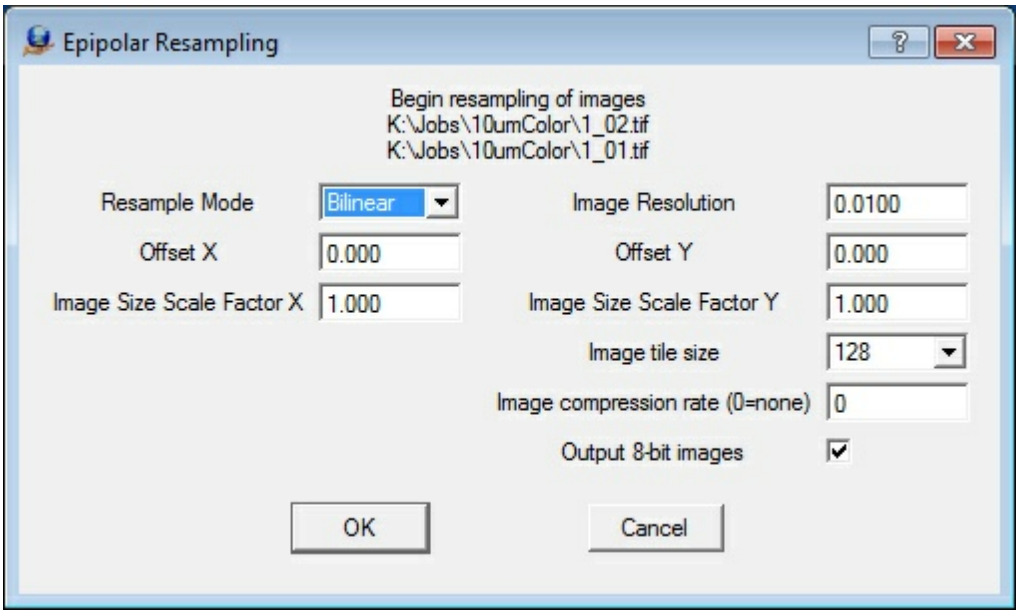
useful when viewing two images with different scales (as occurs in images from two different strips/flight lines). This adjustment makes stereo viewing more comfortable in these situations. This motion is similar to the independent zoom controls found on many analytical stereo plotters.

- **Zoom Up** – Press "Page Up". Also known as Zoom Out.
- **Zoom Down** – Press "Page Down". Also known as Zoom In.
- **Center Images** – Press "Home" to center both images at the current cursor location.
- **Load More Image** – Two image patches are used for stereo viewing. The edges of these image patches can be reached if the cursor moves great distances in the X or Y planes. Press "Home" on the system keyboard to load more image data around the current cursor location.
- **Disengage Cursor** – Press "Insert" on the system keyboard to disengage the stereo cursor, allowing operations to be performed with the mouse. Press the Insert key again to re-engage the stereo cursor.

Epipolar Resample (EpiRes)

Creates epipolar images of the current model. This step is normally included in the orientation process after relative orientation but may be used here if the step was skipped earlier.



The Epipolar Resampling parameter definition dialog

Resample mode

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Sets the resampling mode to create epipolar images: Nearest Neighbor, Bilinear, or Bicubic. These re-sampling modes affect the quality of the output image and the time it takes to create the epipolar images as follows.

- **Nearest Neighbor** - Fast re-sampling, lowest image quality. High contrast edges appear more jagged.
- **Bilinear** – Medium re-sampling speed, medium image quality. The image quality is softer than nearest neighbor and is normally acceptable for stereo viewing.
- **Bicubic** – Slow re-sampling, highest image quality. The image quality is the softest of the three methods. Commonly used to create orthophotos.

Image resolution
This field specifies the resolution of the epipolar images in millimeters, inches, or pixels as set in the Fiducial Units field in Edit Camera. For example, 12 microns would be entered as 0.012 millimeters. The resolutions of the epipolar images do need to be the same as the original images, though it is recommended. In cases where debugging a stereo model orientation and re-sampling is done multiple times while testing orientation parameters, it is useful to re-sample at a higher resolution such as 30 microns (0.030 millimeters) to obtain a stereo model quickly. "Over sampling" is a process to using a higher image resolution for the epipolar images. This results in a softer image but does not increase the model's accuracy and increases the size of the epipolar images.

Offset X, Offset Y
Sets the values by which to move the viewing center for the stereo model. Offsets are needed in close range photogrammetry due to high camera angles to the object being photographed. For aerial photogrammetry, these values are typically set to zero. See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Image size scale factor X, Image size scale factor Y
Sets the scale factors used to adjust the size of the area covered by the epipolar images. The area to be re-sampled is determined by the Photo Overlap setting. However, enlargement is sometimes necessary. These values are normally set to 1.0 (no scale factor). See View Relative Orientation 3D under the Orientation pull-down for a 3D graphical display of the image geometry.

Image tile size
Defines the epipolar image tile size. Options are "Do Not Tile", 64, 128, 256, 512, and 1024. Option "Do Not Tile" specifies non-tiled output files. 128 is the default.

Image compression rate (0=none)
Defines the JPEG compression rate from 1 to 100. Higher values lead to higher quality and larger file size. Lower values lead to lower quality and smaller files. A value of 0 indicates no compression.

Output 8-bit images
Specifies whether the output epipolar images will use eight bits per sample. If unchecked, the bits per sample of the original image will be used.

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Absolute Orientation (AbsOri)

After interior and relative orientations have been completed and epipolar images have been generated, a viewable stereo model is produced. Next, the model must be tied to a known ground control system. This is the "absolute orientation" of the model. To perform manual absolute orientation, at least three elevations and two horizontal positions must be known for photo identifiable positions in the model area.

NOTE: The absolute orientation stereo window is a static image window. The images are stationary below a moving cursor. The cursor may be well above or below the model surface. Using the "Home" key on the system keyboard can better the situation by placing the cursor at the same elevation as the window frame. Alternately, pressing "Mean Z" (MenuKeys button 6) drives the elevation to the average model elevation.

When driving the cursor to the ground surface using the wheel on the system mouse, hold "Shift" on the system keyboard to apply a x4 multiplier to Z movement.

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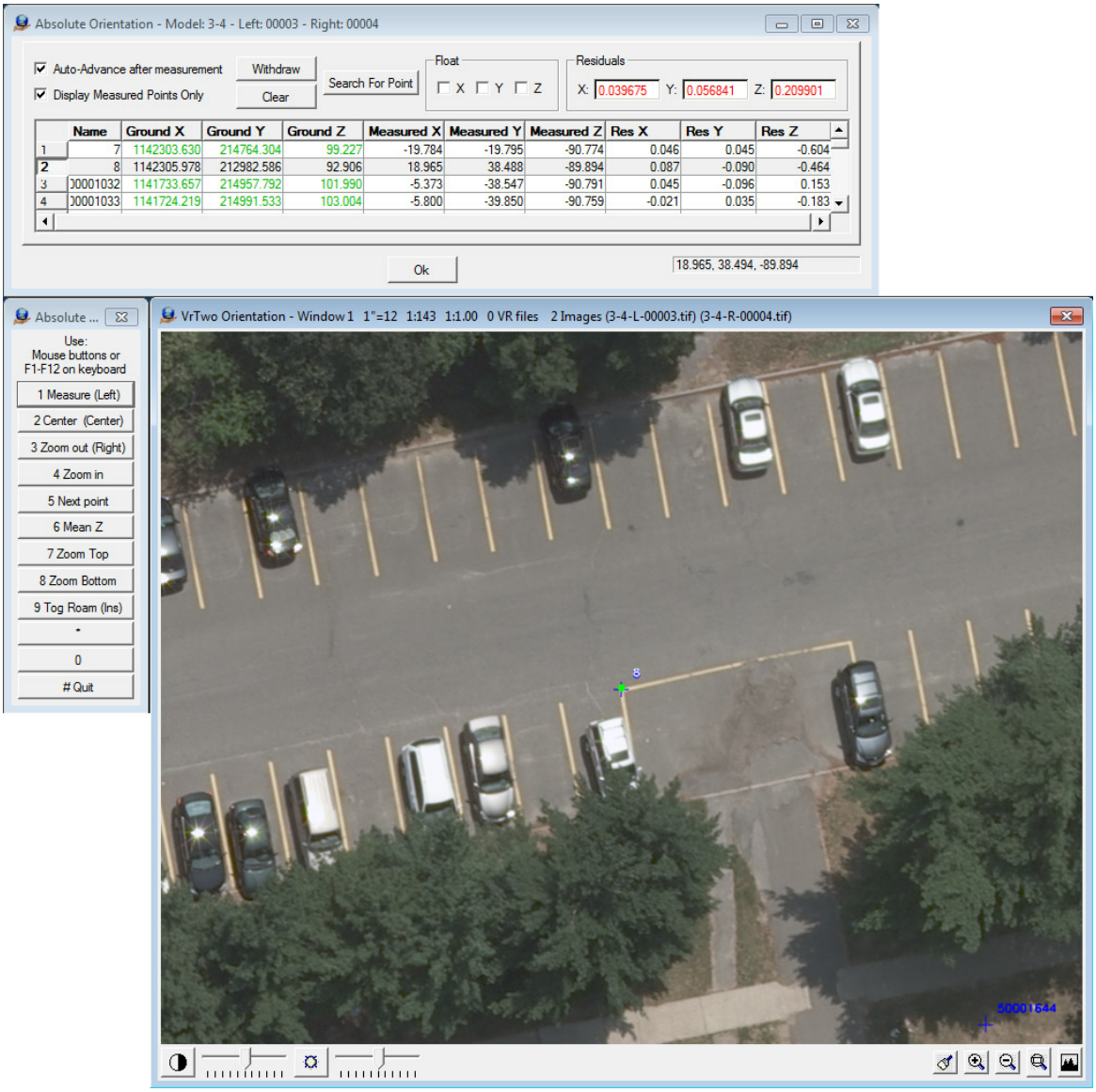

The Absolute Orientation interactive measurement environment

Three windows or dialog boxes are displayed during relative orientation.

Residuals – Displayed in the upper left corner. Shows the current residuals of the adjustment.

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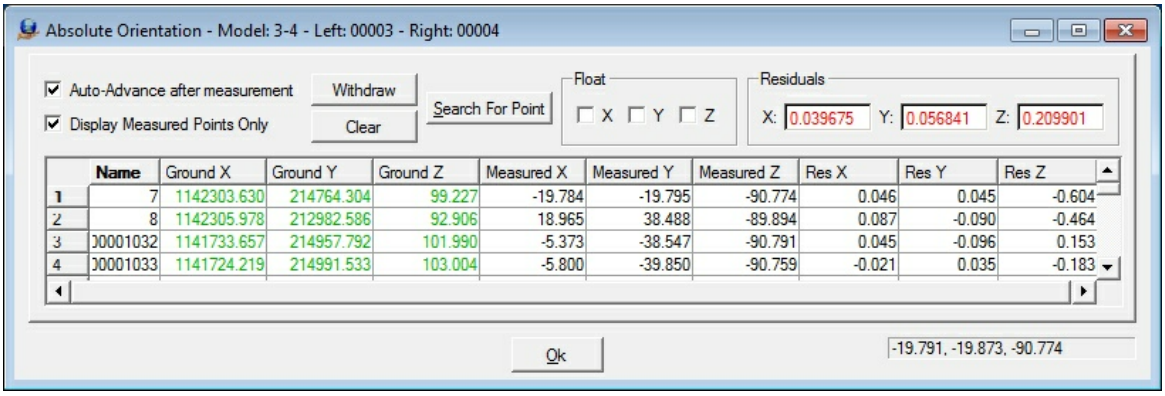
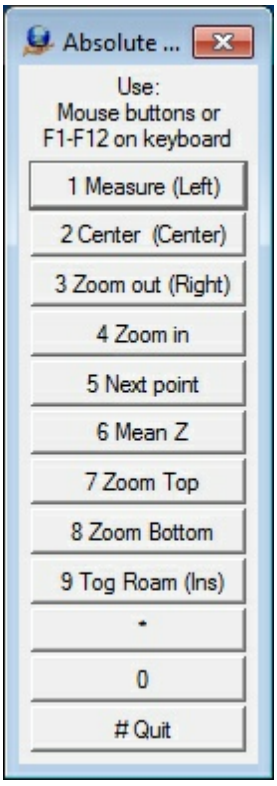


The Absolute Orientation interactive measurement control and results dialog

Drive to any point by clicking its sequence number. An axis from any point in the adjustment may be floated or taken out of the absolute orientation solution by driving to the point then checking its Float axis.

Menu Keys – Displays measurement controls. Buttons may be mapped to the mouse. Buttons may be engaged using their corresponding Function keys on the system keyboard (i.e. F3 to engage "Zoom out").



The Absolute Orientation Menu Keys

1 Measure (Left)

Measures absolute orientation observations. This is mapped to the left mouse button.

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2 Center (Center)
Centers the screen at the current cursor location. This is mapped to the center wheel on the mouse. The Home key on the system keyboard performs the same function.

3 Zoom out (Right)
Zooms out using the zoom scale factor specified in Preferences. This is mapped to the right mouse button. The Page Up key on the system keyboard performs the same function but zooms out at 2x increments.

4 Zoom in
Zooms in using the zoom scale factor specified in Preferences. The Page Down key on the system keyboard performs the same function but zooms in at 2x increments.

5 Next fiducial
Advances to the next fiducial.

6 Mean Z
Drives the elevation of the cursor to the average elevation of the model's control points. This can make it easier to place the Z in a reasonable location if the cursor is well above or below the model surface.

Measurement Window

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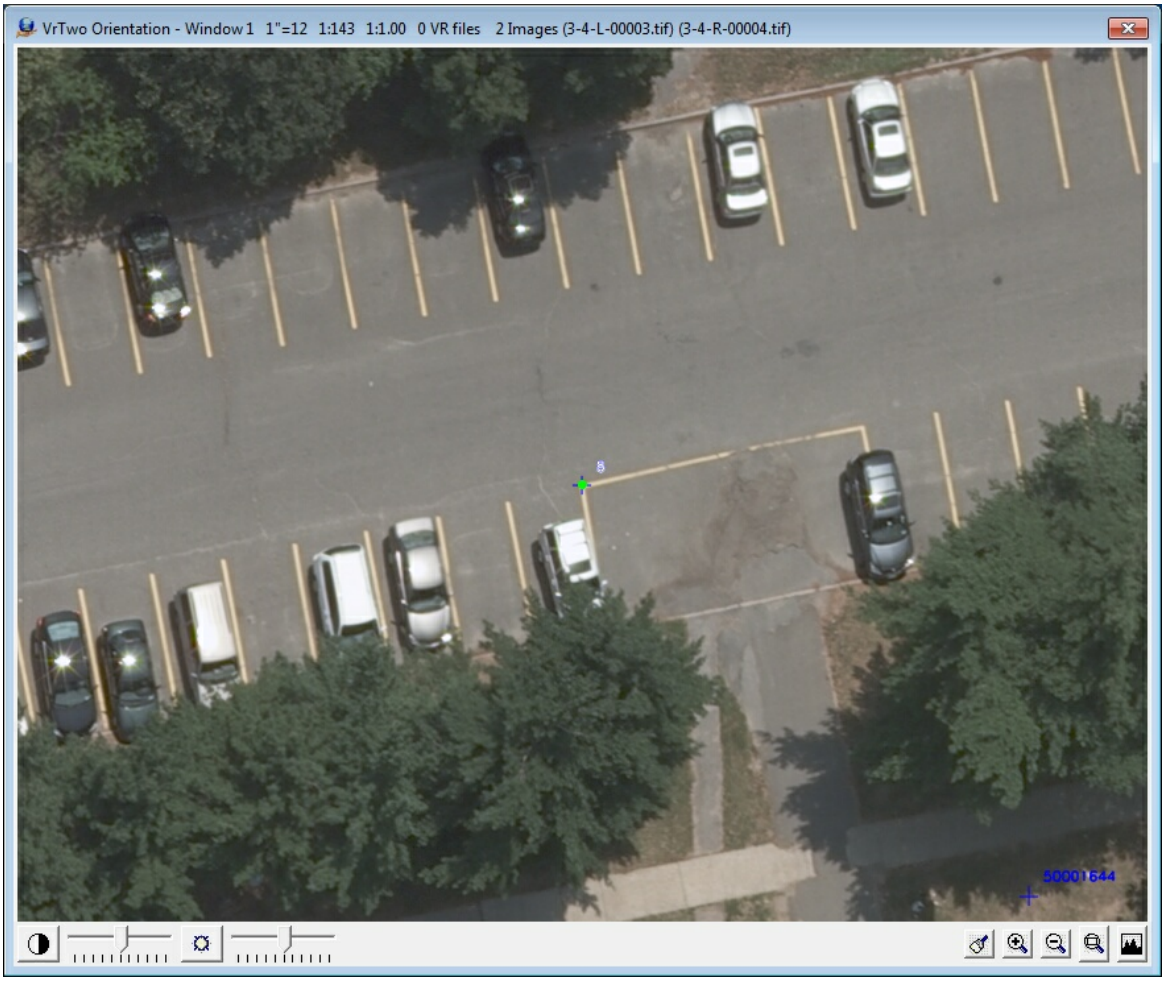

The Absolute Orientation interactive stereo measurement window

Three-dimensional view window used to measure control points.

Corner Interior Orientations (CorInt)

Computes the interior orientations of the current model images using their corners. This can be used to establish a generic interior orientation for images without fiducials or camera calibrations. When using this format, the Import orientation file parameter does not need to be defined.

NOTE: Corner Interior Orientations automatically sets the photo size in the current camera calibration definition (.cam) using the photo pixel size defined in Project -> Edit Project -> Define Images.

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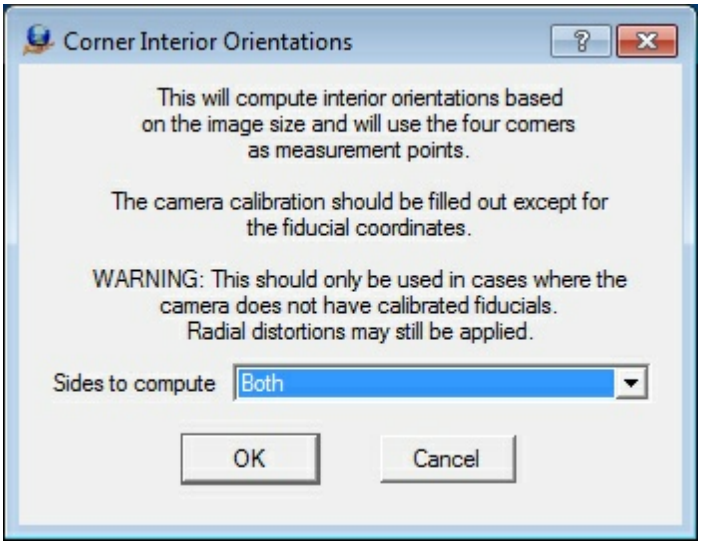

The Corner Interior Orientations dialog

Sides to compute
Defines the sides to compute (Both, Left, or Right).

View Relative Orientation 3D (VieRel)

Views the geometry of the stereo model and its interactions with the two images, focal lengths, the model areas, and the image angles and projections. This is useful to view stereo geometry for close range applications. Omega, Phi and Kappa angles in degrees, the Bx, By and Bz shifts in Fiducial Units, and the photo overlap are shown. Refer to File -> Preferences for preference parameters for the Relative Orientation 3D window.

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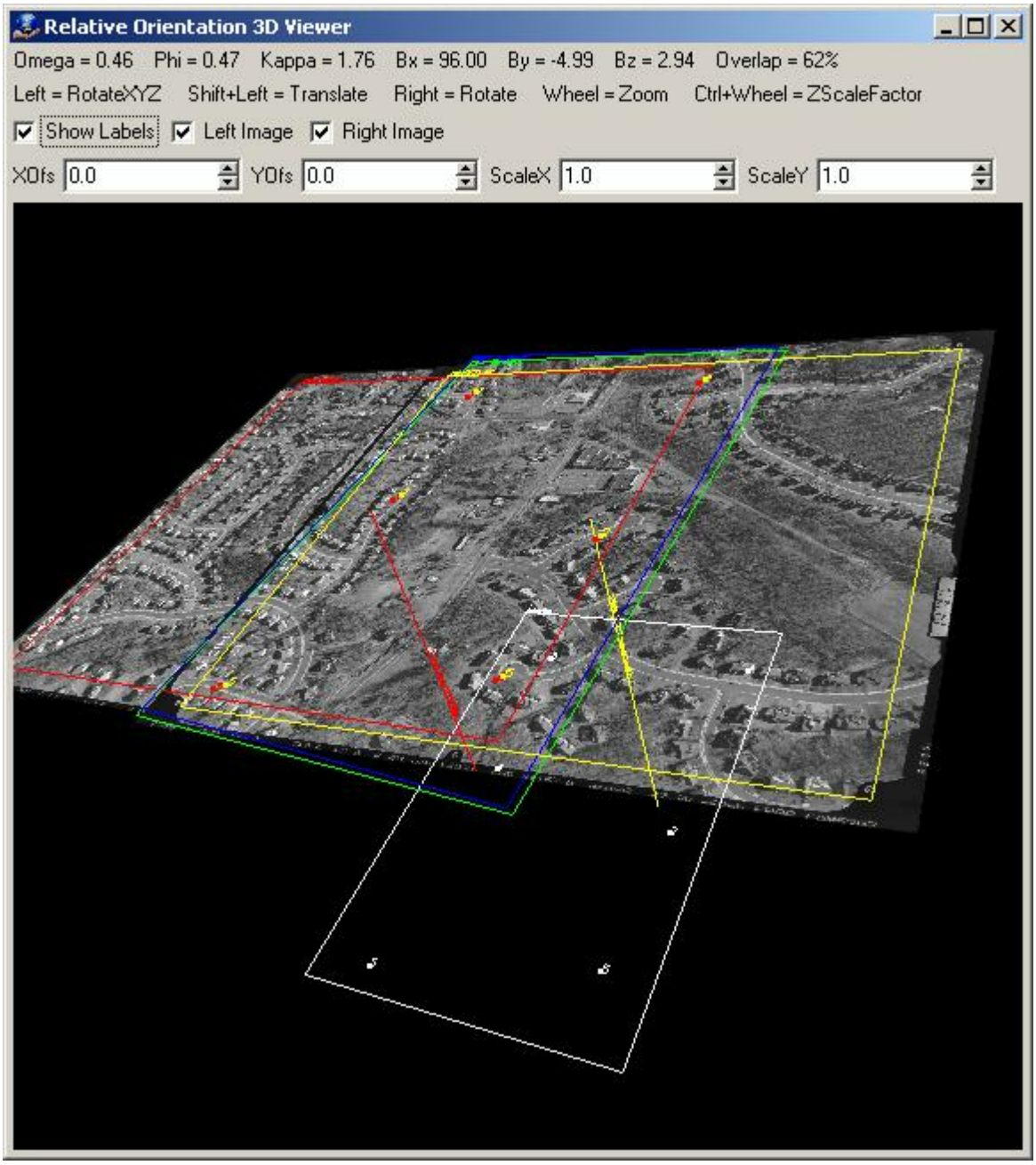

The Relative Orientation 3D Viewer

XOfs, YOfs

Graphically show the x and y offsets of the images to the stereo model plane. The stereo model plane is shown as a white rectangle. The offset values move the viewing center for the stereo model. This is necessary in close range photogrammetry, in which there are high camera angles to the object being photographed. For aerial photogrammetry, these values are normally set to zero.

ScaleX, ScaleY

Graphically show the x and y scale factors of the images to the stereo model plane. These scale

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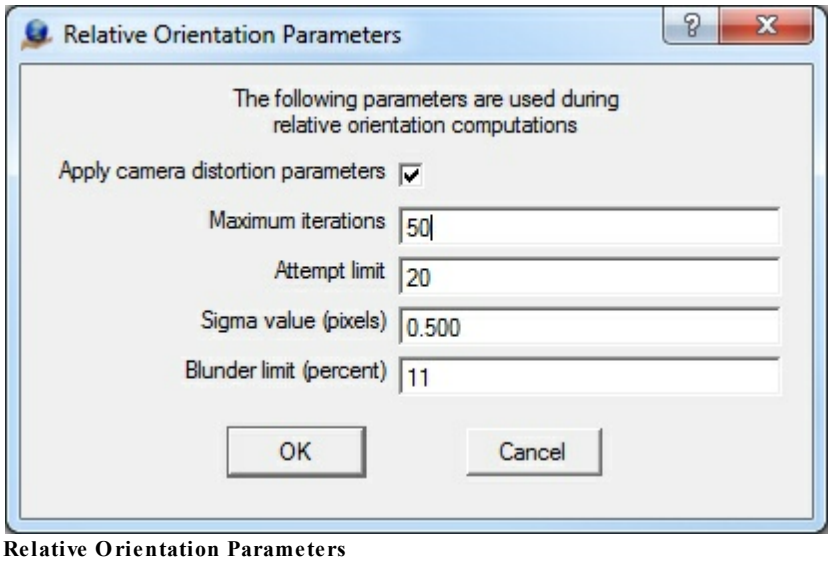
factors adjust the size of the area covered by the epipolar images. The area to be resampled is based on the Photo Overlap setting, but enlarging the image is sometimes required. These values are typically set to 1.0 (no scale factor).

Controls to rotate and manipulate the viewing of the 3D model are:

- **Rotate XYZ** - Press and hold the left mouse button to rotate the model about the X, Y and Z axis.
- **Translate XY** - Press and hold the Shift key on the system keyboard and the left mouse button to translate the model in the X and Y directions.
- **Rotate XY** – Press and hold the right mouse button to rotate the model about the view XY axis.
- **Zoom** – Rotate the mouse wheel to zoom in and out on the model.
- **Fast Zoom** – Press and hold the shift key on the system keyboard and rotate the mouse wheel to fast zoom in and out on the model
- **Z Scale Factor** – Press and hold the control (Ctrl) key on the system keyboard and rotate the mouse wheel to change the Z scale factor of the model.

Relative Orientation Parameters (RelPar)

Defines parameters used in the relative orientation solution.



Relative Orientation Parameters

Apply camera distortion parameters

Determines whether to solve the relative orientation using refined (pinhole) coordinates. (default = checked)

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Maximum iterations
Specifies the maximum number of iterations when seeking a solution. (default = 50)

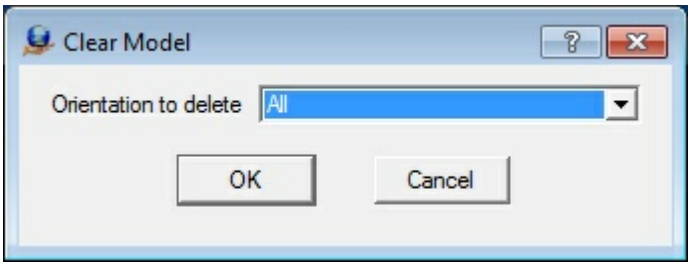
Attempt limit
Specifies the maximum number of attempts to find new/better solutions using different initial data sets. (default = 20)

Sigma value (pixels)
Specifies image measurement start deviation in pixels. (default = 0.5)

Blunder limit (percent)
Defines the maximum blunder point percentage in an acceptable solution. For example, a value of 11 (11%) would allow approximately one blunder point for every 10 points in the relative orientation adjustment. The range for this parameter is 0 to 100. [default = 11 (11%)]

Clear Current Model (CleMod)

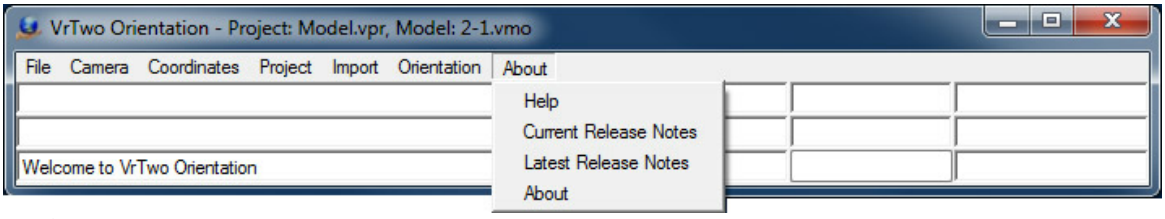
Clears all or part of the steps used in model orientation for the current model.



The Clear Model orientation dialog

Orientation to delete
Deletes orientation steps.

About



The About Menu

Help (Help)

Displays this VrTwo Orientation help document

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Current Release Notes

Displays the release notes that were delivered with the current release

Latest Release Notes

Displays the release notes from the Vr Mapping Software web site (www.cardinalsystems.net/help5/ReleaseNotes.html)

About (Abo)

Displays the current software version.



The About dialog showing version information

Reference

Left and Right Image Rotations

The two images that make up a stereo model may be in one of several supported rotation configurations. Images may be rotated 0, 90, 180 or 270 degrees, corresponding with strip locations of left, top, right and bottom. Images may be in normal or pseudo-overlap configurations and the stereo direction between image overlaps may in the X and/or Y directions.

When entering parameters for a camera calibration (.cam) file, the values should be entered with the strip direction to the left (0 degree rotation). These values would include the image size and the Calibrated Principal Point values. If rotated images are used to set stereo models, the camera values are defined with the strip location to the left. Image rotations are defined in Edit Project -> Define Images -> Strip Location. Projects may use multiple image rotation configurations but only a single camera calibration file.

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The following are examples of rotations for the left and right images and the resulting stereo model. A red square denotes the lower left corner of the un-rotated (strip location left) image. The examples below indicate most of the common rotations but do not show all the available combinations for image rotations. The unshaded area in each image shows the side that is displayed in stereo.

The model comes from an aerial triangulation solution. The stereo overlap was performed in the Y direction. The camera system used for this example produces un-rotated images with a longer X axis. Please refer to the project camera calibration report to determine the zero rotation (strip location left) orientations of the images for your project.

Left image: 3 - Right image: 4



Left strip location: Left / 0 degrees
Right strip location: Left / 0 degrees
Stereo overlap: -Y / down

Resulting Stereo Model



Stereo orientation: Normal

Left image: 3 - Right image: 4



Left strip location: Top / 90 degrees
Right strip location: Top / 90 degrees

Resulting Stereo Model



Stereo orientation: Pseudo

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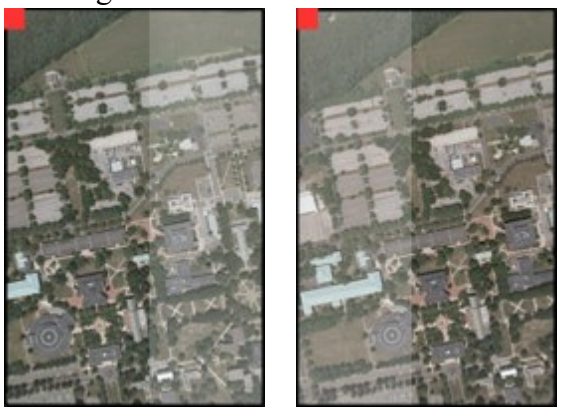
Stereo overlap: X Pseudo

Left image: 3 - Right image: 4



Resulting Stereo Model



Stereo orientation: Pseudo

Left strip location: Right / 180 degrees
Right strip location: Right / 180 degrees
Stereo overlap: +Y / up

Left image: 3 - Right image: 4



Resulting Stereo Model



Left strip location: Bottom / 270 degrees
Right strip location: Bottom / 270 degrees
Stereo overlap: X Normal

Stereo orientation: Normal

Left image: 3 - Right image: 4



Resulting Stereo Model

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Left strip location: Left / 0 degrees
Right strip location: Top / 90 degrees
Stereo overlap: X and Y





Stereo orientation: Normal

Left image: 4 - Right image 3





Left strip location: Top / 90 degrees
Right strip location: Left / 0 degrees
Stereo overlap: X and Y

Resulting Stereo Model





Stereo orientation: Normal

Vr Mapping Coordinate File Format

The Vr Mapping coordinate file (.cor) comprises a header and a list of point names, coordinates and optional weights. Fields may be arranged in several different orders. The coordinate file is an ASCII file and may be viewed with any text editor. Documentation about the file format is included in each file header. The following is a typical Vr Mapping coordinate file.

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```
# Coordinate File
# Layout  - Field Order              Min number of fields
#  0        NAME X Y Z CX CY CZ                 3
#  1        NAME Y X Z CY CX CZ                 3
#  2        X Y Z NAME CX CY CZ                 4
#  3        Y X Z NAME CY CX CZ                 4
#  4        NAME X Y Z                          3
#  5        NAME Y X Z                          3
#  6        X Y Z NAME                          4
#  7        Y X Z NAME                          4
#  8        X Y NAME                            3
#  9        Y X NAME                            3
#
# Format  - Coordinate format
# 0         State plane
# 1         UTM
# 2         Geographic Decimal Degrees
#
# SpZone  - State plane zone
#
# Datum   - Datum
# 0         NAD1927
# 1         NAD1983
#
# UtmZone - UTM Zone
# 1-60      UTM zone number
#
# Units   - Coordinate units
#  0        Us Foot
#  1        International Foot
#  2        Meters
#  3        Inches
#  4        Pixels
#
Layout  4
Format  0
SpZone  901
Datum   0
UtmZone 17
Units   0
#
       201   837831.194130   951352.037020   303.8200
       202   836399.079330   951266.642540   337.6800
       203   837994.618340   950634.951710   299.6000
       204   836711.670600   950565.198920   326.3200
       205   836018.411470   950724.804370   309.2900
```

Any record starting with a # symbol is considered a comment. The Layout is the most important keyword in the file as it specifies the order of the fields.

Importing a File to Use as a Vr Mapping Coordinate (.cor) File

Any ASCII file in the following format may be read by Vr Mapping. The file must have a .cor file name extension and the fields must be separated by one or more blanks or tabs. The f ollowing is an ASCII file that would be acceptable for use by Vr Mapping. It is formatted as point name followed by X, Y, and Z.

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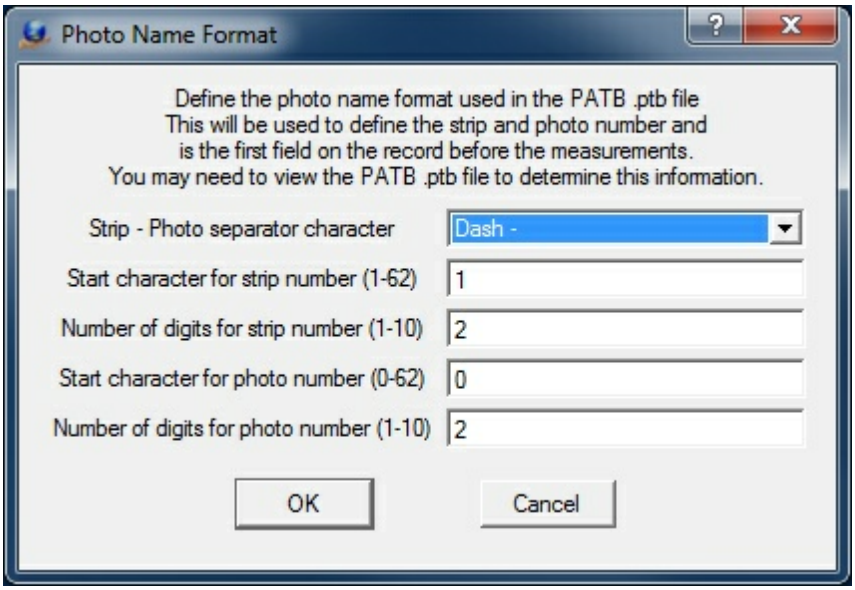
```
      35  1410993.867000   667652.883000   268.0300
      36  1421351.907000   670064.772000   251.8240
      37  1432756.960000   660002.435000   438.6740
      38  1426080.595000   651648.623000   417.5070
      39  1437426.118000   648649.673000   256.5350
   99999  1440539.957000   647417.838000   241.1880
 2727011  1410534.575000   658885.235000   294.5090
 2727012  1412335.275000   659061.598000   280.9620
 2727021  1410279.378000   661225.872000   260.6650
 2727022  1412458.095000   661055.148000   284.6200
 2727023  1413884.366000   661259.361000   425.0660
 2727031  1410433.453000   663554.024000   267.3830
 2727032  1412556.566000   663154.921000   244.1890
 2727033  1414464.428000   663015.598000   460.9970
```

Photo Name Format

Processes like aerial triangulation and model orientation use image strip and photo number. These numbers are typically encoded in the image file name. Photo Name Format describes the method for extracting this information.



The Photo Name Format dialog

Photo Name formatting parameters are Strip-Photo separator character, start character for the strip number, number of digits for the strip number, start character for the photo number, and number of digits for the photo number. If the separator character is used to describe the format, no further parameters are needed. If the file name does not have a separator character, the start character and number of characters must be used.

The photo separator character may be Underbar '_', Dash '-', or Tilde (~). The following are several examples of the Photo Name Format:

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```
Photo name:                          23-56.tif
Photo separator character:           Dash
Start character for strip number:    any
Number of digits for strip number:   any
Start character for photo number:    any
Number of digits for photo number:   any
Strip number:                        23
Photo number:                        56

Photo file name:                     23056.tif
Photo separator character:           None
Start character for strip number:    1
Number of digits for strip number:   2
Start character for photo number:    3
Number of digits for photo number:   3
Strip number:                        23
Photo number:                        56

Photo file name:                     23056.tif
Photo separator character:           None
Start character for strip number:    1
Number of digits for strip number:   3
Start character for photo number:    4
Number of digits for photo number:   2
Strip number:                        230
Photo number                         56
```

2.10 Vr Image Utility

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Image Utility

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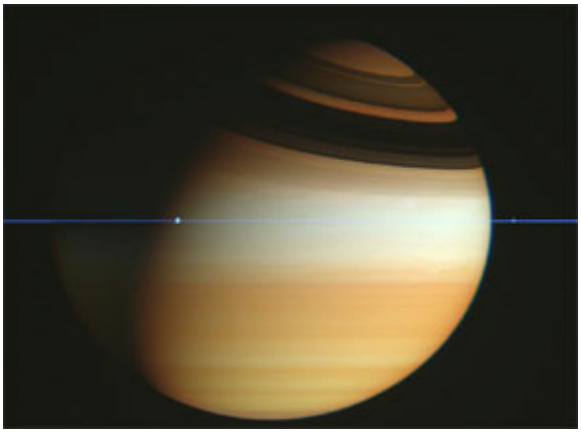

Image Utility contains many useful image functions. It should be the starting point for projects which use VrTwo Orientation, VrOrtho, or VrAirTrig software. Image Utility provides the following main features:

- Image settings management (assigning camera settings, strip locations, and name formats).
- Inner Orientation in manual and automatic modes.
- Camera file creation and editing.
- Batch image rotations in 90 degree intervals.
- Batch image pyramid creation.
- Batch image format conversion.
- Image Pixel size computation.

Vr Image Utility Documentation

2.10.1 Documentation

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Vr Image Utility

Type: Stand-alone application (imageutil.exe)

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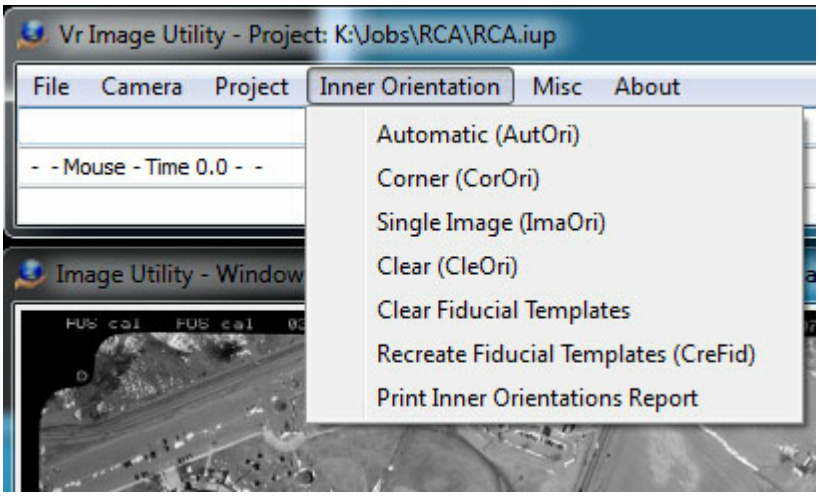
Vr Image Utility provides functions to facilitate management and preparation of images for the Vr Mapping environment.



Overview

- Image Utility Basics
- Using Image Utility

File

- Preferences (Pre)
- Open Image Viewer (OpeImv)
- Exit (Exi)

Camera

- New Camera (NewCam)
- Edit Camera (EdiCam)
- Edit Radial Distortions

Project

- New Project (NewPro)
- Open Project (OpePro)
- Edit Project (EdiPro)
- Change Project Location (ChaLoc)

Inner Orientation

- Automatic (AutOri)
- Corner (CorOri)

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Single Image (ImaOri)
Clear (CleOri)
Clear Fiducial Templates (CleFid)
Recreate Fiducial Templates (CreFid)
Print Inner Orientations Report (PriInn)

Misc
Compute Pixel Size (ComPix)
Rotate Images (RotIma)
Apply Levels Adjustment (AppLev)
Convert Images (ConIma)
Strip Pyramids (StrPyr)
Create Pyramids (CrePyr)
Convert Exterior Orientation File (ConExt)

About
About (Abo)

Overview

Image Utility contains many useful image functions. It should be the starting point for projects which use VrTwo Orientation, VrOrtho, or VrAirTrig software. Image Utility provides the following main features:

- Image settings management (assigning camera settings, strip locations, and name formats).
- Inner Orientation in manual and automatic modes.
- Camera file creation and editing.
- Batch image rotations in 90 degree intervals.
- Batch image pyramid creation.
- Batch image format conversion.
- Image Pixel size computation.
- Exterior Orientation format conversion.

Image Utility Basics

The Vr Image Utility program starts by opening the Main Window and the Image Viewer Window.

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The Vr Image Utility environment showing the Main Window and the optional Image Viewer window

Starting an Application (Command)

Start commands by selecting an item from a dropdown menu. Alternatively, start commands with a key-in using the command name.

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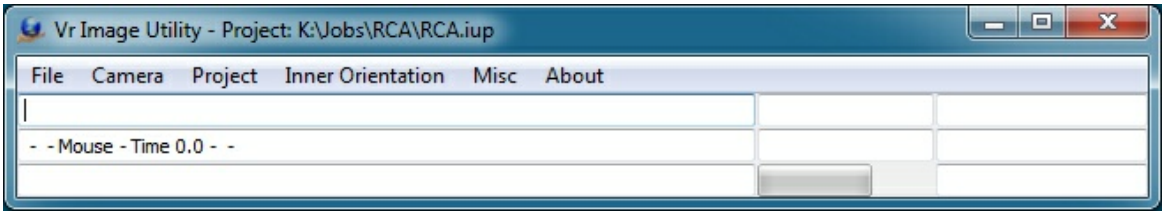
The Main Window



The Vr Image Utility Main Window

The Main Window in Vr Image Utility contains the command pull down menus, a key-in area, two information areas, a progress bar, and the coordinate display. Enter commands in the key-in area. The active project's name is shown in the Main Window's border.

The Image Viewer Window

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The Vr Image Utility Image Viewer window

The image viewer window allows any image in the current project to be quickly reviewed. Directly below the image, a drop-down box contains a list of all of the images in the current project. Select any image from the list to display it. In addition to the view control icons at the bottom of the image preview window, the standard VrOne zoom keys (PgDn, PgUp, Home, etc.) can change the view.

Close the image viewer window at any time by selecting the close icon in the upper right corner. It may be opened again using the Open Image Viewer (OpeIma) command or by selecting File -

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> Open Image Viewer pull-down.

Using Image Utility

Some of the Vr Image Utility features require a project to be defined; others are miscellaneous utilities that work without a project. A project in Image Utility comprises a list of images and camera files. The "Edit Project" command and all commands under the "Inner Orientation" pulldown require a defined project. None of the commands under the Misc. pull-down menu require a defined project.

Image Utility should be the first program used when setting up a new job for VrOrtho, VrAirTrig, or VrTwo Orientation software. A typical work flow for creating an ortho photo could be:

1. Obtain raw images.
2. Run Image Utility.
3. If no camera file exists for images, create a camera definition file using Camera -> New Camera.
4. Create a new Image Utility project using Project -> New Project. The project editor dialog should be displayed.
5. Add the camera definition file to the list of project cameras.
6. Add all images to the project and define the correct strip location, pixel size, and image name format for each image. **NOTE**: Image name format is only important if using VrAirTrig.
7. Perform inner orientation on all images using Inner Orientation -> Automatic or Inner Orientation -> Single Image commands. **NOTE**: At least one image per strip location must be measured manually before using Automatic mode.
8. Run VrOrtho.
9. Create a new project.
10. Define standard VrOrtho project parameters and import the Image Utility project file. VrOrtho will recognize the image settings and inner orientations completed using Image Utility.
11. Define ortho areas for the Images.
12. Create ortho output images.

File

Edits program preferences, opens the Image Viewer, and exits the program.

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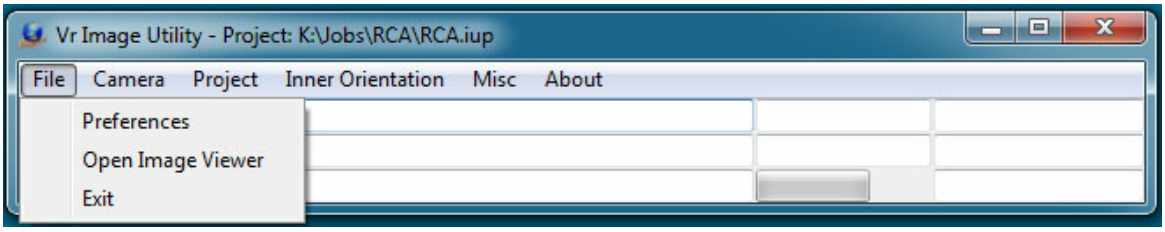
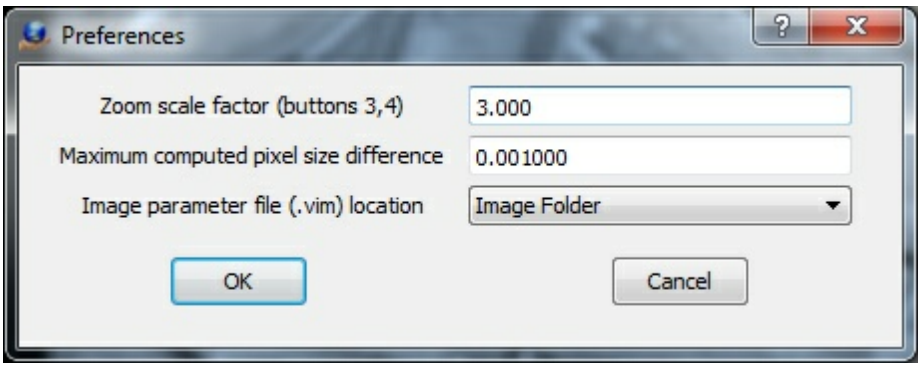


The Vr Image Utility File menu

Preferences

Sets operating parameters.



The Preferences dialog box

Zoom scale factor (buttons 3, 4)

Sets the scale factor to use while zooming in and out.

Maximum computed pixel size difference

Defines the maximum difference between the computed pixel size and the entered pixel size without a warning being displayed upon exiting Interior Orientation.

Image parameter file (.vim) location

Each image used in the Vr Image Utility program has an associated parameter (.vim) file. This file contains the interior orientation values and other image parameters. The image parameter file has the same name as the image but has a .vim file extension. These parameter files may be stored in the same directory as the images ("Image Folder") or they may be stored in the project folder ("Project Folder").

Open Image Viewer

Opens the Image Viewer window if it is not currently displayed.

Exit

Exits The Vr Image Utility program.

Camera

Creates and edits camera calibration parameters.

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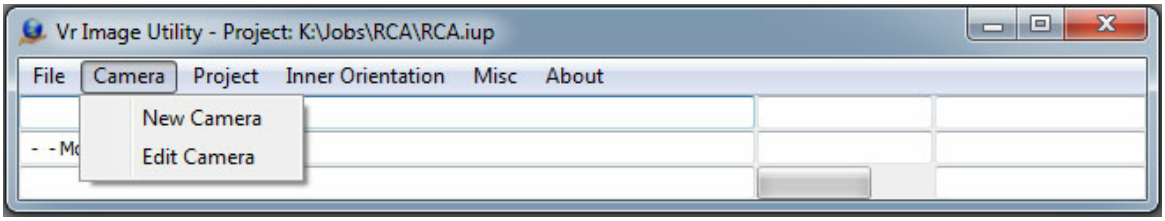


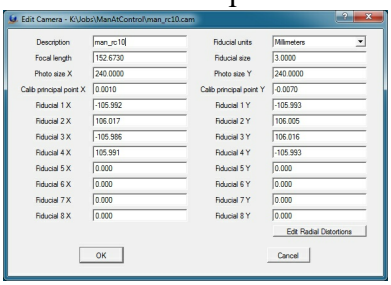
The Vr Image Utility Camera menu

New Camera (NewCam)

Creates and edits a new camera calibration file. Prompts the user for the new camera's file name. Camera files in Vr Mapping have the .cam file name extension.

Edit Camera (EdiCam)

Edits an existing camera calibration file. The edited camera does not need to be one of the current cameras. Any existing camera file may be edited. When edit camera starts, it prompts the user for a camera file name. Upon exiting, the user has the opportunity to save the modified camera calibration parameters.



The Edit Camera dialog box

Description

Describes the camera for user reference. This description is for information only and is not used in model orientation.

Fiducial units

Specifies the units of the coordinate positions (millimeters, inches, or pixels). Many programs used to calibrate handheld cameras output the focal length of the camera in pixels. The coordinates entered to represent the fiducial positions must be in the same units as those specified here.

Focal length

Defines the camera lens' focal length, the distance from the focal point to the center of the lens. This value is provided by the camera calibration report. Focal length units should be the same as those used for the fiducial positions.

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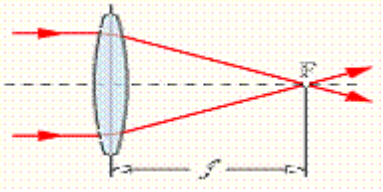

Photo size X Y
Specifies image dimensions. Photo size dimensions should be the same as those used for the fiducial positions.

Calib principal point X Y
Specifies the calibrated principal point (also known as the point of best symmetry). This coordinate position is available from the camera calibration report. Calibrated principal point coordinate units should be the same as those used for the fiducial positions.

Fiducial X Y
The coordinate positions for up to eight fiducials may be entered and must be in the user-specified Fiducial units. Most aerial cameras have eight fiducials. It is strongly recommended that all eight be entered and used to compute interior orientation. If only four fiducials are used, errors may occur and make residuals useless in determining if the wrong camera calibration was selected.
Lens distortion causes image positions to be displaced from their ideal or true locations. In aerial cameras, these distortions are normally minimal but they can still have an effect on accuracy. Some digital cameras have large lens distortions and radial distortions must be entered for accurate mapping results.

Adjustment mode
Most camera calibration programs output radial distortion values as polynomial parameters. Though angular parameters are listed, this output type is currently unsupported.

Distance Parameters
Radial distortions, represented by concentric rings about the camera lens' calibrated principal point, may be entered as distance parameters. The radial distortions shown below are from a small format camera and show high radial distortion values.

Edit Radial Distortions

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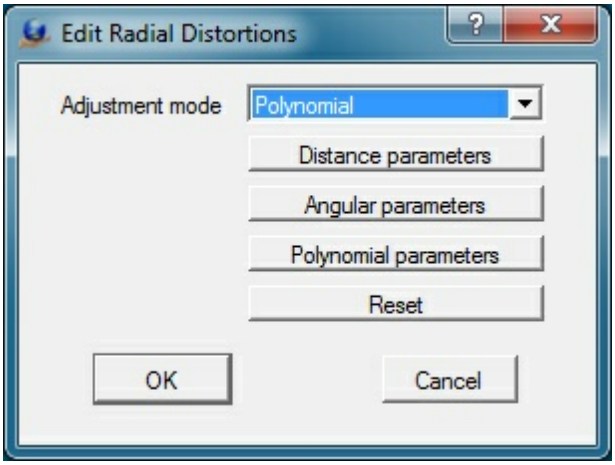

Lens distortion causes imaged positions to be displaced from the ideal or true locations. In aerial cameras these distortions are normally minimal but can still have an effect on accuracy. Some of the digital cameras have large lens distortions and radial distortions must be entered for accurate mapping results.

Adjustment mode

There are two methods of representing radial distortions which are by distance or with polynomial values. Most camera calibration programs output radial distortions values as polynomial parameters. Note that Angular parameters are listed as an option as one of the adjustment modes but this method is currently unsupported.

Distance Parameters

Radial distortions that are represented as concentric rings about the camera lens calibrated principal point may be entered as distance parameters. The radial distortions shown below are from a small format camera and show high radial distortion values.

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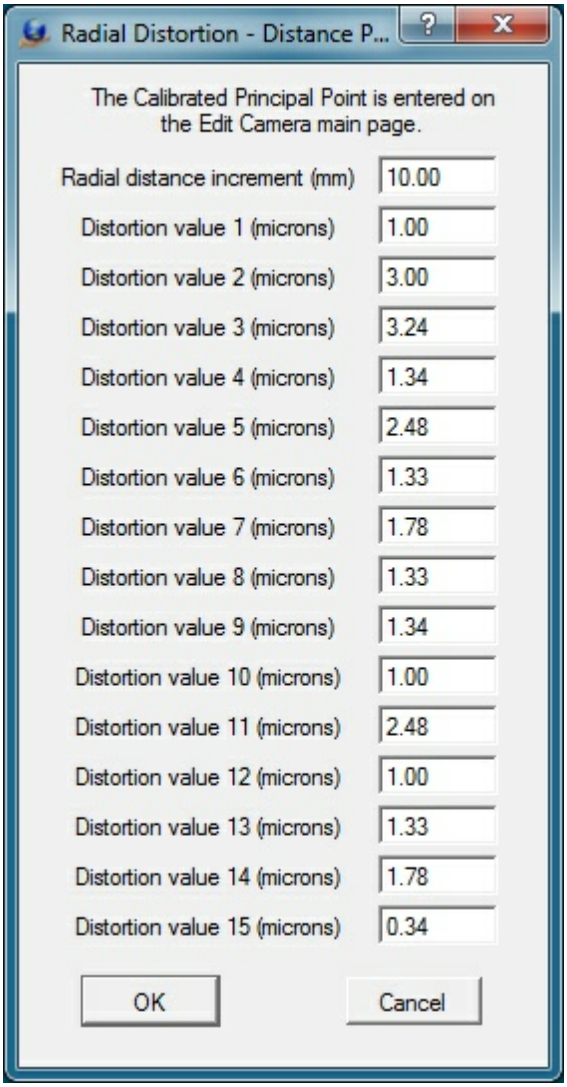

Defining radial distortions by distance

Radial distance increment

Represents the distance between the concentric rings that make up the distance parameters. Radial distance increment units should be the same as those used for Fiducial positions.

Distortion value n

Specifies distortion values for each distance. There may be up to 15 values. Distortion value units should be the same as those used for Fiducial positions.

Angular Parameters

Computation of radial distortions by angular parameters is currently unsupported. Please use distance or polynomial parameters.

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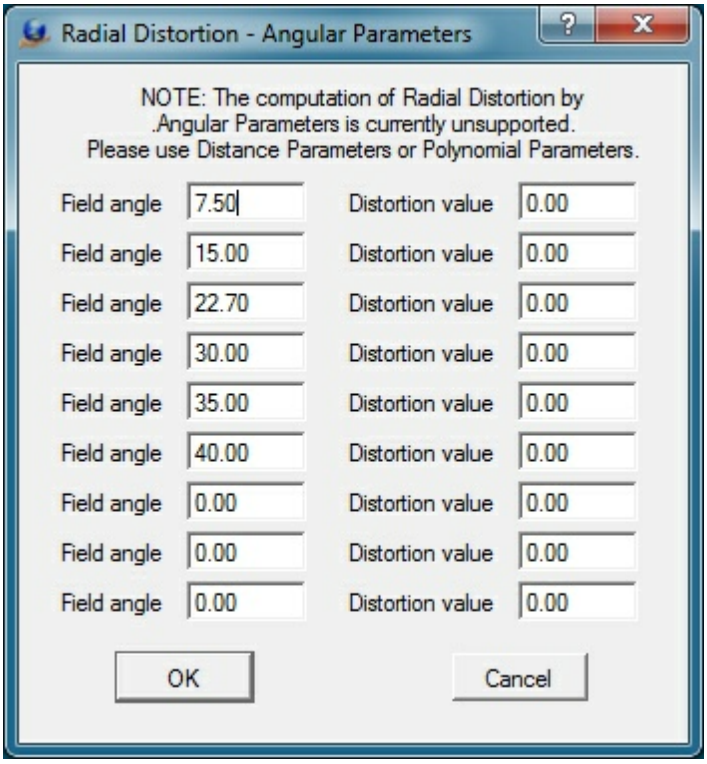

Defining radial distortions by angle

Polynomial Parameters

The polynomial values and principal point or autocollimation are provided by the camera calibration report. The mathematical model used is based on the Simultaneous Multi-camera Analytical Calibration (SMAC) method. Care should be taken when entering these parameters, as entry errors cause model orientation errors and distortions which affect model accuracy.

Entry of Exponential Notation

The k0-k4 values and the p1-p4 values are entered into the Polynomial Parameters dialog box in exponential notation. The values entered from the USGS camera calibration report may have the decimal place moved one position to the left depending on the number entered. For example:

```
USGS value:  0.1403x10-3
Value typed:  .1043e-3
Shown value: 1.403000e-004
```

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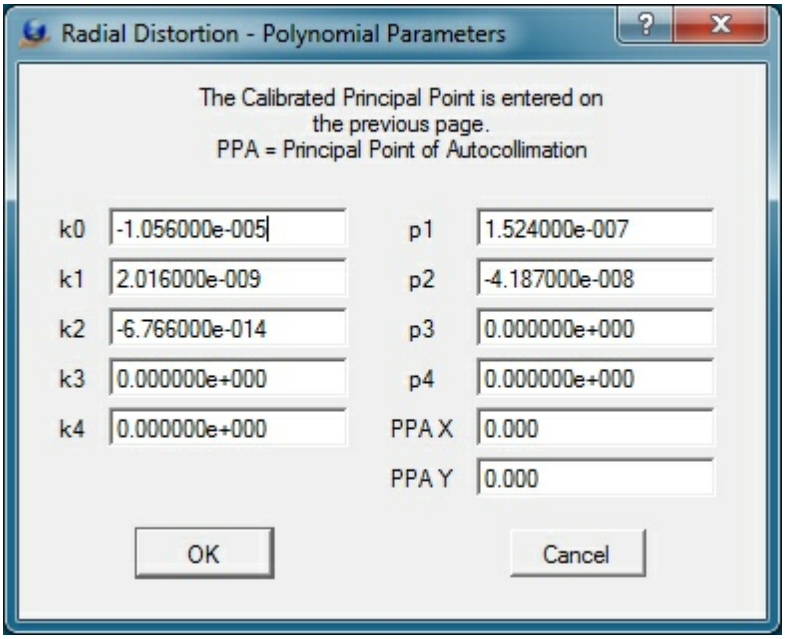


The Radial Distortions dialog box for entering the polynomial parameters

K0-K4

Defines up to five K coefficient values. These are coefficients of symmetric radial lens distortion from the camera calibration report. These values are entered in exponent form.

P1-P4

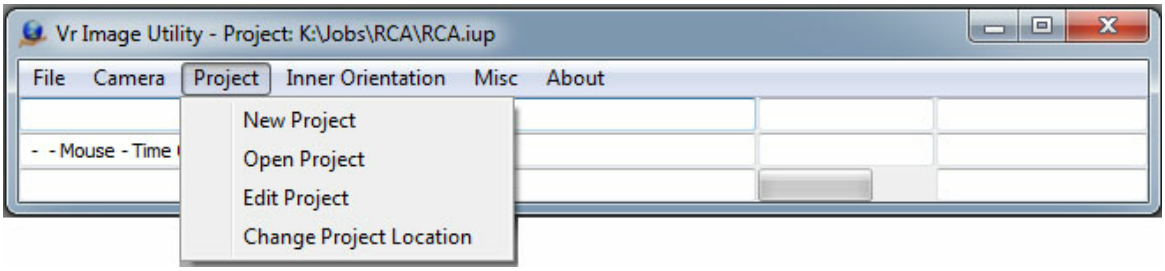
Defines to four P coefficient values. These are the coefficients of de-centering distortion from the camera calibration report. These values are entered in exponent form.

PPA X Y

Defines the principal point of autocollimation as provided by the camera calibration report.

Project

The Project menu is used to manage projects and project parameters.



The Vr Image Utility Project menu

New Project

Creates a new project.

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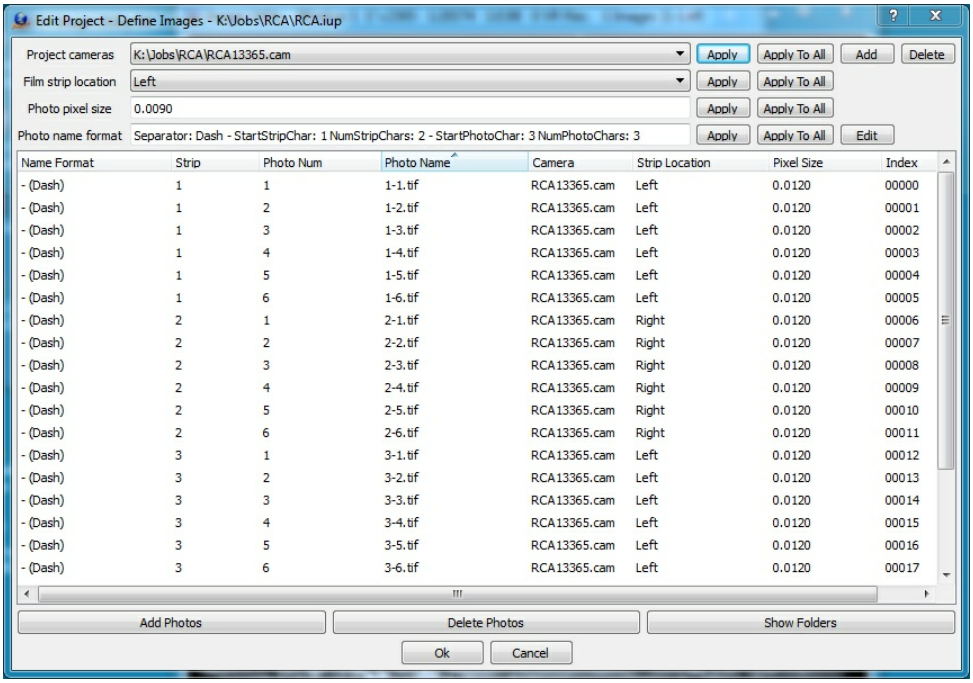
Open Project

Opens an existing project.

Edit Project



The Edit Project dialog box

The Edit Project dialog box allows all images to be added to the project and defined. Pressing "Add Photos" displays a dialog to select and add photos to the project. Pressing "Delete Photos" deletes all highlighted photos. Pressing "Hide Folders" hides the folder locations of the image and camera names. The "Hide Folders" button will change to "Show Folders" when pressed. It then can be used to display the folder locations again.

To define a setting for all images, set the appropriate value and press "Apply To All" next to the setting. To define a setting for individual images, highlight the images first, then press the "Apply" next to the setting. The currently-defined settings are applied to new photos as they are added to the project.

Project cameras

Multiple cameras may be defined for a project. Use "Add" to add cameras to the project (the camera definition file must already exists). Use "Delete" to remove the highlighted camera from the project. Up to ten camera (.cam) files may be defined for a single project.

Film strip location

Sets the location of the camera's data strip in reference to the rotation of the image. This parameter is not dependent on the direction of flight, but rather on the orientation of the image as

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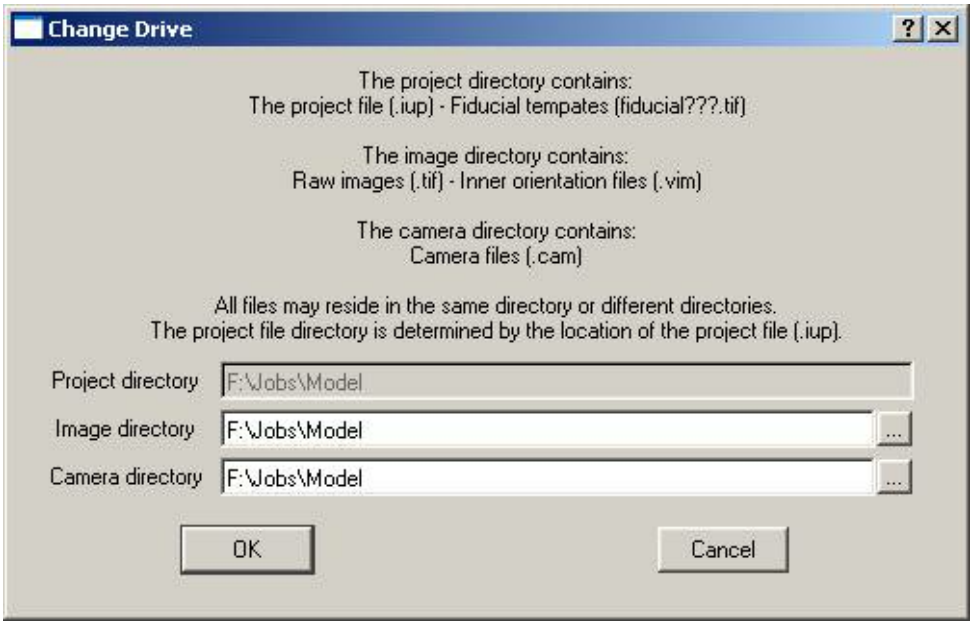
viewed by the user. See Film Strip Location.

Photo pixel size
Sets the size of each pixel based on the fiducial coordinate units. This is normally expressed in millimeters, but may be in inches or pixels. If the fiducial coordinate units are "pixels",the photo pixel size must be 1.

Photo Name Format
Determines the format for and initial position of pass points. See Point Name Format for more information.

Change Project Location

Changes the project file locations when project files are moved from one directory or drive to another. A dialog displays, allowing an existing Vr Image Utility project file to be selected. Once the file is selected, the following dialog is displayed.



The Vr Image Utility Change Drive dialog box

Project Directory
Shows the current project directory.

Image directory
Defines the location of the directory containing the images for the project.

Camera directory
Defines to location of the directory containing the camera files for the project.

Inner Orientation

Inner (Interior) Orientations may be performed using several methods in Vr Image Utility. These

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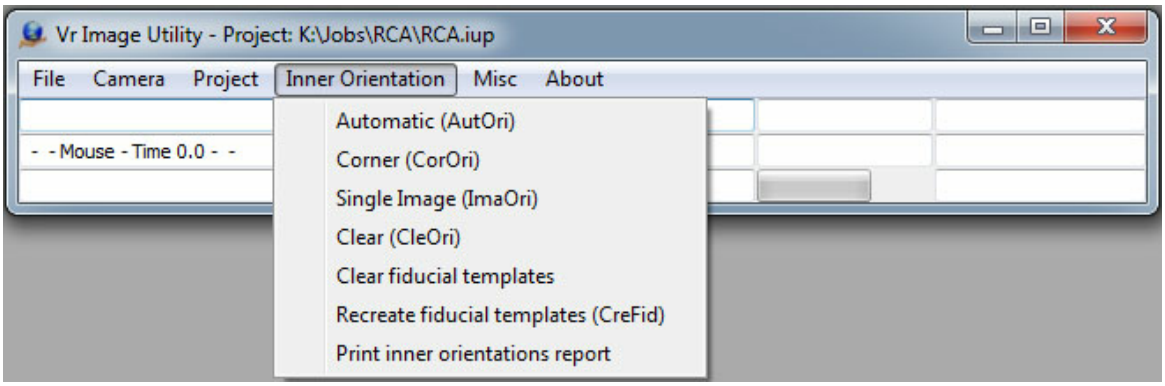
methods include:

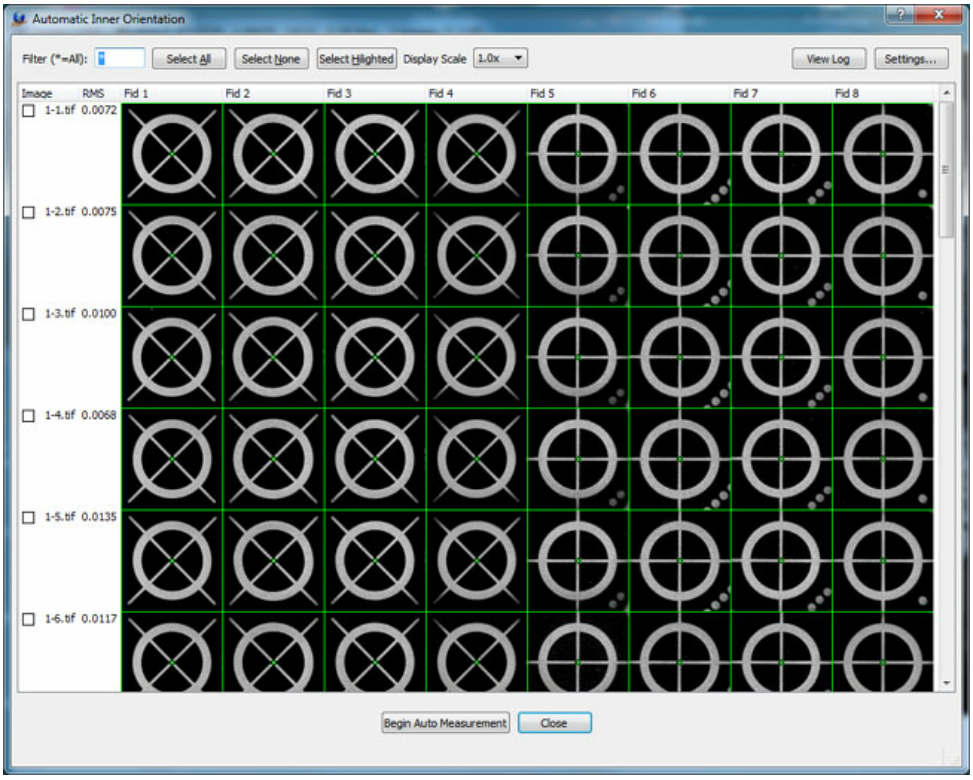
- **Automatic** - Fiducials are found on each image and the Interior Orientation is computed automatically.
- **Corner** - Fiducials are determined from file size parameters. Use for images without fiducials or reseau points.
- **Single Image** - Fiducials are measured manually on a single image.



The Vr Image Utility Inner Orientation menu

Automatic (AutOri)

Finds the fiducials on each image and automatically computes the orientations.



The Automatic Inner Orientation dialog box

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Displays all images in the current project in a table format with one image per row. Each row displays the image name, total RMS value, and the fiducials numbered from 1 to 8.

If a fiducial has been measured, depending on viewing settings, it will either show the fiducial image with a green x indicating the measured location or the RMS x and y error values. If a fiducial has not been measured, it will display “Not Measured” if there is a template available for the fiducial, or “No Template” if no template has been created. Templates are created automatically when a manual inner orientation is performed on an image.

If an image has been measured, the total RMS displays to the left of the fiducial display. This number is red if the RMS exceeds the "Maximum allowed RMS value". (See Settings)

The filter entry controls which images are displayed. For example, a filter of 01* would only show images that start with the characters “01”.

Press “Begin Auto Measurement” to begin measurement of all images that are currently selected. There are several ways to select images.

1. Use the checkbox beside an image name to toggle that image.
2. Single click an image name to highlight the image. Highlighting a single image then shift-clicking on another image name will select a range of images. Ctrl-clicking on an image name will toggle that image. Once all desired images are highlighted, they can be selected using the “Select Highlighted” button.
3. The “Select All” button checks all images.

Once measurement has started, the fiducial display areas are updated as the measurements are taken. All measurements are recorded to the vrautoinner.log file.

Fiducial images may be displayed at a variety of scales using the Display Scale drop-down. 1.0x, 2.0x, 4.0x, and 8.0x are available.

Press “View Log” to display the measurement reporting log file using the Windows Notepad program

Settings

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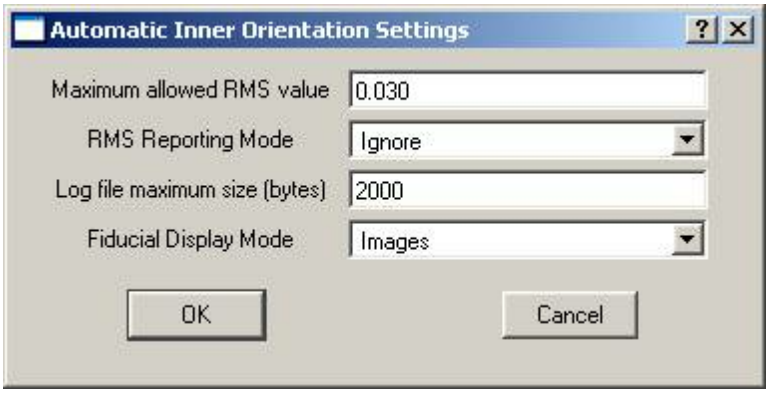

Maximum allowed RMS value

Sets the value above which any RMS figures are displayed in red. They may also be flagged in the report file depending on the Reporting Mode option.

RMS Reporting Mode

Sets the RMS reporting mode to one of three values:

- **Ignore** - Log measurement normally.
- **Log error and continue** - Flag the measurement as being over the tolerance and continue measuring fiducials.
- **Log error and stop** - Flag the measurement as being over the tolerance and stop measuring fiducials.

Log file maximum size (bytes)

When fiducials are measured, the results are written to a log file in the project directory. This file is named vrautoinner.log. To keep the file from growing to an unreasonable size, you can specify the largest file size allowed. If the log file exceeds this size, it is renamed vrautoinnerlast.log and a new vrautoinner.log is started.

Fiducial Display Mode

Sets the Fiducial Display Mode to “Images” or “RMS Values”. On large jobs, using RMS Values can make it easier to scroll through the image table.

Corner (CorOri)

Used on digital images that contain neither fiducial marks nor reseau points. The fiducial coordinates are determined from the Photo Size X and Photo Size Y parameters.

A dialog box displays to set automatic Corner Inner Orientation on one or more images in the current project.

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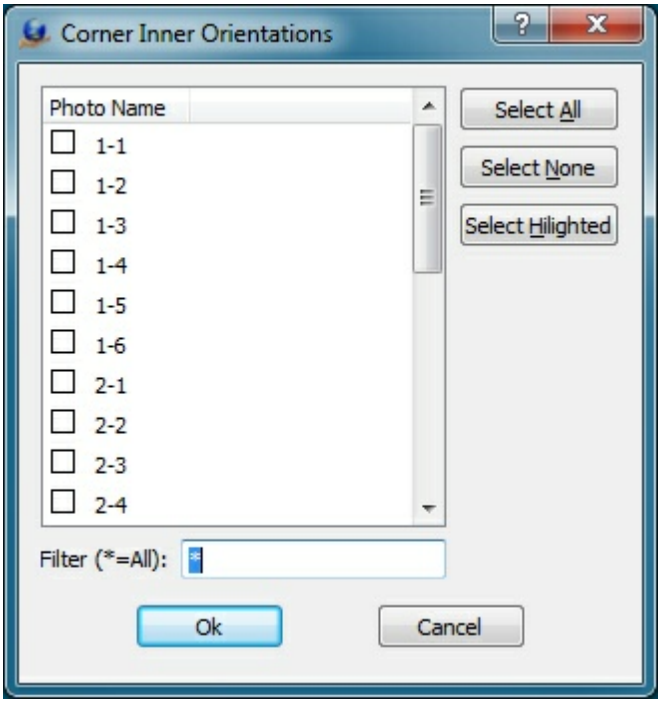

The Corner Inner Orientations dialog box

After the images are selected, press "Ok" to compute the corner inner orientations.

Single Image (ImaOri)

Manually measures an image's fiducials. This can also be used to check and edit existing measurements. The routine starts by displaying the following dialog box, which allows a single image to be selected for manual inner orientation.



The Single Image Inner Orientation is the same process as the Interior Orientation used in VrTwo Orientation. See VrTwo Orientation - Relative Orientation.

Clear (CleOri)

Clears the Inner Orientations of one or more images in the current project.

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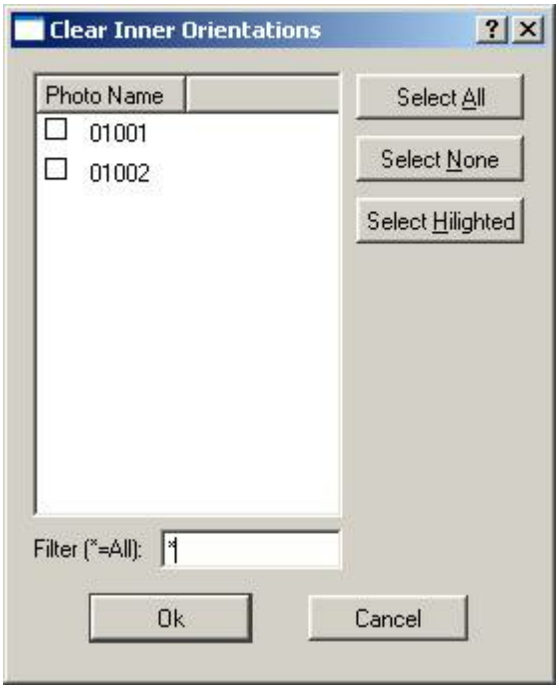

Clear Fiducial Templates

Fiducial templates can be cleared for each photo strip location. Vr Image Utility maintains one set of fiducial templates for each image strip location per project directory. In order to replace the templates for a particular image strip, they must be cleared with this option. One one image must then be manually measured using Single Image Inner Orientation.



Recreate Fiducial Templates (CreFid)

The Recreate Fiducial Templates uses a single image that has already been measured to recreate fiducial templates. Once the image is selected, the fiducial templates are created using the measurements taken on the fiducials for that image. This is useful if you have changed the fiducial template size in the camera definition file and would like new templates to be created without re-measuring any fiducials.

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Print Inner Orientations Report

Prints the Inner Orientation of a image or group of images. These parameters are read from existing Vr Mapping Image parameter files (.vim). Prompts the user for an output file in which to place the results. The operator can identify the .vim files to use for the report.

The following is an example of the output from this routine.

```
# Inner Orientations Measurements and Residuals
# Filename: c:\Texas\Houston.txt
# 16-Jul-2009 17:38:01
#
Photo K:\Jobs\RCA\1-1.vim
    #        Mea X        Mea Y         Res X        Res Y
    1     941.2325   18627.9156       -0.0092       0.0050
    2   18706.5974    1053.0597       -0.0028       0.0051
    3    1036.1506     958.0597        0.0015      -0.0052
    4   18614.0494   18724.7403        0.0111      -0.0085
    5     489.5974    9790.1766        0.0100      -0.0003
    6   19159.6987    9890.9532       -0.0053       0.0026
    7    9873.9273     505.8416       -0.0011      -0.0010
    8    9774.3688   19175.9532       -0.0042       0.0022
Result: Ok

Photo K:\Jobs\RCA\1-2.vim
    #        Mea X        Mea Y         Res X        Res Y
    1     940.2325   18628.9156       -0.0132       0.0014
    2   18701.5974    1049.0597       -0.0077       0.0027
    3    1031.1506     958.0597        0.0044      -0.0006
    4   18614.0494   18720.7403        0.0112      -0.0070
    5     486.5974    9791.1766        0.0097      -0.0043
    6   19157.6987    9886.9532       -0.0020       0.0006
    7    9868.9273     503.8416       -0.0006       0.0000
    8    9774.3688   19173.9532       -0.0018       0.0073
Result: Ok

Photo K:\Jobs\RCA\1-3.vim
    #        Mea X        Mea Y         Res X        Res Y
    1     952.2325   18643.9156       -0.0025       0.0069
    2   18709.5974    1058.0597        0.0040       0.0084
    3    1036.1506     973.0597       -0.0062      -0.0070
    4   18626.0494   18731.7403        0.0082      -0.0135
    5     495.5974    9806.1766        0.0161      -0.0030
```

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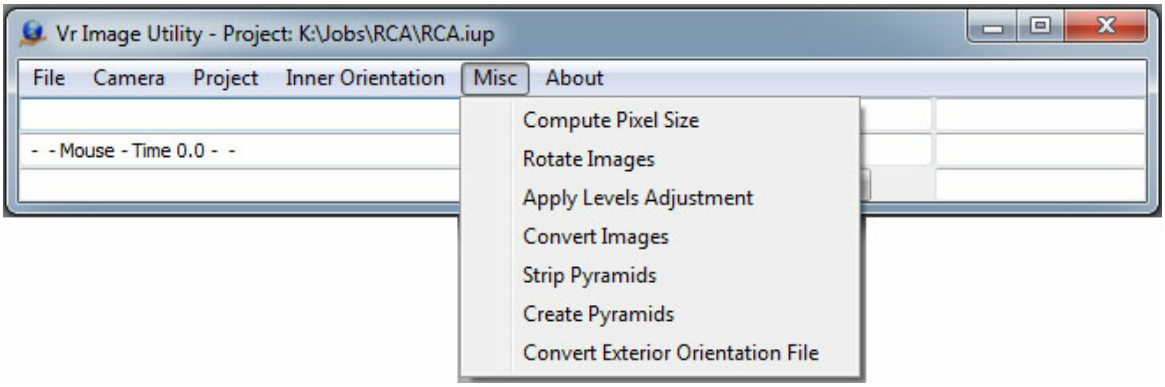
```
    6   19167.2164    9896.6830       -0.0038       0.0018
    7    9874.9273     515.8416       -0.0042      -0.0006
    8    9785.3688   19186.9532       -0.0117       0.0070
Result: Ok
```

Misc

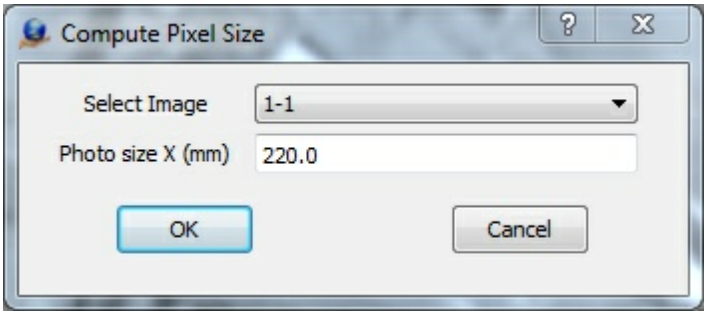
Provides various image and image support routines.



The Vr Image Utility Miscellaneous menu

Compute Pixel Size

Computes the approximate pixel size of an image based on the size of the photo in pixels and a user-defined photo size. Displays the image size in pixels, the pixel size in millimeters, and the resolution of the image in "Dots per Inch" (DPI).



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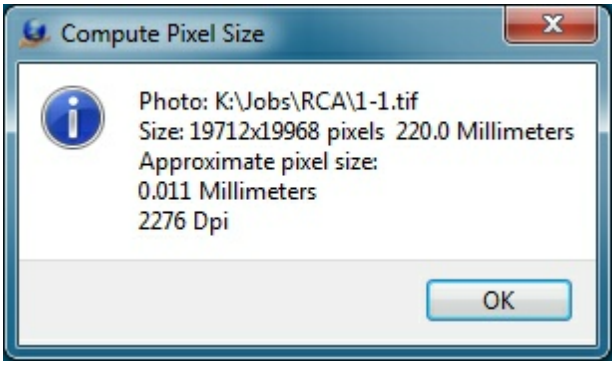
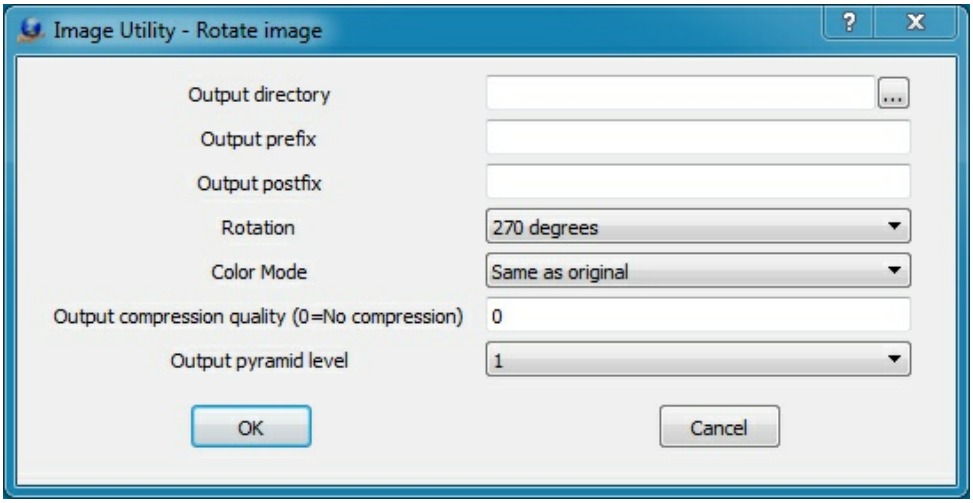


Rotate Images

Rotates images 90, 180 or 270 degrees. This operation can be performed on a single image or a group of images.



Output compression quality is only used if the input image is a JPEG file

Output directory

Specifies directory into which to place rotated files. If this field is left blank, the output files will be placed in their original directories, overwriting the original files.

Output prefix

Defines a character string to be prepend to each output file name. This field may be left blank.

Output postfix

Defines a character string to append to each output file name. This string is placed after the file name and before the file name extension. This field may be left blank.

Rotation

Sets the angle of rotation to 90, 180, or 270 degrees.

Color Mode

Defines the output color mode:

- **Same as original** – The output image uses the same color mode as the input image.

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- **Greyscale** – The output image uses grayscale color mode.
- **RGB** – The output image uses RGB color mode.
- **YCbCr** – The output image uses YCbCr color mode.

Output compression quality (0=No compression)
If the input image is compressed, this setting controls the compression quality of the output image as a value from 1-100. Higher values mean higher quality and less compression. For ECW/ JPEG2000 images, this field represents an approximate compression ratio. If 0 is entered, output images are written uncompressed. **NOTE**: It is recommended that rotations be performed on original uncompressed images. Rotations on compressed images involve un-compressing and re-compressing the image, resulting in some image quality loss.

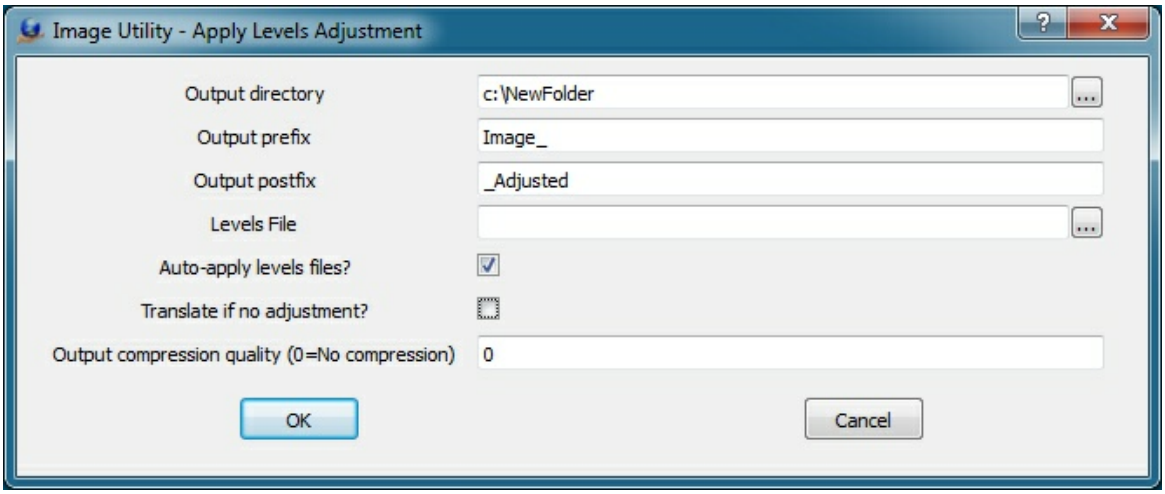
Output pyramid level
Images may be output at a reduced resolution by selecting an Output Pyramid Level greater than 1.

Once the rotation parameters are defined, the Open Files dialog displays and one or more images may be chosen for rotation. If images are to be written back to the original file, it is recommended that these files be backed up before rotation.

Use this dialog to select all images to be rotated. The images are written back to the original file, so it is recommended a backup be made before running this routine.

Apply Levels Adjustment

Applies levels adjustment to a group of images. A single levels adjustment file may be applied to all of the images. Alternately, separate levels files may be automatically applied to each image.



Output directory
Specifies the output directory for the new images. If this is left blank, the output directory is the same as the input image directory.

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Output prefix
Specifies output prefix. The string entered here is prepended to all output image names.

Output postfix
Specifies output postfix. The string entered here is appended to all output image names.

Levels File
Defines file from which to take level adjustment parameters. This may be either a Photoshop .alv file saved from the Levels adjustment dialog or a .lvl file produced by VrOne or GIMP. This can be left blank if the "Auto-Apply levels files" is on.

Auto-apply levels files
If this is on and an image has a matching .lvl file, the .lvl file is used when applying the levels adjustment (overriding the Levels file entered above). The .lvl must have the same base filename and must be in the same directory as the image.

Translate if no adjustment
If this is on, the files will be translated even if the levels adjustment results in no changed to the image. This is useful if Auto-apply is engaged and some images have adjustment files and others do not, but all images should be copied to the output directory.

Output compression quality (0=No compression)
Controls the compression quality of the output image if the input image is compressed. A value from 1-100 may be entered. Higher numbers reflect higher quality and less compression. For ECW/JPEG2000 images, this field represents an approximate compression ratio. If 0 is entered, output images are written uncompressed. **NOTE**: It is recommended that rotations be performed on original uncompressed images. Rotations on compressed images involve un-compressing and re-compressing the image, resulting in some image quality loss.

Convert Images

Converts a group of images to a different format or name. File name pre/postfixes can be added, planar configurations can be changed, file type and color modes can be altered, compression can be added, and file size can be modified.

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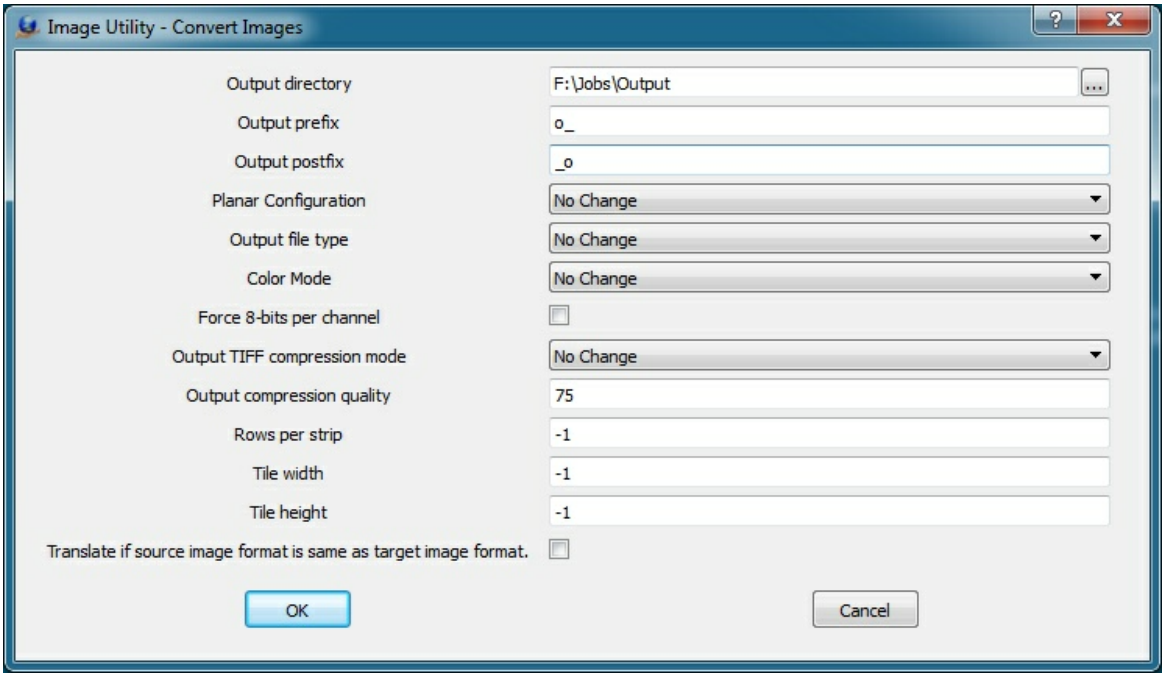

Output directory
Specifies the output directory for the converted images. If this is left blank, the output directory is the same as the input image directory.

Output prefix
Specifies output prefix. The string entered here is prepended to all output image names.

Output postfix
Specifies output postfix. The string entered here is appended to all output image names.

Planar Configuration
Determines planar configuration of the output file. The options are:

- **No Change** - The output image contains the same planar configuration as the input file.
- **Contiguous (pack samples contiguously (RGBRGB...)** - The output image uses the Contiguous planar configuration.
- **Separate (store samples separately (RRR...GGG...BBB...)** - The output image uses the Separate planar configuration.

Output file type
Specifies output image file type:

- **No Change** - The output image's file type is the same as the input file's.
- **Tiff Scanline (uncompressed)** - The output image is a standard uncompressed TIFF file.
- **Tiff Strip** - The output image is a TIFF file using image strips (either compressed or uncompressed).
- **Tiff Tiled** - The output image is a TIFF file using image tiles (either compressed or

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uncompressed).

- **Jpeg** - The output image is a JPEG image.
- **JPEG2000** - The output image uses JPEG2000 compression.
- **ECW** - The output image is an ECW image.

Color mode
Specifies the output image color mode:

- **None** - The output image's file type is the same as the input file's.
- **Grayscale** - The output image is grayscale
- **RGB** - The output image is RGB color

Output compression mode:

Specifies the output compression mode:

- **No Change** - The output image's compression mode is the same as the input file's.
- **None** - The output image is not be compressed.
- **Jpeg** - The output image uses JPEG compression.

Output compression quality
Sets quality setting for JPEG compression on an output image. This is a value between 0 and 100. Higher values mean higher quality but larger file size. Compressing files multiple times or un-compressing files and re-compressing them again will result in image quality loss.

Rows per strip
If images are output in "Tiff Strip" mode, this number controls the number of rows per strip. If -1, the number of strips per row in the input image is used. A default of 16 is used if the input image is not in Strip mode.

Tile width
If images are output in "Tiff Tiled" mode, this number controls the width of each tile. If -1, then the width of tiles in the input image is used. A default of 128 is used if the input image is not in Tiled mode.

Tile height
If images are output in "Tiff Tiled" mode, this number controls the height of each tile. If -1, then the height of tiles in the input image is used. A default of 128 is used if the input image is not in Tiled mode.

Translate if source image format is same as target image format
If not checked, no translation is done if the source image format matches the target image format. This can help prevent images from being compressed multiple times.

Strip Pyramids

Takes a group of images with embedded pyramid images and removes them from the embedded pyramid images. If the images are using compression, the original image will be re-compressed,

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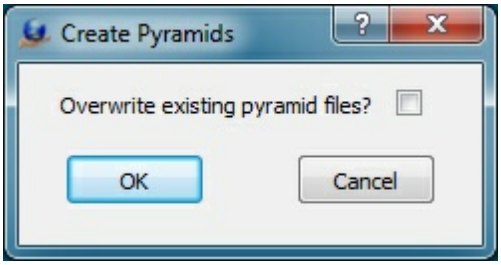
so there may be some image quality loss.

Create Pyramids

Creates image pyramid files on one or more images. VrOne automatically creates image pyramid files when new images are opened. This allows image pyramids to be created for large groups of images before opening them in VrOne. Image pyramids are created either as external files or internal sub images based on the settings in Vr Configuration.



Overwrite existing pyramid files?

If checked, new pyramid files will be created for all selected images, even if they already exist. This parameter is considered only in the image pyramids are to be created as external files and not included in the original image.

Once the single parameter is defined, the Open Files dialog is displayed and one or more images may be chosen for image pyramid creation.

Convert Exterior Orientation File

Converts an Exterior Orientation file from one EO format to another supported EO format. The foloowing Exterior Orientation format are supported:

- ALBANY
- Applanix
- PATB
- JFK
- AeroSys
- ISAT EO file
- BINGO
- ISAT ‘photo’ file
- MATCH-AT

See Exterior Orientation File Formats for more information about the supported Exterior Orientation formats.

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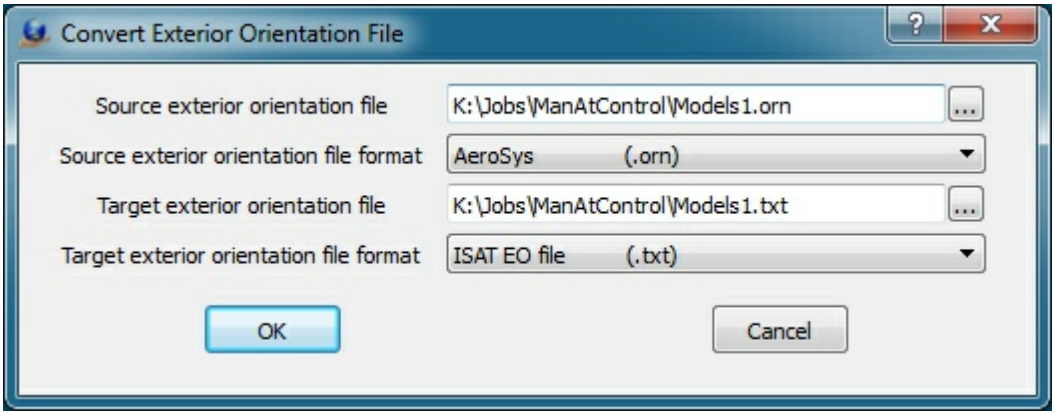


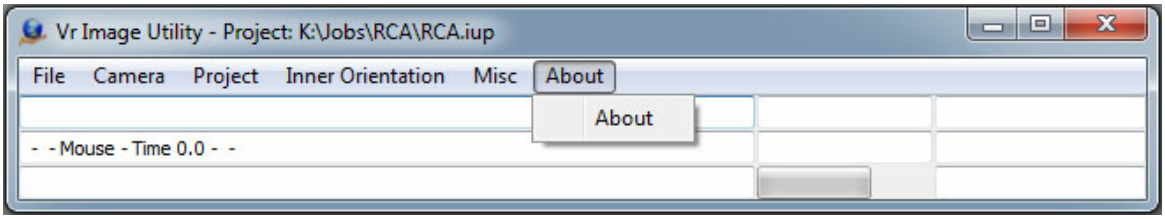
Source exterior orientation file
Defines the source or input file name.

Source exterior orientation file format
Defines the source or input orientation file format.

Target exterior orientation file
Defines the target or output file name. This file name must be different than the source exterior orientation file name.

Target exterior orientation file format
Defines the target or output orientation file format.

About



The Vr Image Utility About menu

About

Displays a dialog box showing the current version number and release date and software build (32-bit or 64-bit).

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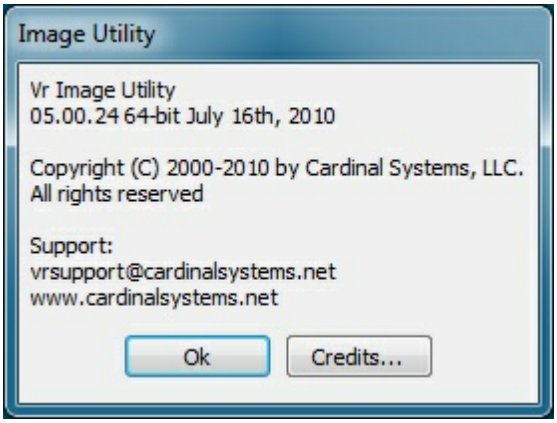

Credits
Displays the copyrights of the third party software used by Vr Mapping.

2.11 Vr Licensing

Vr Mapping

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Vr Licensing

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Description

The following information describes the licensing for Vr Mapping version 6 and above. Licensing methods and obtaining a license file are also discussed.

Choosing A Licensing Method

The License File

Obtaining A License File

Finding the ComputerName and HostId on Windows 10

Finding the ComputerName and HostId on Windows 7

Choosing A Licensing Method

There are two licensing options available for Vr Mapping.

- **Cloud-based floating license (recommended)**
  A number of licenses for multiple Vr Mapping programs are shared among a larger number of computers. In this configuration, the license server is on the cloud and accessed via an internet connection thus allowing licenses to "float". Vr Mapping can run on any computer with an internet connection.

  The cloud server does not run on a Cardinal Systems server but is maintained by a company specializing in cloud-based solutions for hosting license servers. The cloud-based floating license configuration is a good solution for companies that have multiple locations and/or situations where users work remotely or from home. A single license (.lic) file is provided and

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is placed in the license folder (typically C:\vr\license) of each computer with the Vr Mapping software.

A customer portal is available when using the Cloud-based floating license method. License usage may be monitored which details the use of each licensed product including the user and computer name. The status of the server may be viewed along with the ability to restart the server. Log files may be viewed and downloaded. Login information will be provided when the license file is delivered.

The cloud-based floating license configuration is "always on" and requires almost no user setup or maintenance. This is the easiest licensing method available.

- **Node-locked license**
  One license is issued for each single computer. There is no sharing of multiple licenses with the node-locked license configuration. This configuration is the least versatile of the two licensing methods. In cases where an off-line or temporary license is needed, the node-locked license configuration works well. The license (.lic) file is placed in the license folder (typically C:\vr\license).

The License File

Cardinal Systems will provide a license (.lic) file that is placed in the license folder. This folder is typically c:\vr\license. The license file is a text file however, do not change the contents of the license file. Changing any contents, even a single character, in the license file will render it unusable.

The license (.lic) file contains the needed license information when using local-based licensing or node-locked licensing. When using the cloud-based licensing, the license file contains communication information for the cloud-based server.

The License File Location

- **Cloud-based floating license** - One license file is delivered and it is copied to the license folder of each computer running the Vr Mapping software. The license folder is typically C:\vr\license.
- **Node-locked license** - A license file will be delivered for each computer and this file is placed in the license folder. The license folder is typically C:\vr\license. Each license file is "locked" to a single computer and the name of the license file will contain the ComputerName that it is assigned to.

Obtaining A License File

In order for Cardinal Systems to provide a license file for local-based floating, or node-locked licensing, the computer's ComputerName and HostId must be sent to Cardinal System. This

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information may be sent to the Cardinal Systems support system via an email to vrsupport@cardinalsystems.net.

If using the cloud-based floating licensing option, Cardinal Systems does not need a ComputerName or HostId of any of the computers running the Vr Mapping software.

If using the node-locked option, the ComputerName and HostId for each computer running the Vr Mapping software are needed.

Finding the ComputerName and HostId on Windows 10

The ComputerName and HostId for a computer may be obtained using the methods described below.

Note: While the ComputerName remains the same, The HostId for Vr Mapping version 6 and above is different than previous versions.

Finding the ComputerName

- Right click on the Start button (lower left corner of the desktop)
- In the pop-up menu, click on System
- Select About from the list on the left
- The ComputerName is shown as the Device name

Example:

```
Device name   COMPUTER1
```

Finding the HostId

- Right click on the Start button (lower left corner of the desktop)
- In the pop-up menu, click on Command Prompt
- In the Command Prompt window, type "ipconfig /all"
- The HostId is on the "Physical Address" line

Example:

```
Physical Address. . . . . . . . : DA-42-3E-8B-DE-44
```

Finding the ComputerName and HostId on Windows 7

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Finding the ComputerName

- Click on the Start button (lower left corner of the desktop)
- Right click on Computer and then select Properties
- The ComputerName is shown

Example:
```
Computer name: COMPUTER1
```

Finding the HostId

- Click the Start button (lower left corner of the desktop)
- In the "Search programs or file" box, type "cmd" to open a Command Prompt Window
- In the Command Prompt window, type "ipconfig /all"
- The HostId is on the "Physical Address" line

Example:
```
Physical Address. . . . . . . . : DA-42-3E-8B-DE-44
```

Revised: November 2022

3 Tutorials

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Vr Mapping

Tutorials

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Tutorials include "Getting Started" guides and step-by-step walkthroughs to help users start using Vr Mapping.

Getting Started with VrOne
Getting Started with VrOne/VrTwo
Getting Started with ADS40
Getting Started with 3D VrThree (VrLiDAR)
Vr Aerial Triangulation (VrAirTrig) Tutorial
Single Model Orientation Tutorial
Single Model Orientation from ISAT Measurements Tutorial
Single Model Orientation from ISAT Exterior Orientations Tutorial
Batch Model Orientations from ISAT Measurements Tutorial
Batch Model Orientations from ISAT Exterior Orientations Tutorial
Make Polygons Tutorial
Function Keys Tutorial
On End Command Tutorial
VrMosaic Tutorial

3.1 Workflow Overviews

Vr Mapping

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Workflow Overviews

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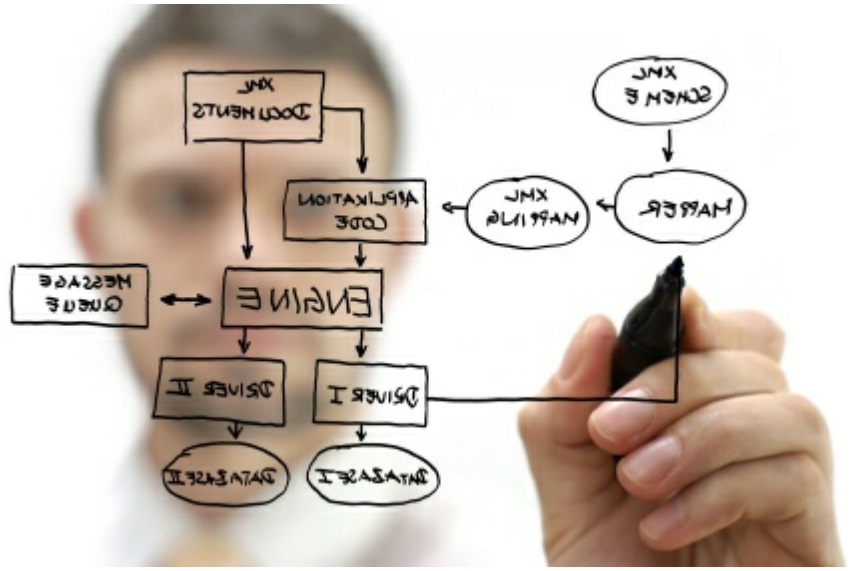

Workflow

Overview
Camera Calibration File Preparation
Image Preparation
Aerial Triangulation Workflow Overview
Vr Two Workflow Overview
Orthophoto Workflow Overview
Point Cloud Workflow Overview

Overview

The Vr Mapping software offers solutions to many mapping tasks. Projects may require a variety of workflows to produce the final mapping products. The following are several workflows that may be needed. These are workflow overviews and are not intended to offer detailed processes. Please see the tutorials and other Vr Mapping documentation for more details on individual mapping operations.

Camera Calibration File Preparation

Task

Create camera calibration files for the Vr Mapping software.

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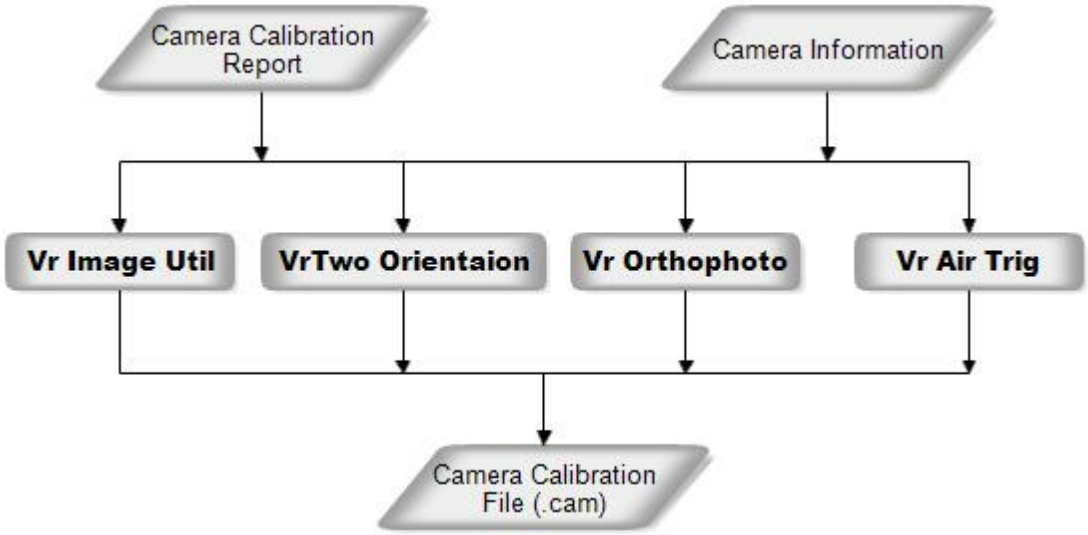

Images used in a mapping project require information about the camera that was used to capture the images. This information includes the photo size, focal length, calibrated principal point offset, fiducial units, fiducial coordinates and radial distortion values. If the images are taken with a camera that does not use fiducials such as the newer digital cameras, a camera calibration file is still required. More detailed information about the information in the camera calibration file can be found at Camera from the VrTwo Orientation program help page.

Image Preparation

Task

Prepare images for use with the Vr Mapping software.

Images used for mapping require some parameter information before they can be used by the Vr Mapping software. This parameter information includes the Image Name Format (in which a strip and photo number can be parsed from the image name), the camera calibration (.cam) file name, the strip location or image rotation, and the pixel size of the image. When these parameters are assigned to an image, a Vr Image file (.vim) is created for each image on a project. The .vim file contains the parameters listed above along with the observations from the interior orientation, the six parameters that make up the exterior orientation (EO), and the pixel to photo transformation matrix.

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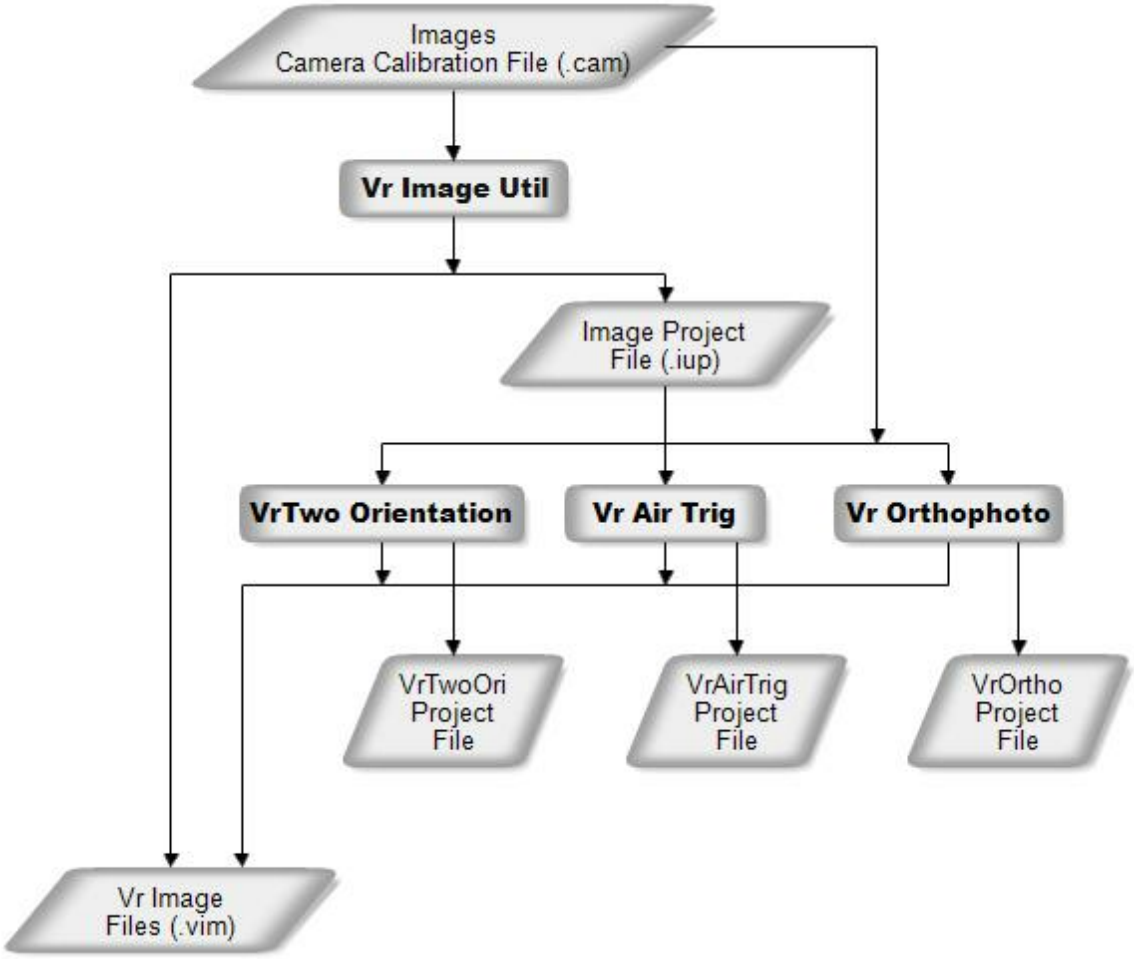

The Vr Image Utility program is normally the software used to create the output files. The image project (.iup) file that is created may be imported by the VrTwo Orientation program, the Vr Aerial Triangulation program, or the Vr Orthophoto program. It is possible to use VrTwoOri, VrAirTrig and VrOrtho to create the same parameters needed for each program. For example, if the workflow only required aerial triangulation and VrTwoOri and VrOrtho were not being used, the VrAirTrig program can be used for image preparation and VrImageUtil would not be required.

The Vr Image Utility program also provides other image utility operations including automatic interior orientation, batch image rotation, image format conversion, batch image pyramid creation and exterior orientation (EO) file format conversions. Please see the Vr Image Utility help page for more information about this program and image preparation.

Aerial Triangulation Workflow Overview

Task

Perform aerial triangulation point measurement, bundle adjustment and quality control.

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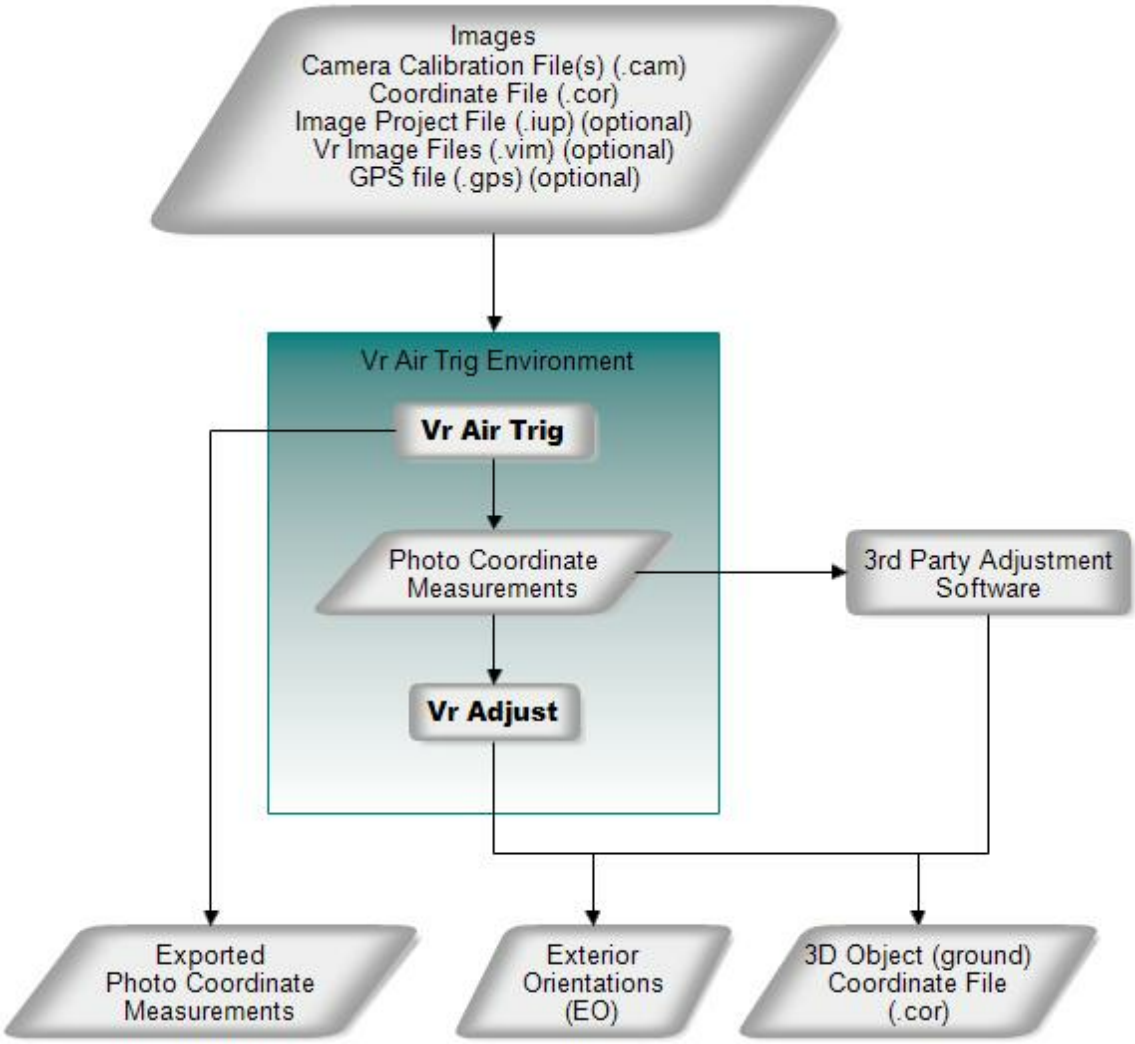
The process of aerial triangulation determines 3-dimensional object ground coordinates using several images of the same object taken from different positions. The VrAirTrig program performs project management, point measurement, and quality control. The VrAdjust program performs the computations (bundle adjustment) and calculates the object coordinates. The output from the aerial triangulation process is typically used as input to orient stereo models in VrTwo and/or provide image geometry for the orthophoto process in VrOrtho.



Aerial Triangulation Workflow Overview

The input coordinate file (.cor) is typically contains the base coordinate points (ground control) used to control the project. The output coordinate file (.cor) contains adjusted 3D coordinate positions for all measured points including pass, tie, and ground control points. Please see the Vr Aerial Triangulation (VrAirTrig) help section for more information about the aerial triangulation software.

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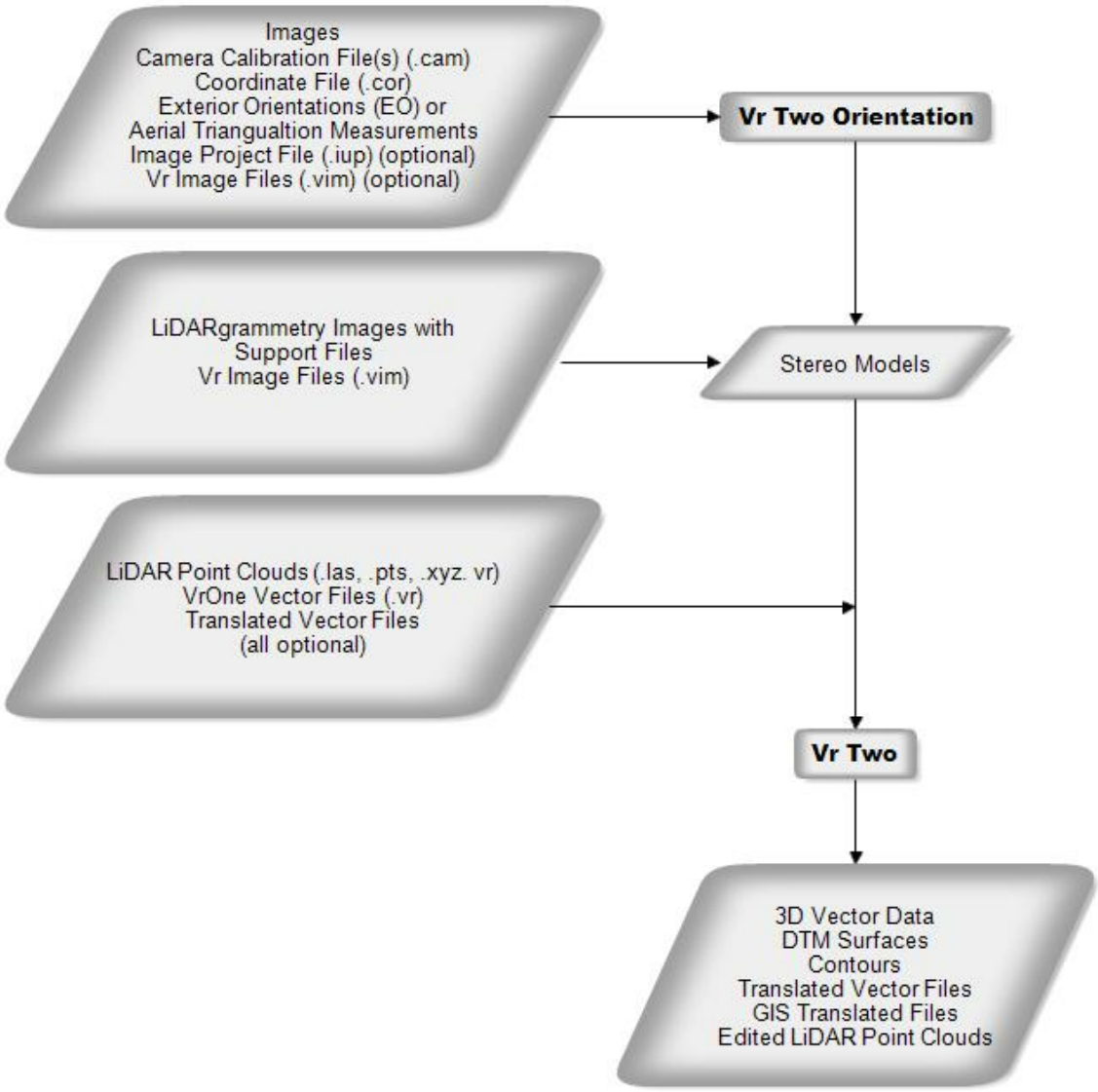
Vr Two Workflow Overview

Task

Collect vector data consisting of planimetric, topographic and elevation data from stereo models.

The workflow for VrTwo can include collecting vector and elevation (DTM) data. The editing of 3D vector and point (LiDAR) can also be part of the workflow. Non-image inputs into VrTwo include existing vector files and LiDAR data, which are displayed with 3D stereo imagery. Quality control for new and existing data is another key workflow option. The VrOne and VrTwo programs also provide data translations to other vector and LiDAR formats.



VrTwo Workflow Overview

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Input images sources be from frame cameras, LiDARgrammetry (synthetic images created from LiDAR intensity) and Leica ADS-40 imagery. Please see VrTwo Orientation Getting Started with VrOne and VrOne-VrTwo help sections for more information on model orientations and the available tools for data collection, editing, batch processing, DTM processing, plotting and data translation.

Orthophoto Workflow Overview

Task

Create ortho rectified images and, optionally, mosaic and balance the images.

The ortho rectification process entails taking standard perspective images without uniform scale and transforming them into geographically referenced images with the perspective removed to provide uniform scaling. The ortho images can then be brought into a mosaicing application such as VrMosaic to tie the orthophotos together into a seamless image mosaic.

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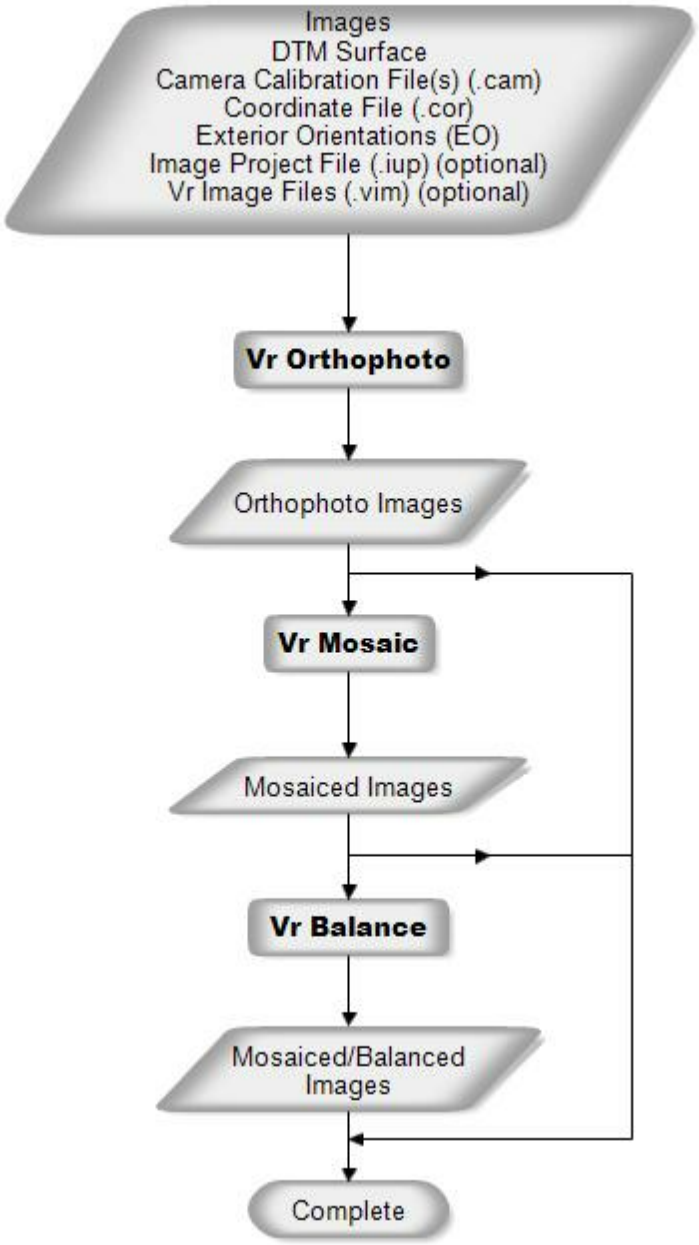

Orthophoto Workflow Overview

In order to perform the ortho rectification process, VrOrtho must have a images that have been fully oriented and a DTM ground surface for the area to be rectified. The DTM ground surface may be computed from standard VrOne vector files, containing points and break lines, or may be loaded from a VrOne surface file. If the DTM ground surface is specified as a VrOne vector file with points and break lines, then the surface will be computed as needed directly from the VrOne file(s). If a surface file is used, then the surface is loaded directly from the file, potentially saving a significant amount of processing time. Please see VrOrtho and VrMosaic for more information on these processes.

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Point Cloud Workflow Overview

Task

Collect vector data from LiDAR point clouds and, optionally, perform quality control and correct errors in point classification.

Point clouds (LiDAR, DSM, vectors) may be displayed in several viewing environments. Existing Vr Mapping commands and workflows can collect and edit vector data. The 3D VrThree and 2.5D VrThree environments offer cursor draping, in which the 3D cusor is automatically draped onto LiDAR surfaces. These two environments also offer near and far clipping along the view direction for the additional isolation of data. The VrThree (VrLiDAR) data base supports up to 20 attributes for each LiDAR point. Input to and output from the VrThree (VrLiDAR) data base supports the LAS, Points and xyz formats.

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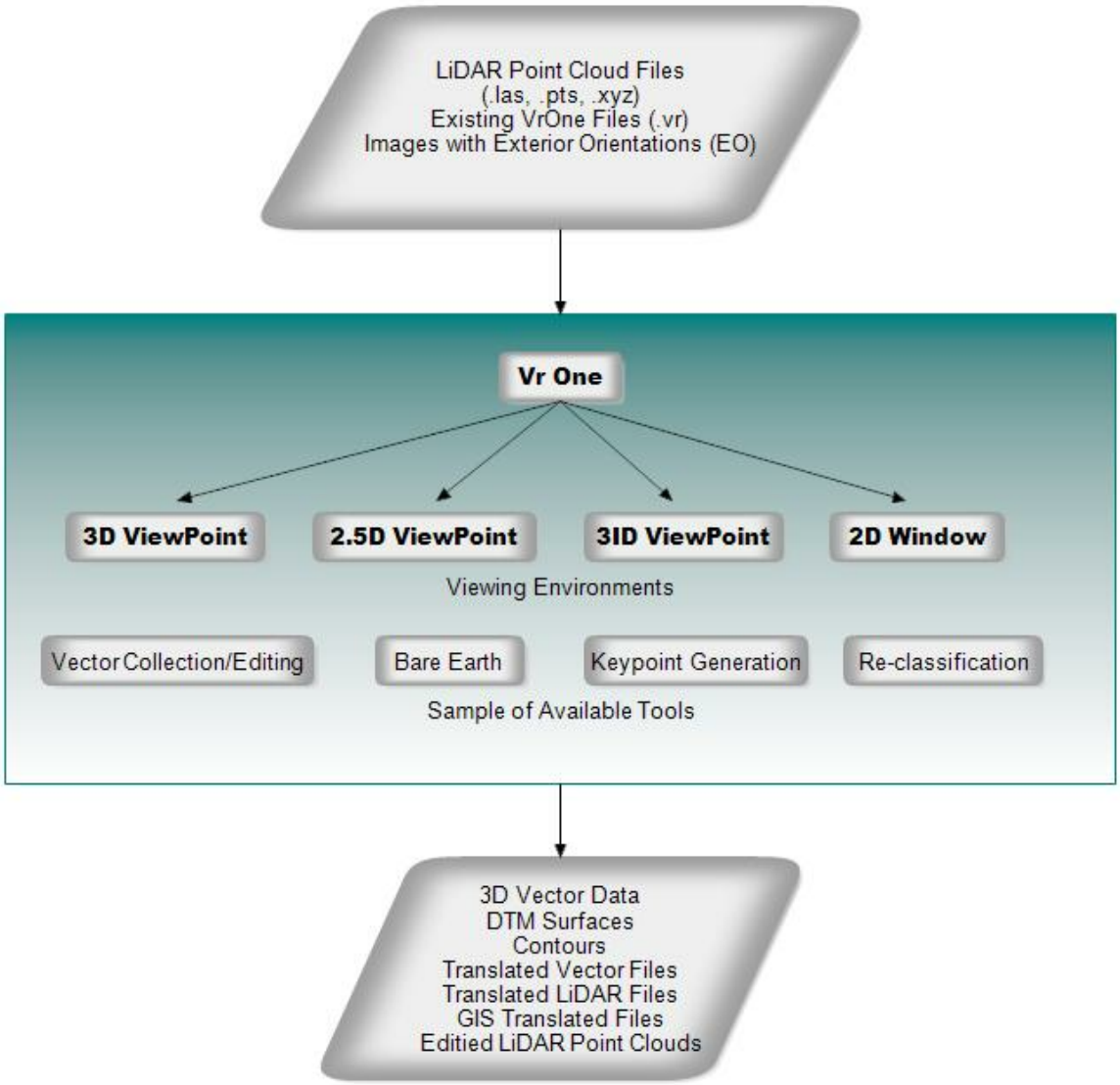

LiDAR Workflow Overview

VrThree (VrLiDAR) runs within the VrOne program, making the existing mapping commands and program features available when working with point clouds. The viewing environments include:

- **3D VrThree** - LiDAR point data and vector data are displayed in 3D stereo. The user has the ability to collect and edit. Cursor draping and near and far clipping are available.
- **2.5D VrThree** - LiDAR point data and vector data are displayed in 2.5D (perspective or pseudo-3d) with the ability to collect and edit. Cursor draping and near and far clipping is available.
- **3ID ViewPoint** - Displays an un-rectified image and drapes LiDAR points onto the image along with vector data. Cursor draping is supported.

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- **2D Window** - LiDAR point data and vector data are displayed in a standard 2D window.

Point cloud (LiDAR, DSM) data may be displayed in the four environments listed above and in the VrTwo stereo environment. All environments support vector collection and editing and all have access to the commands and mapping features of VrOne. Please see VrThree (VrLiDAR) and VrOne - VrTwo for more information.

3.2 Getting Started With VrOne

Vr Mapping

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Getting Started With VrOne



Overview
Installation and Startup
VrOne Basics
VrOne Database Structure
- Entity Header
- Line Entity
- Symbol Entity

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Text Entity
VrPoint (LiDAR / Point Cloud) Entity
VrOne Commands
Function Keys
Macros

Overview

"Get the job, do it right, get it out on time, make a profit. That's what every mapping company is about!"

- Jeff Crenshaw
Northern Division Manager
North American Mapping

VrOne is a powerful photogrammetric vector collection and editing package with image display capability. Photogrammetry today requires the mapping professional to deliver vector, image and digital terrain model (DTM) data as digital products. VrOne addresses many of the problems encountered in handling the collection, editing, and plotting of vector, image, and DTM data. Map updating and revision may also be performed with VrOne.

Features

- Up to 2000 vector files may be open
- Up to 2000 image files may be open
- Up to 8 windows may by open
- Runs on Windows XP and Windows 7
- 32-bit and 64-bit versions are available (64-bit is available in versions 5.1 and above)
- Supports application overlaying (see below)
- Supports run-time key-ins
- Time tested fast vector access and display
- Fast image read and display
- Supports user-defined symbols and line fonts
- Rich, pragmatic set of mapping applications and batch routines

Input sources

- Analog photogrammetric instruments
- Analytical photogrammetric instruments
- Stereo softcopy
- XY digitizing tablets
- Mouse
- Various file formats

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Vector database

- Designed for mapping and photogrammetry
- 3D double precision
- 32,001 data layers
- Unlimited file size
- Unlimited number of points on a line
- LiDAR (VrPoint) storage capability
- 48 character feature code available for each entity (except VrPoint)
- 32 bit non-graphic pointer
- Text labels up to 512 characters
- Support for 256 vector colors

Image handling

- Support for standard TIFF files with world file and other image formats
- Uses image pyramids
- Color (24 bit) and Grayscale (8 bit) and other image depth support
- Images can be displayed and plotted at any scale

Digital Terrain Modeling (DTM)

- Embedded in VrOne
- Uses points and break-lines currently in file
- Adds contour and triangles into file
- Models entire file(s) or current view window
- Option to keep DTM surfaces on-line for cursor and entity draping

Plot Formats

- Ability to plot to system printers and plotters
- HPGL for vectors to old HP line plotters
- HPGL/2 for vectors to current HP plotters
- HPGL/2 RTL for vectors and Grayscale/Color images to current HP plotters
- PostScript for vectors and Grayscale/Color images to various systems

Installation and Startup

"Rule of thumb; if you think something is clever and sophisticated, beware – it is probably self indulgence."

- Donald A. Norman, 1990

VrOne can be downloaded from the VrOne web page. Go to the home page, press the

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Download button, enter your username and password, and navigate to the desired folder.

There are two forms of VrOne installation:

- **Full** - VrOne full installation where all programs are installed. This is used for a new installation and most major revisions.
- **Patch** – Used when only a few programs need to be updated.

Full Installation

The full installation is always done from an executable program. This program may be downloaded from the VrOne web page or may be delivered via CD.

The name of the executable is as follows:

vr-MA_MI_BU.exe

Where:
MA - Major version number
MI - Minor version number
BU - Build number

Example:

vr-05_01_05.exe would be Vr Mapping version 05.01.05

Once the file has been downloaded, run this program and follow the prompts to complete installation.

Patch Installation

Patch installations are partial installations designed to update certain programs and/or data. A full installation must be completed before patches can be applied. Patches are downloaded and installed in the same manner as full installations.

VrOne Folder Structure

Following is the default VrOne folder structure:

C:\vr
The VrOne base folder. It may be necessary to place VrOne on another drive such as D: or E:. If possible, the default folder of vr should be used.

C:\vr\bin
VrOne executables folder. Contains all Vr Mapping Software programs.

C:\vr\data

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Contains VrOne data files, such as:

- VrOne character sets used to draw text into the graphics windows
- The default symbol library (default.sym)
- The default screen color table (defaultscreen.ct)
- The default plotter color table (defaultplotter.ct)
- The default pen table (default.pen)
- The default Function Key file (default.fk)
- The default Macro file (default.mac)
- The default Menu Board definition file (default.mb)
- The default key pad definition file (default.kp)
- The SOCET SET VrOne mouse button definition file (vrone.acc)
- VrOne file containing the digitizing table menu board overlay (menuboard.VR)
- VrOne file containing the Polytel Keyport 300 key overlay (kp300.VR)
- VrOne file containing the Cedeq Enterpad P120 key overlay (cedeq.VR)
- Download key assignments for the Cedeq key pad (vrone.pos)
- Various .bmp images used by VrOne during runtime.

NOTE: These files are re-installed each full installation. However, if these files are modified, it is recommended they be moved to another folder or renamed.

C:\vr\hostdir

Contains run-time parameter files. It is delivered empty. Parameter files are created as needed by VrOne.

Running VrOne

After installation, links to the Vr Mapping programs are placed in a folder called Vr Mapping and this folder is placed on the desktop. VrOne can be run by double clicking the VrOne icon or by typing vrone from a command prompt window.

Release Notes

Each full installation of VrOne will have a corresponding Release Notes file that will document recent changes and additions to VrOne and it's support files and programs.

VrOne Basics

"Nothing is happening, there are no lights and everything is quiet… Oops, it's unplugged."

- A hardware support call, 1981

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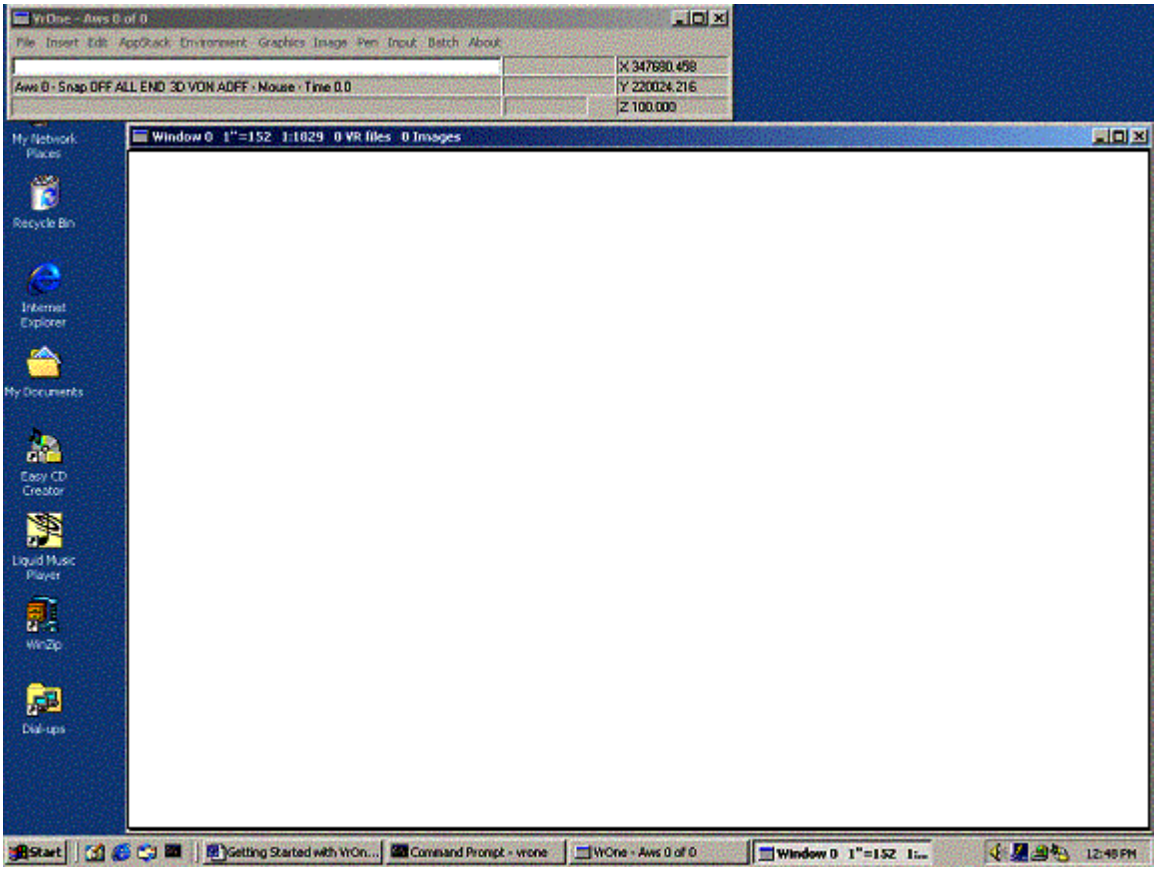
Before starting VrOne for the first time, the VrOne configuration program should be run to set the proper input devices and parameter files. This is not a requirement and the configuration defaults allow VrOne to start the first time.

VrOne will start by opening the Main Window and one Graphics Window.



VrOne's main and graphics windows

If the current input device is the mouse, moving the mouse across the Graphics Window should show a cursor. The coordinates in the main window should change. Pulling down the File menu and selecting "Open Vr File" will open a VrOne file.

Starting an Application (Command)

Select an item from a dropdown menu to start commands. Alternatively, commands may be started from a key-in using the command name. Each command name is the first three letters of the first two words on the pull down. For example: The command name for Insert line is InsLin. If this rule is not followed the key-in is listed after the command in parentheses. For example: Zoom all (zooa).

The Main Window

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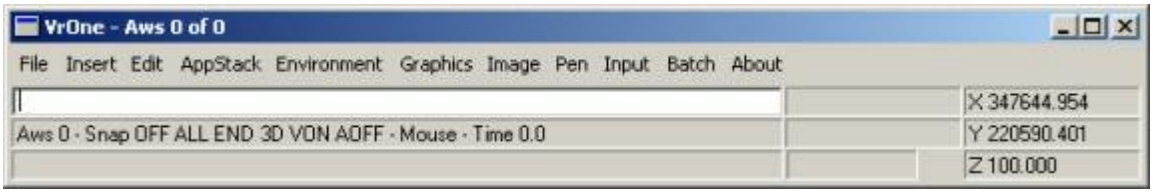


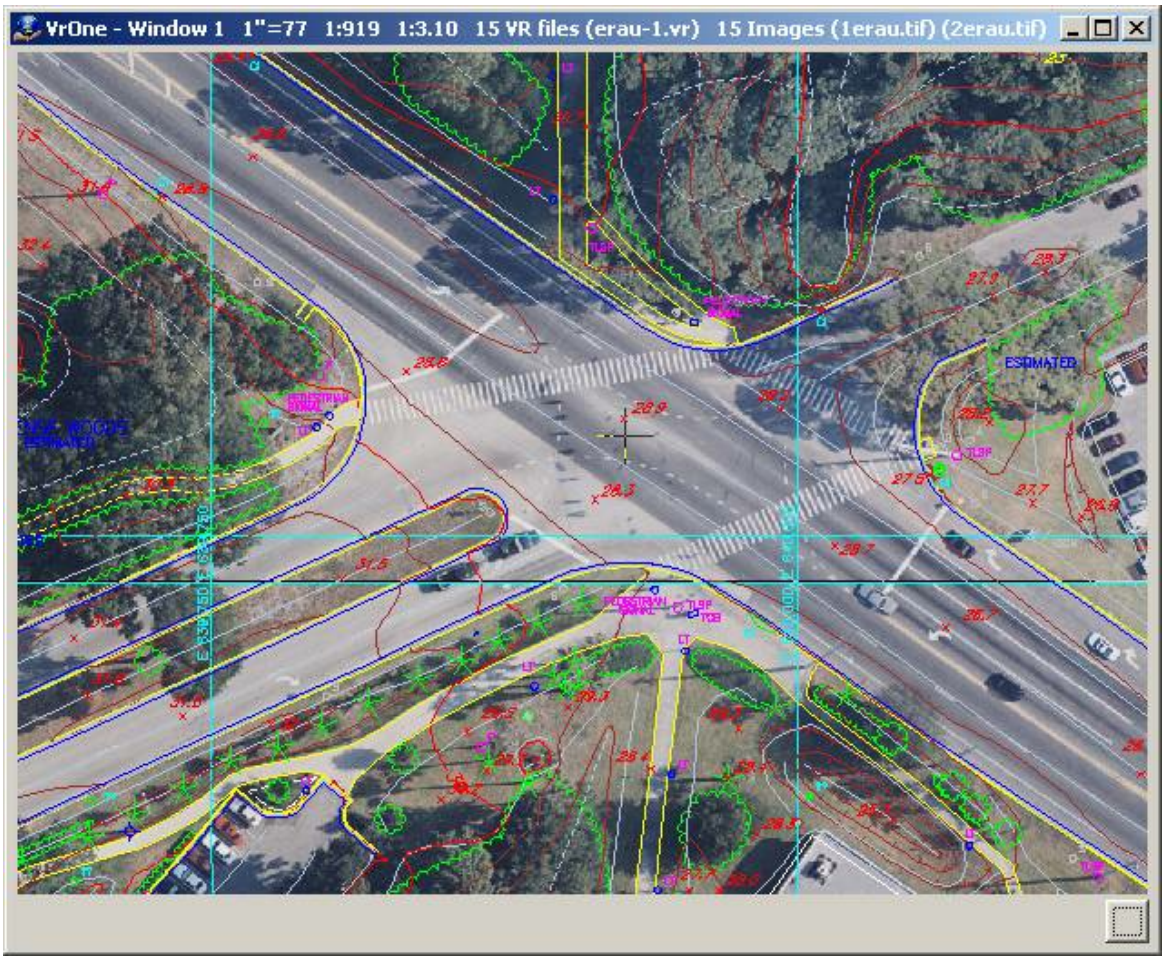
VrOne's main window

The Main Window in VrOne contains the command pull down menus, a key-in area, two information areas, the application (command) stack, a progress bar, and the coordinate display.

Command names may be typed into the key-in area at almost any time. The mouse must be in the Main or Graphics window for keystrokes to be entered in the key-in area.

The active workspace and the number of currently opened workspaces is shown on the border of the Main Window.

The Graphics Window



VrOne's graphics window

The VrOne graphics window displays vectors and images. In Windows XP and Windows 7

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there may be up to 8 windows open at a time. At the top of the window is displayed the window number, the scale of the window, the number of VrOne files opened and the number of images open. Also displayed is the image pyramid scale (i.e. 1:3.10) and the first two image names.

In the lower right corner of the graphics window is a push button that allows setting display of images, image names and image edges.

The Menu Keys Dialog



The Menu Keys Dialog window is displayed by most interactive commands. At the top of the window is the command name. The next area displays the entity parameters. This information is command dependent and normally shows where the data is to be stored on insert commands or where the data came from on edit commands.

The third area is the menu keys area. These show what functions are assigned to the 12 menu key buttons. These keys are normally mapped onto an input device such as the keypad on a digitizing tablet cursor. They are also mapped onto the 12 function keys on a standard keyboard.

Commands

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- **Local Commands** – These commands are passed to the current application (command) and are often used to modify parameters of that command. For example, if Insert Line is the current application and LAY=23 is keyed in then the current layer for Insert Line would be changed to 23.
- **Global Commands** – These commands operate on VrOne globally. For example if SnaOn (Snap on) is keyed in then snap is turned on for all active commands. Global commands include application (command) names also such as InsLin (Insert Line).

VrOne Database Structure

"Everything should be as simple as possible...
But no simpler."

- Albert Einstein

VrOne is a mapping system. It is normally used as the first step in map data collection. Although it may be used to edit vector data and generate DTM, the VrOne database will normally be translated to another system for final processing. These other systems include ARC-INFO, AutoCAD, and MicroStation.

It is important that the original database is simple enough to make moving the data easy. The VrOne database is an entity-based non-topological structure. Although the database contains some non-graphic and extended information other CADD systems do not, it cannot be considered a true Geographic Information System (GIS). It can however, prepare vector data for accurate translation to GIS and other CADD systems.

The VrOne database is a single file with all vector information contained in the one file. Support files include the symbol library and pen table (if specified). The size of the file is operating system dependent.

NOTE: The VrOne database is considered proprietary information to Cardinal Systems, LLC and is here for informational purposes for Vr Mapping uses. Copyright © 2000-2011 by Cardinal Systems, LLC.

Entity Header Information

Each VrOne entity contains the following information:

Layer

Layering is a method of logically grouping graphic data. Buildings, roads and trees will probably occupy different layers.
Range: 1 to10,001

Mode

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Defines the entity type as follows:

1	Line
2	Splined Line
3	Symbol
4	Text
5	Point (LiDAR)

Arcs in VrOne are embedded in a line and contain arc flags to identify the start, mid-point, and end of each arc.
Range: 1 to 5

Graphic Pointer

The graphic pointer represents the display characteristics of an entity. A line will have a graphic pointer that might define it as a fence, tree or water line. A symbol will have a graphic pointer that might define it as a circle, cross or highway symbol.
Range: 1 to 1000

Non-graphic Pointer

May be used to define a pointer to non-graphic data. Currently unimplemented, although it can be set by the user.
Range: -2 billion to 2 billion

Pen Number

Defines the color of the entity.
Range: 1 to 256

Link

Currently unimplemented, although it can be set by the user. In the future, it can link entities together or represent entity ownership. For example: This sidewalk and fence belong to this house.
Range: -2 billion to 2 billion

Construction Flag

Line entities may be flagged as construction, which allows them to be turned off. This line description might be applied to hidden lines, reference lines, or other non-topological lines.
Range: 0 to 1

Feature Code

A user-defined 48-character non-graphic alphanumeric field for further entity classification.
Range: 48 characters

Line Entity Information

All lines in VrOne are three-dimensional. The number of points per line is unlimited (within the range of physical memory in the computer). Each line contains an entity header and the following information for each line point.

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X Y Z
Each line point is represented by a double precision, three-dimensional coordinate.
Range: -1.8e307 to 1.8e307

Width
Represents the width of the line. This number defines the number of line strokes to place on each side of the centerline. The distance between the strokes is user-defined.
Range: 1 to 256

Pen Code
Defines the pen up/down status to the current point as follows:

- 1 - Up
- 2 - Continue
- 4 - End

This allows a line to appear broken graphically but remain contiguous in the VrOne database.
Range: 1 to 4

Arc Flag
Defines the arc status of the current point as follows:

- 1 - Beginning or end of arc. May also be used to define point of reverse curve (PRC).
- 2 - Mid point on the arc
- 3 - Point on the arc

Range: 1 to 3

Code
Commonly used to define cross section codes such as top of bank, bottom of bank and edge of road. Cross sectioning has been largely replaced by DTM over the last several years and VrOne does not support cross sectioning.
Range: 0 to 255

Flag
System defined bit encoded flags. This field is not user definable.
Range: 0 to 255

Symbol Entity Information

Each symbol entity contains an entity header and the following information:

X Y Z
Double precision three-dimensional coordinate.
Range: -1.8e307 to 1.8e307

Radius
Symbol radius in ground units.

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Range: -1.8e307 to 1.8e307

Rotation

Symbol rotation expressed counterclockwise from the X-axis in decimal radians.
Range: 0 – 2 * p. This value will be entered and displayed by VrOne as decimal degrees with a range of 0 to 360.

Text Entity Information

Each text entity in VrOne may contain up to 512 characters. Each text entity contains an entity header and the following information:

X Y Z

Double precision three-dimensional coordinate.
Range: -1.8e307 to 1.8e307

Justification X

Text justification along the X-axis

- 1 – Left
- 2 – Center
- 3 – Right
- 4 – Decimal

Range: 1 to 4

Justification Y

Text justification along the Y-axis

- 1 – Lower
- 2 – Center
- 3 – Upper

Range: 1 to 3

Font Number

Text font to be used when drawing text.

1	CI	Complex Italic
2	CR	Complex Roman
3	CS	Complex Script
4	DR	Duplex Roman
5	GE	Gothic English
6	GG	Gothic German
7	GI	Gothic Italic

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8	HS	Standard
9	SR	Simplex Roman
10	SS	Simplex Script
11	TI	Triplex Italic
12	TR	Triplex Roman

Height
Text height in ground units.
Range: -1.8e307 to 1.8e307

Width
Width of one text character in ground units.
Range: -1.8e307 to 1.8e307

Rotation
Text rotation expressed counterclockwise from the X-axis in decimal radians.
Range: 0 – 2 * π. This value will be entered and displayed by VrOne as decimal degrees with a range of 0 to 360.

Slant
Text slant.
Example: *This text is slanted*
Range: 0 – π. This value will be entered and displayed by VrOne as decimal degrees with a range of 0 to 180.

VrPoint (LiDAR / DSM / point cloud) Entity Information

Each VrPoint entity in the VrOne database contains XYZ coordinates and up to 16 attributes per point . The definition of point attribute data is dependent on the input system and format. Even though available in the Vr Mapping database, all attributes may not be defined in the LiDAR data input. The Vr Point structure is based on the ASPRS LAS Specification Version 1.2 and ASPRS LAS Specification Version 1.4. Please see LAS In or LAS Out or LAS 1.2 and LAS 1.4 for more information about the LAS format and Vr Mapping's implementation.

Each point entity contains an entity header and the following information:

X Y Z
Double precision three-dimensional coordinate.
Range: -1.8e307 to 1.8e307

Layer
Vr Layer number. This attribute is not defined in the LAS specification.
Range: 0-30001

Intensity
The intensity value is the integer representation of the pulse return magnitude. This value is

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optional and system specific.
Range: 0-65535

Display Flag

Flag to indicate if the point should be displayed. This attribute is not defined in the LAS specification.
Range: 0=No 1=Yes

Return Number

The Return Number is the pulse return number for a given output pulse. A given output laser pulse can have many returns, and they must be marked in sequence of return. The first return will have a Return Number of one, the second a Return Number of two, and so on up to five returns.
LAS 1.2 - Range: 1-5
LAS 1.4 - Range: 1-15

Number of Returns

The Number of Returns is the total number of returns for a given pulse. For example, a laser data point may be return two (Return Number) within a total number of five returns.
LAS 1.2 - Range: 1-5
LAS 1.4 - Range: 1-15

Scan Direction

The Scan Direction Flag denotes the direction at which the scanner mirror was traveling at the time of the output pulse. A bit value of 1 is a positive scan direction, and a bit value of 0 is a negative scan direction (where positive scan direction is a scan moving from the left side of the in-track direction to the right side and negative the opposite).
Range: 0-1

Edge Flag

The Edge of Flight Line data bit has a value of 1 only when the point is at the end of a scan. It is the last point on a given scan line before it changes direction.
Range: 0-1, 1=Point is edge of flight line

Classification

Point Classification. If a point has never been classified, this value must be set to zero.

LAS 1.2 - Range: 0-31

0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point (mass point)

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9	Water
10	Reserved for ASPRS Definition
11	Reserved for ASPRS Definition
12	Overlap Points
13-31	Reserved for ASPRS Definition

LAS 1.4 - Range: 0-255

0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Reserved
9	Water
10	Rail
11	Road Surface
12	Reserved
13	Wire - Guard (Shield)
14	Wire - Conductor (Phase)
15	Transmission Tower
16	Wire-structure Connector (e.g Insulator)
17	Bridge Deck
18	High Noise
19-63	Reserved
64-255	User defined

Synthetic Flag

If set to 1, then this point was created by a technique other than LiDAR collection such as digitized from a photogrammetric stereo model.
Range: 0-1

Key Point Flag

If set to 1, this point is considered to be a model key-point and thus generally should not be withheld in a thinning algorithm.
Range: 0-1

Delete Flag

If set to 1, this point should not be included in processing (synonymous with Withheld).
Range: 0-1

Overlap

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If set, this point is within the overlap region of two or more swaths or takes.
LAS 1.2 - Not defined
LAS 1.4 - Range: 0-1

Scan Angle

LAS 1.2 - The Scan Angle has a valid range from -90 to +90 and is the angle (rounded to the nearest integer in the absolute value sense) at which the laser point was output from the laser system including the roll of the aircraft. The scan angle is within 1 degree of accuracy from +90 to –90 degrees. The scan angle is an angle based on 0 degrees being nadir, and –90 degrees to the left side of the aircraft in the direction of flight.
Range: +90 to -90

LAS 1.4: The Scan Angle is a value that represents the rotational position of the emitted laser pulse which respect to the coordinate system of the data. Down in the data coordinate system is the zero position. Each increment represents 0.006 degrees. Counterclockwise rotation, as viewed from the rear of the sensor, facing in the along-track (positive trajectory) direction, is positive. The maximum value in the positive sense is 30,000 (180 degrees)
Range: -32000 to 32000

Flight Number

User-defined flight numbed. This attribute is not defined in the LAS specification.
Range: 0-255

Point Source ID

This value indicates the file from which this point originated. Valid values for this field are 1 to 65,535 inclusive with zero being used for a special case discussed below. The numerical value corresponds to the File Source ID from which this point originated. Zero is reserved as a convenience to system implementers. A Point Source ID of zero implies that this point originated in this file. This implies that processing software should set the Point Source ID equal to the File Source ID of the file containing this point at some time during processing.
Range: 0-65535

Sensor (Scanner Channel)

The Scanner Channel is used to indicate the channel, or scanner head of a multi-channel system. Channel 0 is used for single channel systems.
LAS 1.2: Not defined
LAS 1.4: Range 0-3

NIR

Near Infrared Channel. This attribute is available in VrPoint (LAS) format 8.
LAS 1.2: Not defined
LAS 1.4: 0-65535

GPS Time

GPS time at which the point was acquired in seconds. This attribute is available in VrPoint (LAS) formats 1, 3, 6, 7, and 8.
Range: -1.8e307 to 1.8e307

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Red
The Red image channel value associated with this point. This attribute is available in VrPoint (LAS) formats 2, 3, 7, and 8.
LAS Range: 0-65535
Vr Range: 0-255

Green
The Green image channel value associated with this point. This attribute is available in VrPoint (LAS) formats 2, 3, 7, and 8.
LAS Range: 0-65535
Vr Range: 0-255

Blue
The Blue image channel value associated with this point. This attribute is available in VrPoint (LAS) formats 2, 3, 7, and 8.
LAS Range: 0-65535
Vr Range: 0-255

LAS 1.2 and LAS 1.4
For more information on the supported LAS formats please see:

LAS Specification Version 1.2
LAS Specification Version 1.4

Overview of Changes in 1.4 from 1.2
Following is an overview of the changes from LAS 1.2 to LAS 1.4. This list does not include all the differences. Please see the LAS format specifications for more details.

- The number of returns per LiDAR pulse and the return number has been extended from 5 to 15.
- The sensor number is now included in version 1.4 and has a range from 0 to 3.
- The overlap flag has been added.
- The number of point classifications has been extended from 32 to 256.
- The Near Infrared Channel (NIR) field has been added.
- The scan angle is now defined with a range of -30,000 to 30,000 with a resolution of 0.006 degrees.

Supported Point Data Records
LAS 1.4 supports waveform data, however the Vr Mapping LAS translators does not support this data so the LAS Point Data Record formats 4, 5, 9 and 10 are not supported. LAS 1.4 consists of 11 Point Data Record formats. Formats 0-3 are legacy formats from version 1.2 which are still supported and formats 6-8 are defined in the 1.4 specification. For more details

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on each of the supported point formats, please see the LAS format specifications in the LAS documentation listed above. Following are the record formats supported by Vr Mapping.

- **Format 0** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID
- **Format 1** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time
- **Format 2** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Red, Green, Blue
- **Format 3** (LAS 1.2) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, GPS Time, Red, Green, Blue
- **Format 6** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number, GPS Time
- **Format 7** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue
- **Format 8** (LAS 1.4) - X, Y, Z, Intensity, Return Number, Number of Returns, Scan Direction Flag, Edge of Flight Flag, Classification, Scan Angle Rank, User Data, Point Source ID, Overlap flag, Sensor number,GPS Time, Red, Green, Blue, Near Infrared Channel (NIR)

Additions and Modifications to the LAS Specification

- Vr Mapping contains a layer number for each point (1-32001)
- Vr Mapping contains a flight number for each point (0-255)
- Vr Mapping contains a display flag for each point (0-1)
- The red, green, and blue values in LAS point data record formats 2, 3, 7, and 8 are defined with a range of 0-65535 (6 bytes). Vr Mapping scales these values to 0-255 (3 bytes)
- LAS version 1.4 waveform data is not supported so LAS Point Data Record formats 4, 5, 9 and 10 are not supported.
- LAS version 1.4 specifies the maximum number of points in an LAS file to be up to18 quintillion (18,446,744,073,709,551,615). Currently, Vr Mapping supports the LAS 1.2 specification which allows point counts up to 4 billion (4,294,967,295).

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VrOne Commands

"Hay don't you remember, you called me Al…"

- Song from the depression era

VrOne commands are the heart of the system. While these commands are available from the pull-down menus in VrOne they are also available as key-ins. Key-in commands may be entered real-time or may be placed in macros and placed in function keys. See List of Commands for a list of the VrOne commands.

Function Keys

"The art of mapping is the art of organizing complexity."

- Anonymous

Function Keys are the most important aspect of VrOne data collection. Taking the time to properly set up function keys before a project has started will save hundreds of hours of production time.

Function keys are the means of giving Vr Mapping (which internally is structured like a CADD system) a mapping system interface. This simplifies operations for mapping professionals by reducing the apparent complexity. For example, instead of using the CADD operation Insert Line (InsLin) to place a road, the operator could use a Function Key such as "Paved Road" which will assign the user definable parameters, attributes and behavior to Insert Line and start it. Function Keys are fully customizable, and-if the need arises-the full flexibility of the CADD operations is always available.

In practice, the mapping professional simply chooses the feature they want to collect and starts collecting data.

Entering its name or function key number may start a Function Key. These names or numbers may be keyed-in, placed in macros or even placed in other function keys.

The name of the Function Key file to use must be set in the VrOne configuration program (VrCfig). It is possible to have multiple function key files but only one can be active at a time.

Creating and Editing Function Keys

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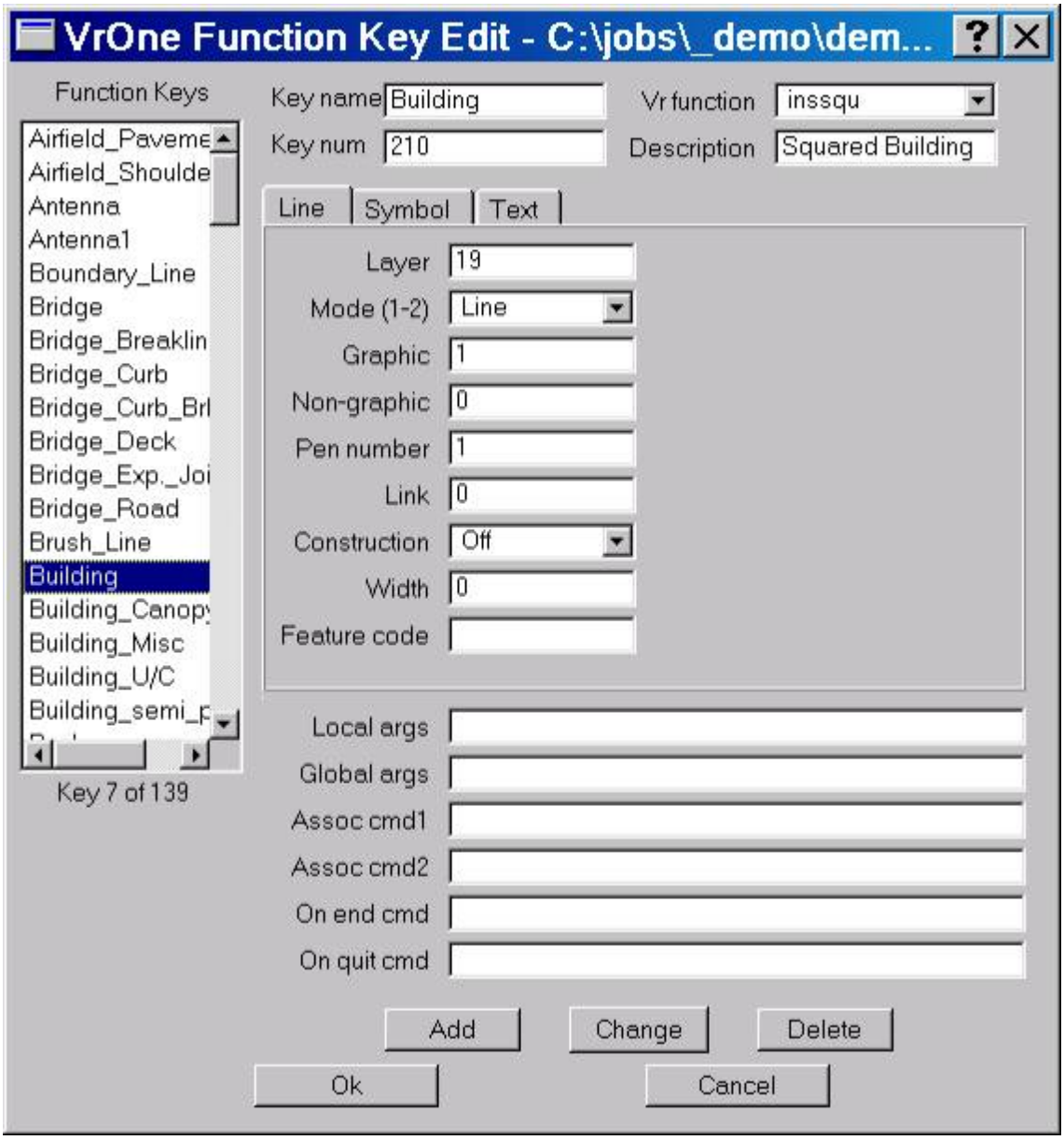

The Edit Function Key (EdiFun) dialog box

In the above dialog box a function key called Building is being created. The line that is placed by this function key will be a squared, un-fonted white line placed in layer 19.

Function Keys

Lists the currently defined function keys. A key may be selected and its parameters will be displayed to the right.

Key name

This is the name of the function key and may be used to start the function key. This name may be keyed in, placed in a macro or on another function key.

Key num

Function keys may also be numbered. This number may be entered to start the function key.

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This is useful when a menu board is not available and function keys must be started from the system keyboard.

Vr function
Defines the VrOne application to start when the key is executed. The proper Line, Symbol or Text tab will be selected depending on the type of VrOne command selected.

Desc
This is the function key description and is for information only.

Line Tab
Line parameters that will be assigned when the function key is executed.

Symbol Tab
Symbol parameters that will be assigned when the function key is executed.

Text Tab
Text parameters that will be assigned when the function key is executed.

Local Arguments
These commands will be executed when the function key is started. Normally local commands are placed here. For example, if the Insert Symbol command is started by a key and the symbol rotation needs to be turned on then ROTMODE=1 would be entered on the Arguments line. Multiple commands may be entered separated by a comma.

Global Arguments
These commands will be executed when the function key is started and when the function key is woken up after being overlaid. Normally global commands are place here. (See the On End Example)

For example, consider the state of a global command such as snap:

- Contour is started and it sets snap to end point (SnaEnd).
- Drive overlays Contour and sets snap to intersect (SnaInt).
- Drive is terminated and Contour wakes up and becomes active.
- Since snap is global, the state is snap is now intersect. This is a state that Contour did not intend.

Placing SnaEnd in the Wake up command of Contour ensures the state of this global parameter is what is expected.

Assoc cmd
Associate commands allow function keys to be linked. In many cases there may be several function keys used to insert a certain map feature. One might put in a line and another may put in text.

For example, consider the operation of inserting a parking area. This feature consists of line that will define the parking edge and a text label of "Parking Area". There are two function keys defined which are ParkLine and ParkText. The associate command 1 of ParkLine has be set to

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ParkText as follows:

Assoc cmd1	ParkText

- ParkLine is started and the parking lot edge is collected.
- Ac1 is keyed in and the ParkText starts and “Parking Area” is labeled.
- ParkText is terminated and ParkLine continues collecting the parking lot edge.

On end cmd

The on end command allows one function key to execute a key-in, a macro or another function key each time an entity is saved. (See the On End Example)

For example, consider a spot elevation. This feature consists of a symbol and a text label. There are two function keys defined as follows:

SpotX	Places the spot elevation X.
SpotElev	Places the elevation of the previously read symbol.

The On end command of SpotElev is set as follows:

On end cmd	SpotText

When the spot elevation symbol is placed, the On End command will start Spot Text.

The On end command of SpotText is set as follows:

On end cmd	Pop

The Pop command tells VrOne to terminate the current application (command) that is at the top of the application stack.

- SpotElev is started and the spot elevation location is digitized.
- SpotText starts automatically and the elevation of the first point is labeled.
- SpotText terminates due to the On end Pop statement
- SpotElev wakes up and the next spot elevation is ready to be read.

There are more parameters that would need to be set to make the spot elevation functions keys work as expected but the above example shows how to chain function keys together.

On quit cmd

The on quit command will be executed when the function key application ends. This field may consist of key-ins, macros or other function keys. On quit commands are commonly used to set global parameters to a know state when an application ends. For example, if a function key was

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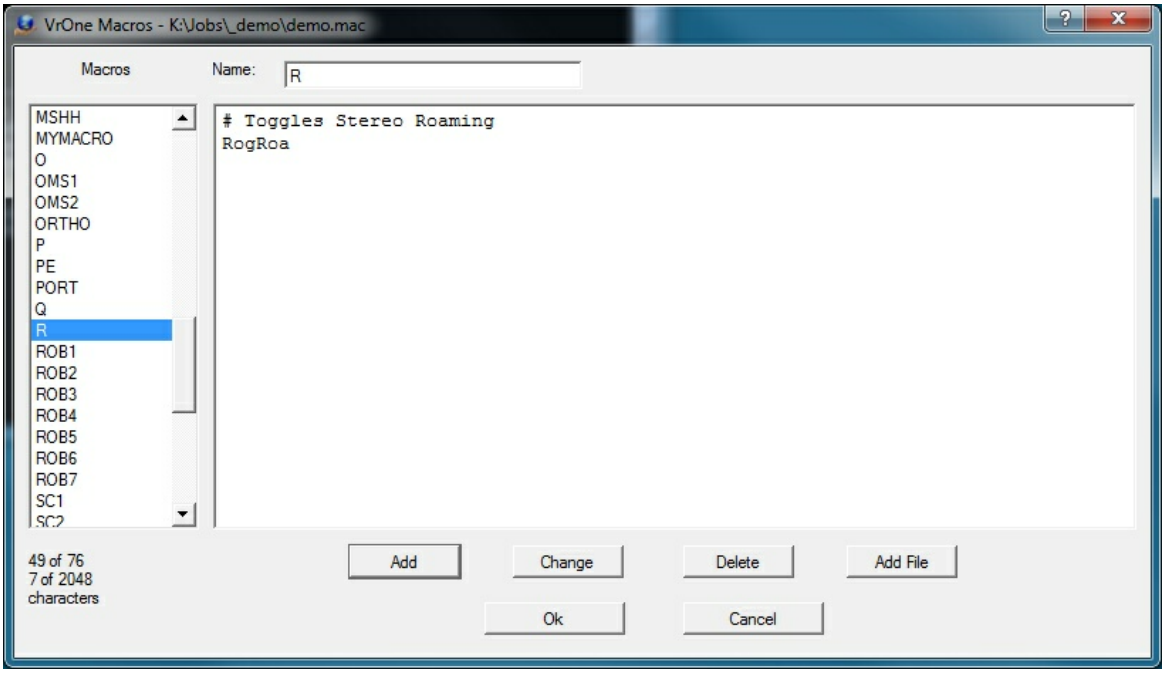
snapping to existing entities to obtain elevations, the on quit command may be used to turn snapping off.

Macros

"Become proficient in another language – or at least get the tapes and try."
- Richard A. Moran

Macros give the ability to execute a group of VrOne commands as a single word. Macros can execute VrOne commands, function keys and other macros.
It is common to use macros to condition snap parameters; they is useful for turning groups of layers on and off.
In the following example, a macro called "R" toggles stereo roaming with the Toggle Roaming (TogRoa) command.



The Edit Macro dialog box

It is possible to have a macro start an application (command) such as Insert Line and then condition the local parameters, but Function Keys were designed to do this.

3.3 Getting Started With VrOne/VrTwo

Vr

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Mapping

Getting Started with VrOne/ VrTwo

This document explains the process for creating maps with VrOne and VrTwo. It will walk through some of the steps to go from raw stereo image pairs to a finished mapping file. When this tutorial is complete, the user should be able to take raw stereo image pairs (either scanned or digital), orient them to a project coordinate system with VrTwo Orientation, collect vector data with VrTwo, and perform final cleanup, editing, and exporting with VrOne.

What is Vr Mapping?

Vr Mapping is a collection of software applications written specifically for creating digital maps. Vr Mapping software was designed for the Photogrammetry industry, and is the result of over 20 years of software development in this field. From its initial roots as an interface to stereo plotters, it has evolved into a full digital mapping toolset for multiple disciplines. Vr Mapping software has been used to map a variety of projects using stereo images, ortho rectified images, LiDAR data, or a combination of all three. Project types range from the mapping of Mount St. Helens, the exterior of the Space Shuttle, and the surface of Mars.

Two of Vr Mapping's main products are VrOne and VrTwo. A user with previous experience with CAD programs such as AutoCAD or Microstation would be familiar with VrOne and VrTwo. VrOne and VrTwo bear some resemblance to these other CAD systems but go beyond the standard CAD features to provide specific tools for Photogrammetry and other map making functions. There are over 200 mapping commands covering collection, editing, batch processing and more. Vr Mapping is also highly customizable with Function Keys, Macro Commands, and the Python programming language.

This tutorial does not go over all of the possible uses for Vr Mapping software, but focuses on two of the main programs required to create a basic map from aerial images. Although maps can be created using several different methods, such as tracing over ortho images and collecting from LiDAR data, this tutorial covers mapping from stereoscopic image pairs.

Software Tools Overview

There are many mapping products in the Vr Mapping suite, but this tutorial uses only four of them. Vr Image Utility will be used for initial project setup. VrTwo Orientation will be used to orient the raw stereo image pairs to your project coordinate system and to create stereo

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viewable epipolar images. VrTwo will be used to collect 3D mapping data from the epipolar stereo image models. VrOne will be used for final map cleanup and export.

Image Utility

Image utility contains many useful functions for dealing with images and should be the starting point before using VrTwo Orientation, VrOrtho, or VrAirTrig. Image utility provides the following main features:

- Image settings management (assigning camera settings, strip locations, and name formats)
- Inner Orientation in manual and automatic modes.
- Camera file creation and editing.
- Batch image rotations in 90 degree intervals.
- Batch image pyramid creation.
- Batch image format conversion.
- Image Pixel size computation.

VrTwo Orientation

VrTwo Orientation is used to create stereo image pairs (or models) for viewing in the VrTwo and VrLite mapping software. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model or multiple models may be oriented in a batch mode. The importing of models from aerial triangulation may be performed from the exterior orientations or from the measurements used to tie images and strips together.

VrTwo

VrTwo provides the ability to display stereoscopic images and collected full 3D mapping data from the images. Almost all of the features of VrOne are built into VrTwo. VrTwo provides two display modes which are static mode that displays fixed images with a moving 3D cursor and roaming mode featuring continuous roaming image with a fixed 3D cursor. Roaming mode is the preferred display method, and allows the operator to seamlessly move around large stereo image models without having to manually pan or re-center.

VrOne

VrOne is a powerful photogrammetric vector collection and editing package with image display capability. Photogrammetry today requires the mapping professional to deliver vector, image and digital terrain model (DTM) data as digital products. VrOne addresses many of the problems encountered in handling the collection, editing and plotting of vector, image and DTM data. Map updating and revision may also be performed with VrOne.

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Mapping Work Flows

There are several work flow paths that can be taken to transform raw stereo pair images to a finished mapping product. The work flows depend on the type of starting images and how they are to be oriented to the project coordinate system.

Each work flow starts with raw images that contain no orientation information. The first part of each work flow is called model orientation. Model orientation is a three step process that involves Interior Orientation, Relative Orientation, and Absolute Orientation.

Three Step Orientation Overview

Interior Orientation



Aerial image showing eight fiducial positions

Interior Orientation determines the interior perspective of an image by assigning a coordinate system and applying the camera calibration. This is normally done with a least-squares adjustment between known and measured fiducial point coordinates. When using film, the interior orientation compensates for film shrinkage or expansion. Camera calibration information

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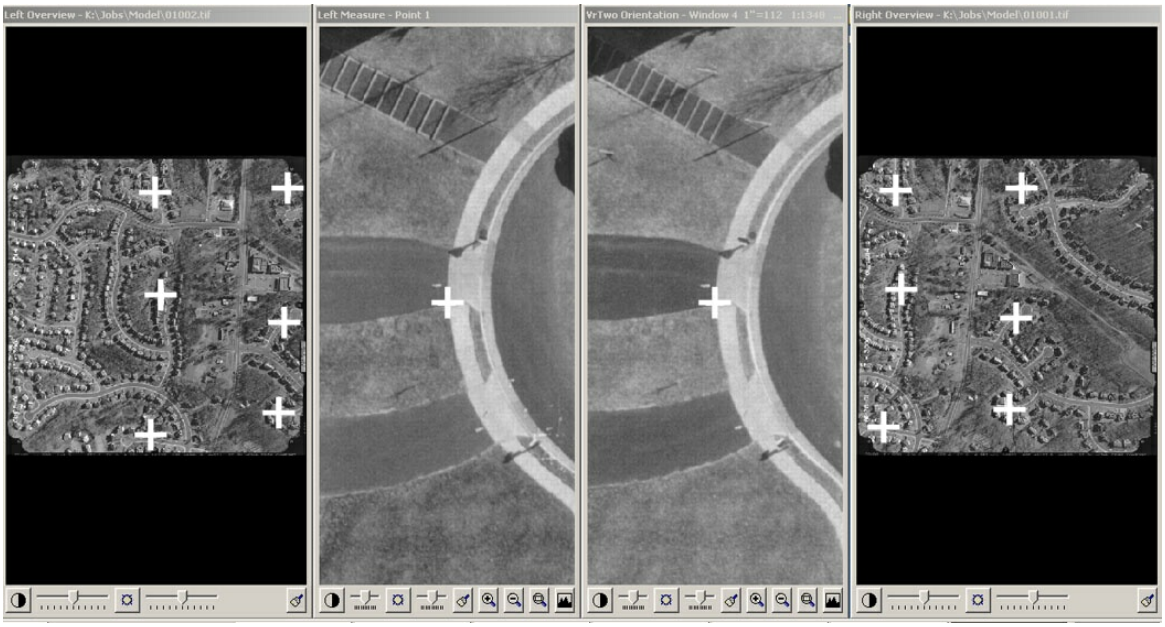
is required by Interior Orientation.

Relative Orientation



Relative Orientation with two overview windows and two measurement windows

Relative Orientation aligns the two images of a stereo pair so they can be viewed in 3D. This is done by observing common points on each image, in effect, tying the images together. Another least-squares adjustment is performed on these observed points. An Interior Orientation is required by Relative Orientation.

Absolute Orientation

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Control point measurement in Absolute Orientation

Absolute Orientation defines the transformations between the model space that was achieved with relative orientation and a known ground or object space coordinate system. Again, anther least-squares adjustment is performed to obtain these transformations. In this process an Exterior Orientation is created for each image. A Relative Orientation solution control point file in the project coordinate system is required by Absolute Orientation.

The results of orientation are stereo viewable epipolar image pairs, model definition files (.vmo) , and orientation (.orp) files. The .vmo files are opened in VrTwo using the Open Model (OpeMod) command in order to view the stereoscopic images. The .orp files have the same name as the left epipolar image file with the .orp extension, and contain the final orientation data to be used by VrTwo.

Below are examples of several work flow scenarios.

Work Flow Scenario One - Single model Orientation

The first type of work flow does not require any processing outside of the Vr Mapping tools. This is normally used for small projects that only require a few stereo models to be set up and have ground control consisting of at least two horizontal points and at least three vertical points.

1. **Interior orientation** - Images with fiducials: Use Vr Image Utility to define images and

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perform automatic Interior Orientations. Images without fiducials: Use Image Utility or VrTwo Orientation to define images and perform corner Interior Orientations. VrTwo Orientation may also be used to define images and perform manual interior orientations or Corner Interior Orientations.

2. **Relative orientation** - Use VrTwo Orientation to create model definitions and measure common points between left/right images on each model. This process will generate stereo viewable epipolar images.
3. **Absolute orientation** - Use VrTwo Orientation to measure control points in stereo to compute the final model parameters.
4. **Collect mapping data in VrTwo** - Use VrTwo to open the model files produces by VrTwo Orientation, and place mapping features from a stereoscopic 3D view.
5. **Clean mapping data and prepare for delivery** - Use VrOne to perform batch clean up operations, generate contours if required, and put together final map sheets and translate the mapping data if needed.

Work Flow Scenario Two - VrAirTrig Measurement and Import

The second type of work flow requires processing by VrAirTrig and VrAdjust or a third part aerial triangulation adjustment application. This is normally used for larger projects where single model setups are not practicable.

1. **Interior orientation** - Images with fiducials: Use Vr Image Utility to define images and perform automatic Interior Orientations. Images without fiducials: Use Vr Image Utility or VrTwo Orientation to define images and perform corner Interior Orientations. VrTwo Orientation may also be used to define images and perform manual interior orientations.
2. **Aerial triangulation** - Use Vr Aerial Triangulation (VrAirTrig) to measure points on all images and run a block adjustment using VrAdjust or a third party adjustment application. VrAdjust runs inside VrAirTrig while adjustments with other third party adjustments may be done my exporting the measurements.
3. **Import AT measurements or exterior orientations** - Use VrTwo Orientation to import the measurements created in VrAirTrig, or import the exterior orientations produced by VrAdjust or other third party aerial triangulation adjustment application. This will produce stereo viewable epipolar images along with exterior orientations for each model.
4. **Collect mapping data in VrTwo** - Use VrTwo to open the model files produces by VrTwo Orientation, and place mapping features from a stereoscopic 3D view.
5. **Clean mapping data and prepare for delivery** - Use VrOne to perform batch clean up operations, generate contours if required, and put together final map sheets and translate the mapping data if needed.

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Work Flow Scenario Three - Third Party AT Measurement and Import

The third type of work flow requires AT measurement and processing by third party aerial triangulation application. This is normally used for larger projects where single model setups are not practicable.

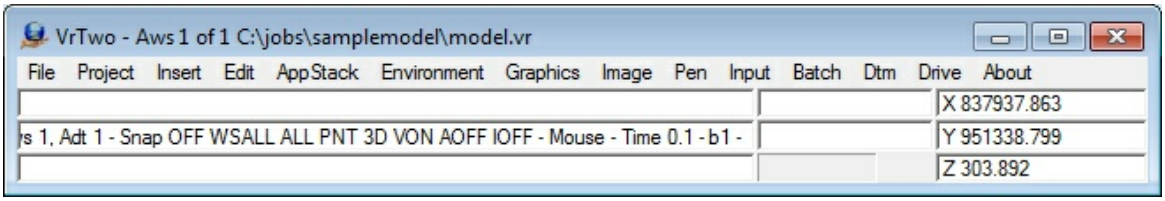
1. **Interior orientation** - Images with fiducials: Use Vr Image Utility to define images and perform automatic interior orientations. Images without fiducials: Use Vr Image Utility or VrTwo Orientation to define images and perform corner interior orientations. VrTwo Orientation may also be used to define images and perform manual interior orientations. NOTE: This step may be skipped if you are importing a third party aerial triangulation format that supports Interior Orientations.
2. **Import AT measurements or Exterior Orientations** - Use VrTwo Orientation to import the measurements or exterior orientations produced by the third party aerial triangulation adjustment application. This will produce stereo viewable epipolar image along with exterior orientations for each model.
3. **Collect mapping data in VrTwo** - Use VrTwo to open the model files produces by VrTwo Orientation, and place mapping features from a stereoscopic 3D view.
4. **Clean mapping data and prepare for delivery** - Use VrOne to perform batch clean up operations, generate contours if required, and put together final map sheets and translate the mapping data if needed.

Vr Mapping Concepts

This section will describe several concepts used in the VrOne and VrTwo programs.

Main Window

The Main Window in VrOne and VrTwo contains the command pull down menus, a key-in area, two information areas, the application (command) stack, a progress bar and the coordinate display. Commands names may be typed into the key-in area at almost any time. The system mouse must be in the Main or Graphics window for keystrokes to go into the key-in area.
On the border of the Main Window is shown the active workspace, the number of workspaces currently opened and the current VrOne file that is open.



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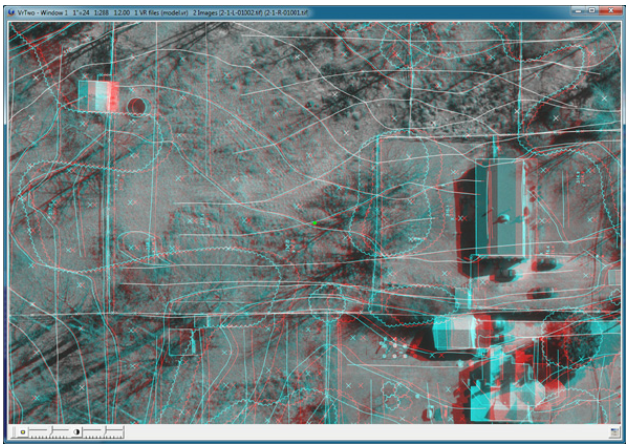
Graphics Window

The VrOne and VrTwo graphics windows display vectors and images. At the top of the window is displayed the window number, the scale of the window, the number of VrOne files opened and the number of images that are open. Also displayed is the image pyramid scale (i.e. 1:3.10) and the first two image names. In the lower right corner of the graphics window is a push button that allows the setting of the display of images, image names and image edges.



Graphics window displaying a stereo model (Anaglyph)

Menu Keys Dialog

The Menu Keys Dialog window is displayed by most interactive commands. The title of the dialog displays the currently running command name and the current command state. The top area of the dialog contains the entity parameters. This information is command dependent and normally shows where the data is to be stored on insert commands or where the data came from on edit commands. The bottom area contains the menu key buttons. These show what functions are assigned to the 12 menu key buttons. These keys are normally mapped onto an input device such as the keypad on a digitizing tablet cursor, or the button on a 3D input mouse. They are also mapped onto the 12 function keys on a standard keyboard.

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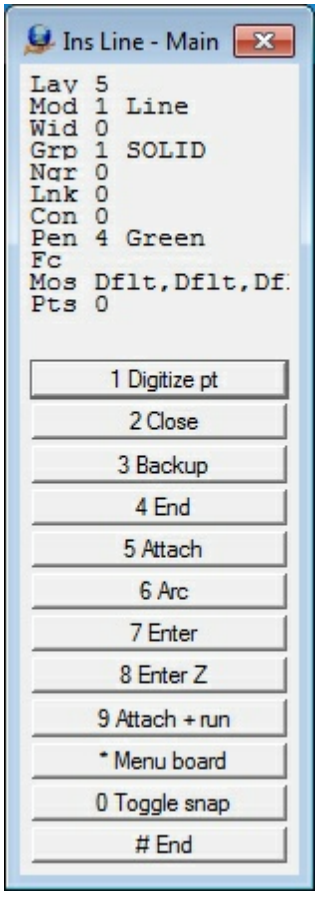

VrOne Vector Files

VrOne and VrTwo store mapping data in VrOne vector database files. These vector files use a .vr extension. The VrOne database is an entity based non-topological structure. Although the database contains some non-graphic and extended information other CAD systems do not, it cannot be considered a true Geographic Information System. It can however prepare vector data for accurate translation to GIS and other CADD systems.

Vector support files

Although each VrOne/VrTwo vector file can be considered a stand-alone database file, there are some support files required for displaying symbols and line fonts. An external pen table may also be used for controlling color by layer. The size of the file is operating system dependent. A VrOne/VrTwo vector file holds five different entity types which are Lines, Splined lines, Symbols, Text, and Points (LiDAR).

Creating new vector files

There are two methods for creating new vector files. The first method uses the "Open Vr Files" dialog, and prompts you for Target Scale and other file header settings. The seconds method is faster, but by default does not prompt for file header settings.

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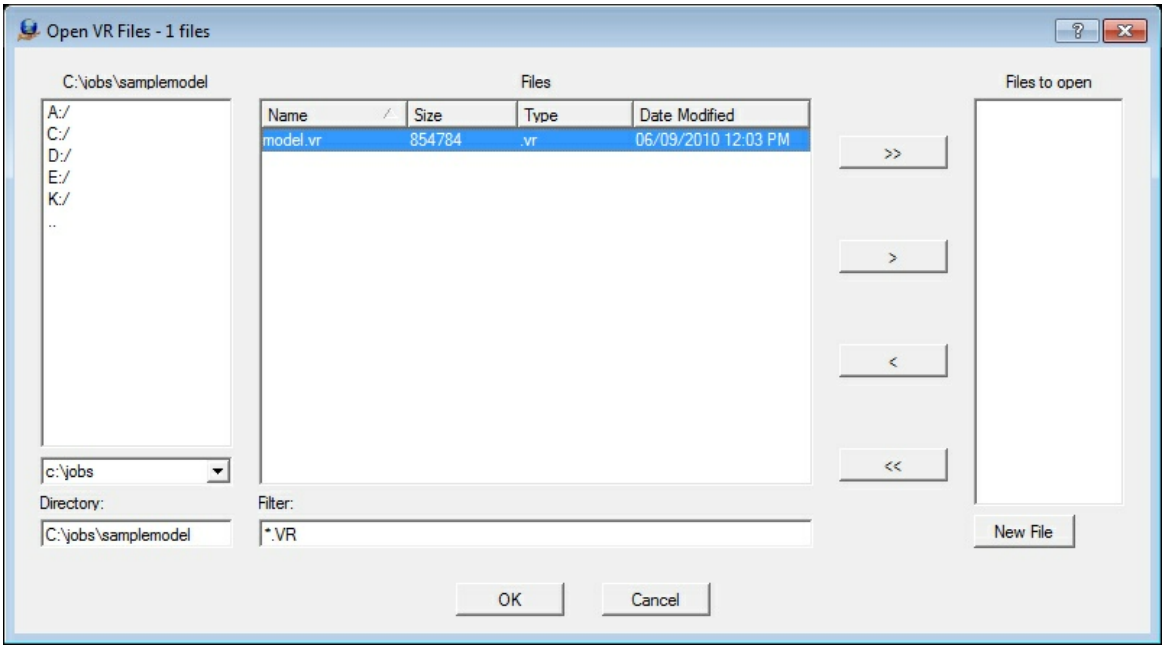
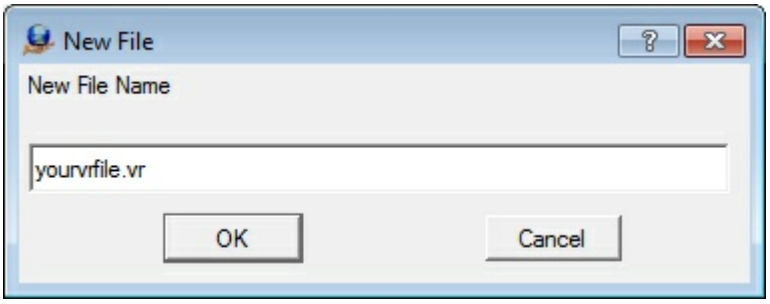
To create a new VrOne File and specify the target scale settings, follow these steps:

1. Click on File then Open VR Files, Then Click on New File.



The Open File dialog box used by Vr Mapping

2. Specify your desired file name for your new VrOne file.



3. Set your Target Scale and Vr File Description. See next section for details on the Target scale settings.

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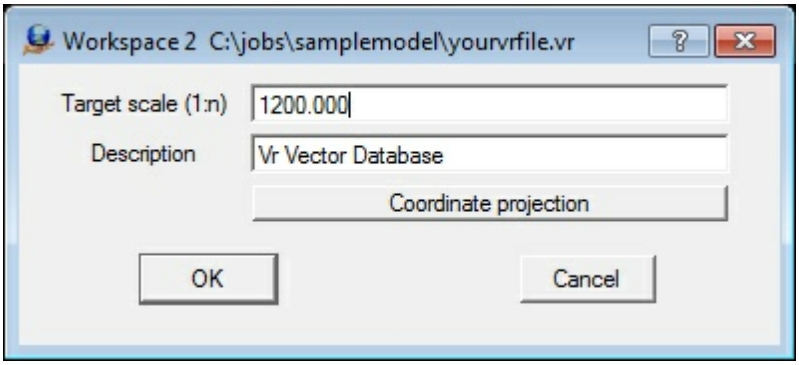

Workspaces

Workspaces are used by VrOne and VrTwo to manage multiple vector files. VrOne/VrTwo allows you to open multiple vector files and view them simultaneously, and each vector file is assigned a unique workspace number.

Active Workspace

Although multiple workspaces may be open at one time, only one workspace is considered active. Only the currently Active Workspace will store new entities. VrOne/VrTwo provides several methods to quickly switch the Active Workspace. VrOne/VrTwo also provides tools for merging workspaces, copying and moving data between workspaces, cutting out data to new workspaces, and more. An inactive workspace may be refereed to as a reference file in other mapping systems.

Target Scale and Prompt Units

Each VrOne/VrTwo vector file contains a Target Scale setting that is defined as the intended plotting scale or project scale. The Target Scale also controls the size of new symbols and text entities. You may configure the Prompt Units in the Vr Configuration program to be inches or millimeters. In VrOne and VrTwo the symbol and text sizes are entered as inches or millimeters at the Target (or plot) Scale. For example, if working in a vector file with a Target Scale set to 1:1200 (1"=100') and Prompt Units set to inches, a symbol placed with a radius of 0.1 will be drawn at radius of 10.0 ground units. The sizes are computed at placement time. If the file target scale is changed later, then symbols and text may be need to be rescaled using the Global Change command. Line Fonts such as tree lines and fence lines will be re-scaled automatically if the Target Scale is changed.

Symbol Radius and Text sizes

In many cases, items such as symbol and text sizes are specified as units at Target Scale. All symbols are stored with a radius of 1.0 and the size of the symbol is applied when the symbol is placed. A symbol radius may be defined as 0.08 of an inch and when placed with a Target Scale of 1:1200 (1"=100') would result in a ground radius of 8.0.

Transform and Shift Workspace

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Vr has two primary commands for changing the coordinates in existing vector files. Transform workspace performs a 2-dimensional transformation on one or more vector files. Transform options include translate, rotate, and scaling. Shift workspace performs a simple 3-dimensional shift of one or more workspaces. See the Transform Workspace and Shift Workspace documentation for more details.

Symbols and Line Fonts

VrOne and VrTwo stores symbol definitions and line fonts in a single symbol definition file. The symbol files use a .sym extension. Vr Mapping ships with a default symbol file containing sample symbols and line fonts, but it is an easy task to add and modify symbols and Line Fonts.

Managing Symbols and Line Fonts

The Manage Symbols (ManSym) command is used to view and manage existing symbols and Line Fonts. The Symbol Manager dialog displays all symbol and line font definitions in the current symbol library. The user can page through all of the symbols in the library, or jump directly to a specified symbol. After selecting a symbol, the user has the option to change the symbol name and size, create a new symbol, edit the symbol, clear the symbol, or copy the symbol. The symbol library can be saved to a new name. Existing symbol libraries can be loaded and edited, and new symbol libraries can be created. The number of symbols displayed per page and the symbol display size may be customized. Double clicking on a symbol will start the Insert Symbol or Insert Line command with the graphics pointer set to the selected symbol. See the Manage Symbols document for more details.

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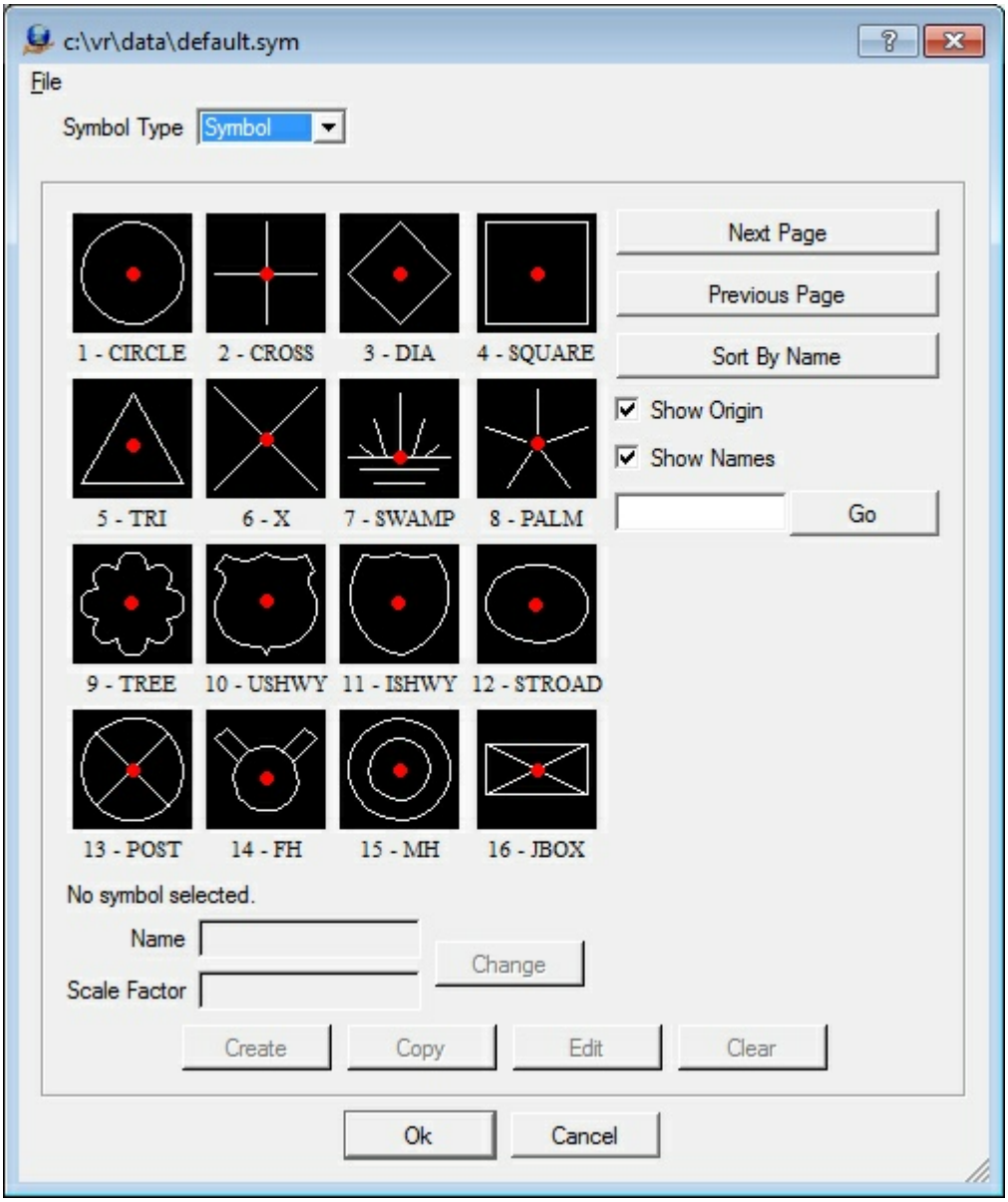

Manage Symbols and Line Fonts

Creating a New Symbol or Line Font

New symbols or line fonts may be created by identifying existing line entities. These entities will be used to make a Symbol or Line Font.

The size of the lines to be used is not important during creation. Line fonts use a line font length and are scaled at plot time. Symbols are stored with a radius of one and are scaled at plot time. Since VrOne files contain a target scale, one symbol library may be used for many map scales.

See the Create Symbols document for details about creating Symbols and Line Fonts.

Programming VrOne/VrTwo

There are three ways to program the VrOne/VrTwo mapping environment. These methods

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include Macros, Function Keys and the Python programming language. Although VrOne/VrTwo is delivered with many powerful tools the ability to program the systems gives users the ability to tune and extend the system.

Function Keys

Function Keys are the most important aspect of VrOne/VrTwo data collection. Taking the time to properly set up function keys before a project has started will save hundreds of hours of production time.

Function Keys are the method of making a mapping system out from a CAD system. For example, instead of using Insert Line to place a road, the operator will used a Function Key such as PavedRoad. PavedRoad will assign all the proper attributes and behavior to Insert Line and start it.

Function Keys reduce the amount of knowledge the mapping professional needs to know about VrOne/VrTow. They simply choose the feature they want to collect and begin collecting vector data.

Entering its name or function key number may start a function key. These names or numbers may be keyed in, placed in macros or even placed in other function keys.

The name of the Function Fey file to use must be set in the VrOne configuration program (VrCfig). It is possible to have multiple function key files but only one can be active at a time.

See the the tutorial on Function Keys or the tutorial on the Function Key On End Command for details about setting up new and editing Function Keys.

Macros

Macros give the ability to execute a group of VrOne commands as a user-defined word or character. Macros can execute VrOne commands, function keys and other macros. Several uses of macros might be to condition snap parameters and with 30,001 layers, it is useful for turning groups of layers on and off.

A macro can be used for simple functions like toggling in and out of roaming. The following Macro allows the user to type the letter R to issue the Toggle Roam (TogRoa) command. This saves the user the additional keystrokes that would be required to type the full command. To add this macro type the name in the Name Field then commands in the main window. When done click the add button at the bottom.

The AddFile button can be used to define file names by selecting them from a dialog box. The resulting file name will contain the drive letter and file path.

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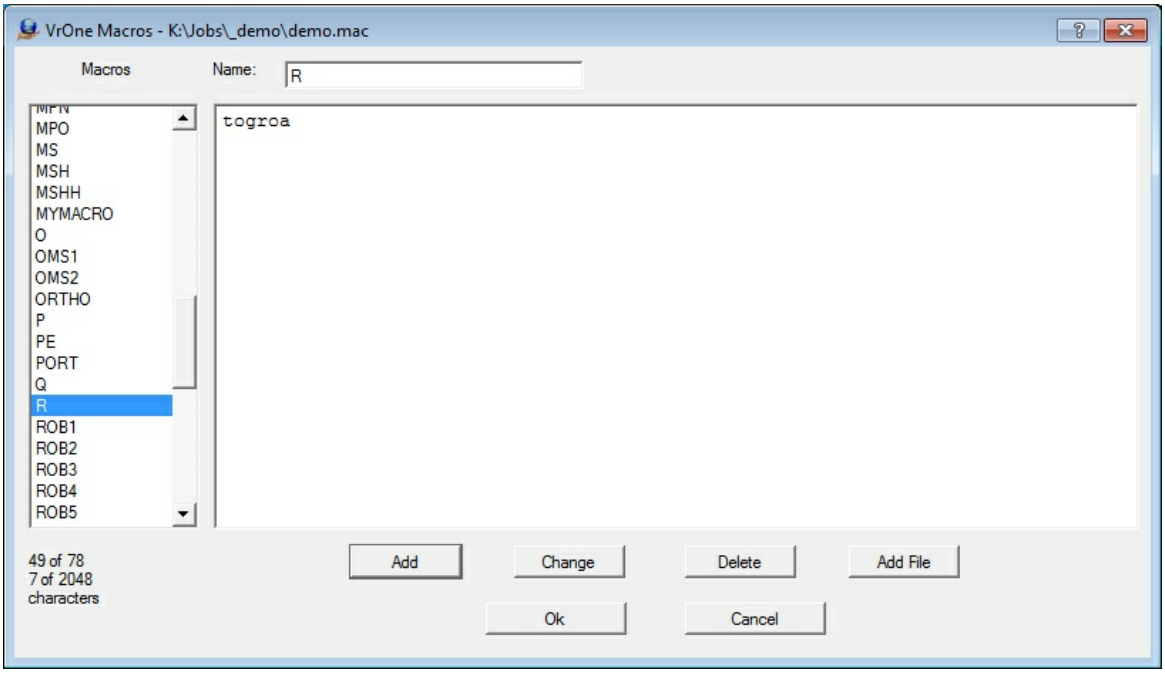

Edit Macro dialog

Python Programming

Python is an object-oriented scripting language. Its design mixes software engineering features of traditional languages with the usability of scripting languages. It is possible to write Python scripts that interface with VrOne through VrOne/Python classes. This interface allows full access to reading and writing the VrOne database and the access to interactive editing. Python is a great way to extend the capabilities of the existing VrOne collection applications. For example, a Python script could be written to place symbols on the ends of a line each time the line is saved. See the Python Programming document for more details.

Tutorial Overview

For this tutorial, a sample stereo model that has already gone through the orientation process will be used. The sample model was produced using Work flow Scenario One - Single Model Setup .

To learn more about the orientation process, and follow the steps to create the sample model from scratch, then please see VrTwo Orientation single model orientation .

Tutorial Walk Through

Downloading the Sample Data

To get started, download some sample data and install it to your local machine. The sample data for this project can be download at the following address.

http://vrdownload.cardinalsystems.net/downloads/sample-data/gettingstartedmodel.exe

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Please contact Cardinal Systems for the username and password for this download.

Install the Sample Data

Run the gettingstartedmodel.exe file. This will install the sample data into c:/jobs/samplemodel.

The sample data consist of the following files.

- Two Epipolar Images
- Orientation file .orp
- Model file .vmo
- VrOne/VrTwo Vector file .vr
- Macro file .mac

Now that the sample data has been installed, you will use VrTwo to open and display the stereo images.

Starting VrTwo

1. Double click on the Vr Mapping folder on your desktop.
2. Double click on the VrTwo Icon in the opened Vr Mapping folder.

Once opened, the VrTwo Main Window is displayed along with one or more graphics windows as shown below.

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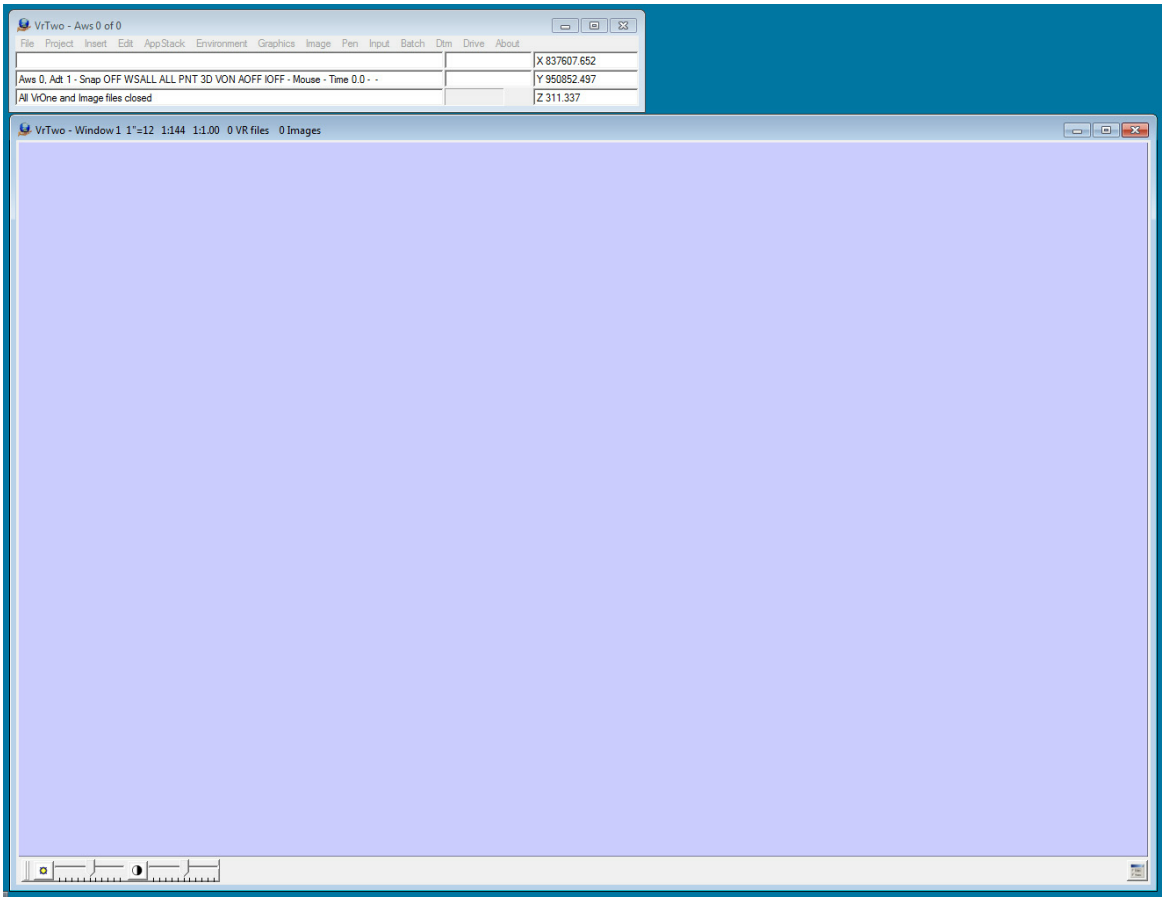

VrTwo Main Window and Graphics Window with no model or VrOne vector file open.

The sample stereo model may now be loaded into VrTwo.

Loading Sample Model Into VrTwo

1. Click on File then Open Model. This can also be done by using the Open Model (OpeMod) command.
2. Navigate to C:/jobs/samplemodel/
3. Select 2-1.vmo then click OK.

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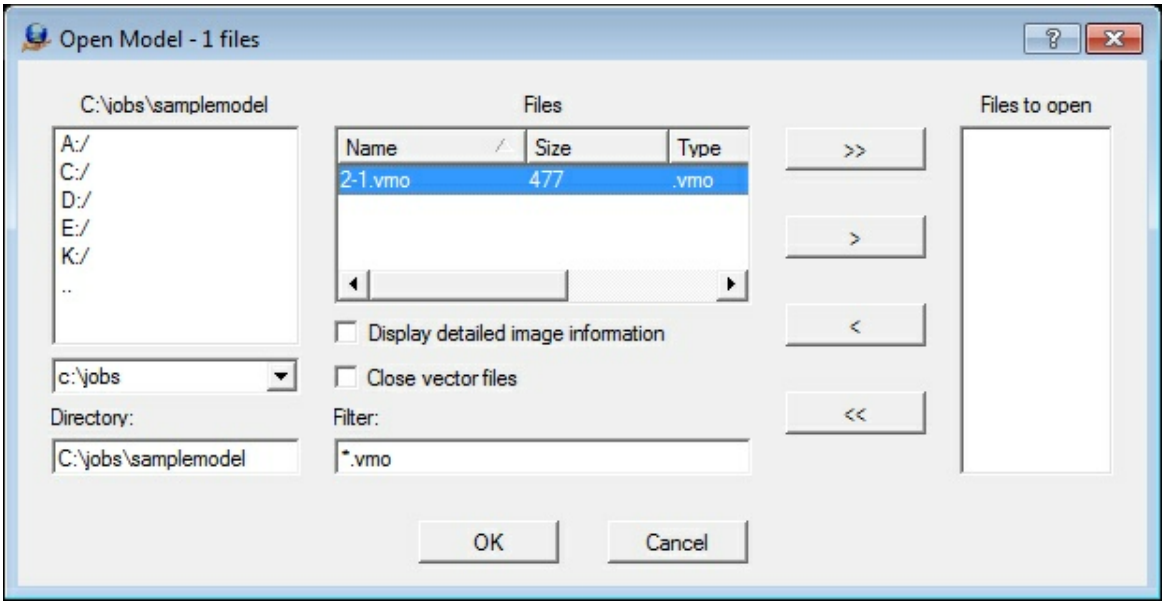

Opening a model in the Open Files dialog box

A stereo model should now be displayed in the VrTwo graphics window. If using stereo shutter glasses with an emitter, you should see the emitter light turn on, and the content should be viewable in 3D using the shutter glasses.

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VrTwo stereo model (Anaglyph)

The Toggle Roaming (TogRoa) command is used to switch between static and roaming modes.

Opening the Sample Vector File

The sample data provided includes a sample line work file named model.vr that may now be opened.

1. Click on File then Open VR Files or use the Open Vr Files (OpeVr) command.
2. Select c:/vr/samplemodel/model.vr then click OK.

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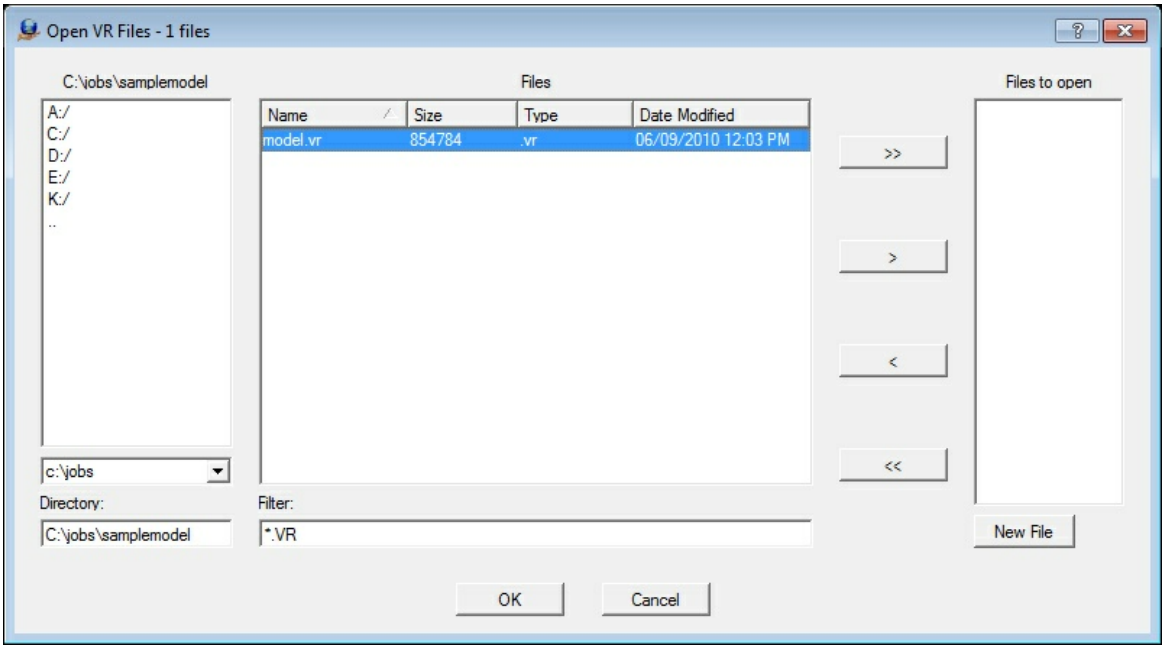

Opening a VrOne/VrTwo vector file in the Open Files dialog box

This concludes the step by step part of this tutorial. The remaining sections describe different methods for collecting and editing data now that you have a stereo model loaded.

Collecting Data

Insert Line Application

The Insert Line (InsLin) application allows multiple point lines where the operator determines the location of the points. To start Insert line, select Insert->Insert Line or type use the Insert Line (InsLin) command.. Pressing button 1 (left mouse click on system mouse) will digitize points. Press button 4 (F4) to end the line. See Insert Line for more information on this application.

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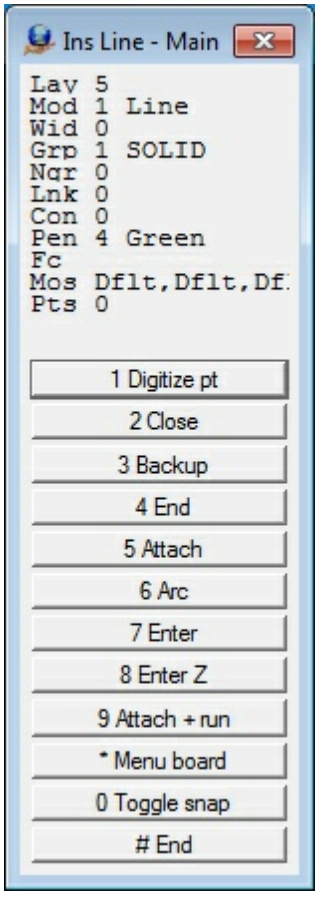

Inserting Lines by Function Key

Most users will digitize data by using predefined function keys. For example, to digitize the edge of a road, the user would start the "Road" command instead of starting Insert Line. Starting the Road command could be done by typing in a number, typing in "Road", or selecting it from an input device. The Road command as defined in the function key definitions, would set all the correct attributes for Insert line. Once in the Road command, all of the normal Insert Line features apply: Press button 4 (F4) to save the current road and begin a new one, or press button 12 (F12) to exit the road command completely. See Insert Line for more information about this application.

Below is configuration for the road function key. Function keys can be edited by using the Edit Function Keys (EdiFun) command or by clicking on Input / Edit Function keys.

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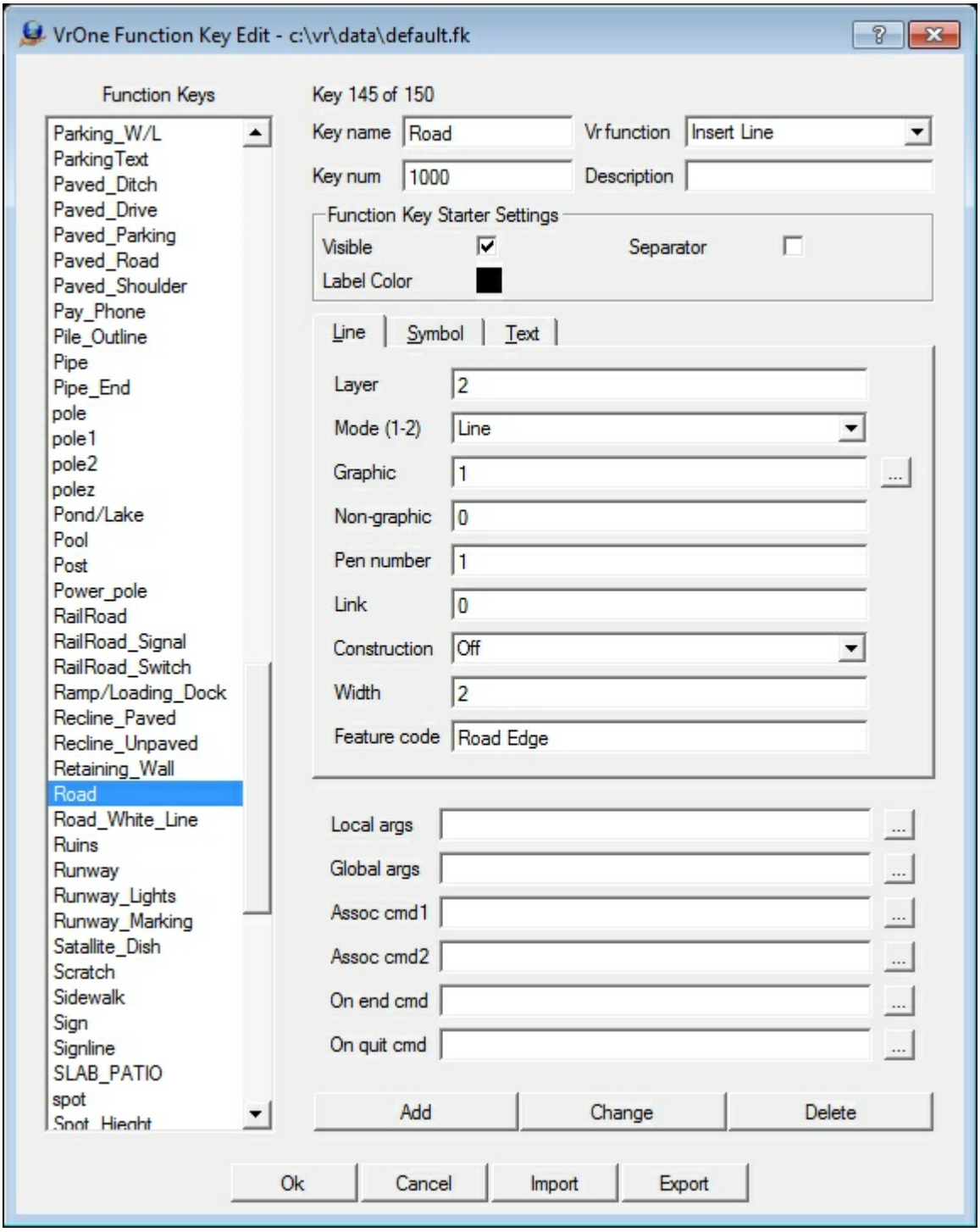

Edit Function Keys dialog box

Following is the Insert Line Menu Keys dialog box that was started from the Roads Function Key.

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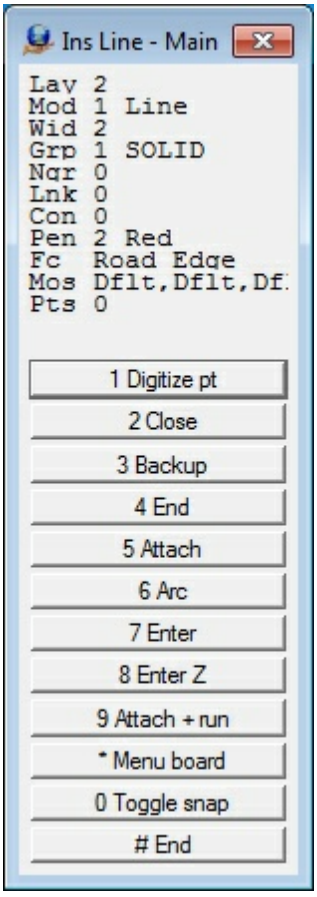

Other Applications That Can be Used for Inserting Lines in VrOne/VrTwo.

Insert Fly Line (InsFly)

Digitizes a line in "fly" mode in which the line is drawn freehand in stream mode. Places the proper number of points on the line as determined by user define parameters to make the line smooth. This is useful for digitizing contours, water lines and break lines. A manual mode may be entered when in stream digitizing mode which allows points to be digitized manually. See Insert Fly Line for more information about this application.

Insert Square Line (InsSqu)

This application inserts a line and squares the line to one of several user-defined parameters. Supports squared and un-squared segments and helps with hidden corner placement. Lines may be closed and squared or left open and squared. Lines may also be squared to and attached to other lines with Insert Square. See Insert Square for more information about this application. Two additional squaring applications are available for squaring lines which are Insert Orthogonal Line (InsOrt) and Insert Orthogonal Corner (InsOrc).

Insert Parallel Line (InsPar)

Places parallel lines from a user-defined baseline. The distance from the base line may be

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specified by a digitized point or by entering an offset distance. The elevation difference from the base line or previous line may also be specified. Parameters for the new line may be obtained from the base line or from a user-defined Function Key. See Insert Parallel Line for more information about this application. Two additional application are available for parallel lines which are Insert Multiple Parallel Lines (InsMul) and Batch Offset (BatOff).

Insert Symbol Application

The Insert Symbol (InsSym) application allows the placement of graphic symbols from the symbol library. Each symbol is assigned a graphic pointer number that coincides with a symbol in the currently loaded symbol file. The symbol file is defined in Vr Configuration under the Vector settings dialog. See Insert Symbol for more information about this application.

There are three main modes when Digitizing symbols.

- A one-point symbol will be placed with one digitized point using the current radius.
- A two-point symbol will be placed with two digitized points. The first point is the symbol's origin and the second is the radius. If symbol interactive rotation is on then the scaling and rotation of the symbol is handled as a single step.
- A three-point symbol can be placed by digitizing three points along the edge of the symbol. The three-point symbol is useful for placing items such as large tanks with a symbol where the center of the tank cannot be determined.

Button 6 (F6) toggles the symbol rotation mode. When the symbol rotation mode is on the symbol will be placed by digitizing two points. The first point defines the symbol origin and the second is the symbol rotation. This is useful when placing symbols such as poles with directional ticks. The rotation of these type or symbols normally changes between each symbol. If the number of points to use when placing a symbol is set to two then the scaling and rotation of the symbol is handled as a single step.

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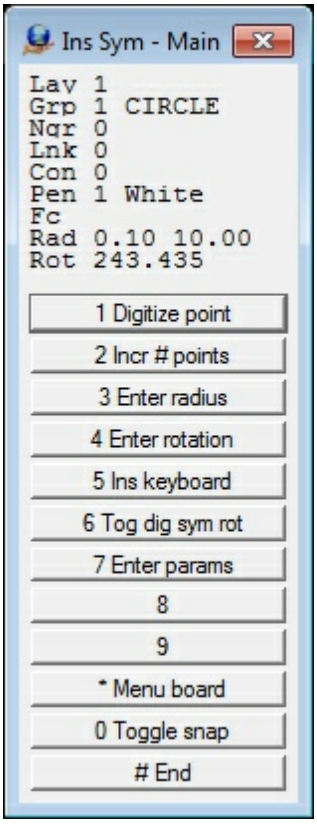
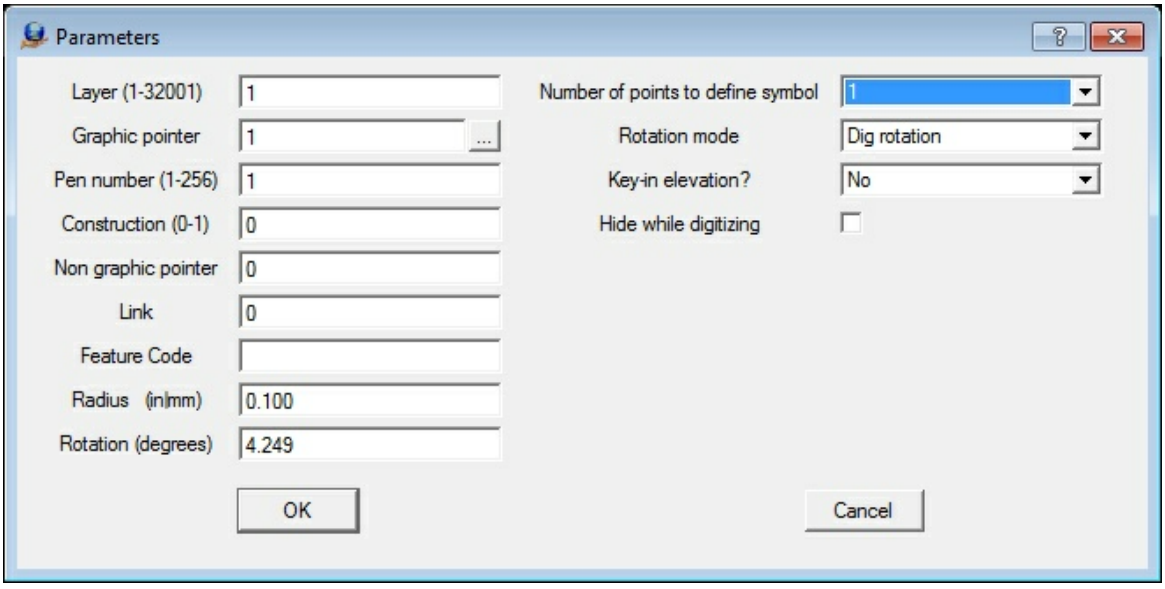


Below is the Parameters dialog box for Insert Symbol. This can be accessed by pressing button 7 (F7) while running Insert Symbol.



Insert Symbol (InsSym) parameters dialog box

Inserting Symbols by Function Key

When collecting data, symbols will typically be placed by starting a predefined Function Key.

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For example, rather than starting Insert Symbol (InsSym), pressing button 7 (F7) then changing the graphic pointer and other parameters, it would be possible to just type spot to start the "Spot Elevation" Function Key. This Function Key would start the proper VrOne/VrTwo application and assign all the needed attributes and conditions to collect this feature type.

Below is the setup for the Spot Elevation Function Key . Function keys can be edited with the Edit Function Key (EdiFun) key-in or by clicking on Input -> Edit Function Keys. See the Function Keys tutorial for more information about setting up these keys and see the On End tutorial for more information about using the On End Command which is available in the Function Key definition.

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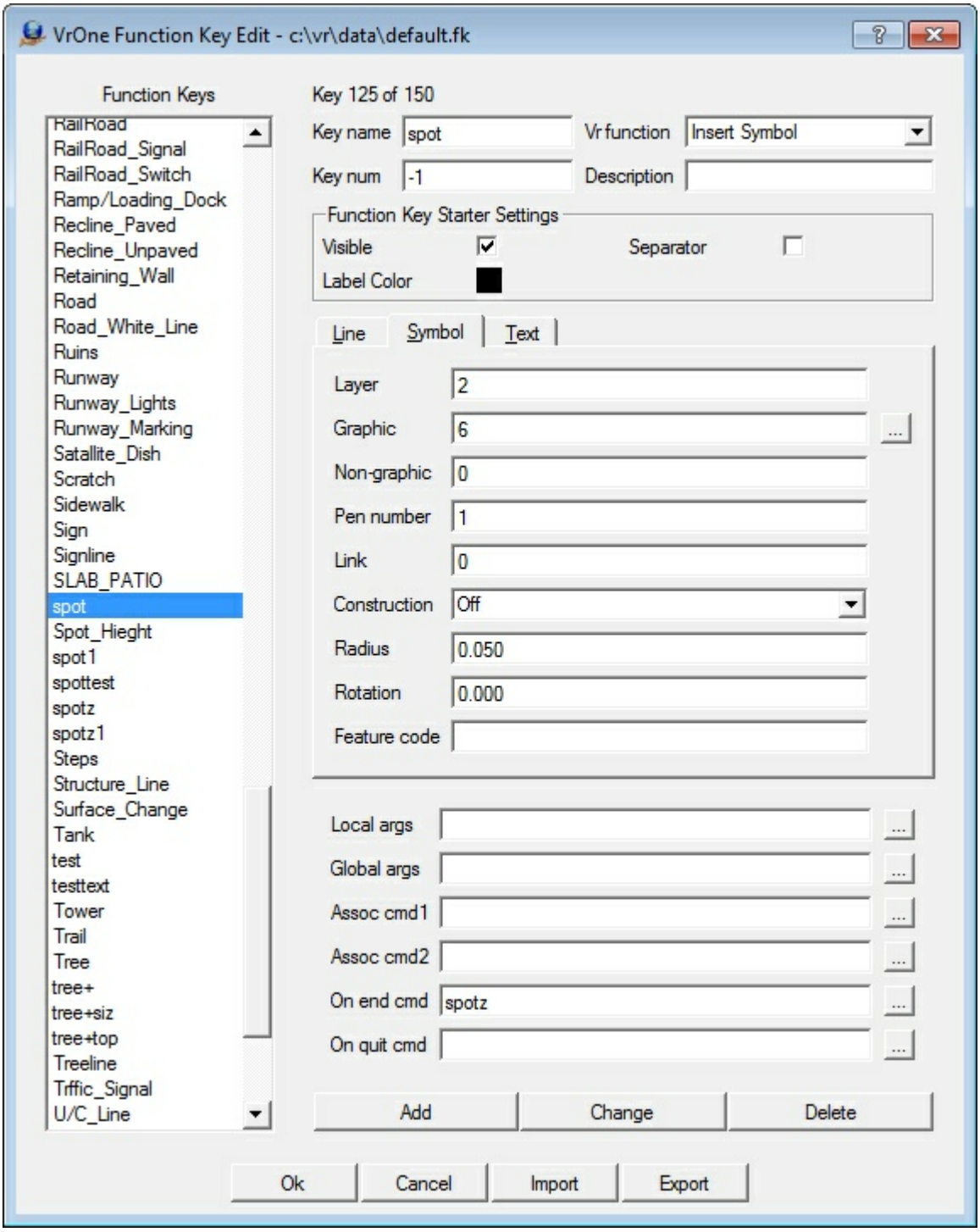

A Function Key to place Spot Elevations

Insert Text Application

Insert Text (InsTex) is designed to be run interactively or to be launched from a Function Key or Macro. When used interactively, a rich set of options enable precise text placement in most situations. When run from another function key, options allow the application to be started and a

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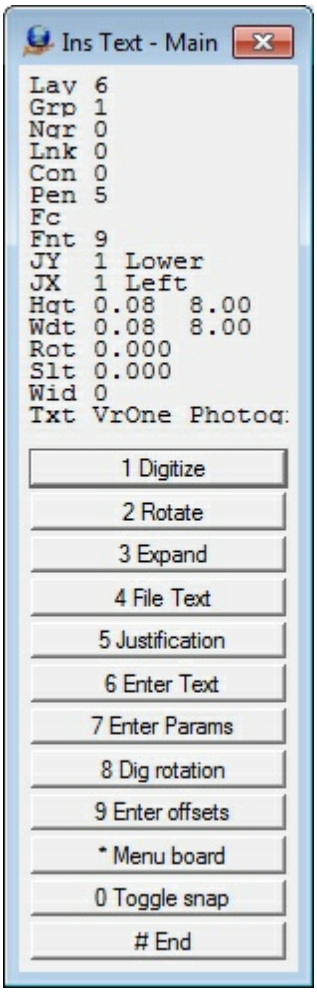
text label to be placed without user intervention. Text labels may be typed in using a dialog box, keyed-in from the key-in area or from a text file.

Running Insert Text interactively can be done by starting the Insert Text application (InsTex) or clicking on Insert -> Insert Text.



Below is the parameters for inserting text, this dialog box can be viewed by pressing button 7 (F7) while Insert Text is running.

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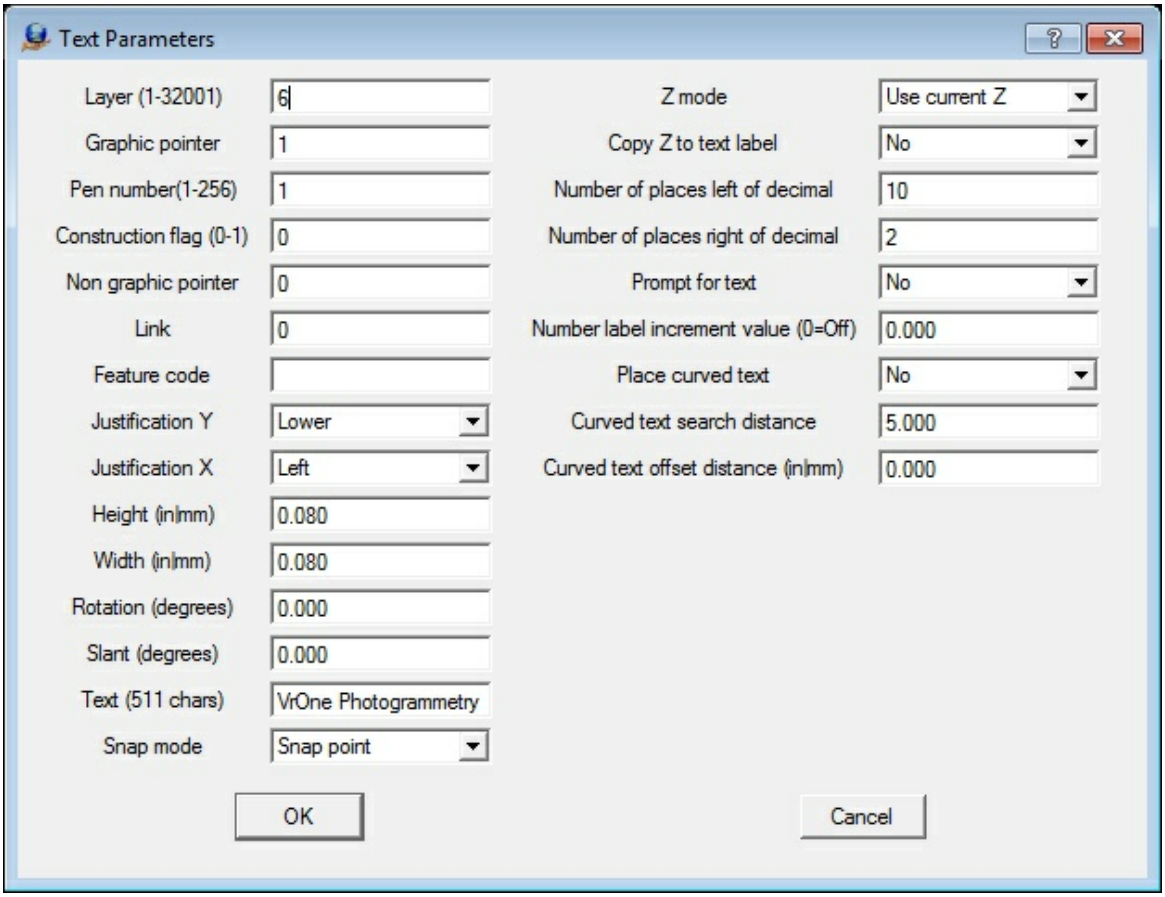

Inserting Text from a Function Key

As with other insert functions in VrOne and VrTwo a Function Key that predefines the application to start and the attributes and parameters will be used for inserting text. See Edit Function Keys (EdiFun) for more information about Function Keys.

The On End Command

Insert Text (InsTex) may also be called from another Function Key's "On End" command. This is useful for features like adding text and elevations when placing Man Holes. In the example below, the user would type "Mh" or "1256" to start the following Function Key. This function key would begin the "Insert Symbol" command and when the symbol was digitized, the Function Keys to place the text "MH" and the elevation would be started. Once the two additional text labels were placed the Function Key would return to placing the symbol. See the On End Command tutorial for more information.

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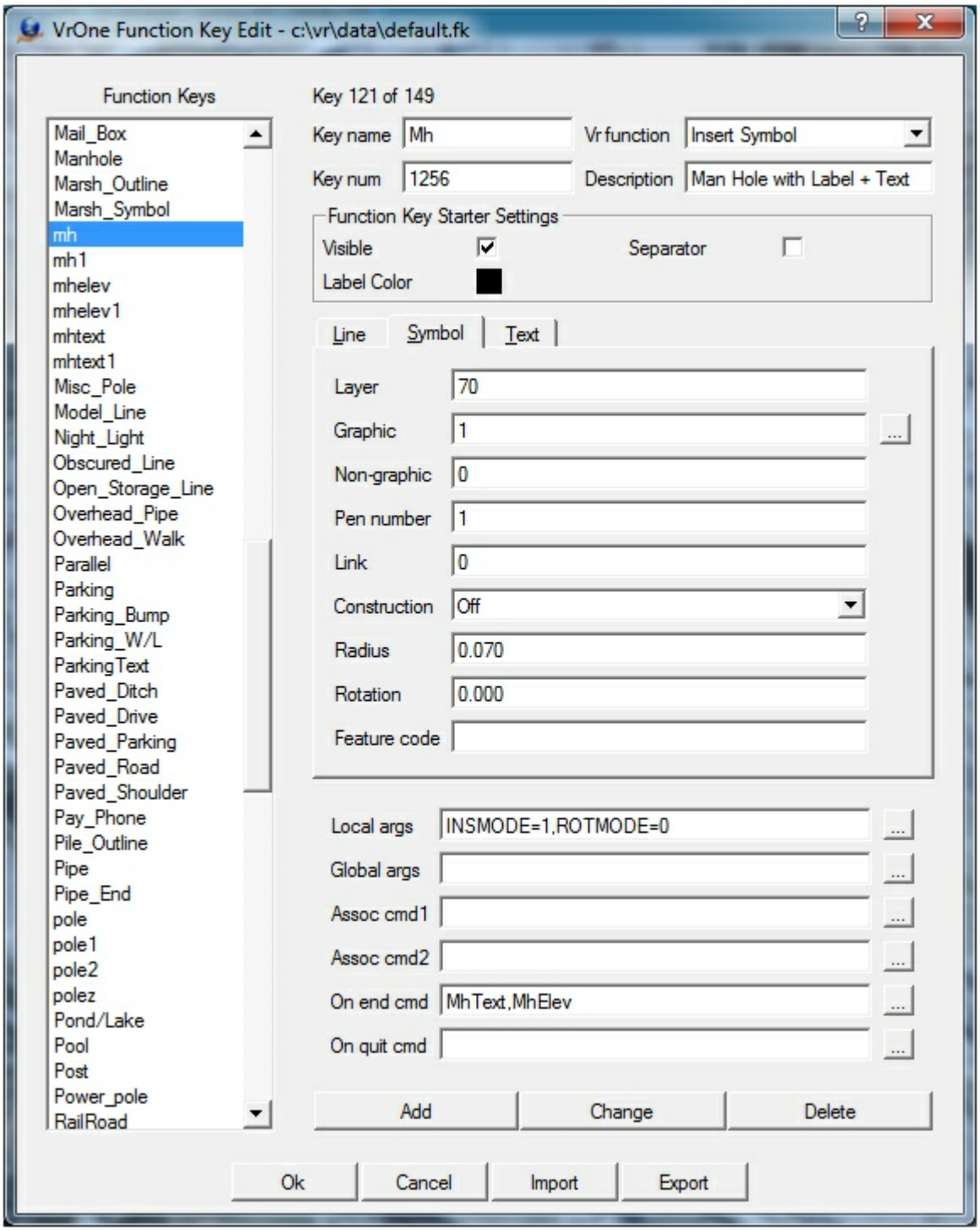

A Function key to place Man Hole symbols with a label and elevation

Generating a DTM Surface for Contours

Once points and break lines have been collected The DTM (Digital Terrain Modeling) application in VrOne or VrTwo may be used to to create contours. There are two applications available when generating DTMs. The Set DTM (SetDtm) application allows the configuration of

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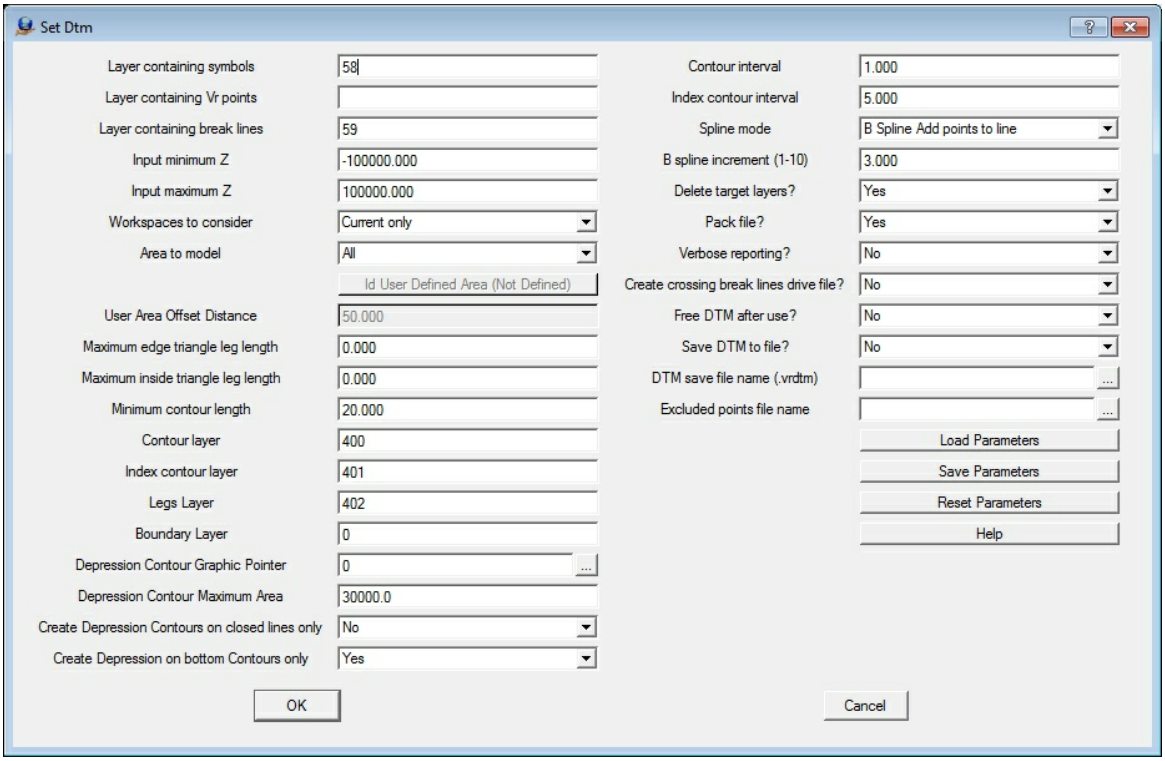
the DTM parameters and the saving and recalling of these parameters. Once the DTM parameters are set then the Run DTM (RunDTM) command will generate the 3-dimensional surface and place contours and triangles if specified.

Other related application include Insert Line Text (InsLte) which is used to place labels on contours and Manage DTM Surfaces (ManDtm) which is an optional package that runs inside VrOne and VrTwo and compares DTM surfaces for volume calculations.

Configuring DTM With the Set DTM Command

To configure the DTM engine use the Set DTM (SetDtm) command or selected DTM->Set DTM parameters. See Set DTM for more information.



Set Dtm dialog box

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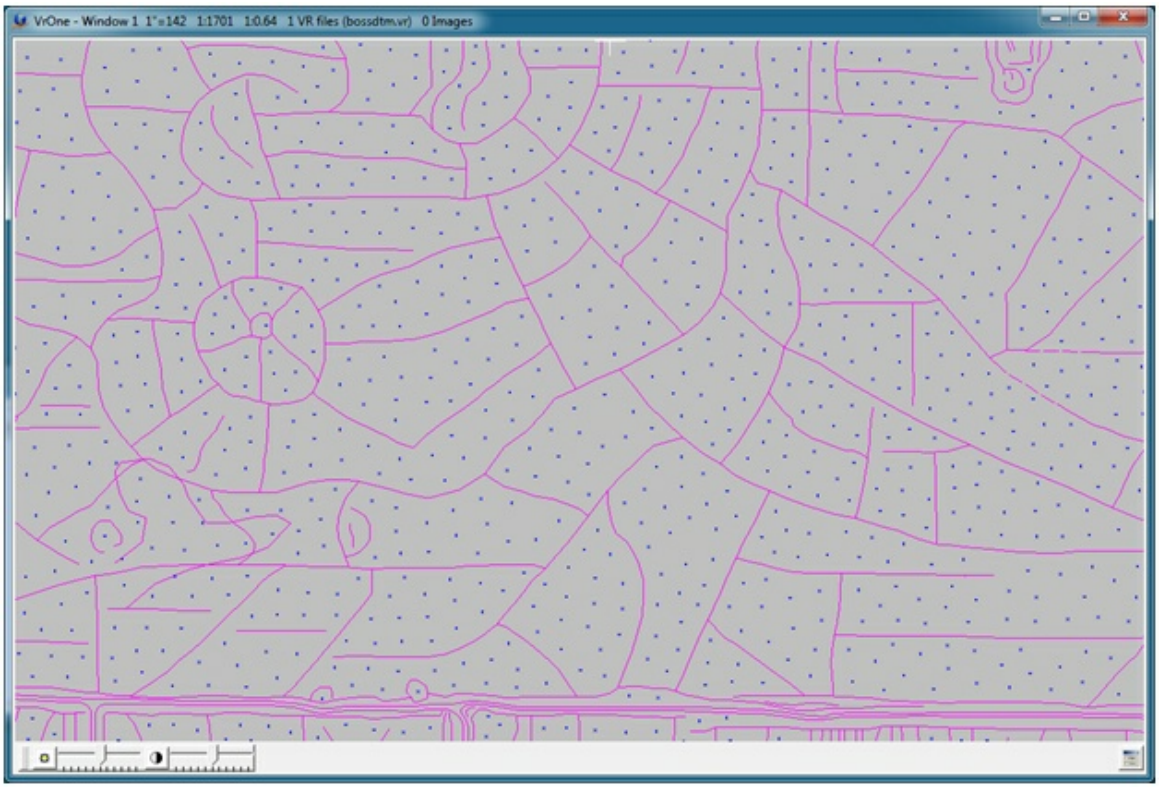

Graphics window showing points and break lines

Processing DTM With the RunDtm Command

Once settings have been configured for the DTM engine through the Set DTM (SetDtm) command, the DTM engine can be started from Run DTM (RunDtm) key-in or selecting DTM->Run DTM from the Main Window pull down menu.

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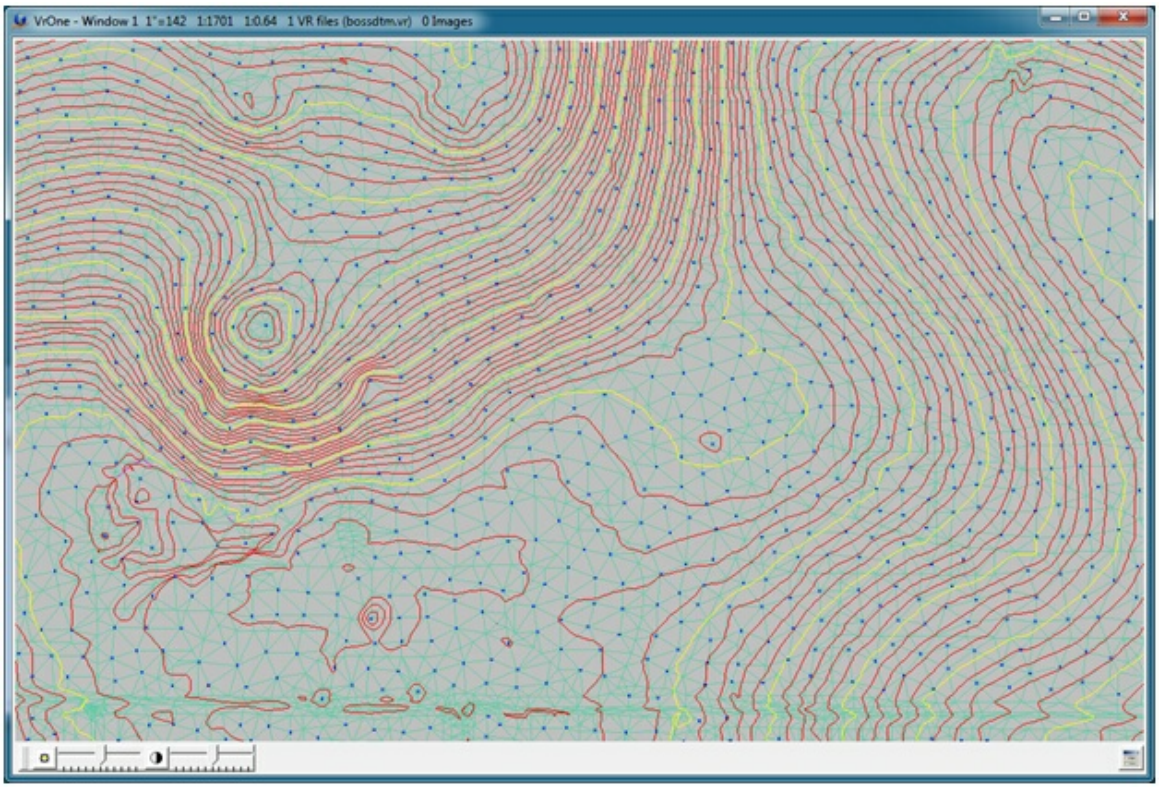

Graphics window showing points, break lines, triangles and contours

Draping Features to DTM Surface

The Drape application has the ability to drape lines, symbols and text over a active DTM surface. It is also possible to drape the active cursor location to the DTM surface to compute a real-time elevation of the cursor. To drape entities onto a DTM surface the following requirements must be met.

1. Free DTM after use must be set to no in the Set DTM (SetDtm) parameters.
2. A DTM surface must be active by running Run DTM (RunDtm) at least one time.
3. The Z Source must be set to 'DTM surface if active' This can be set by the Z Source (ZSou) command or by selecting Input -> Z source from the Main Window.
4. Draping is performed by the Drape (Dra) application or by selecting DTM->Drape from the Main Window.

See Drape (Dra) for more information about the this batch application.

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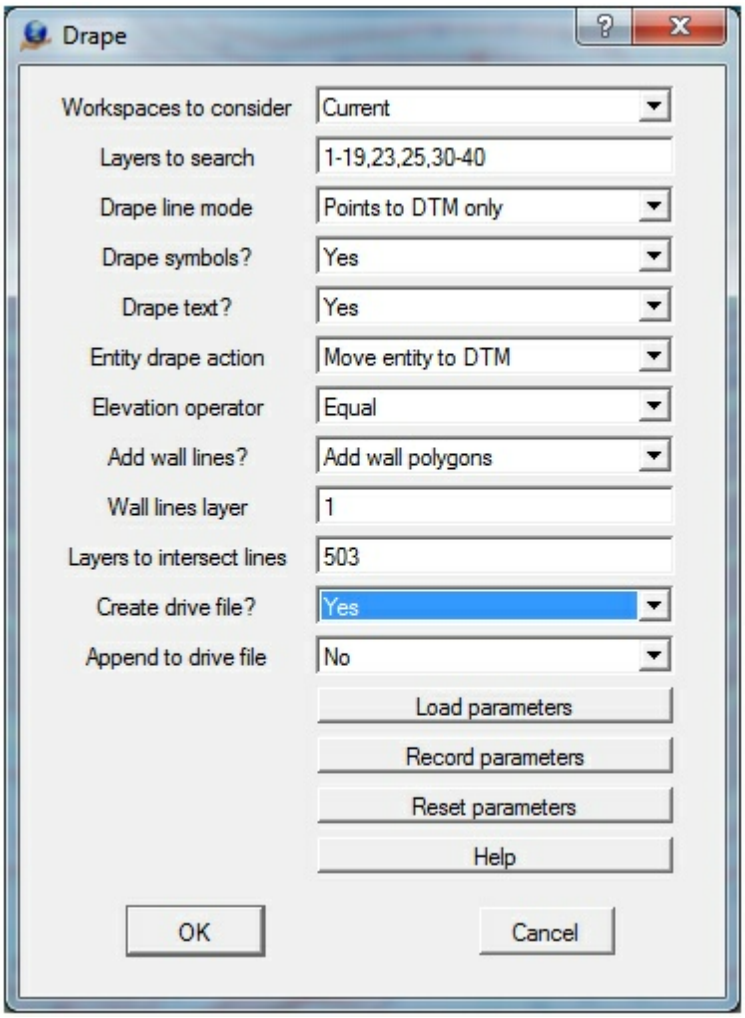

The Drape dialog box

List of Commands

Please see the List of Commands document for to view the available commands and applications in VrOne and VrTwo.

Cleaning up Data

Once the vector data has been collected, there are several steps that can be performed in VrOne for clean up and preparation for final delivery. Although these steps can be performed in VrTwo, it is sometimes more convenient to perform them in VrOne. Clean up may involve trimming and extended lines to eliminate overlapping lines (overshoots) or gaps between lines (undershoots). Another common task is to take the data contained in each stereo model and rearrange it into final project sheets. This may involve merging models, joining lines, and cutting out into sheets.

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Batch Trim (BatTri)

Batch Trim (BatTri) batch application may be used to trim lines and text. The batch application allows the user to collect data without having worry about line overshoots and undershoots. Typical uses for batch trim would include: Trimming Sidewalks to buildings , Contours to buildings , Sidewalks to driveways, Clearing contours through trees. Another application that works with the trimming and noding of lines is Batch Node (BatNod).

Batch Join (BatJoi)

The Batch Join (BatJoi) batch application join lines within parameters specified. Options include limiting the lines to be joined by Layer, Mode, Graphic Pointer, horizontal distance and elevation. This avoids joining entities such as fence lines to entities such as road edges. Many lines may be joined together as a single entity. This results in cleaner and more contiguous data base. Batch join has the ability to join lines into a single entity if they exist in the same workspace and the ability to match the lines if they reside in separate workspaces. There is also an option to match lines only in which the lines will be graphically joined but the lines will remain as separate entities in the data base. In this case the lines will retain their original line properties. When lines are joined into a single entity the properties from the first line will be used. Join Lines (JoiLin) is an interactive application in which the user chooses the lines to be joined.

Make Polygon (MakPol)

Make Polygon (MakPol) looks at the spatial relationship of existing line segments and creates enclosing polygons around areas containing centroid symbols. See the Make Polygon documentation for more details. A video tutorial of Make Polygons is available also.

Exporting Data

There are many options for export data from VrOne/VrTwo to other systems. Options include DXF (AutoCAD), Microstation, Shape File, ASCII (Text list), LAS (LiDAR) and DSFL. Many of these output formats have an input translator to translate data into VrOne/VrTwo.

Exporting to DXF

The DXF format is commonly used to translate map data to Autodesk's AutoCAD program. Due to the popularity of the format, it is used by many other CAD and GIS (Geographic Information Systems) systems for the transfer of map vector data. From GIS to civil engineering systems, DXF is considered the de-facto standard for moving vector data. Experience has shown that DXF is also well suited to move vector data to the ARC INFO GIS system although a Shape File translator is available in VrOne and VrTwo. See DXF Out and DXF In for more information on the DXF translators.

Exporting to Microstation

VrOne translates files to and from Microstation using a neutral file. This allows both programs to

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read and write map data using their internal libraries. This results in a more flexible and accurate translation. See Microstation translators and Microstation Out (MstOut) and Microstation In (MstIn) for more information about these translators.

Exporting to Shape Files

The Shape File format is used by ArcView GIS software sold by ESRI Corporation. At the time of this writing, a free Shapefile viewer named ArcExplorer was available for download at the ESRI web site at the following Location. See Shape Out (ShaOut) and Shape In (ShaIn) for more information about these translators.

Exporting to ASCII files

The ASCII Out (AscOut) translator provides a flexible way to write out Vr vector data to simple ASCII list files. The data may be written out using space or comma-delimited format. The ASCII Out (AscOut) translator uses a line based format. Symbols and Text are translated one entity per line, and Lines are translated one vertex per line. This format is not suited for detailed mapping translations, but is useful for simple line work or control point exporting. See ASCII Out (AscOut) and ASCII In (AscIn) for more information about these translators.

3.4 Getting Started With ADS40

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Getting Started With ADS40



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This document explains the process for using ADS40 stereo images with VrTwo. This document will walk through the steps required to load in ADS40 images and support files to allow collection of mapping features in VrTwo. Before beginning this tutorial, please review the main Getting Starting Tutorial for background information regarding Vr Mapping software. This document will provide the required information to create VrTwo ADS40 model files from ADS40 Level One images and support files, and collect vector data with VrTwo using the ADS40 stereo model.

Mapping Work Flows

There are several work flow paths that can be taken to start with a stereo pair images to finished mapping product. The work flows depend on the type of starting images and the way they will be oriented to the project coordinate system. Several other work flows are discussed in the main Getting Starting Tutorial. This tutorial will cover the ADS40 work flow only.

ADS40 Work flow

When starting an ADS40 based project, images and support files produced by third party ADS40 processing software should already be on hand. Normally, this software would be either GPro or XPro from Leica Geosystems.

1. **ADS40 Model Setup** - The model setup is performed inside VrTwo using the Open ADS Model (OpeAds) command. An ADS model file is required for each ADS40 stereo image pair.
2. **Collect mapping data in VrTwo** - VrTwo is used to open the model files and place mapping features from the stereoscopic 3D view.
3. **Clean mapping data and prepare for delivery** - VrOne is used to perform batch clean up operations, generate contours if required, and assemble together final map sheets.

Tutorial Overview

The tutorial will provide information on the steps of creating a new VrTwo ADS model from standard ADS support files. In the production ADS40 work flow, GPro or XPro will generate support files and images required by VrTwo. This tutorial provides the support files and images that were generated from GPro. On a production job, there are normally multiple image pairs and support files for each flight line. A VrTwo ADS model is required for each stereo image pair. The tutorial only walks through the process of setting up one model.

- **Level One stereo viewable TIFF images**. These are normally panchromatic images and come in backward and forward pairs. The backward looking image will usually have PANB in the filename. The forward looking image will normally have PANF in the filename. Each filename will normally have the flight line number and model number embedded in the name. For example, the left and right image filenames for model one in flight line one may end with "_1_1".

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- **Support (.sup) files**. One for the each image. The filenames usually match or be similar to the left and right image names.
- **ADS40 orientation data files (.odf)**. One for each image, and the filenames should be similar to the image filenames.
- **ADS40 image definition files (.ads)**. One one for each image, and the filenames should be similar to the image filenames.
- **Optional ADS40 adjusted orientation data files (.odf.adj)**. If these are present there will be one for each image, and the filenames should be similar to the image filenames.
- **Two Camera calibration files (.cam).** These files are usually named PANB14A and PANF28A.
- **Control file.** This is a standard VrTwo control file (.vr) containing known control points in the project.

The support files are the primary files used by VrTwo. They define the locations of the other required files. Although the support files will already contain links to the other required files, they may not be on the same location on your computer as they are defined in the support file. When adding support files to a new ADS model definition, VrTwo tries to locate the files in the folders located at or below the ADS model file location. If VrTwo cannot find the files required by the Left and Right support files, the file locations will need to be set up manually. This is explained in the tutorial walk through.

Tutorial Walk Through

Download the sample Data

To get started, download the sample data and install it to your local computer. The sample data for this project can be download at the following address.
http://vrdownload.cardinalsystems.net/downloads/sample-data/gettingstartedads40model.exe

Please contact Cardinal Systems for the username and password for this download.

Install the Sample Data

1. Run the gettingstartedads40model.exe file. This will install the sample data into c:/jobs/sampleads40model.

The sample data consist of the following files.

- Two ADS40 level one images (.tif)
- Two ADS40 support files (.sup)
- Two ADS40 camera calibration files (.cam)

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- Two ADS40 orientation data files (.odf)
- Two ADS40 adjusted orientation data files (.odf.adj)
- Two ADS40 image definition files (.ads)
- Control file

Install the Geoid files

ADS40 requires Geoid files to be installed. If you have not installed the Vr Mapping Geoid files, follow these steps:

1. Go to the www.cardinalsystems.net website.
2. Select Support->Download Vr Mapping Software
3. Accept the Cardinal Systems Software License and Software Support Agreement.
4. Enter user name and password for downloading Vr Mapping software.
5. Navigate to vrsoftware/data and select the geoid-1.0.exe file.
6. Download geoid-1.0 into a temporary folder on your computer (normally the downloads folder on Windows 7)
7. Run geoid-1.0.exe and install to the default location. The password is the same as the Vr Mapping install software.

Now that the sample data has been installed, VrTwo will be used to create an ADS model file and then display the ADS40 stereo images.

Start VrTwo

1. Double click on the Vr Mapping folder on your desktop.
2. Double click on the VrTwo Icon in the opened Vr Mapping folder.

The VrTwo Main Window will now be displayed along with one or more graphics windows as shown below.

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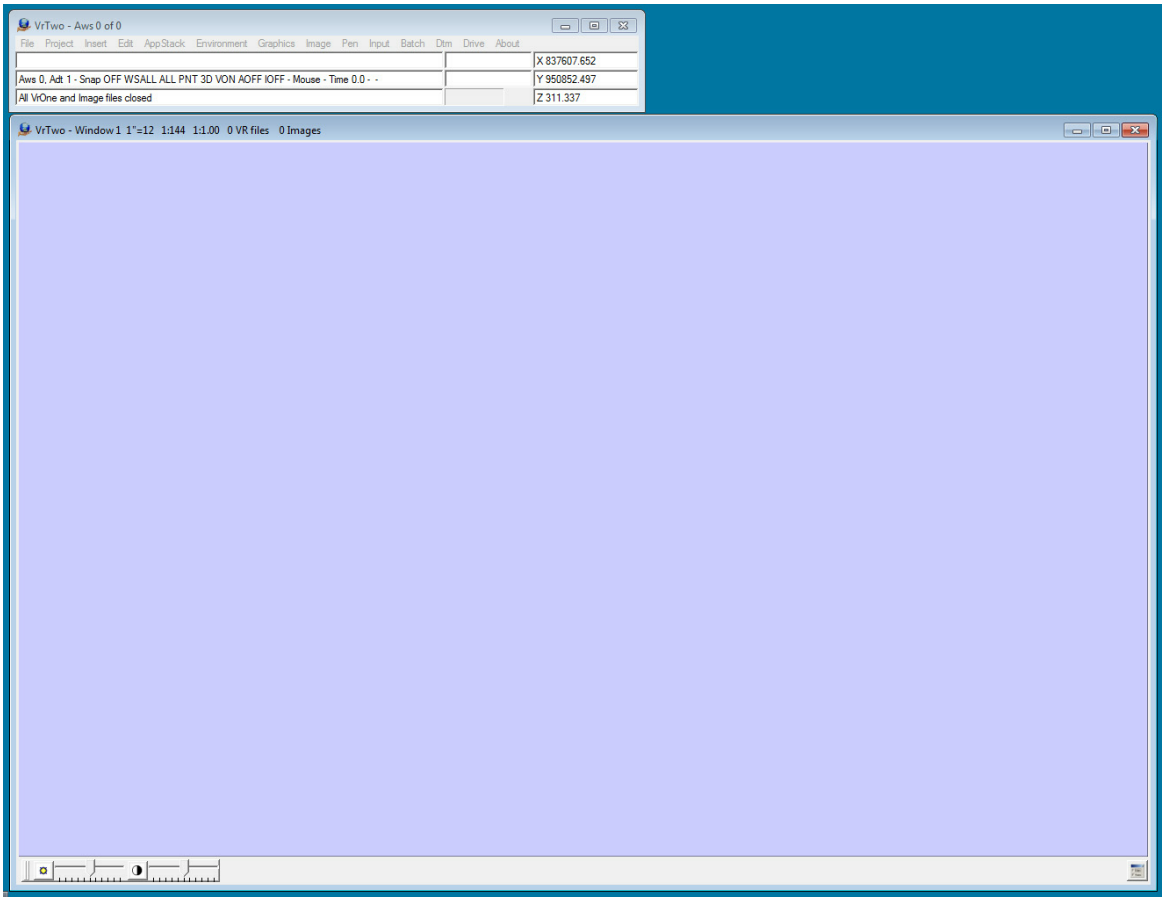
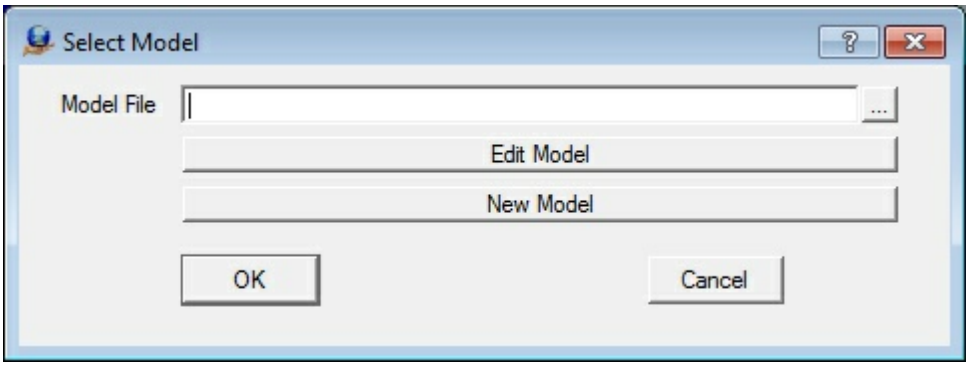


VrTwo Main Window and Graphics Window with no model or VrOne vector file open.

Create ADS40 model file

In order to view the ADS stereo images, a model file must be created in VrTwo. This model file defines the two support files and two images that make up a single ADS stereo model along with the project datum.

1. Click on File then Open the ADS model. This can also be done with the Open ADS (OpeAds) command.



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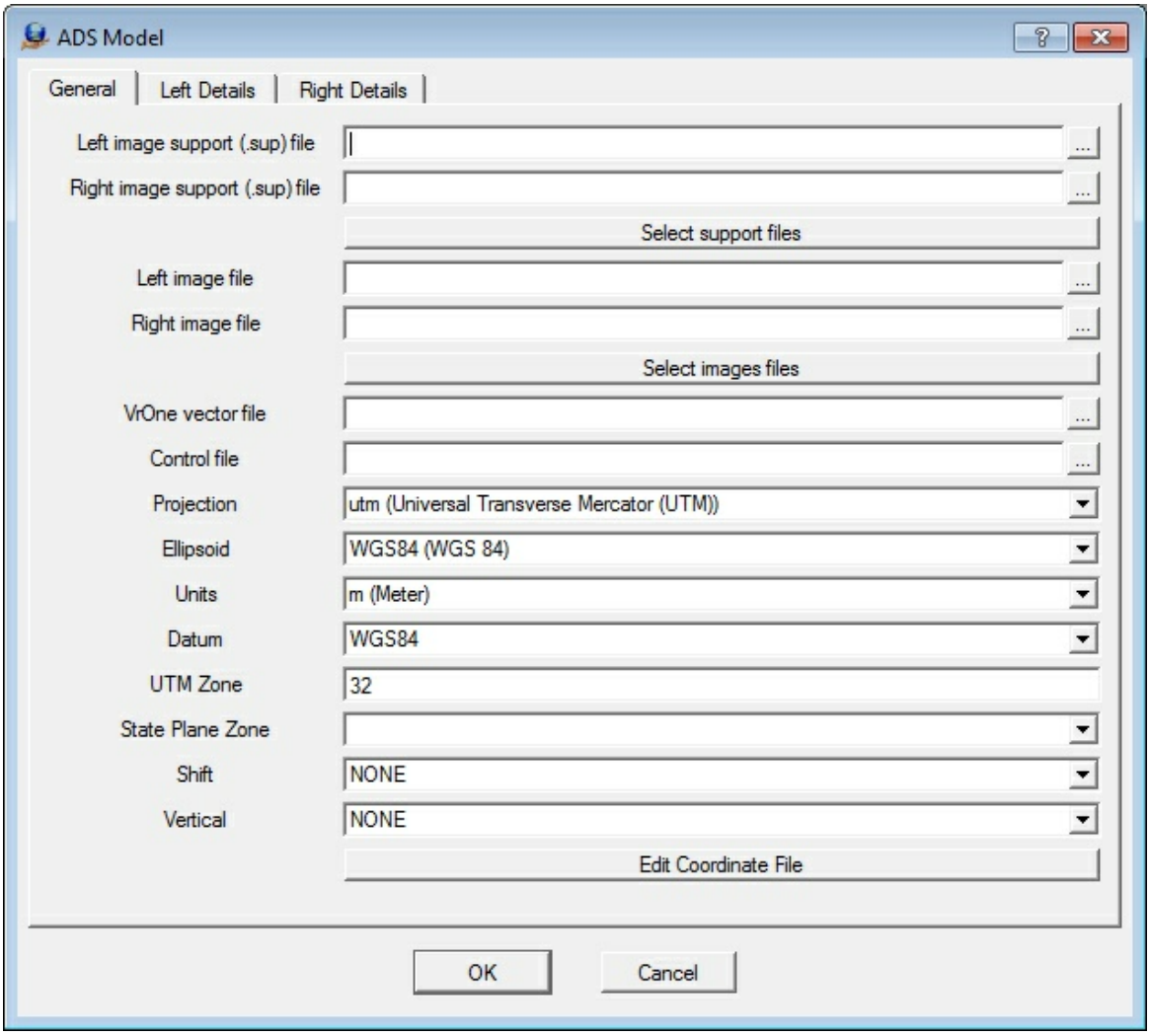
2. Select the "New Model" button which will display the ADS model definition dialog box. This dialog box contains three tabs. The General tab defines the model itself and the Left and Right Details tabs allow the editing of the details of the left and right support (.sup) files.



3. Press the "..." button next to Left image support (.sup) file field to display the file selection dialog box.

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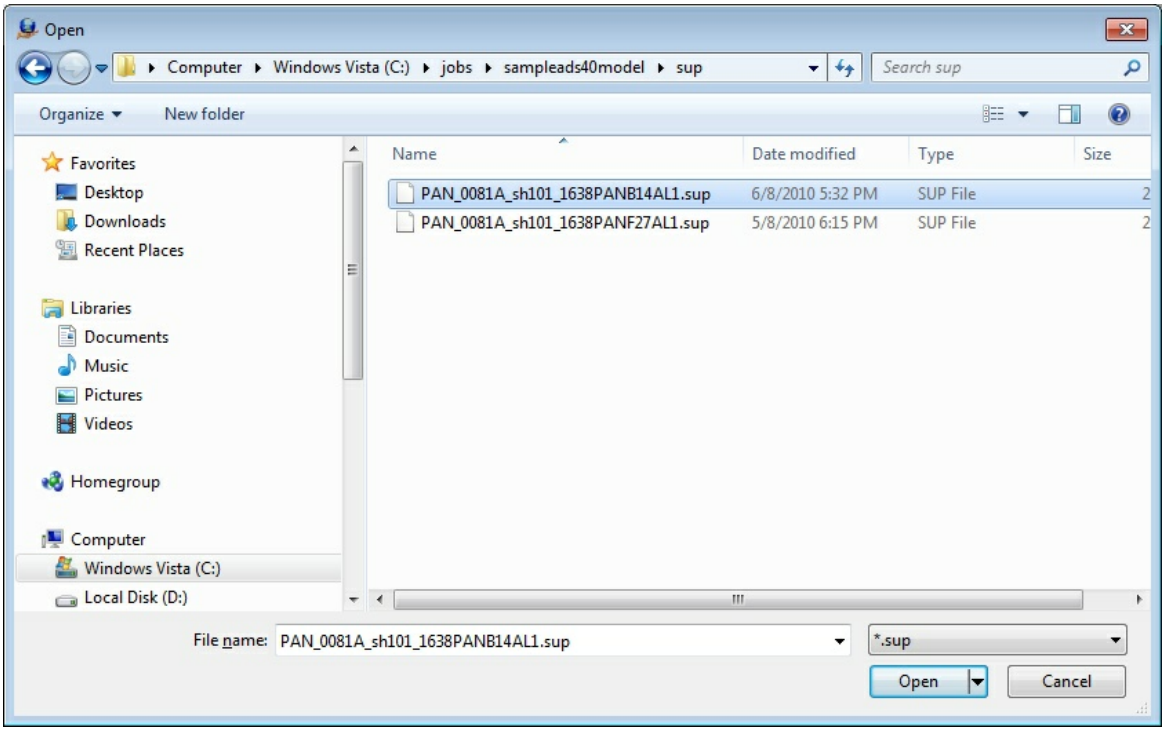

4. Navigate to the c:/jobs/sampleads40model/sup folder and open the PAN_0081A_sh101_1638PANB14AL1.sup file.

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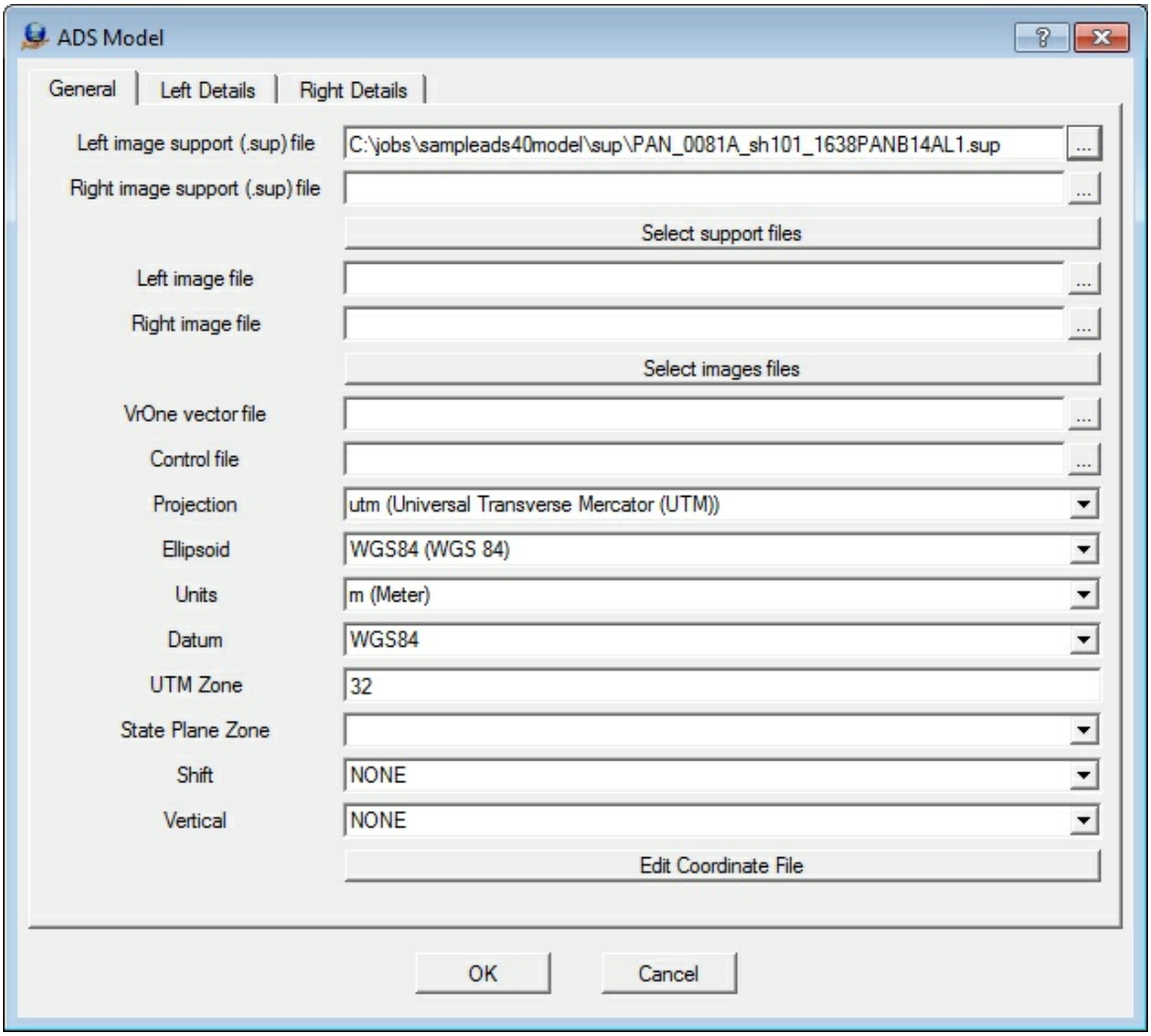

5. Press the "..." button next to Right image support (.sup) file field to display the file selection dialog box.

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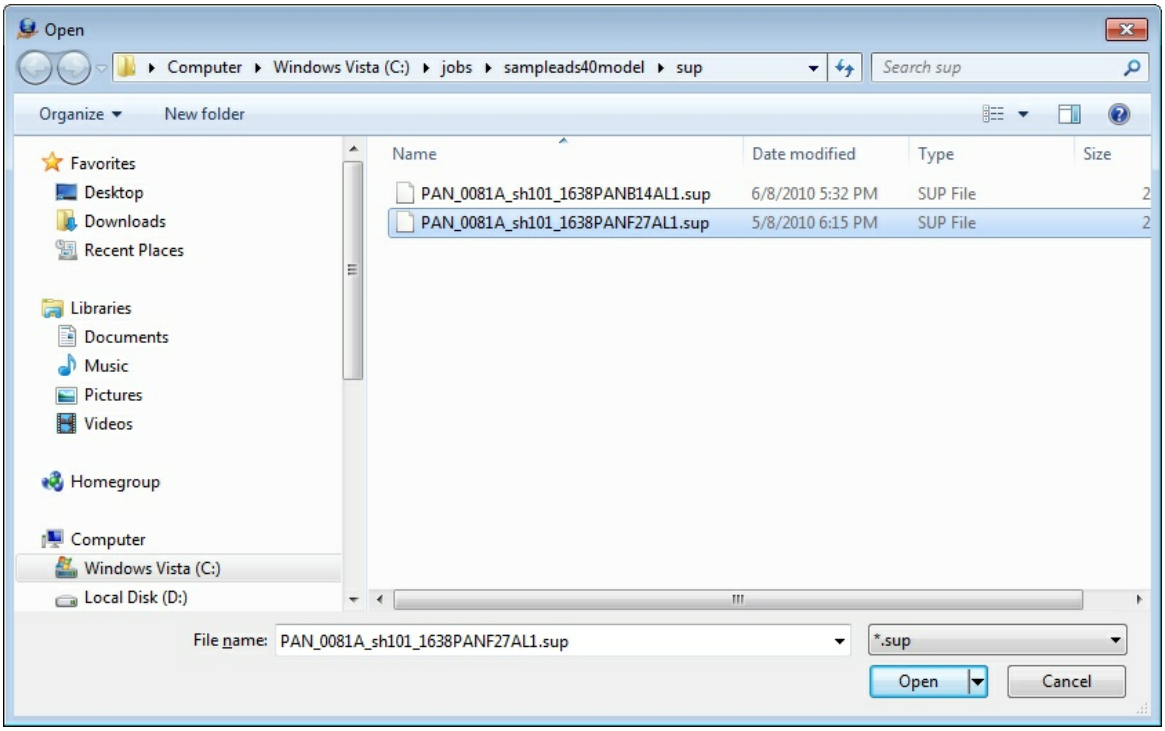

6. Navigate to the c:/jobs/sampleads40model/sup folder and open the PAN_0081A_sh101_1638PANF27AL1.sup file.

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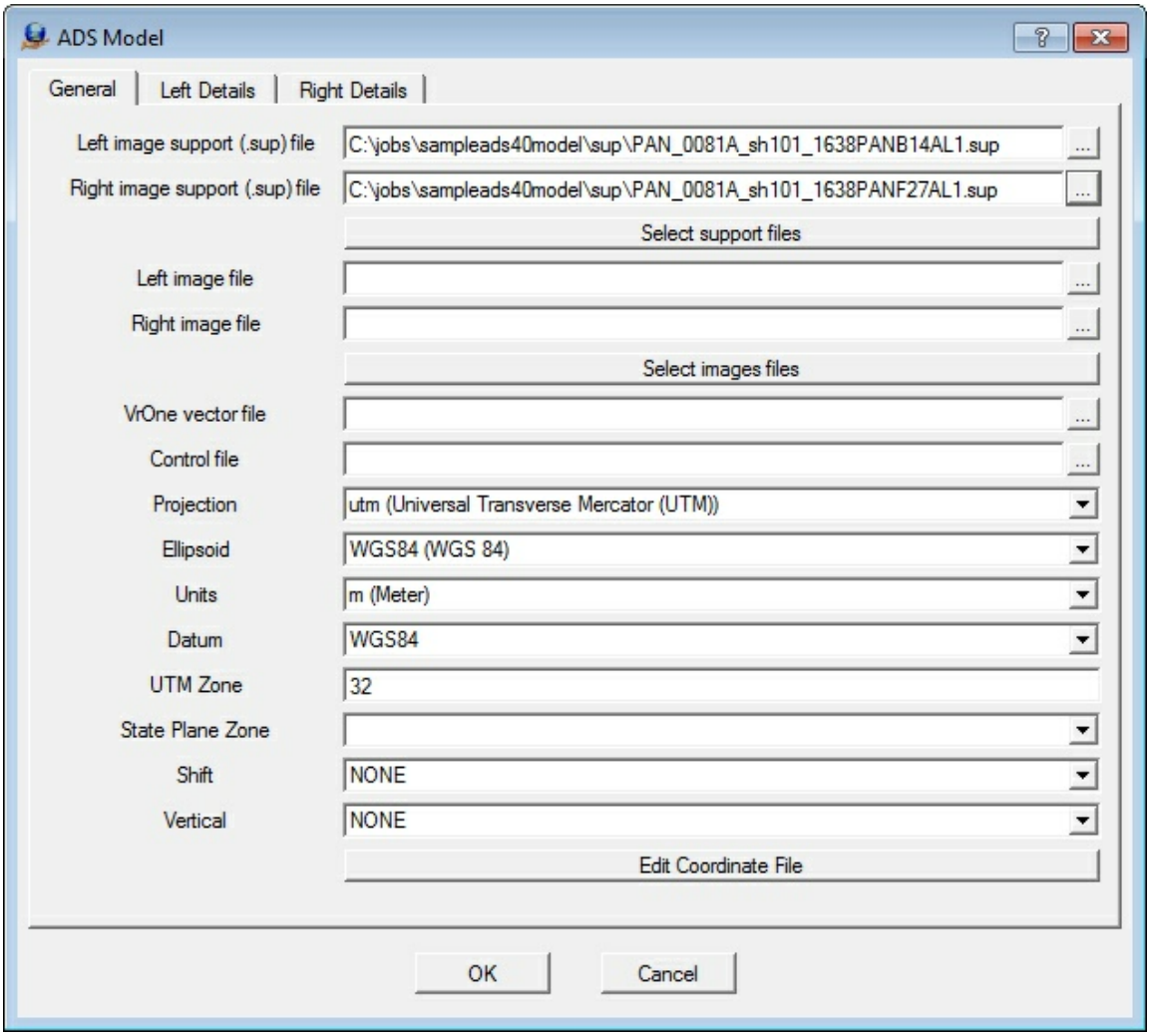

NOTE: The "Select support files" button may be used to select the left and right support files in one step.

7. Press the "..." button next to Left image file field to display the file selection dialog box.

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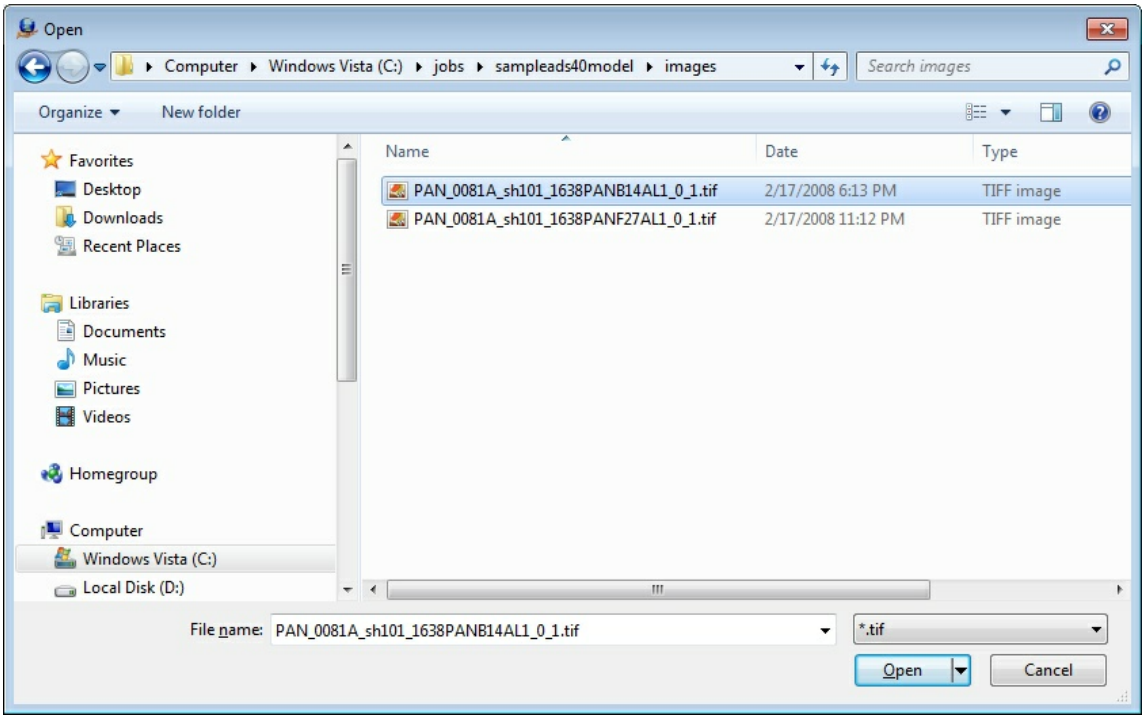

8. Navigate to the c:/jobs/sampleads40model/sup folder and open the PAN_0081A_sh101_1638PANB14AL1_0_1.tif file.

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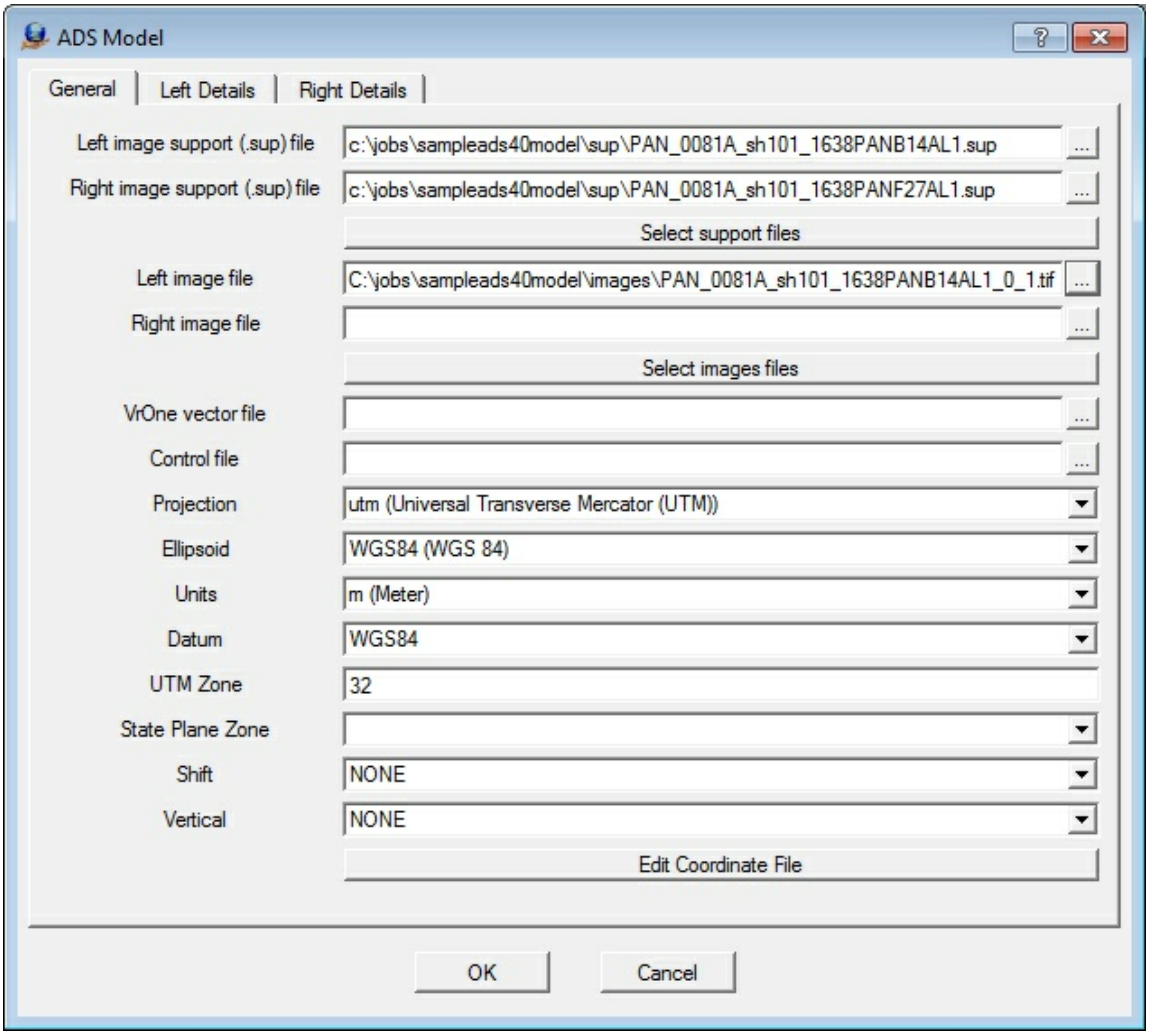

9. Press the "..." button next to Right image file field to display the file selection dialog box.

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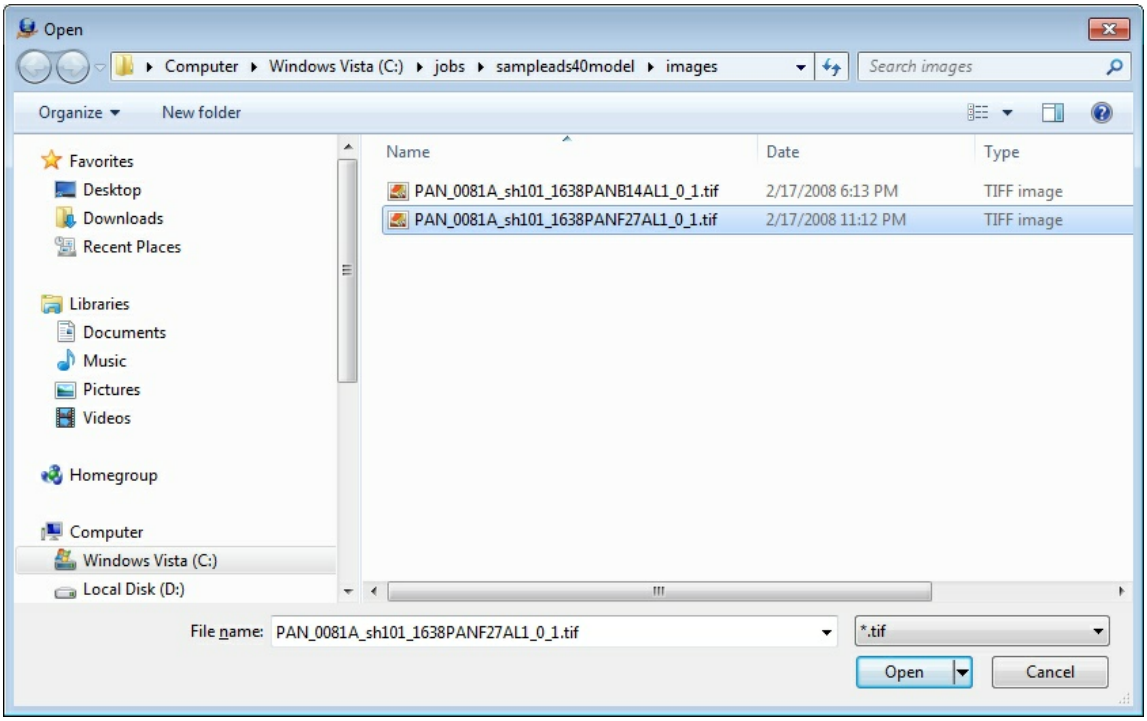

11. Navigate to the c:/jobs/sampleads40model/sup folder and open the PAN_0081A_sh101_1638PANF27AL1_0_1.sup file.

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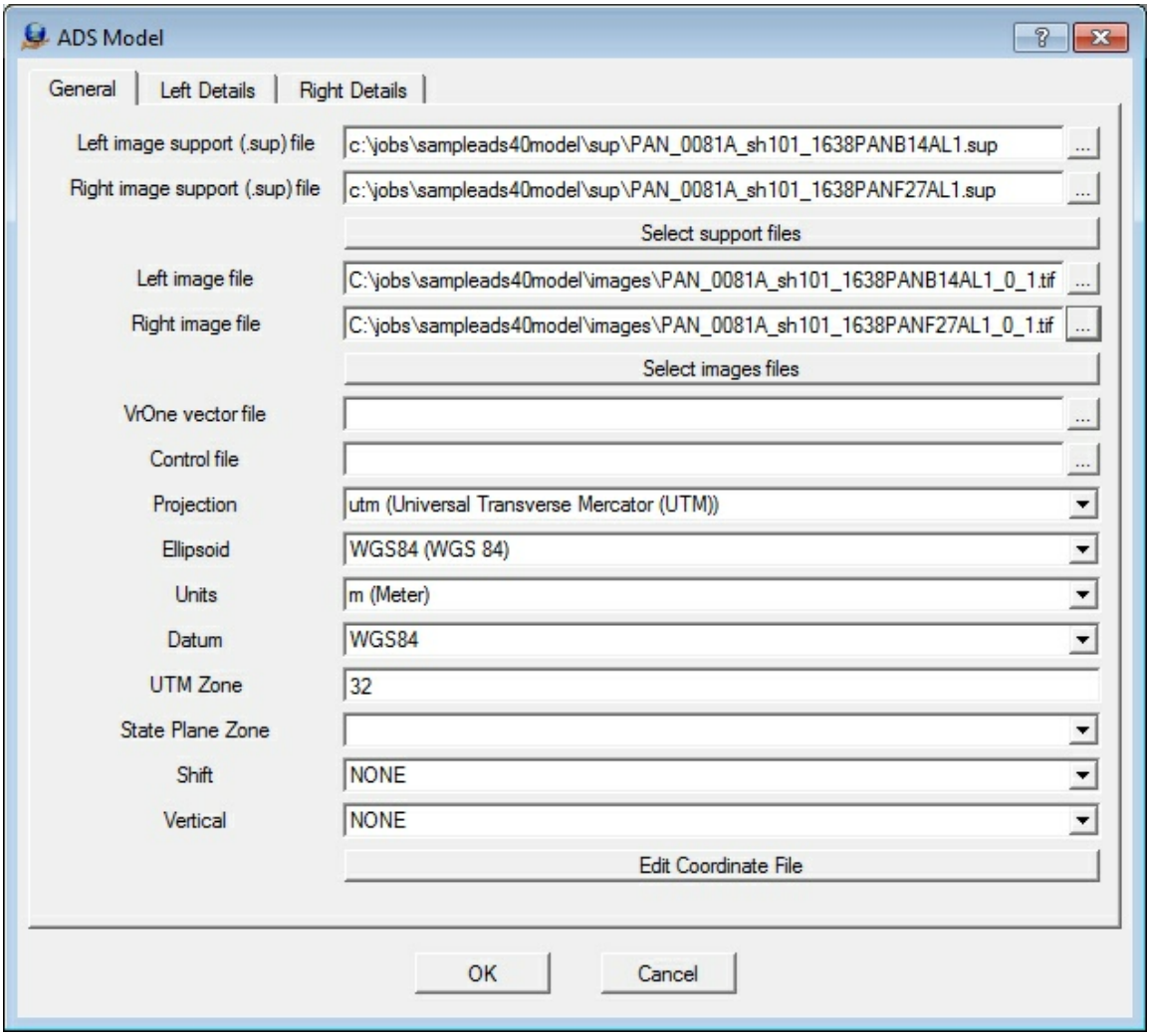

12. Navigate to the c:/jobs/sampleads40model/images folder and open PAN_0081A_sh101_1638PANB14AL1_0_1.tif and PAN_0081A_sh101_1638PANF27AL1_0_1.tif.

Make sure the PAN_0081A_sh101_1638PANB14AL1_0_1.tif file is selected first.

13. Type in "c:\jobs\sampleads40model\model1.vr" in the "VrOne vector file" field. A VrOne vector (.vr) file has not been created yet, so the name used

in the "VrOne vector file" field will be used to create a new VrOne vector file when the model is first opened.

14. Press the "..." button next to the "Control file" field to display the file selection dialog box.

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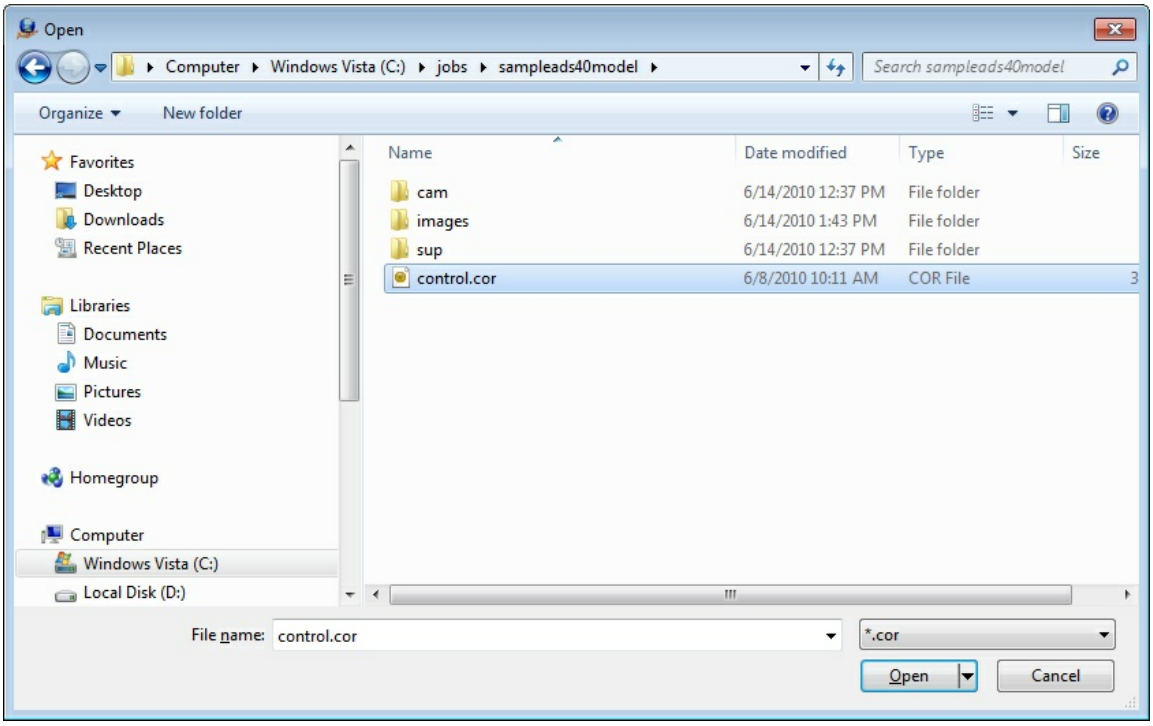

15. Navigate to the c:/jobs/sampleads40model/ folder and open the control.cor ground control file.

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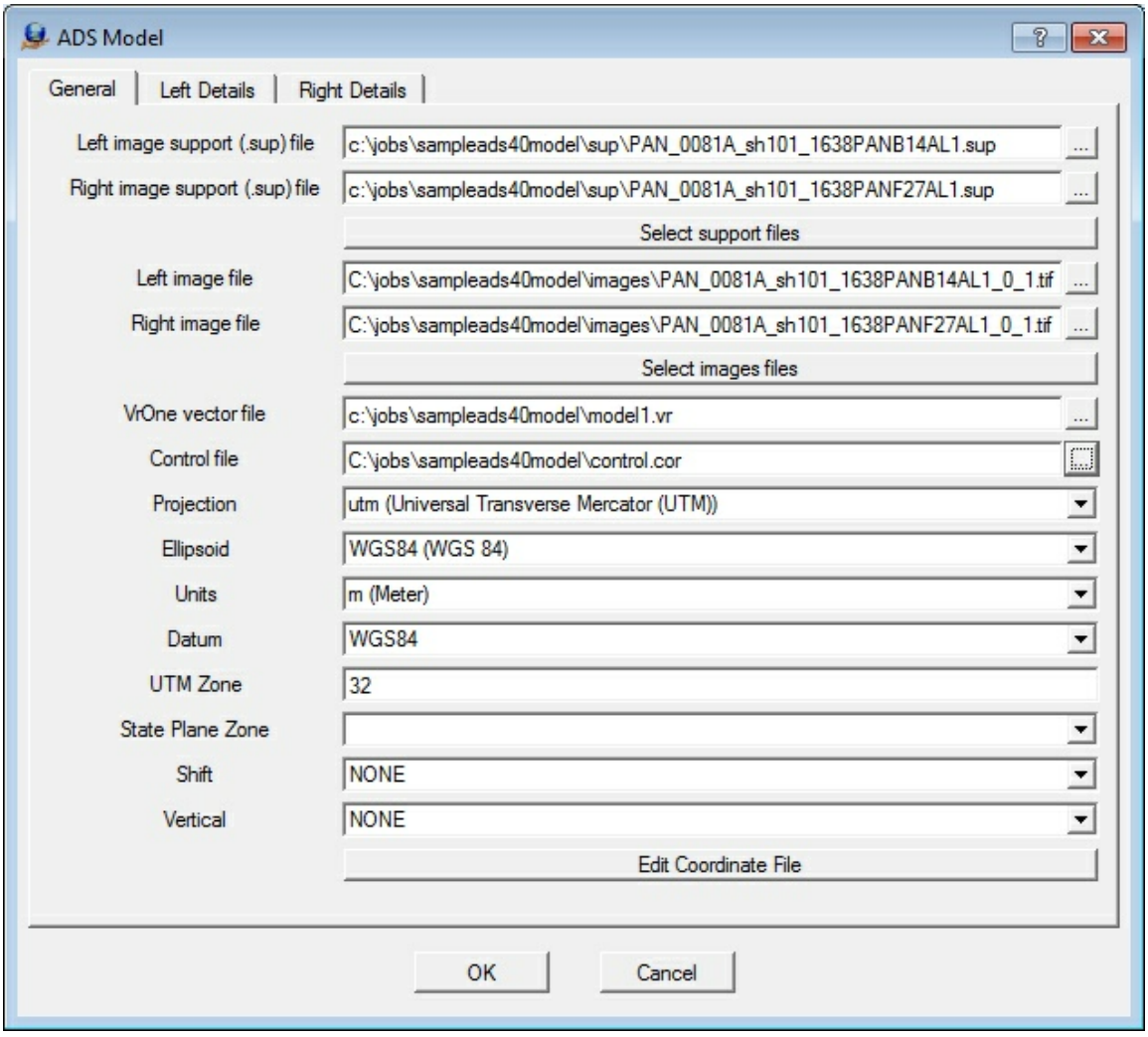

16. Normally, at this stage, the datum for your project coordinate system would be input. For this sample project, the following datum is used:

Projection:	UTM
Ellipsoid:	WGS84
Units:	US Surveyor's Foot
UTM Zone:	0
State Plane Zone:	3402
Shift:	Ohio south
Vertical:	GEOID03

Fill in the dialog to match the values above.

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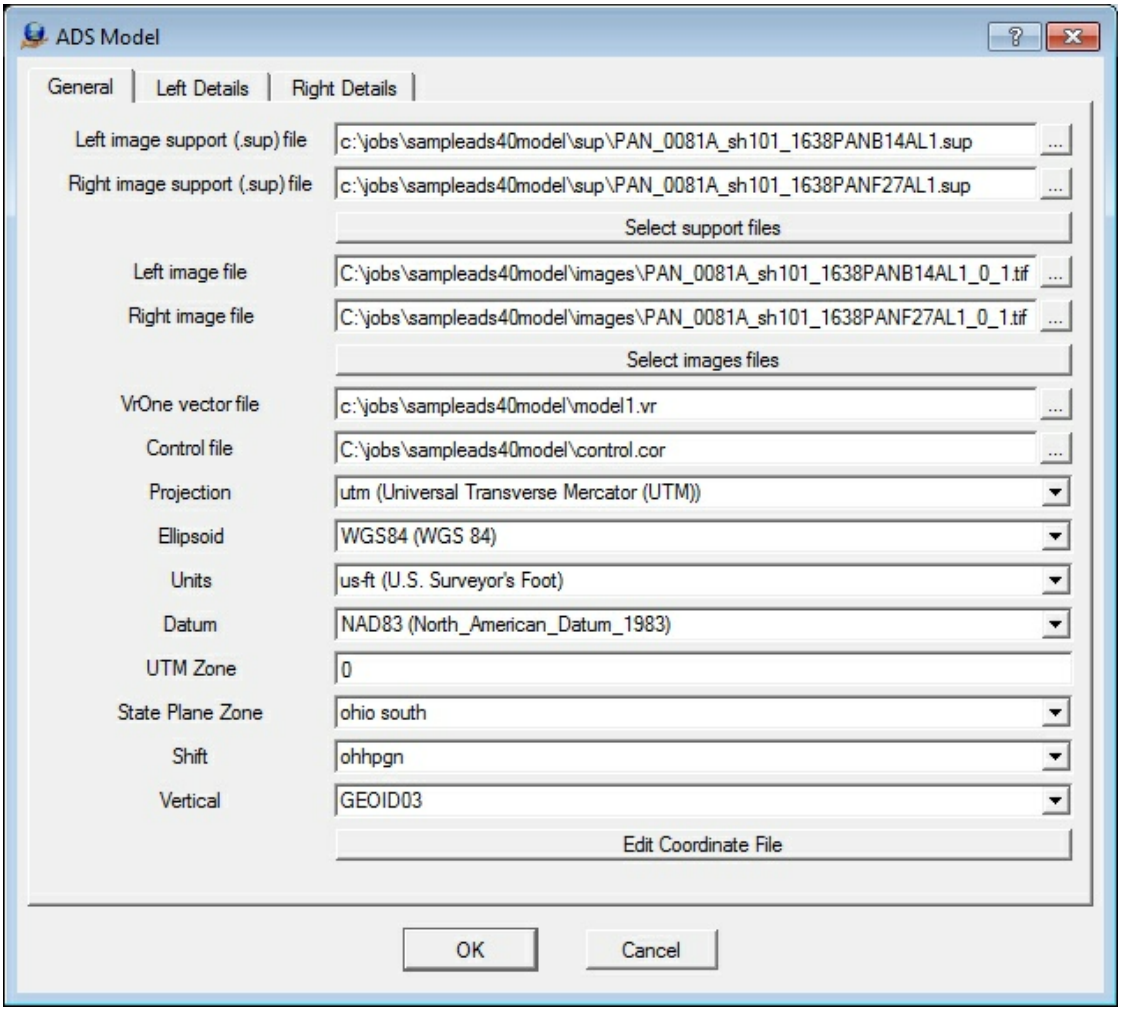

17. Press the OK button which will display a dialog box to confirm the saving of the parameters.

18. Navigate to the c:\jobs\sampleads40model\ folder and type in "sample" for the file name.

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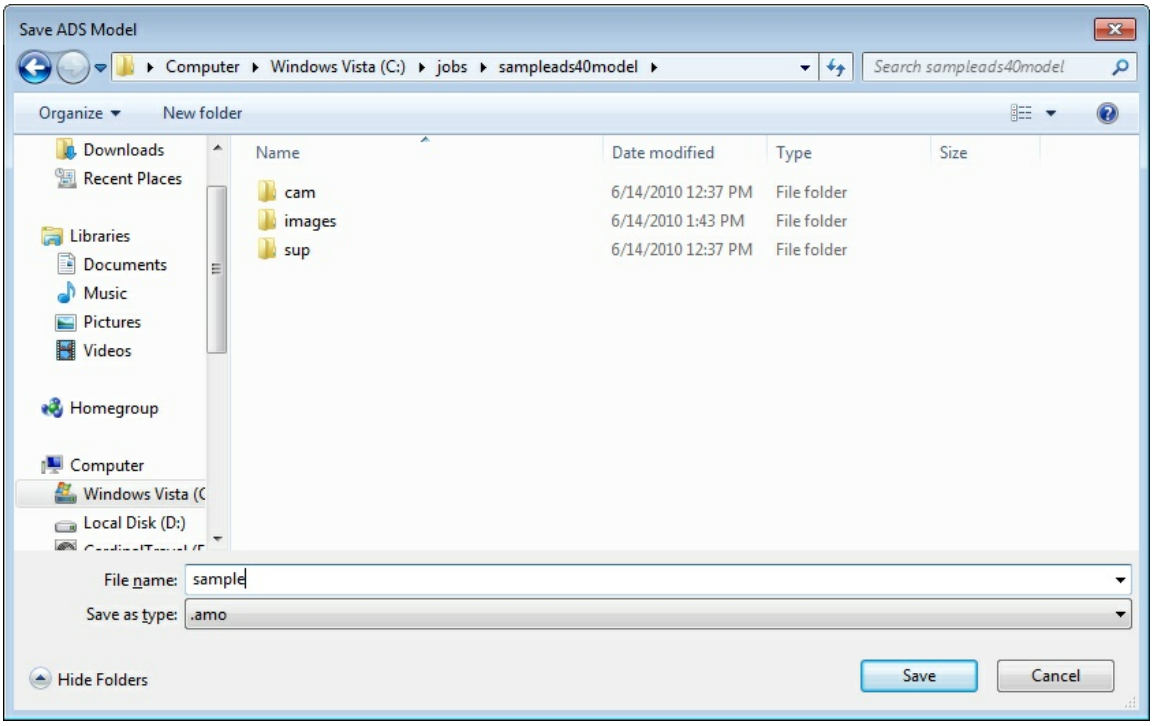
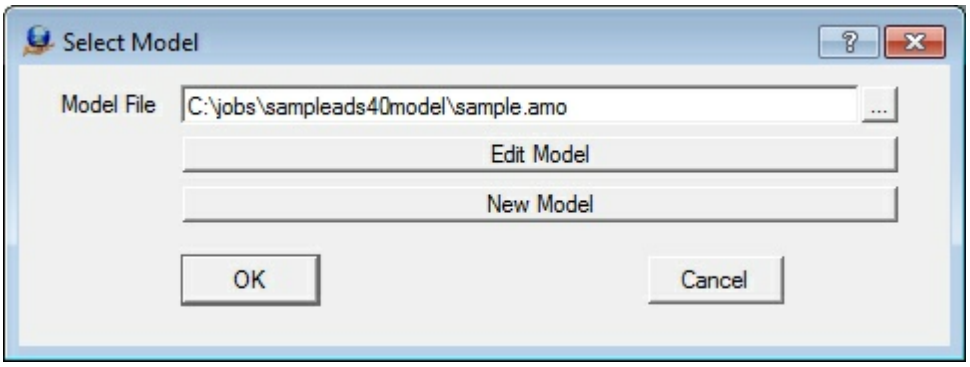


19. Select Edit Model to view the model settings dialog again.



20. Select the "Left Details" tab to view the settings in the left support file. On a normal project, it may be required to modify these settings to match the actual location of your ADS files. If needed, use the "Search" button to fix the path if the project has been moved from another location. This will search for the file names listed and apply the correct path to them.

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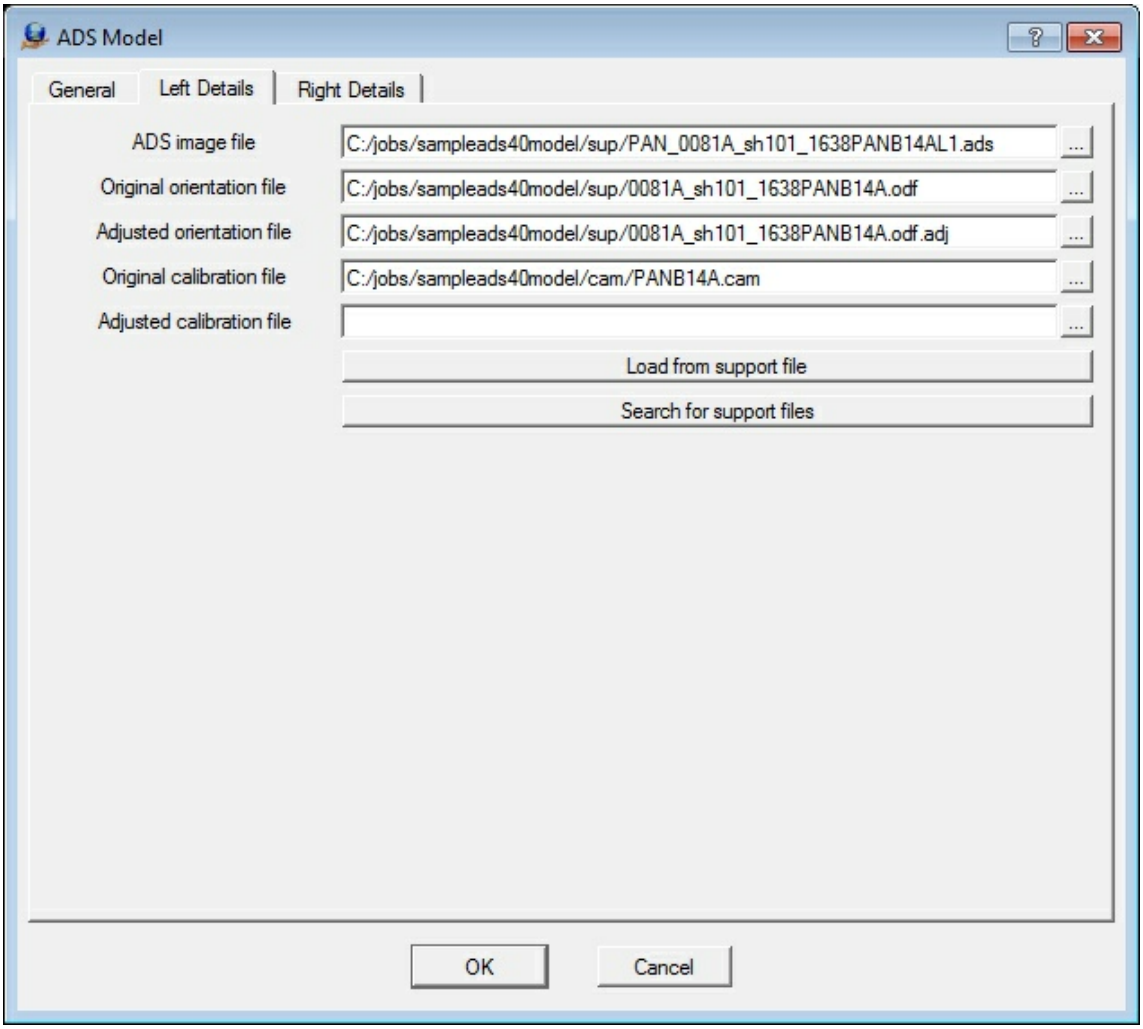

21. Select the "Right Details" tab to view the settings in the right support file.

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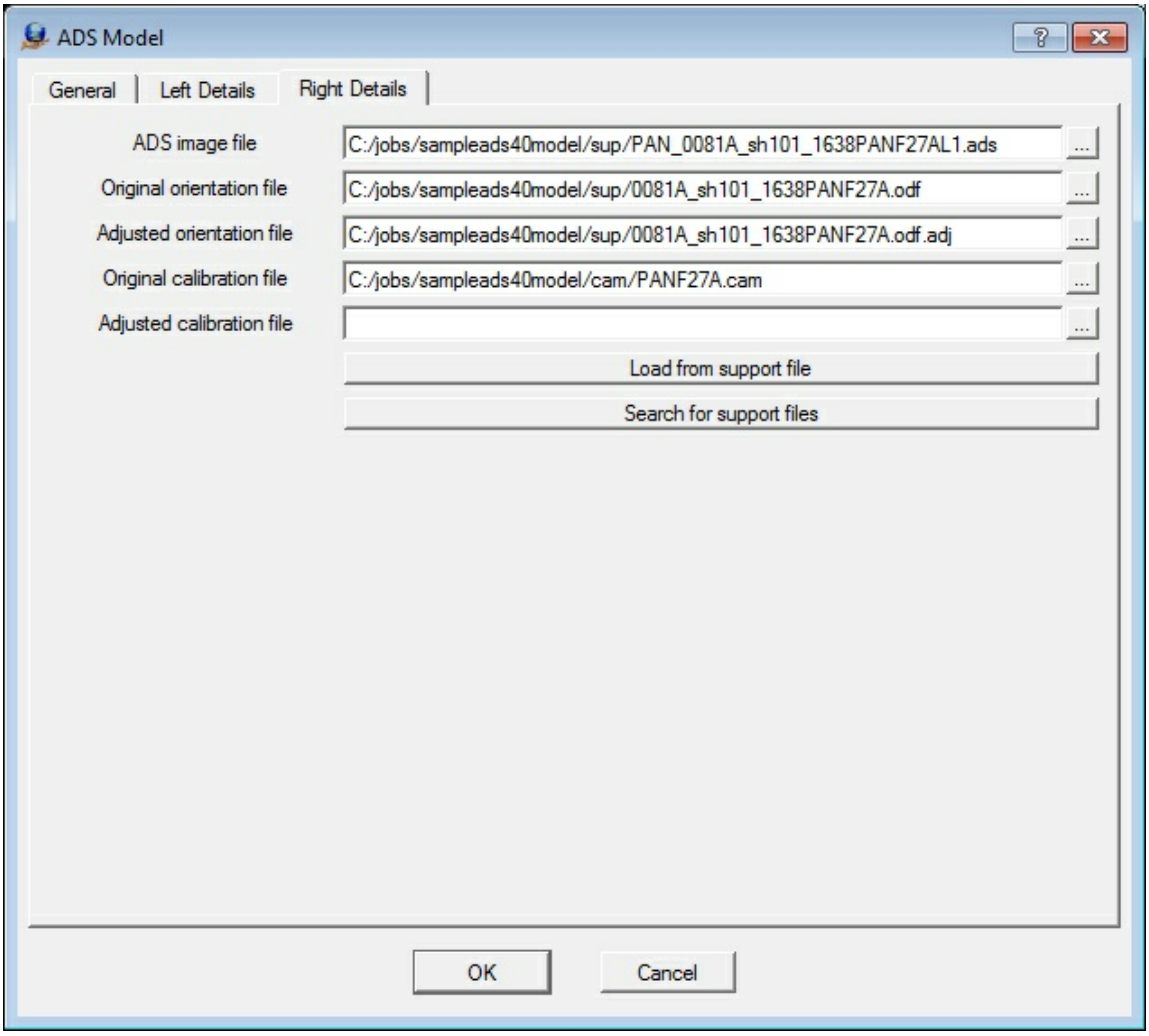
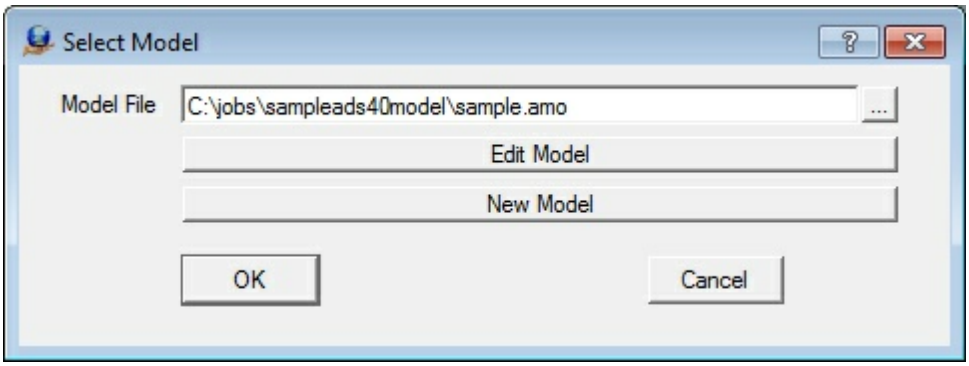


22. Press OK to close the model dialog.



23. Press OK open the sample model file. It may take a minute to build image pyramids if needed.

24. Use the Zoom All command (ZooA) to zoom to the extents of the model. The graphics

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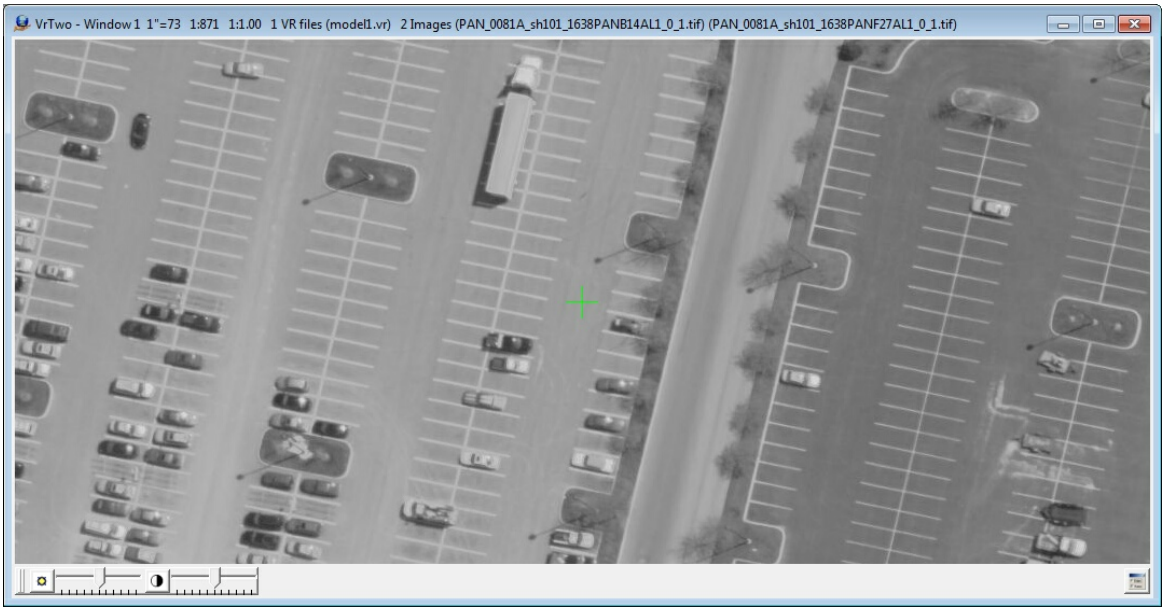
display should look like the following screen shot.
If using stereo shutter glasses with an emitter, the emitter light will turn on, and the content should be viewable in 3D using the shutter glasses.



25. Use the Display Image (DisIma 1) command to display the images at 1:1.

26. The Control Drive (Cd 1) command can be used to drive to the first control point. The display should look similar to this, with the cursor positioned as shown. In a normal project, the Control Drive (Cd 1) command would drive to an actual control point. For this tutorial, the control point location is just a random location selected for the purpose of this demonstration.



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27. The VrOne/VrTwo standard collection tools along with Function Keys may now be used to start placing map features.

3.5 Getting Started With 3D ViewPoint

ON-LINE REFERENCE
DOCUMENTATION
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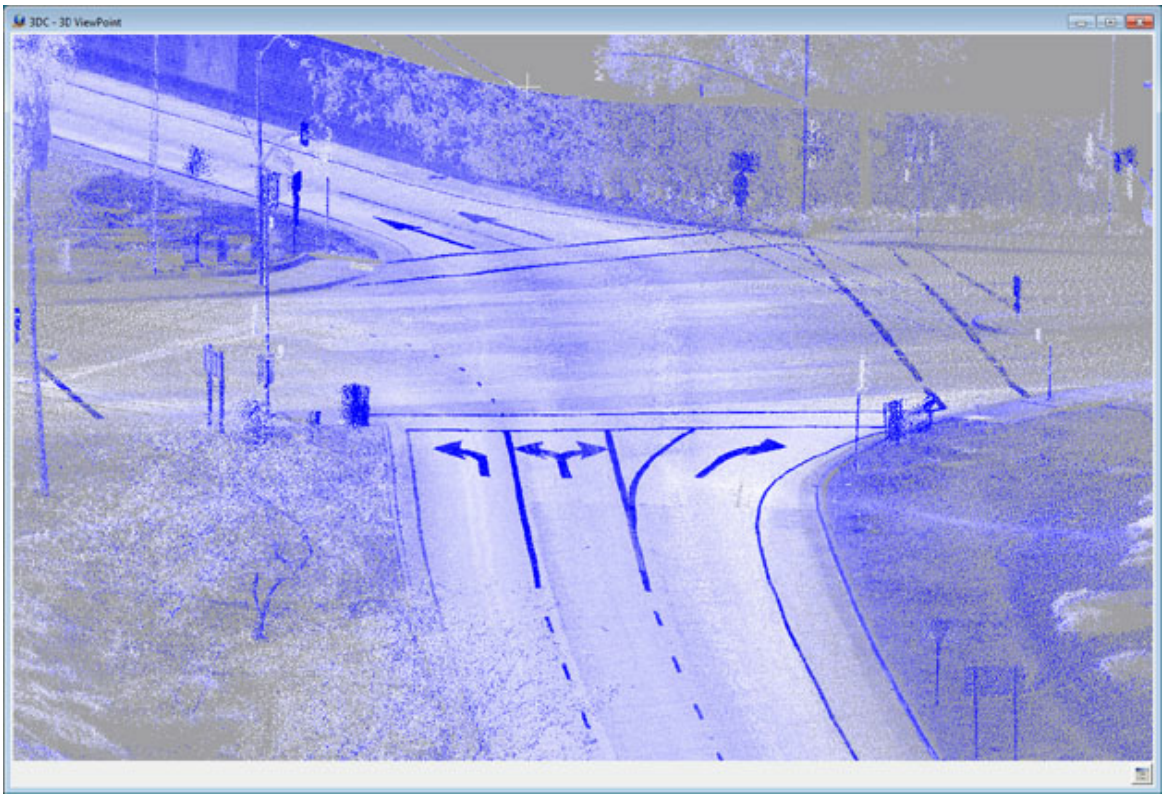
Vr Mapping

Getting Started With VrThree (VrLiDAR)



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Description

VrThree (VrLiDAR) is a 3D stereo window. This window displays point and vector data contained by VrOne data files and is designed for the collection of vector data using LiDAR and (or) point clouds as reference. The VrThree window is designed for point and vector data without any imagery. Although VrThree can be started from VrOne or VrTwo it is recommended that it be started from VrOne.

Features

- All vector and point data is viewed in true 3D stereo.
- Data may be observed from any viewpoint, origin and scale.
- Vector data may be collected and edited using the standard Vr Mapping commands and applications including Function keys.
- Two cursor modes include Cursor Draping and Free Motion.
- Roaming is supported
- On two-screen systems, the 2D VrOne window may be moved to the second screen (typically the right screen)

Requirements

Hardware

The hardware requirements for VrThree are the same as those for VrTwo. At the present time several graphics cards have been tested, namely:

- NVIDIA Quadro FX 3700 (Jan 2008) *
- NVIDIA Quadro FX 3800 (Mar 2009) *
- NVIDIA Quadro FX 4600 (Mar 2007) *
- NVIDIA Quadro FX 4800 (Nov 2008) *
- NVIDIA Quadro 4000 (Nov 2010) *
- NVIDIA Quadro 5000 (Feb 2011)
- NVIDIA Quadro K4000 (Mar 2013)
- NVIDIA Quadro K5000 (Aug 2012)
- NVIDIA Quadro M4000 (Jun 2015)
- NVIDIA Quadro P4000 (Feb 2017)
- NVIDIA Quadro RTX 4000 (Nov 2018)

The release date is shown in parenthesis
* = Obsolete

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Most of the existing stereo graphics cards that are supported by VrTwo should be supported by VrThree but not all have been tested.
If running on 64-bit Windows 7/10, the amount of memory in the computer should be 8GB or greater for large data sets.
See Hardware for more information on hardware configurations.

Operating Systems

The 32-bit version of VrOne with VrThree will run in Windows 7 or Windows 10. The 32-bit version of Vr Mapping is supported up to and including version 6. The 64-bit version of VrOne with VrThree will run in the 64-bit Windows 7 or Windows 10. For larger data sets Windows 7 or Windows 10 64-bit and VrOne 64-bit are recommended.
The recommended operating system for VrThree is 64-bit Windows 10.

Getting Started

Translating LiDAR Data

VrThree requires VrOne files. This LiDAR data can be translated into existing VrOne files or new VrOne files can be created during the translation process.

Typically, LiDAR data is delivered in the LAS format and can be translated into a VrOne/ VrTwo database file or files using the LAS In (LasIn) translator. LiDAR can be translated from the Vr database to LAS using the LAS Out (LasOut) translator. Another supported format for the translation of LiDAR data into VrOne files is the points format. The Points In (PoiIn) and Points Out (PoiOut) translators support this format.
More information on these input/output translators can be found at the following links:

- LAS In
- LAS Out
- Points In
- Points Out

Starting 3D VrThree (VrLiDAR)

VrPoints (LiDAR) data is stored in the VrOne/VrTwo database which is the same database used to store lines, symbols and text. Each VrPoint in the VrOne/VrTwo database contains XYZ coordinates and point attributes as defined by the ASPRS LAS format specification. To start VrThree the following steps may be used.

- Start VrOne
- Open VrOne file
- Start VrThree with the 3DSC or Vr3 or VrThree command

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When VrThree is started, it will open a stereo window. The original VrOne 2D window will remain open. This 2D window may be placed on the second screen if available. It is recommended that the VrOne be started with a single 2D window and then VrThree be opened. Before closing VrOne, it is recommended to close VrThree using the 'X' button on the upper right corner of the window.

With two windows open, the cursor may be moved between the VrThree window and the VrOne 2D window.

VrThree (VrLiDAR) Commands and Applications

A list of compatible VrOne/VrTwo applications can be found at VrThree (VrLiDAR) Applications.

3D VrThree Display Controls

A list of display controls for VrThree can be found at VrThree (VrLiDAR) Display Controls.

Document updated: August 2022

3.6 Tutorial Vr Aerial Triangulation

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Vr Aerial Triangulation Tutorial

A tutorial for the Vr Aerial Triangulation Program (VrAt) (VrAirTrig)

See also: Vr Air Trig - Documentation

Overview
Section 1 Project Setup

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Section 2 Preparing Strips
Section 3 Adding Control Points
Section 4 Measuring Points
Section 5 Adjustment
Section 6 Debugging
Section 7 Exporting Measurements

Overview

The Vr Aerial Triangulation program (VrAirTrig) allows the collection of strip and tie points on a large number of photos and performs a block adjustment using aerial triangulation methods. The optional AeroSys adjustment software is integrated directly with VrAirTrig to perform seamless adjustments. Several third party adjustment packages may also be used by using an export and import method.

VrAirTrig provides a Layout window that enables the technician to layout project photos as if on a desktop and to display point readings as either "to be read" or "completed". The Layout tool shows the completion status of the project and allows operations such as the addition of control points and various other tools.

VrAirTrig's intuitive interface allows setting up, reading, and exporting aerial triangulation readings on up to 2000 photos.

Points may be measured in one of three methods with include Mono-comparator, Semi-automatic correlation assist, and Stereo. Each method is described in more detail in the Using VrAirTrig section.

Before starting a VrAirTrig project, raw photos, a ground control file, and a camera calibration report are required.

Section 1 Project Setup

Requirements for Project setup

1. **Camera File** - The camera file may be imported or generated from a camera calibration report.
2. **Ground Control File** - The ground control file contains points that were obtained from sources such as ground surveys.
3. **Photos** - Raw photos that have not been edited or modified.
4. **Correct Photo Overlap** - The photo overlap must be on inside of photos or in ortho mode. This may require that the photos be rotated. This photo rotation should be done before Interior Orientations are done. If photo rotation is required, this task can be performed, in batch, in the Vr Image Utility program.

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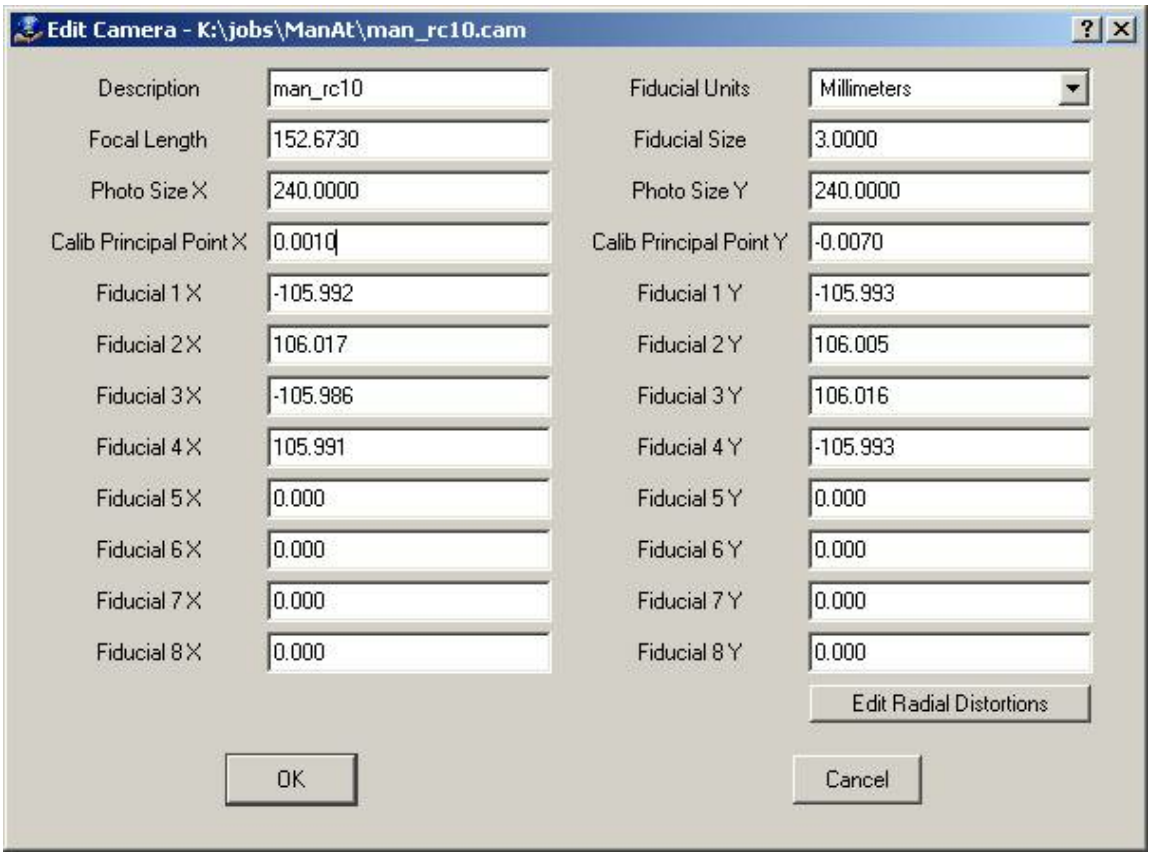
5. **Interior Orientations** - This can be done manually in VrAirTrig or be done in the Vr Image Utility program



An example of photo overlap to the inside (ortho)

Creating or Editing the Camera File

Click on Camera then New Camera or Edit Camera.



The Edit Camera dialog box used to define a camera calibration

Creating or Editing a Control File

Create a new coordinate file if one does not exist. Click on Coordinates then New Coordinate

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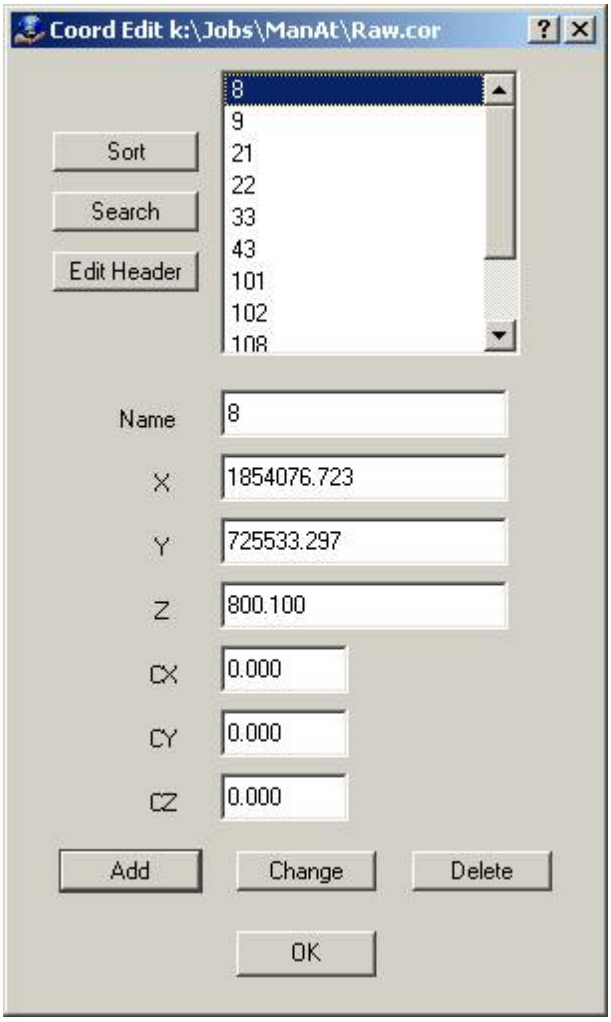
File.



The Coordinate Edit dialog box for entering or editing control points.

If a control file exists and contains the PointName X Y Z fields, it can be used directly by the various programs in Vr Mapping, including VrAirTrig. Simply rename the file by replacing the file postfix with .cor. For example, if a coordinate file is named TheCoords.txt and contains the PointName X Y Z fields, then it can be renamed TheCoords.cor and be subsequently used by VrAirTrig.

The following is an example of a contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The first field is the point name followed by the X, Y and Z coordinates.

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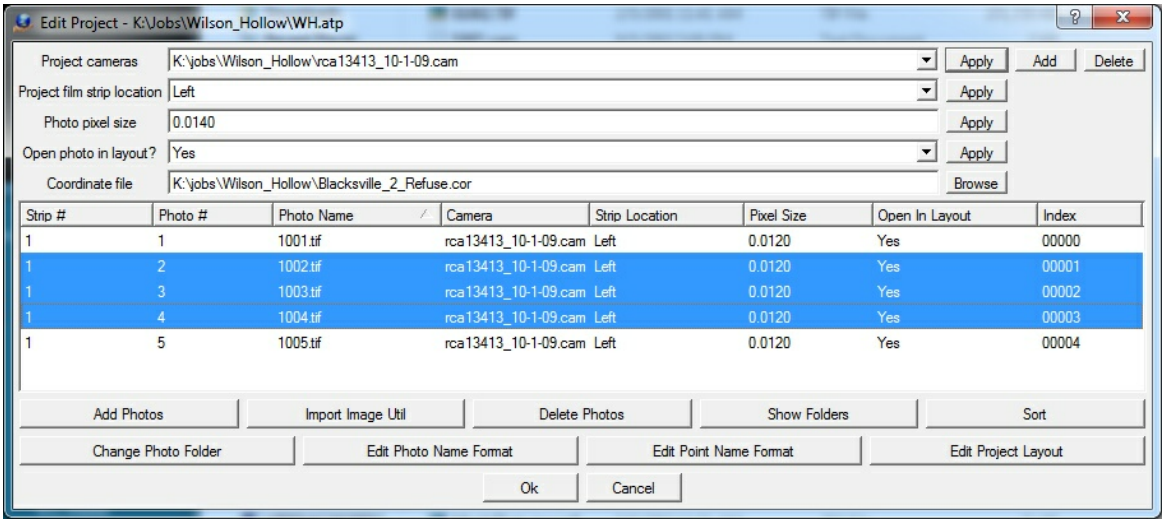
Creating or Editing a Project

Create a new project file by clicking on Project ,then New Project, then Project Edit Project

1. Add Project Camera(s)
2. Set strip direction
3. Set Pixel Size.
4. Add Coordinate file
5. Click on Add Photos at the bottom of the screen to add all raw photos.
6. Click on Edit Project Layout Standard settings are shown (Photo Overlap 60% Sidelap 30%)
7. Press OK, Then Press OK again at the bottom of Edit Project



The Edit Project dialog box for VrAirTrig

The Edit Project dialog box is designed to allow the definition of multiple photo files. Each photo file has a Photo Name Format which are parameters that define the strip and photo number from a photo file name. Also defined for each photo is the Strip Direction, Pixel size and the Open In Layout flag. The top portion of the dialog box is a template of these parameters that may be copied to a photo or group of photos by selecting a photo or dragging the cursor over a group of photos then pressing the Apply button for that item.

Opening the Layout Window

The Layout window is the work flow focal point for aerial triangulation collection, measurement progress, and point management, along with other features. It is similar to using a table top to lay out the photos for an aerial triangulation project. There, photos could be prepared by directly placing pass, tie, and control points on them. VrAirTrig modernizes this concept with more features and functions.

If this is the first time that Layout is used for this project, the photos will need to have their initial

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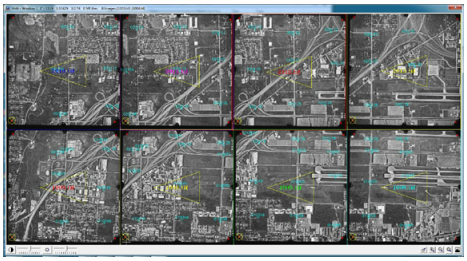
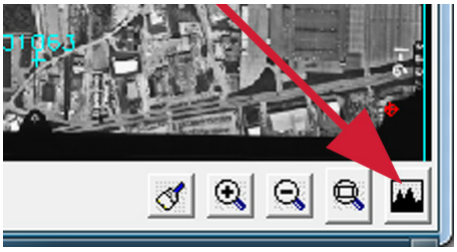
positions computed for the Layout window. Choose Layout -> Set Photo Positions from the pull-down menu to perform this operation. For the Layout window, it is typical to use zero for the over-lap and side-lap parameters.

Open the Layout tool by choosing Layout -> Open Layout from the pull-down menu.



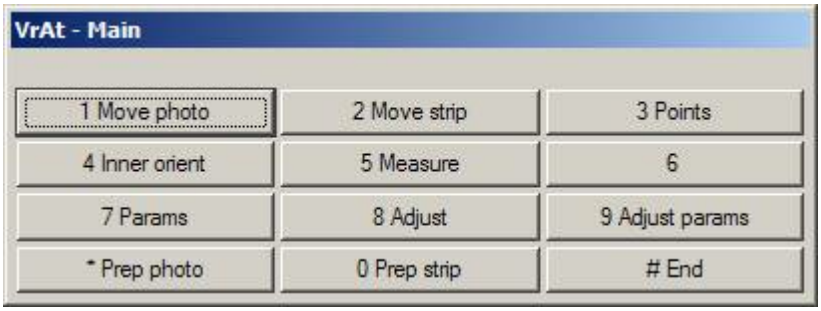
The VrAirTrig Layout window

When the Layout window is open for the first time in a project, the window may appear with a black background with no photos displayed. Press the Zoom All button in the lower left corner of the Layout window to display all the photos.



The Zoom All button in the Layout window

Above the Layout window should be the VrAirTrig Menu Keys dialog box. This dialog box controls many of the VrAirTrig operations.



The VrAirTrig Layout window Main Menu Keys dialog box

The VrAirTrig Layout window is the focus point for the job work-flow and once the Layout window is open various operations may be performed including point management, starting measurement and re measurement operations, block adjustment, blunder detection, and final aerial triangulation adjustments.

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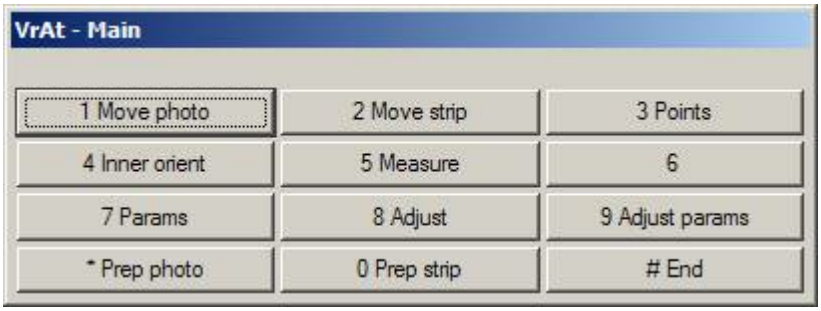
Section 2 Preparing Strips

Preparing Strips for Pass Points

1. Press the "Prep strip" button (button 0)



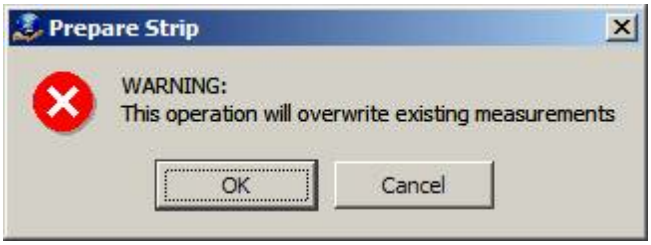
The VrAirTrig Layout window Main Menu Keys dialog box

2. Press the "Pass points" button (button 1)



The VrAirTrig Layout window Prepare Strip Menu Keys dialog box

4. **NOTE:** If there are existing measurements on the strip being prepared, these measurements will be overwritten. If this is acceptable, press OK.



A warning that data will be overwritten

6. Press "Id strip" (button 1).
7. Identify each strip to which to add "Pass points" by clicking on the strip of photos in the Layout window.

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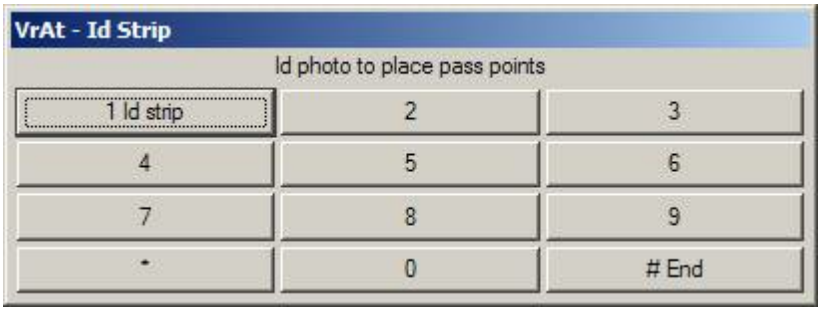
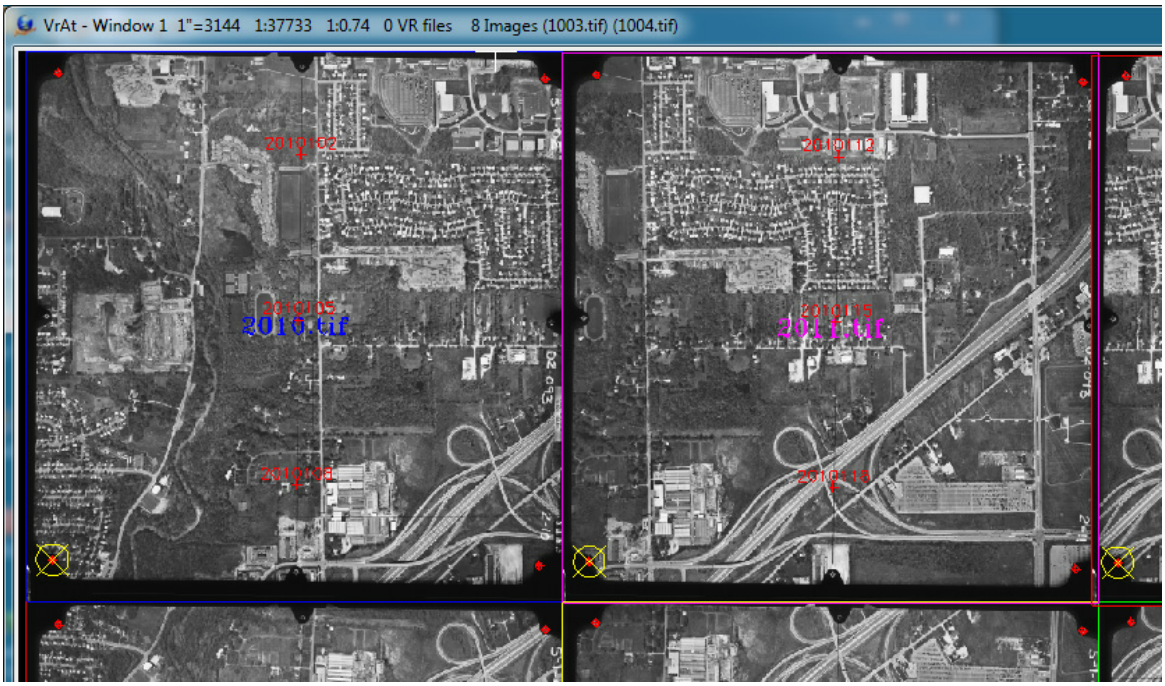


The VrAirTrig Layout window Identify Strip Menu Keys dialog box

Below is shown two photos after the "Prep strip" operation. The unmeasured pass points are shown in red.



A potion of the Layout window showing the results of the Prepare Strip operation

Section 3 Adding Control Points

Adding Control Points to the Project

The following process allows the addition of ground control points to the current project.

1. Press the "Points" button (button 3)

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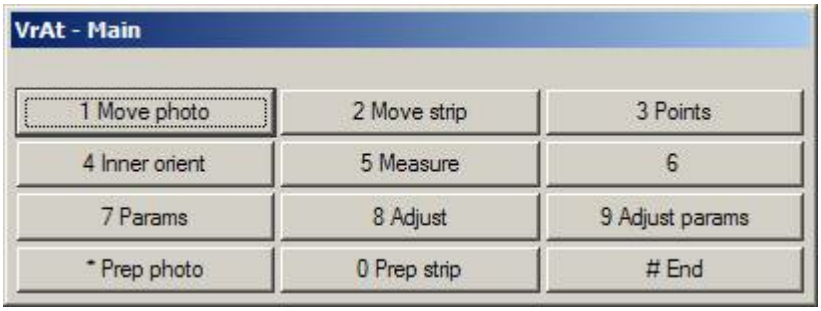
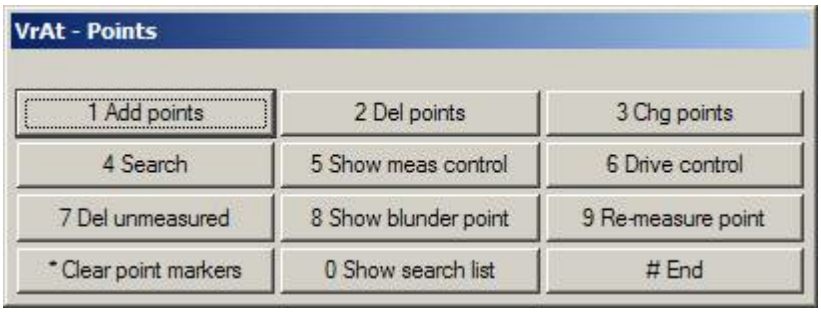


The VrAirTrig Layout window Main Menu Keys dialog box

2. Press the "Add points" button (button 1)



The VrAirTrig Layout window Points Menu Keys dialog box

3. Press "Id point" (button 1) and select the control point location on one of the photos in the Layout window. The control point may be placed in its approximate location and it needs to be placed only on one photo. During the measurement process, the control point will be placed at its proper location and will propagate its position to all overlapping photos.



The VrAirTrig Layout window Add Point Menu Keys dialog box

4. Enter the "New point name". This name must match a point name in the ground control (.cor) file for it to be considered in the block adjustment as a ground control point.

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Add point dialog box

5. Repeat this process to place other control points. If VrAdjust (AeroSys) is being used, it is not necessary to place all the control points at this time. A lesser quantity of control points may be placed now. After a block adjustment has been performed, the Drive Control function may to used to drive to unmeasured control points for measurement.



A potion of the Layout window showing the addition of a control point

Section 4 Measuring Points

Measuring Control, Pass, and Tie Points

There are three methods to measure points. All three methods are available at each point. Because the ground features change from point to point, where one point may be on a city street and the next may be in trees, one method of measurement will not suit all situations. The three measurement methods are:

- **Mono-comparator** - A common point is selected in the left photo and the same point is selected on the right photo. The "Measure" (button 1) is used to measure the point on the left and right photos and the left mouse button should be used to make the measurements.
- **Semi-automatic correlation assist** - The cursor is positioned on one photo and its corresponding location is found on the other photo by pressing the "Correlate" button (button 7). It is recommended that the system keyboard button F7 is used for this operation. When using correlation assist the cursor is positioned (do not press any buttons) in one of the

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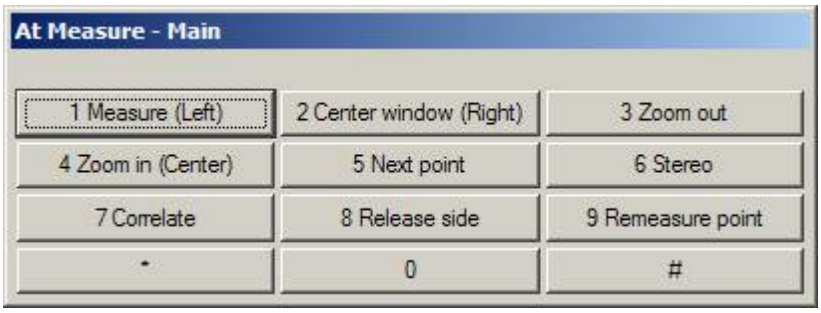
measurement windows and then the "Correlate" (button 7) is pressed to find the corresponding point in the other photo. The correlation will display the matching point in the other measurement window. The cursor may be placed in the left or right measurement window. After correlation, the results are displayed in the At Measure dialog box and in the Menu Keys dialog box. A result of 0.9 to 1.0 is good, 0.8 to 0.9 is acceptable, 0.7 to 0.8 is poor and the correlation should be rejected with results less than 0.7.

- **Stereo** - Photos are displayed in stereo and parallax is cleared at the point location. This operation is similar to the method used on analytical stereo-plotters. Options in this mode include image correlation, dove prism adjustment (rotation of one photo) and photo scale factor adjustment (changing the scale of one photo). There is also an option to rotate both photos 0, 90, 180 and 270 degrees to better display stereo for point measurement between strips. The stereo mode of measurement may be started by pressing the "Stereo" (button 6).



The VrAirTrig Layout window Main Menu Keys dialog box

There are two environments for measuring points. Both measurement methods are used measure or remeasure pass points, tie points and ground control points. The two measurement environments are:

- **Measure mode** – Two photos are displayed in a Relative Orientation format. A least squares best fit is computed when at least six points have been measured. This method helps identify blunders between conjugate points in two photos. If a point has more than one ray then it is held on one photo and the corresponding photo must be adjusted to the held photo. It is possible to start the remeasure method described below from the Model mode of measurement and return. This is useful when a point is not visible from a new strip and must be moved on all photos.
- **Remeasure mode** – Photo patches of all photos that contain the point are displayed on the screen. A point may be remeasured using one of the three measurement methods.

Making Measurements in Measure Mode

Press the "Measure" (button 5) button then identify the first two photos.

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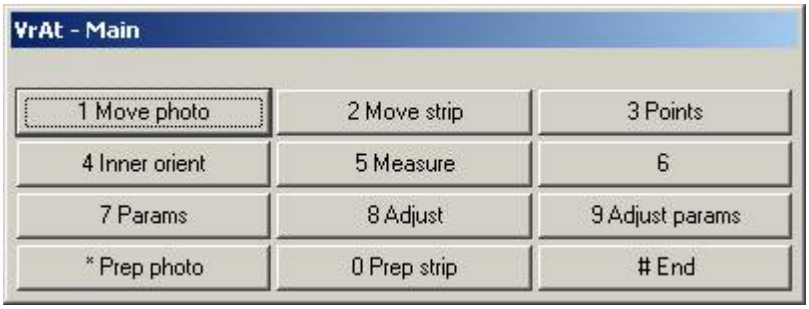
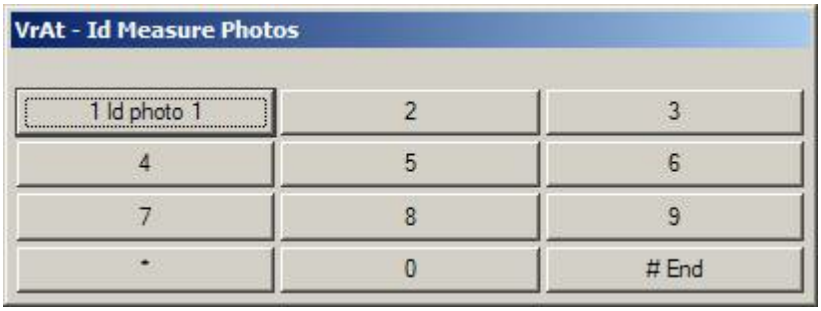


The VrAirTrig Layout window Main Menu Keys dialog box

Move the cursor over a photo in the Layout window and press the "Id photo" (button 1) button. Repeat this for the second photo. The two photos to be measured may overlap on the same strip or may side-lap between strips.



The VrAirTrig Layout window Identify Measure Points Menu Keys dialog box

Once the two photos to be measured have been identified, the measurement windows and dialog boxes are displayed.

Menu Keys Dialog Box

The Menu Keys dialog box displays the active menu and the functions that are associated with it. Buttons in this window may be pressed by placing the mouse over them or with the associated F1-F12 keys on the system keyboard. During measurement, several of these buttons are mapped onto the mouse and in these cases the mouse buttons should be used instead of pressing the buttons in the dialog box. When a button has been mapped onto the mouse a notation of (Left), (Right) or (Center) indicating the left, right and center mouse buttons. When measuring, the mouse pointer becomes the measuring device, so pressing buttons on the mouse instead of the dialog box is necessary.

At Measure Dialog Box

This is the dialog box in the upper right corner of the screen. The point names, left and right coordinates, model coordinates and residuals are displayed for each point along with the current Total RMS Error. Points that are displayed in red are unmeasured while points displayed in blue are measured.

Overview Windows

These windows are the two windows on the left and right edges of the screen that display the entire left and right photos.

Measurement Windows

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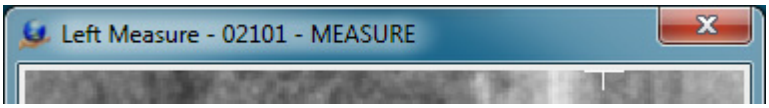
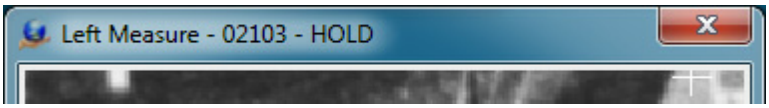
The two middle windows are used for measurements.and measurements are made my placing the cursor in one of the windows and performing one of three measurement methods.
Each measurement window's top border contains the photo name and the measurement status of the point for that side. The measurement status can be MEASURE or HOLD.



Measurement window indicating the point may be measured

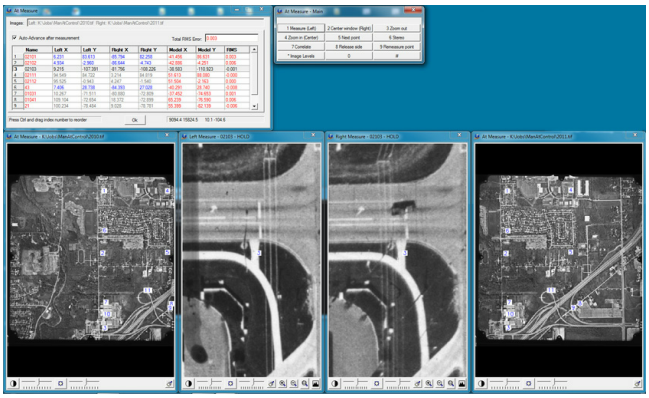
If the status is MEASURE, then the point may be measured in that photo.



Measurement window indicating the point is held and cannot be measured

If a point in the left or right side has already been measured in two or more other photos (two or more rays), it will be flagged has HOLD. If the point is being held it may not be measured unless it is released by pressing "Release Side" (button 8) . This is a safety feature to ensure that common points that have been measured on two or more photos are not moved when observing a new photo. To release a side, the system keyboard button F8 must be pressed while the cursor remains in the target measurement window. If one side, left or right, is flagged as HOLD and the other side is flagged as MEASURE, the point in the MEASURE side may be measured to match the point in the HOLD side.

If the location of a point needs to be moved in all the photos, the "Remeasure point" (button 9) function can be used.


The VrAirTrig point measurement environment (similar to Relative Orientation)

A Measurement Work-flow

The suggested work-flow for measuring points is to first tie the photos together on a single strip and then tie that strip to the strip above and/or below it. The process is then repeated for the other strips.

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The necessity of tying one strip to another and then "cross tying" points back to the first strip after the second strip has been measured is determined by the measurement philosophy of the company. It is suggested that "cross tying" is not needed.

Section 5 Adjustment

Running a Block Adjustment

Running the block adjustment from inside VrAirTrig is possible if the current configuration is using the optional VrAdjust (AeroSys) package. There are two adjustment modes when using VrAdjust from VrAirTrig. The first is “Check Photogrammetry”, which forms photos into strips and forms the strips into a block.This step checks the Photogrammetry and yields results based on the accuracy and tie quality of the points without consideration of the ground control file (though enough ground control points must be measured to allow the adjustment to solve). The second mode is “Full”, where photos are formed into strips and the strips are formed into a block and fit to the ground using the ground control file.

Each of the adjustment modes reports results as residuals. The results from “Check Photogrammetry” are expressed as a statistical number and the results from the “Full” adjustment are expressed in ground unit residuals. It is possible to change point weights to allow suspect points to “float”. If a point has been floated and the adjustment has been run at least once, use "Drive Control" to drive to the point's computed position. This is useful if there are misidentified control points.

After an initial block adjustment, it is possible to drive the layout window the blunder points. It is also possible to drive to unmeasured control points and mark a control point position for remeasure and inclusion in the next block adjustment.

To display the adjustment parameters dialog box, press "Adjust Params" (button 9) from the Main menu in Layout.

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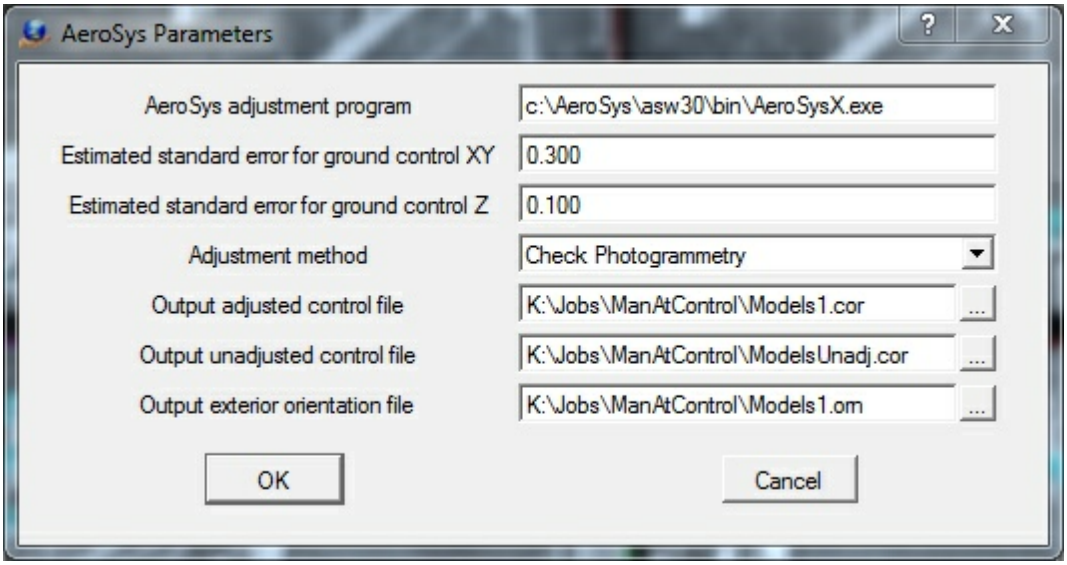
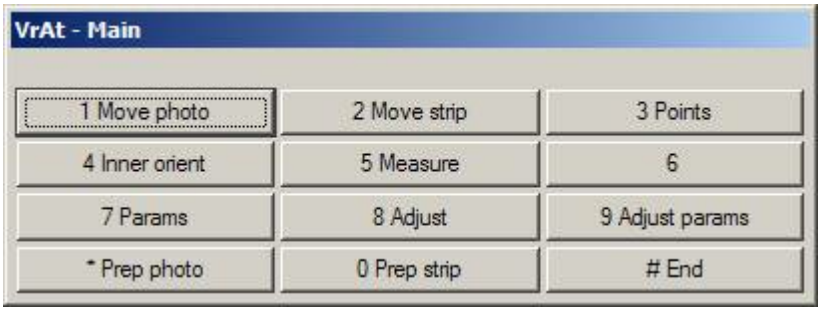


The Adjustment Parameters dialog box

Running Check Photogrammetry Adjustment

1. Press "Adjust params" (button 9) from the Main menu in Layout.
2. Set Adjustment Method to Check Photogrammetry, which will report on the quality of the point observations.
3. Press "Adjust" (button 8) to run the block adjustment.



The VrAirTrig Layout window Main Menu Keys dialog box

The following is a portion of the main report generated from the "Check Photogrammetry" adjustment. The adjustment in this example shows point 102 as a blunder point. Point 102 is highlighted in the photo point list with a <== symbol. After an adjustment, the "Drive Control" function could be used to drive to a suspect point in Layout and possibly run the Remeasure function to adjust one or more of the measurements.

```
-------------------------------------------------------------------------
VRAT - CHECK PHOTOGRAMMETRY REPORT

FileName          : c:\Jobs\AeroSys\VrAeroSys.rep
Date Time         : 8-Jul-2009 22:18:33
Adjustment Mode   : Check Photogrammetry
```

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```
Number of strips : 2
Number of Photos : 8

------------------------------------------------------------------------
PHOTOGRAMMETRY RESULTS

The results shown in this report are unit-less statistics.
It is intended to show the results of the photogrammetric measurements.
The ground control was not used during the adjustment.
Results over 3.0 indicate a blunder and are noted with <==

------------------------------------------------------------------------
BLUNDER POINTS

1 point:
       102

------------------------------------------------------------------------
ALL POINTS BY PHOTO

Photo 1003
       102   3.78   5.13 <==
       101   0.15   0.15
      3782  -1.13  -1.13
        21  -0.69   0.33
     01043   0.22  -0.53
     01042  -0.28  -0.23
     01041  -0.16   0.46
     02103  -1.32  -1.75
     01033   0.63   0.63
     01032  -0.86  -0.86
     01031  -1.45  -2.35
Photo 1004
       102  -0.43  -5.52 <==
       101  -0.15  -0.15
         9   0.27   0.27
      3782   1.13   1.13
        21   0.13  -0.12
     01053  -0.00  -0.01
     01052   0.11  -0.16
     01051   0.40  -0.10
     01033  -0.63  -0.63
     01032   0.86   0.86
     01031  -0.33   2.44
     02123   0.03  -0.12
     02103   0.22   1.78
     01043  -0.28   0.48
     01042   0.24   0.12
     01041  -0.14  -0.17
Photo 1005
         8  -0.00  -0.00
       176  -0.01   0.26
         9  -0.27  -0.27
```

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```
        21  -0.19   0.14
     01063  -0.00  -0.00
     01062   0.18   0.18
     01061   0.08  -0.17
     01043   0.32   0.04
     01042  -0.22   0.11
     01041   0.26  -0.19
-------------------------------------------------------------------------
```

Running a Full Adjustment

1. Press "Adjust params" (button 9) from the Main menu in Layout.
2. Set Adjustment Method to Full.
3. Press "Adjust" (button 8) to run the block adjustment.

The following is a portion of the main report generated from the "Full" adjustment. The adjustment shows a high residual in the Y axis on point 21. This line is shown with an <== at the end. After an adjustment the "Drive Control" function could be used to drive to a suspect point in Layout and possibly run the Remeasure function to adjust one or more of the measurements.

```
-------------------------------------------------------------------------
VRAT - FULL ADJUSTMENT REPORT

FileName         : c:\Jobs\AeroSys\VrAeroSys.rep
Date Time        : 8-Jul-2010 22:48:23
Adjustment Mode  : Full
Number of strips : 2
Number of Photos : 8

-------------------------------------------------------------------------
CONTROL POINT RESIDUALS (RMS)

          X          Y          Z
     0.180      0.246      0.250

-------------------------------------------------------------------------
RESIDUALS AND PREDICTED POSITIONS AND POINT WEIGHTS

     Point  Type       ResX       ResY       ResZ      WgtXY       WgtZ
         8    HV     -0.003      0.300      0.129      0.300      0.500
         9    HV     -0.011      0.165     -0.091      0.300      0.500
        21    HV     -0.196     -0.613      0.312      0.300      0.500 <==
        22    HV     -0.189      0.243      0.076      0.300      0.500
        33    HV     -0.111     -0.030      0.486      0.300      0.500
        43    HV      0.091     -0.141     -0.096      0.300      0.500
       101    HV     -0.232      0.270     -0.034      0.300      0.500
       102    HV     -0.188     -0.178     -0.313      0.300      0.500
       108    HV      0.142     -0.025     -0.372      0.300      0.500
       176    HV      0.298     -0.166      0.003      0.300      0.500
      3782    HV      0.103      0.032      0.215      0.300      0.500
```

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```
 4082     HV       0.295       0.143      -0.304       0.300       0.500
01031      T       0.103       0.037       0.044
01032      P       0.000       0.004       0.000
01033      P       0.006       0.062       0.028
01041      T       0.130       0.048       0.038
01042      P       0.067       0.029       0.015
01043      P       0.009       0.015       0.004
01051      T       0.111       0.067       0.041
01052      P       0.038       0.040       0.011
01053      P       0.022       0.053       0.024
01061      T       0.029       0.038       0.008
01062      P       0.005       0.095       0.012
01063      P       0.001       0.006       0.003
02101      P       0.002       0.015       0.008
02102      P       0.003       0.055       0.000
02103      T       0.057       0.048       0.015
02111      P       0.033       0.072       0.034
02112      P       0.051       0.059       0.014
02121      P       0.014       0.088       0.044
02122      P       0.002       0.056       0.001
02123      T       0.095       0.058       0.054
02131      P       0.010       0.072       0.041
02132      P       0.004       0.105       0.019
02133      T       0.030       0.038       0.007

Point types -
V-Vertical  H-Horizontal  HV-Horizontal+Vertical
T-Tie       P-Pass        VI-Visual
L-Lake      C-Check
--------------------------------------------------------------------------------
```

Adjustment Results Reports

When a block adjustment is run in "Check Photogrammetry" mode or in "Full" mode a general report is displayed showing the results of the adjustment. There are more reports available in the C:\jobs\AeroSys folder that are more detailed than the general reports.

Section 6 Debugging

A block adjustment from VrAirTrig may be debugged if the user's current configuration includes the optional VrAdjust (AeroSys) package. Several methods can be used to help debug a VrAirTrig block adjustment. This process might involve identifying bad measurements and/or misidentified locations for ground control points. These methods include:

- Running the Check Photogrammetry adjustment.
- Relaxing a control point or points by point weighting.
- Driving to a measured or unmeasured control point
- Remeasuring a point or points.

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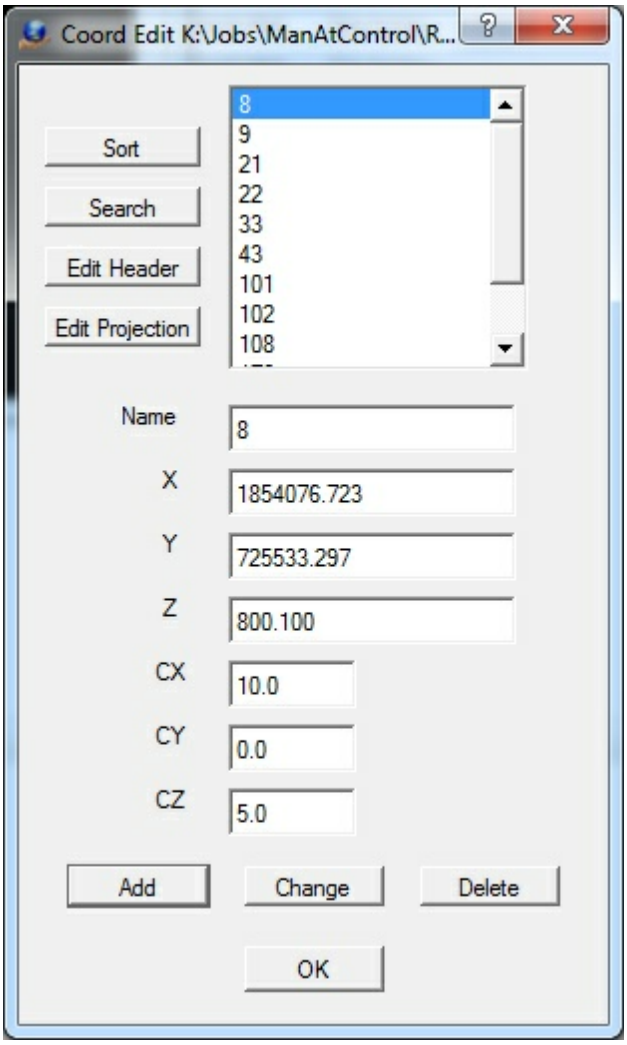
After relaxing a control point or re-measuring a point, the bundle adjustment may be run again and the results checked.

Relaxing a Control Point

A ground control point may be floated or weighted, which allows the adjustment to move the point within a user-defined ground value in XY or Z.

To weight a point, click on Coordinates -> Edit coordinate file, or use the Edit Coordinate (EdiCoo) command. The Edit Coordinate command dipslays a dialog box containing the control points and their X,Y,Z and weight values (CX, CZ).



The Edit Coordinate dialog box

If the CX, CY and CZ values for a control point are zero, the "Estimated standard error for ground control XY" and the "Estimated standard error for ground control Z" will be used.. These values are set in the "Adjust params" (button 9) from the Main menu in Layout.

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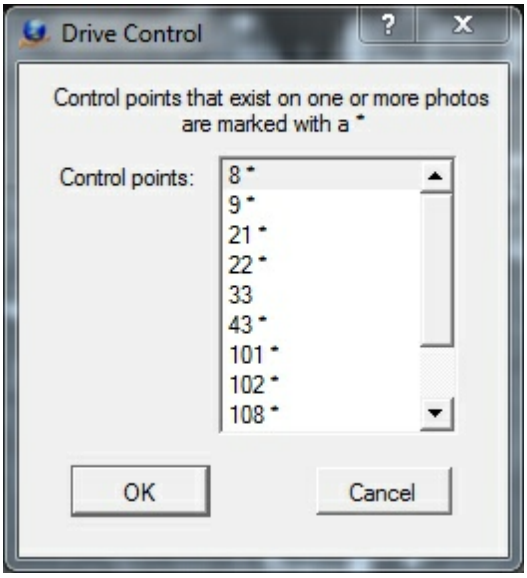
Setting the CX and/or CZ values to a non-zero ground value will set the weighting for that point. The CX value is used for X,Y weighting and the CY value is not used from the Edit Coordinates dialog box. After setting the weight values (relaxing a point), the bundle adjustment may be run again and the results checked. In the above Edit Coordinates dialog box, the X,Y axis is weighted with ten ground units and the Z is weighted with five ground units.

Driving to a Measured or Unmeasured Control Point

After the bundle adjustment has been run one or more times, any ground control point may be "driven to" and displayed in the Layout window. If the point measurements or location are suspect then the point may be remeasured.

To drive to a control point, click "Points" (button 3) -> "Drive control" (button 6).



The Drive Control dialog box

The Drive Control dialog box shows all the points in the ground control file. Points that have been measured are marked with an asterisk (*). In the example dialog box above, point number 33 is shown as unmeasured. Selecting that point would show the point in all photos in Layout and prompt for an action to take on this point.



The Drive Control action dialog box

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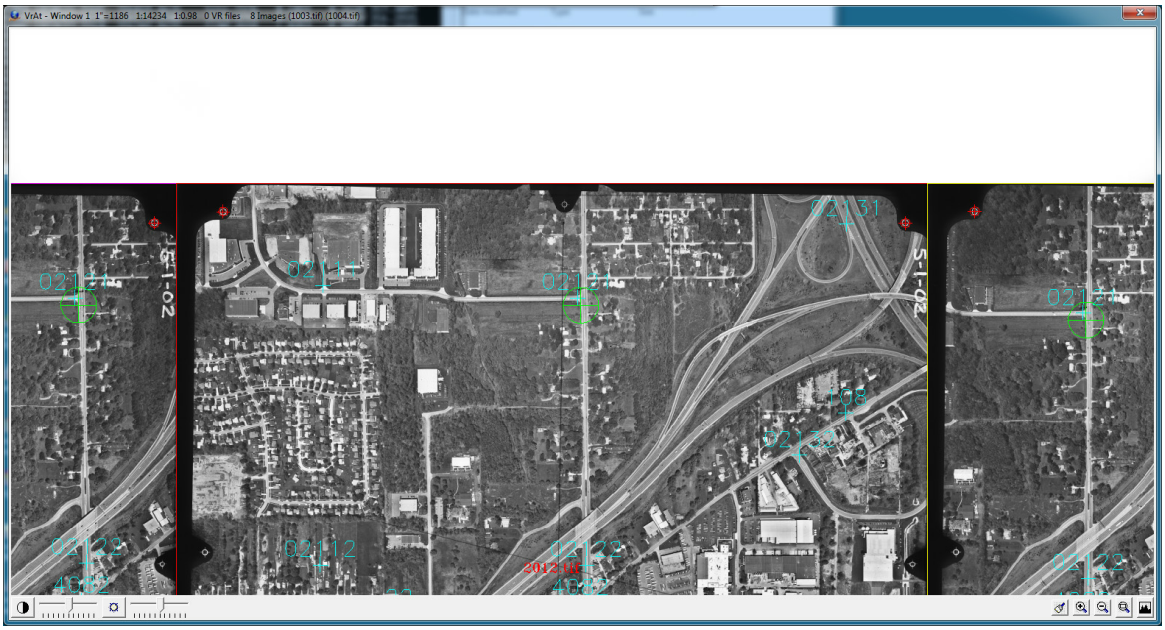
There are one of three actions that may be taken on a control point drive which include:

- **One photo** - The point will be placed in one photo.
- **No photos** - No point placement will occur and the Layout window will display the locations of the point in the photos that it falls within.
- **All photos** - The point will be placed in all photos that it falls within. At this time a remeasure may be started to measure the point in all qualifying photos.



Results of Drive Control in the Layout window

In the above example, the location of point 33 is displayed in three photos with a green cross and circle.

Remeasuring a Point or Points

- Remeasure is a useful function that allows a single point to be remeasured on the photos that it falls within.
- Remeasure can be started from Measure by clicking the "Remeasure point" (button 9). After the point is remeasured, the program will return to Measure and the results will be recalculated.
- Remeasure can also be started from the Layout window by clicking "Points" (button 3) -> "Remeasure point" (button 9) and identifying the point to be remeasured.

When Remeasure is started the photo patches will be displayed, one for each photo that the point falls within. In the following example, point 21 has been measured in six photos.

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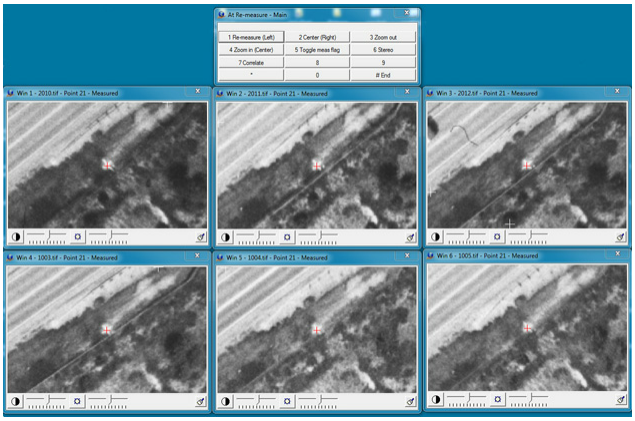
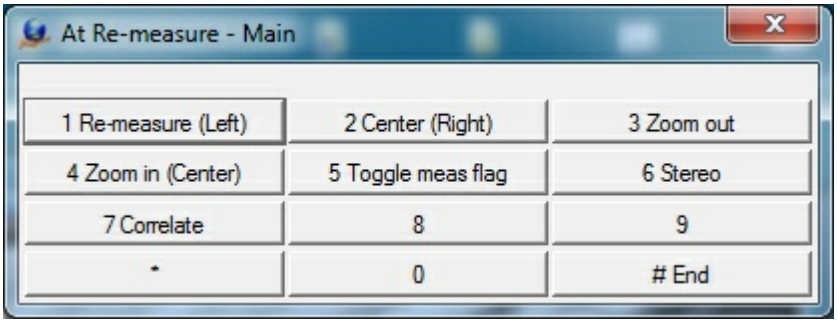


The Remeasure dialog and point photo patches

Several measurement tools are available in Remeasure, including single point remeasure, correlate and stereo measure.
NOTE: When in Remeasure, the HOLD flag is ignored, allowing the point to be remeasured on any photo.



Point remeasure dialog box

After a point has been remeasured, program control returns to Measure or to Layout.

Section 7 Exporting Measurements

If performing the block adjustment with another stand-alone program is required, measurements from VrAirTrig may be exported in several different formats. Exporting measurements may also be performed if models are to be set in the Vr Orientation program using measurements as input.

Measurements may be exported from VrAirTrig by clicking Export and then choosing the format to export the measurements.

Supported measurement formats include:

- PATB
- Albany
- JFK

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- VrAt

3.7 Tutorial Vr Aerial Triangulation, RPC Satellite Images

Vr Aerial Triangulation Tutorial, RPC Satellite Images

A tutorial for the Vr Aerial Triangulation Program (VrAt) (VrAirTrig)

See also: Vr Air Trig - Documentation

Overview
Section 1 Project Setup
Section 2 AutoTie
Section 3 Measuring Control
Section 5 Bundle Adjustment

Overview

The Vr Aerial Triangulation program (VrAirTrig) allows the collection of strip and tie points on a large number of photos and performs a simultaneous bundle block adjustment. For RPC images, the bundle refines the coefficients provided with the images. Measured points can also be exported for adjustment in third party packages.

VrAirTrig provides a Layout window that enables the technician to arrange the project photos as if on a desktop. In the layout, users can view point readings, measure points, add control points, etc.

VrAirTrig's intuitive interface allows setting up, reading, and exporting aerial triangulation readings on up to 2000 photos.

Points may be measured in four modes mono-comparator, stereo, semi-automatic, and automatic.

Project Setup

First, create a 'New Project' in VrAirTring.

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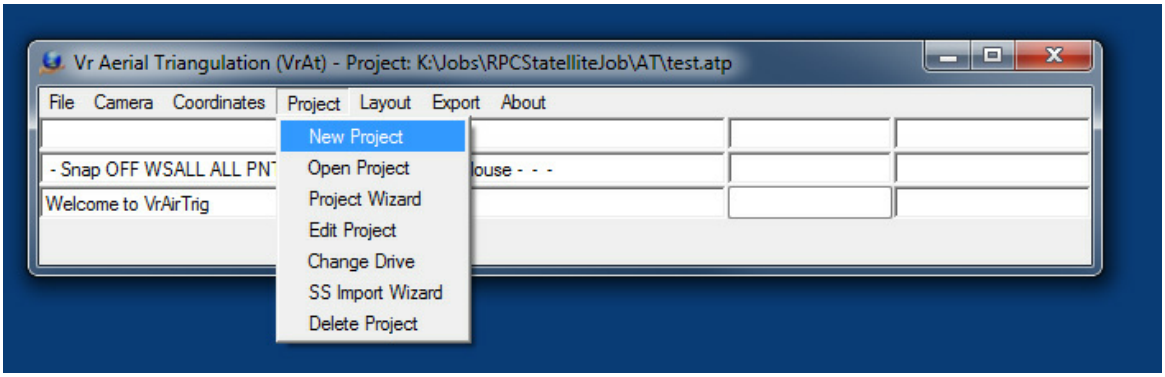
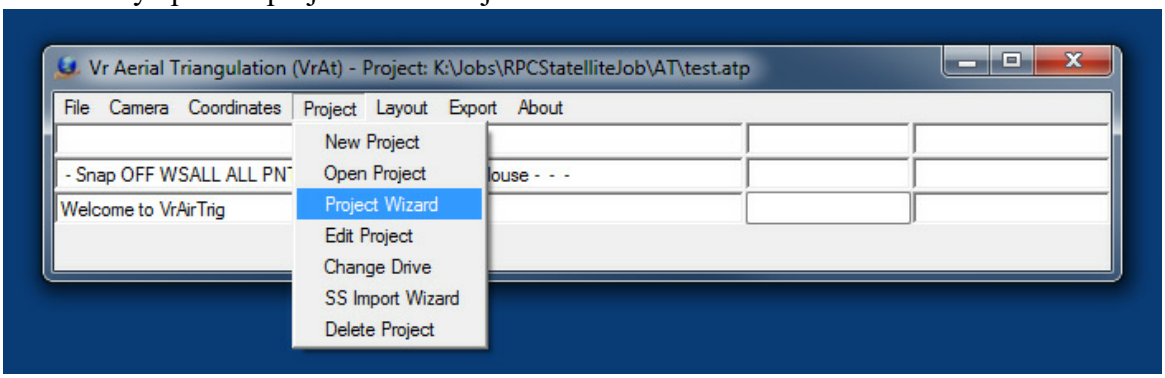


The software will prompt for a location and name, and then save an empty .atp file.

Immediately open the project in the 'Project Wizard'.



This will open the tabbed project wizard interface that steps through the setup process. Note that at any time Alt-S will save the project file. Clicking on the 'Save and Exit' tab will also save the project (and exit the project wizard). Clicking on the red 'X' at the top right will exit without saving.

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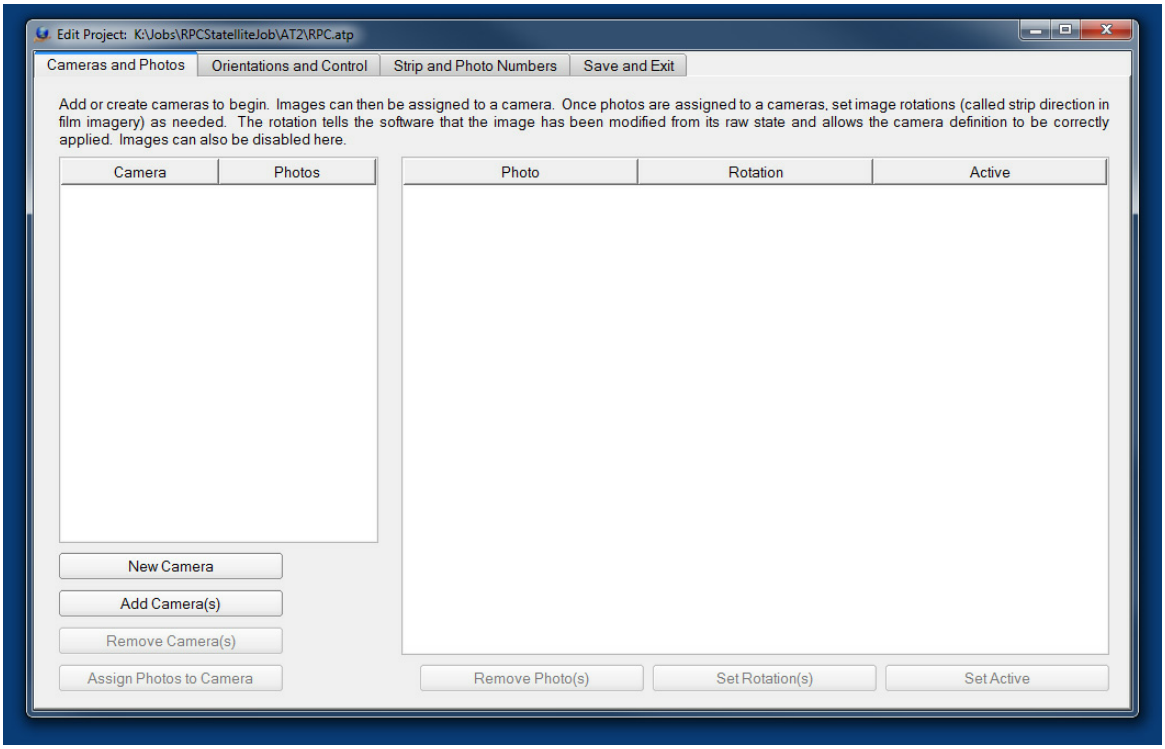

It is necessary to begin on the first tab of the project wizard by defining a camera file. All the photo based modules in VR require that images be associated with camera definitions. In order to support RPC within this convention a generic RPC camera is used. To create this generic camera click on the the 'New Camera' button. The edit camera dialog will open, and the camera type will default to 'Digital'. When the camera type is changed to RPC, all of the input fields will disappear (This is because all of the camera data is imbedded in the polynomial coefficients). Click 'OK' to save the RPC camera.

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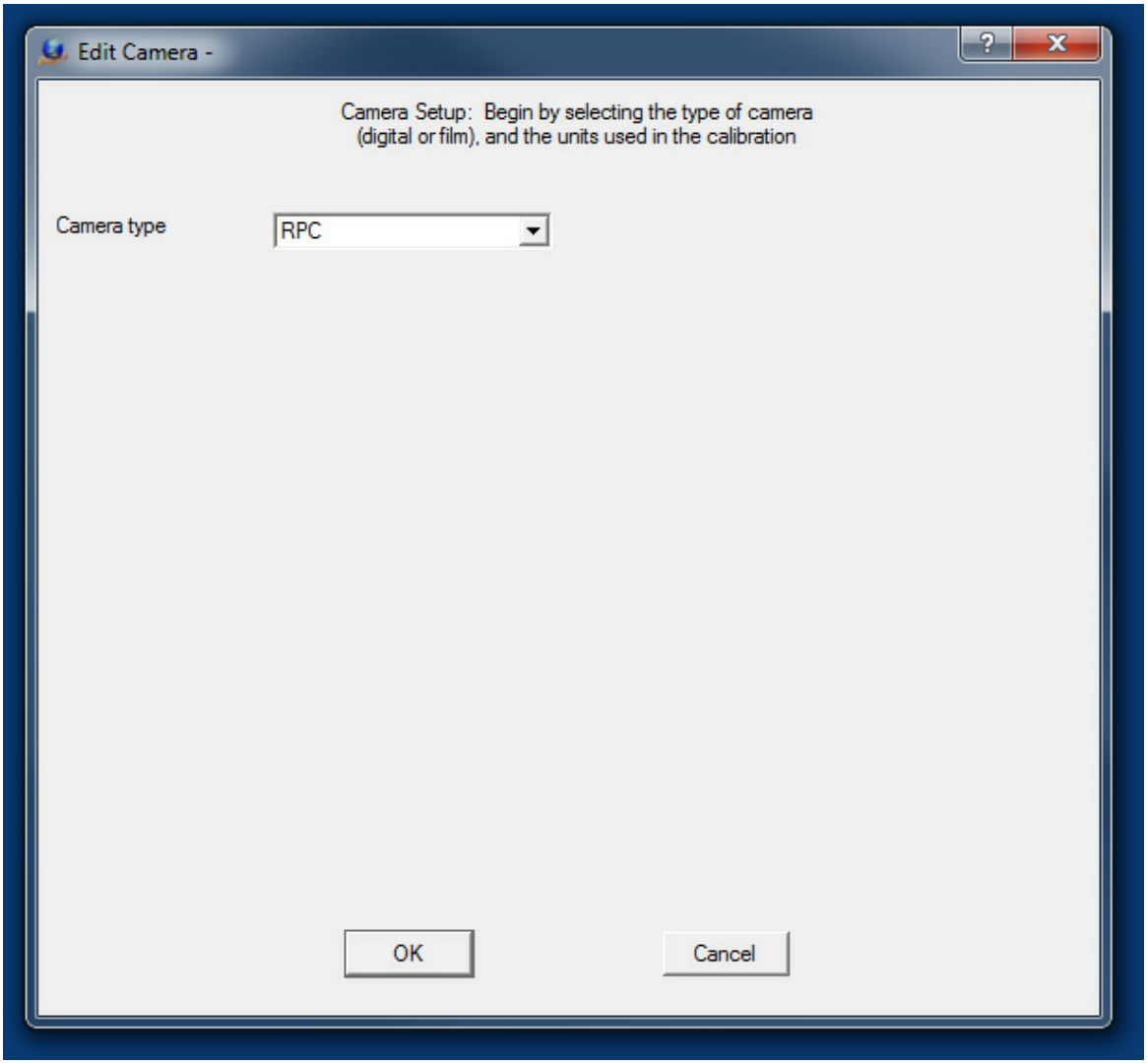

The new camera will be listed in the left table. Clicking on the number to the left of the camera name will select it; once a single camera is selected the 'Assign Photos to Camera' button becomes active. This button will open a file browse dialog that can be used to select the photos.

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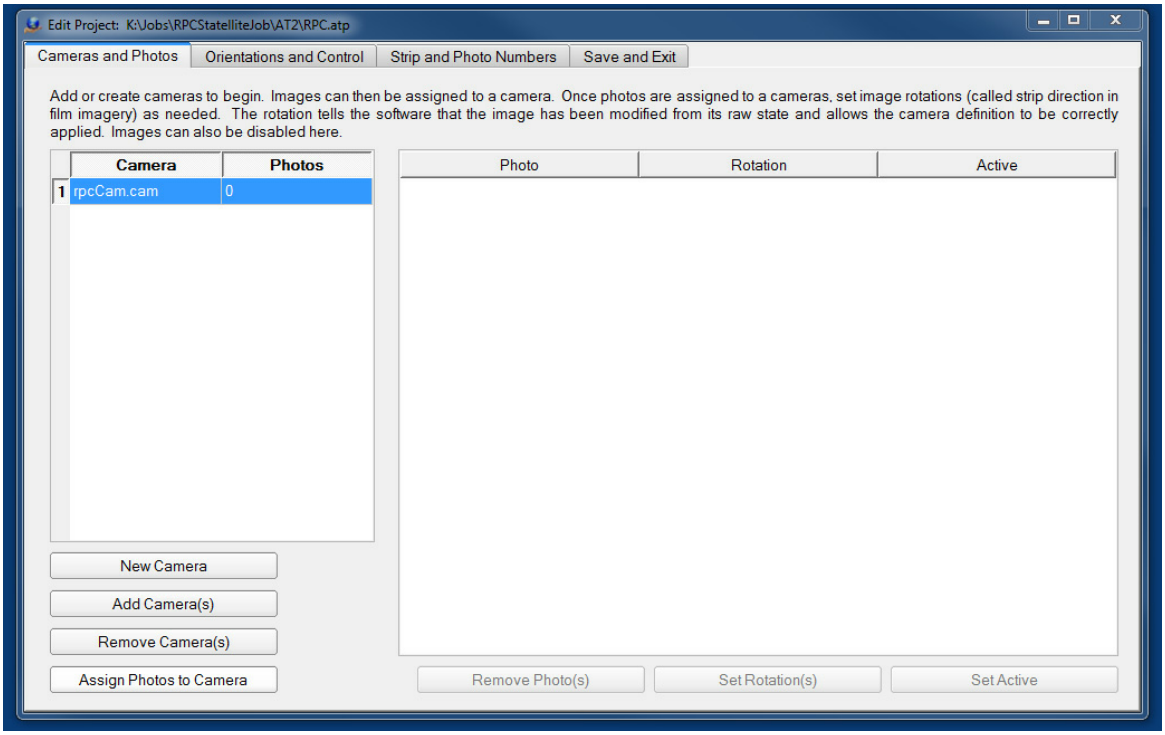
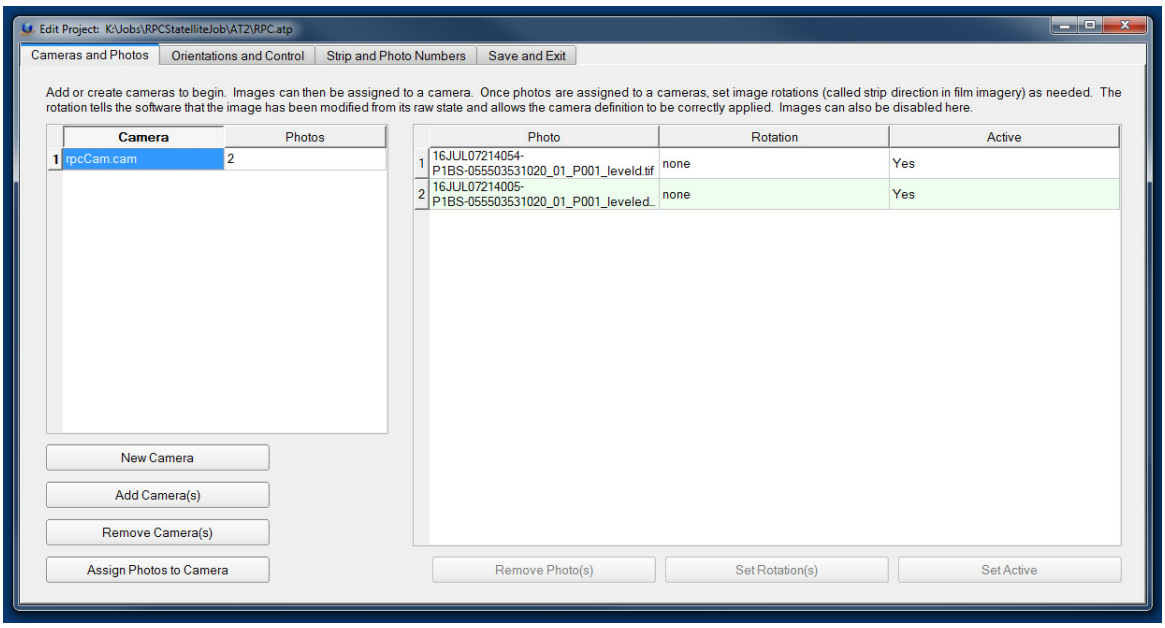


The photos will be listed in right table. This concludes the work in the first tab. Note that the images used in this example have been edited and saved with a '_leveled' postfix. The original images made very poor use of their dynamic range and were leveled in photoshop prior to processing. It is not yet known if this is typical.



Moving on to Project Wizard Tab 2, 'Orientations and Control'. The three buttons on the right

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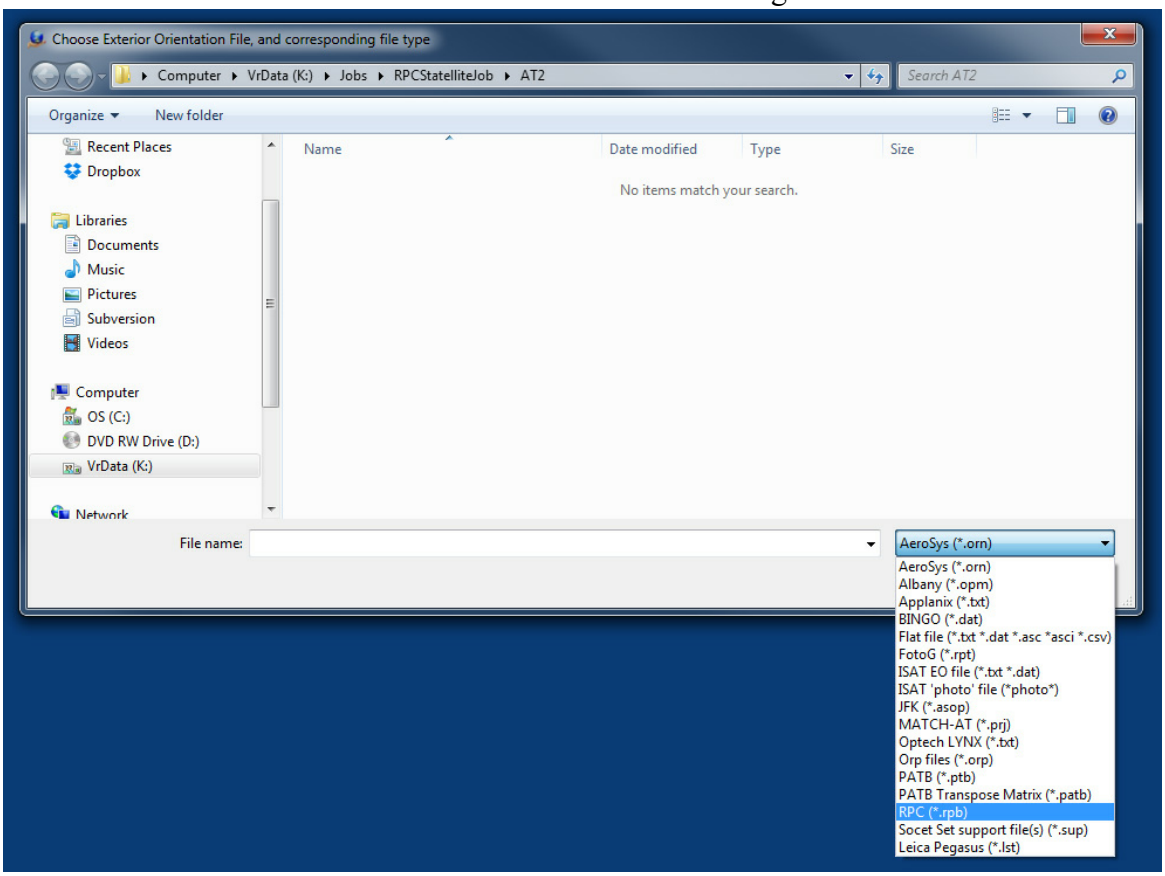
of the tab correspond to the three operations that can be done here. The first 'Control File' is used to browse and find a control file. Any file of the format:
Name1 Lon1 Lat1 Height1
Name2 Lon2 Lat2 Height2
Name3 Lon3 Lat3 Height3...
Can be opened and used for the control file. The second button 'Import IOs' is not needed because IO's are automatic for any digital image including RPC satellite. The third button, 'Import EOs' is used to import the exterior orientations. The file browse dialog that will open lists all the available EO formats in a combo box at the bottom right.



Currently there is only one format of RPC file supported, the .rpb provided with WorldView3 images. The reason for this, is that we only have example data from that sensor. More sensors will be added as clients request them.

Example WorldView3 rpb file:

```
satId = "WV03";
bandId = "P";
SpecId = "RPC00B";
BEGIN_GROUP = IMAGE
        errBias =    1.11;
        errRand =    0.27;
        lineOffset = 6453;
        sampOffset = 13833;
```

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```
latOffset =   65.0682;
longOffset = -147.4682;
heightOffset = 486;
lineScale = 6454;
sampScale = 13833;
latScale =    0.0324;
longScale =    0.1495;
heightScale = 501;
lineNumCoef = (
                    +2.600687E-03,
                    +7.321254E-02,
                    -1.105985E+00,
                    +3.155668E-02,
                    +3.927141E-04,
                    -1.196724E-05,
                    +3.942317E-05,
                    -2.818333E-03,
                    -1.246034E-03,
                    -2.458765E-06,
                    -6.631219E-07,
                    +2.110715E-06,
                    +8.928089E-06,
                    +1.384127E-06,
                    -1.744533E-05,
                    -8.882365E-05,
                    -2.077458E-05,
                    +5.507292E-07,
                    +4.266188E-06,
                    +5.887024E-07);
lineDenCoef = (
                    +1.000000E+00,
                    +4.508323E-04,
                    +1.457076E-03,
                    -3.735878E-05,
                    +1.194044E-05,
                    +1.922784E-08,
                    +6.076005E-06,
                    +1.602818E-05,
                    -6.060599E-05,
                    +1.863469E-05,
                    +4.320563E-07,
                    +2.492354E-08,
                    -7.789835E-06,
                    +1.152282E-08,
```

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```
                -3.870810E-07,
                +4.400122E-05,
                +1.065839E-07,
                +0.000000E+00,
                -3.647255E-06,
                +0.000000E+00);
        sampNumCoef = (
                -3.593168E-03,
                +1.014127E+00,
                +1.414506E-04,
                -1.197804E-02,
                -9.495031E-04,
                +4.082122E-04,
                -1.673931E-04,
                +2.804113E-03,
                +5.613618E-05,
                +4.792464E-07,
                +2.737975E-07,
                -9.904634E-07,
                -2.171797E-05,
                -3.740261E-06,
                +2.031331E-05,
                +1.860997E-04,
                +4.014185E-07,
                +1.494090E-06,
                -1.611103E-05,
                +4.214402E-08);
        sampDenCoef = (
                +1.000000E+00,
                +8.055703E-04,
                +9.606289E-04,
                -4.569766E-04,
                -2.443157E-06,
                -4.773518E-07,
                -9.661562E-07,
                +4.508436E-06,
                +1.958310E-05,
                -3.954105E-06,
                +6.199317E-08,
                -4.508929E-08,
                -1.449302E-06,
                +0.000000E+00,
                +1.069904E-07,
                +5.719918E-07,
```

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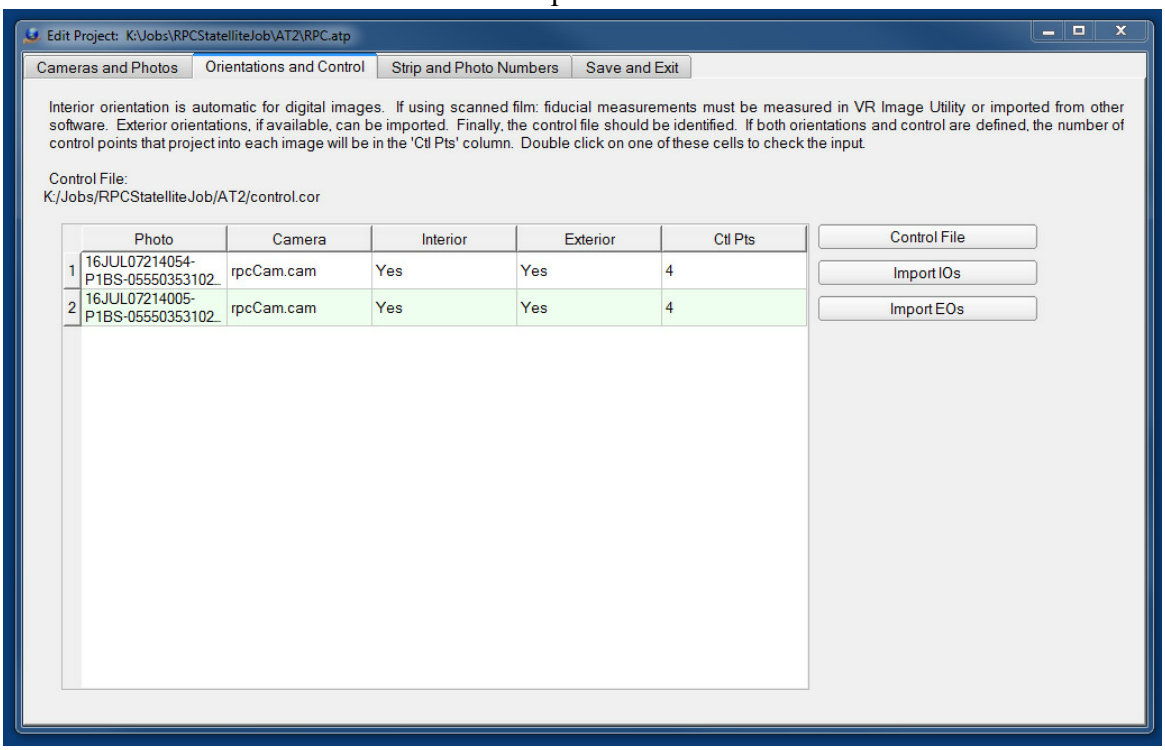
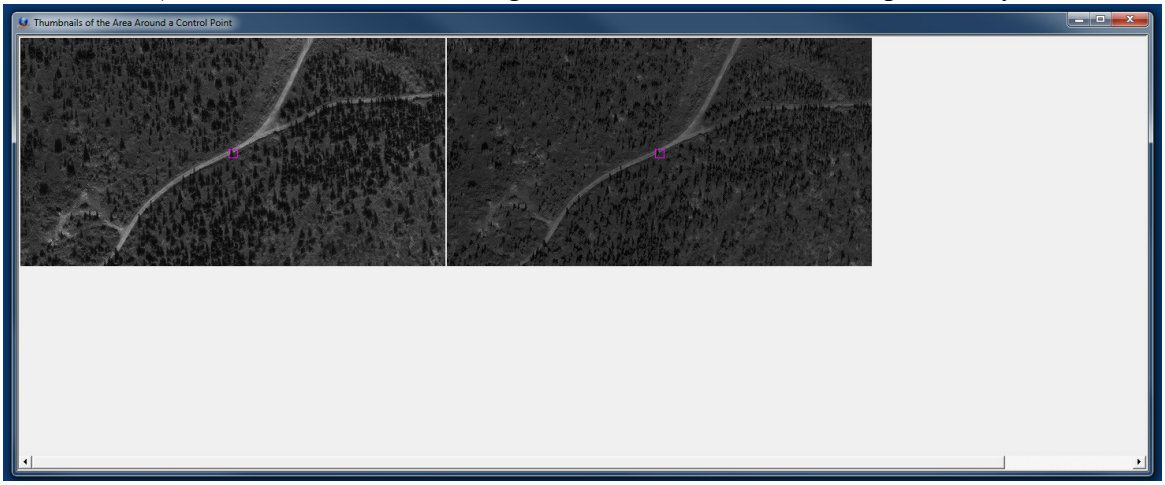
+0.000000E+00,
+0.000000E+00,
-7.269755E-08,
+0.000000E+00);
END_GROUP = IMAGE
END;

Once a control file is selected and EOs are imported the tab should look similar to this.



Notice the fifth column of the table titled 'Ctl Pts'. This column lists the number of control points that project into each image. Double clicking on one of the cells in this column allows user to view thumbnails of the control points in the images. If the image thumbnails look reasonable (as shown below) it demonstrates that the image EOs and control file are setup correctly.



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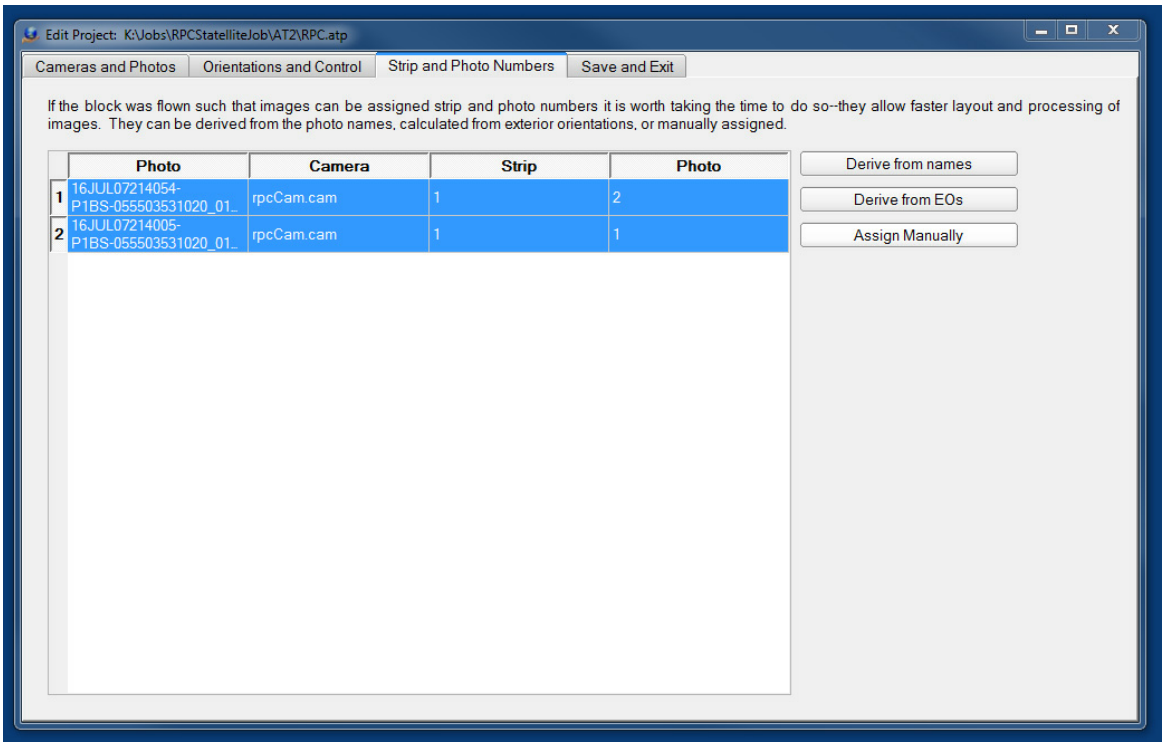
Moving on to Project Wizard Tab 3, 'Strip and Photo Numbers'. Strip and photo numbers are not really necessary. However, it takes only moment to assign them, and they may make project management easier. In this example, the two images were selected by dragging the curser down the row numbers to their left. The 'Assign Manually' button was then used to assign them to photo strip 1.



Project setup is complete. Alt-S to save and/or click on the tab "Save and Exit' to save and exit the project wizard.

Autotie

After project setup, the images can be opened in layout. If the images are not visible when you open the layout, click the 'Zoom All' button which is the extreme bottom right of the layout. To navigate in layout use the 'HOME' key to recenter the view and 'PAGE DOWN/UP' to zoom in and out.

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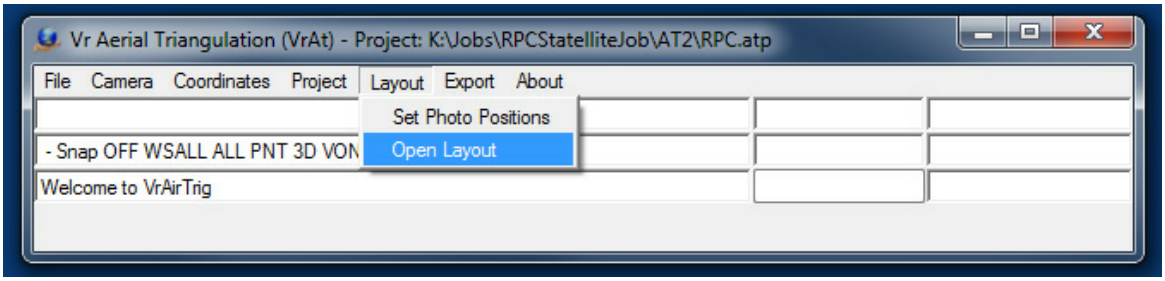
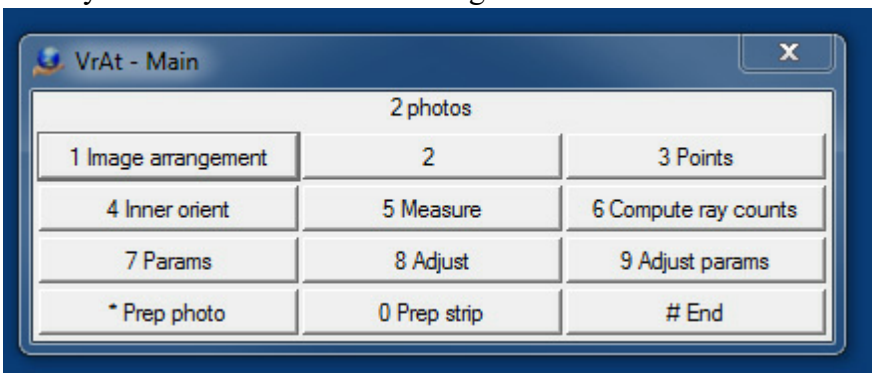
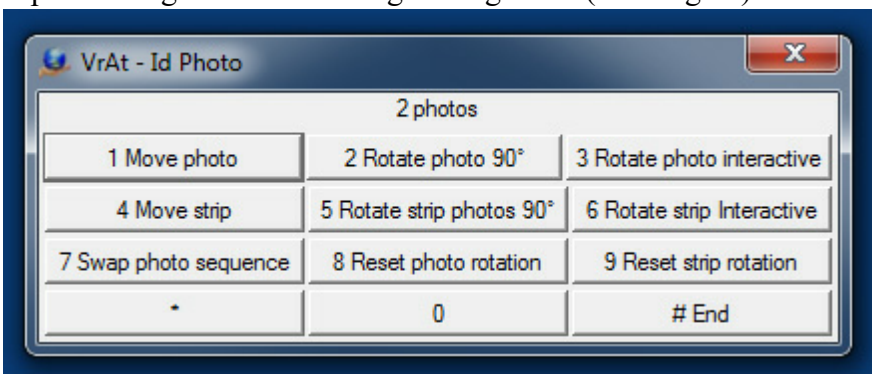


Layout uses a 12 button menu navigation system. The buttons on the twelve key can be clicked with the mouse or activated using the F1-F12 keys on the keyboard. Also, the mouse left click is always linked to F1 and the mouse right click is linked to F2.



Upon clicking the button '1 Image arrangement' (or hitting F1) the menu will change to this.



The nine active commands in this menu (F1-F9) are used by hovering the mouse over the images and pressing the F-Key for the command. They allow the images to arrange as desired. Note however that many layout functions will not work well if the images are overlapping. For very narrow images it may even be better to leave a little space between them. The '# End' key (or F12) will return to the Main menu. Here is an example of two arranged satellite images.

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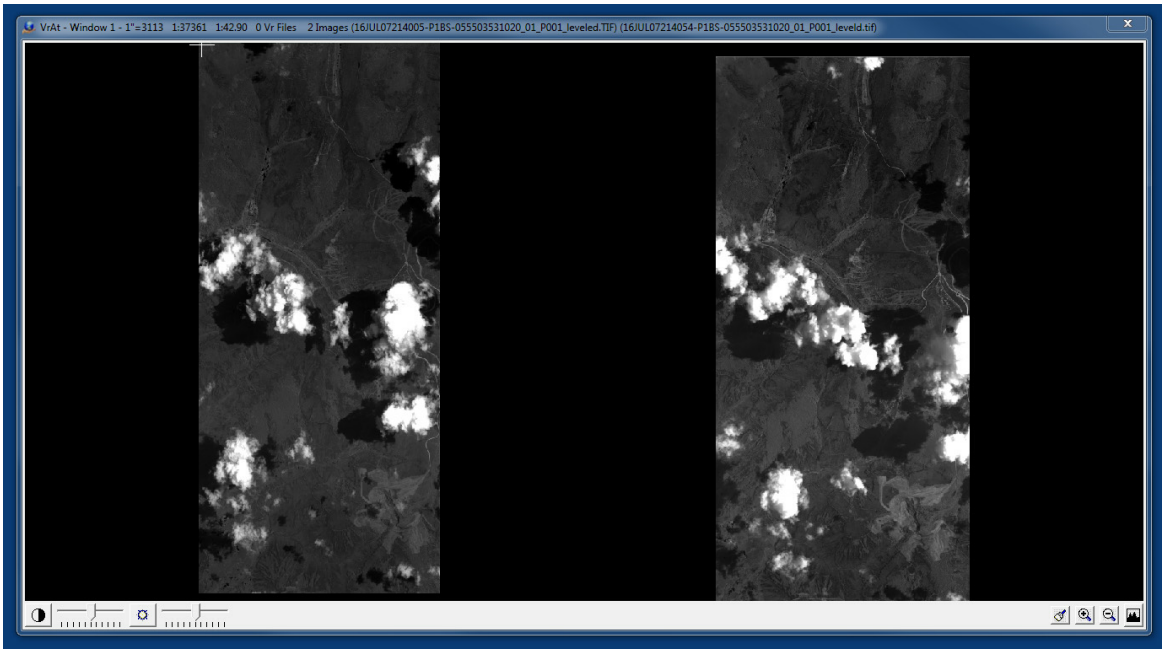
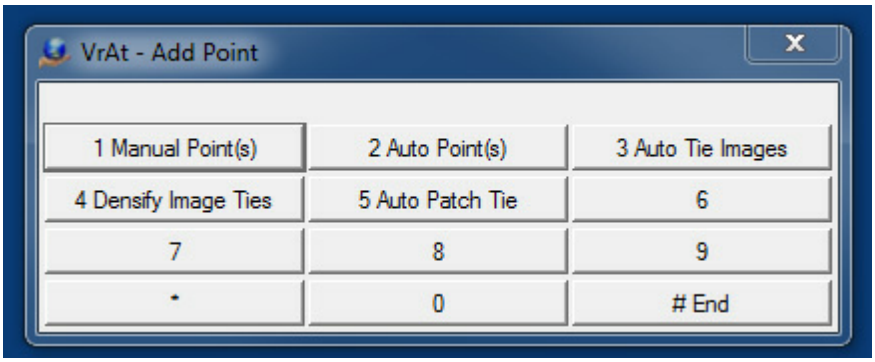


After the images are laid out as desired, navigate to the Add Points menu: Main->'3 Points'-> '1 Add Points Menu'.



Use '5 Auto Patch Tie' (F5) to put in a few patches of points. To use this tool left-click on corresponding areas in the two images. Boxes will be drawn around the areas. Left click again to reposition a box. Right-click (or press F2 or click on the '2 Match patches' button) when satisfied to auto tie two areas. Below is a view of the layout with two patches ready to be matched.

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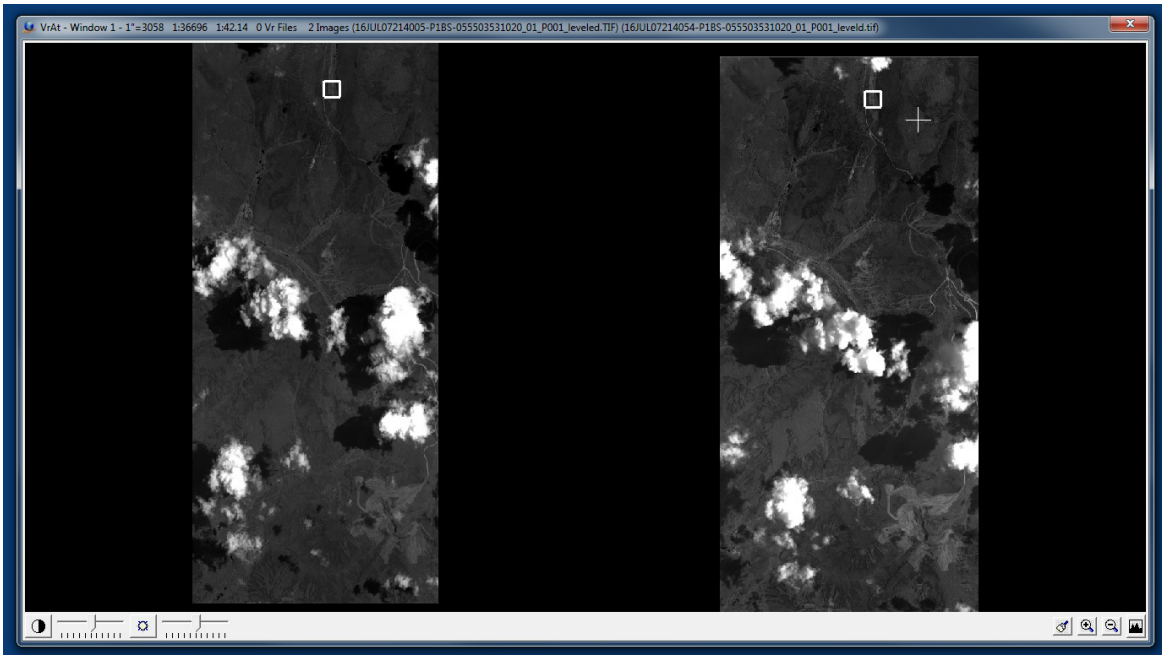
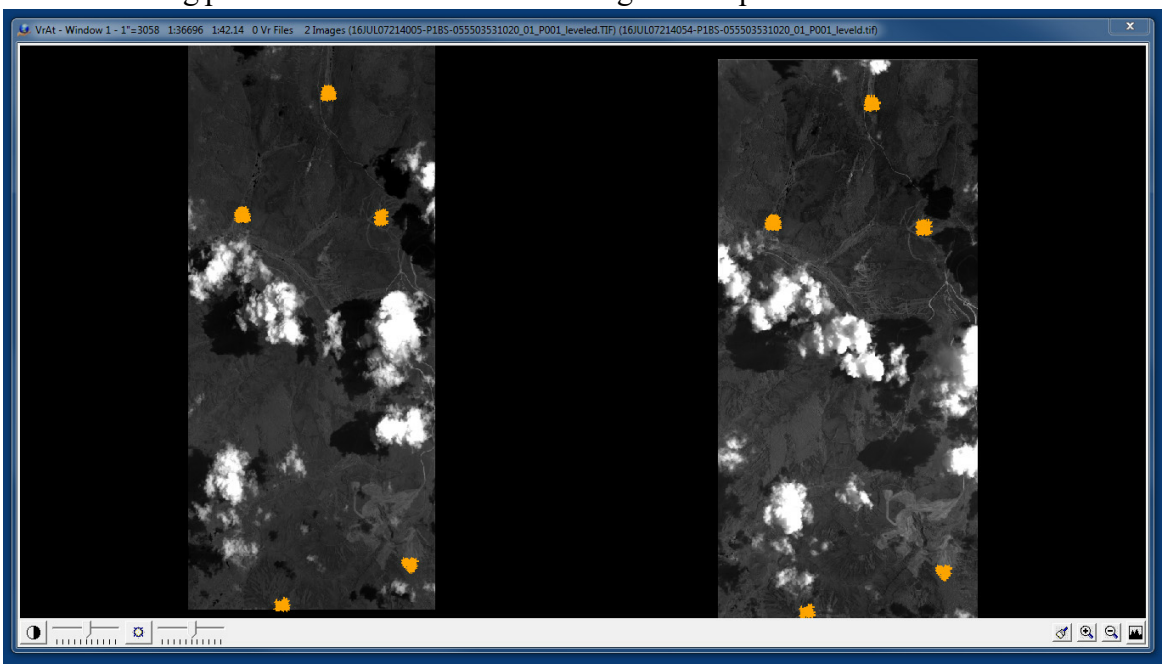


Continue adding patches to define how the two images overlap as follows:



When the patches are finished the '4 Densify Image Ties' from the same 'Add Points' menu is used to fill in the rest. Left click on the button (or hit F4). Then left click on the two images, and finally right click to start the matcher. A parameter prompt will appear. For RPC images lots of data is recommended to prevent the solution from wandering away in areas with sparse data. In the example below 10,000 tie points are requested for this image pair. Note that '4 Densify Image Ties' can be run multiple times and additional patches or manual points can be added to fill in difficult areas.

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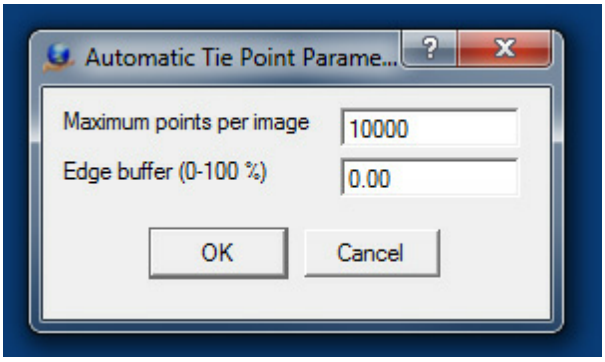
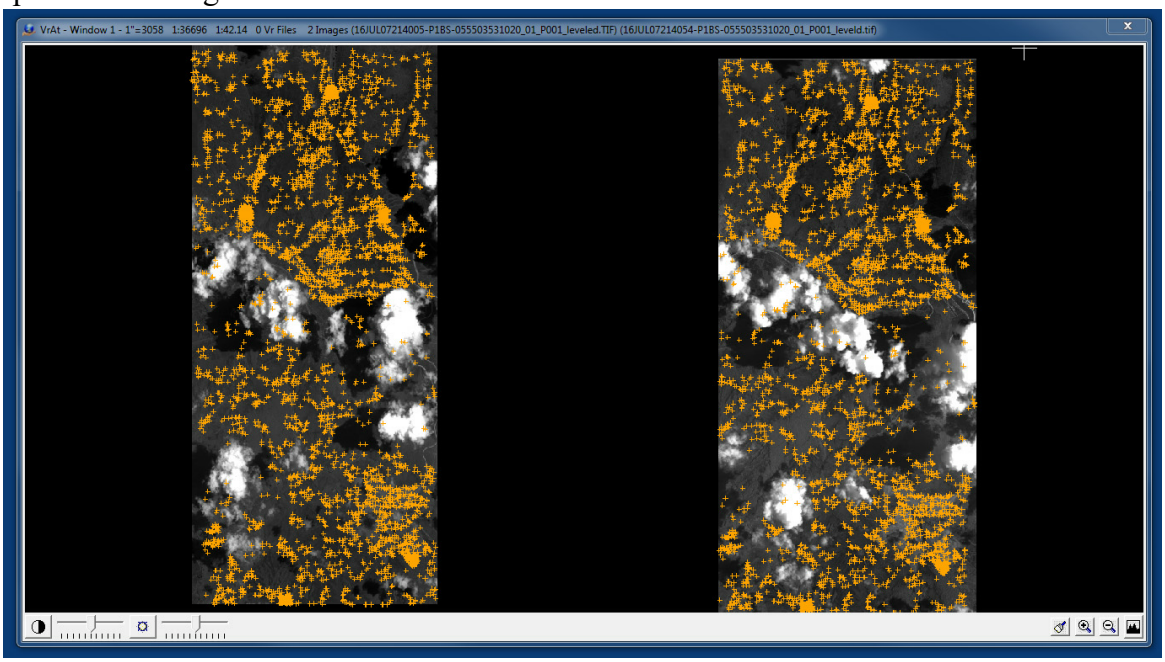
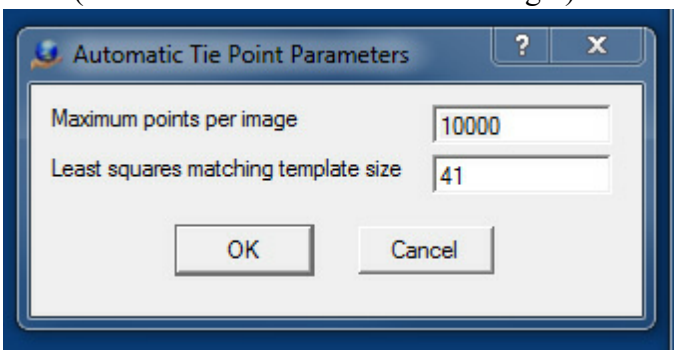


In this example '4 Densify Image Ties' was run twice because one corner of the images was sparse after a single run.



When satisfied with the point density use the Backup Atm command ('BacAtm') to save all the points. In case of any error these points can be restored using the ResAtm command. Then run a least squares match to refine and thin the data. Simply click through the bundle parameters menu (the bundle won't be run for RPC images). There are then two LS matching parameters



Again, for RPC images it is best to use a lot of points (10000 in this example). The template size can be varied. Large patches (60-200 pixels) will generate more matches and may be necessary

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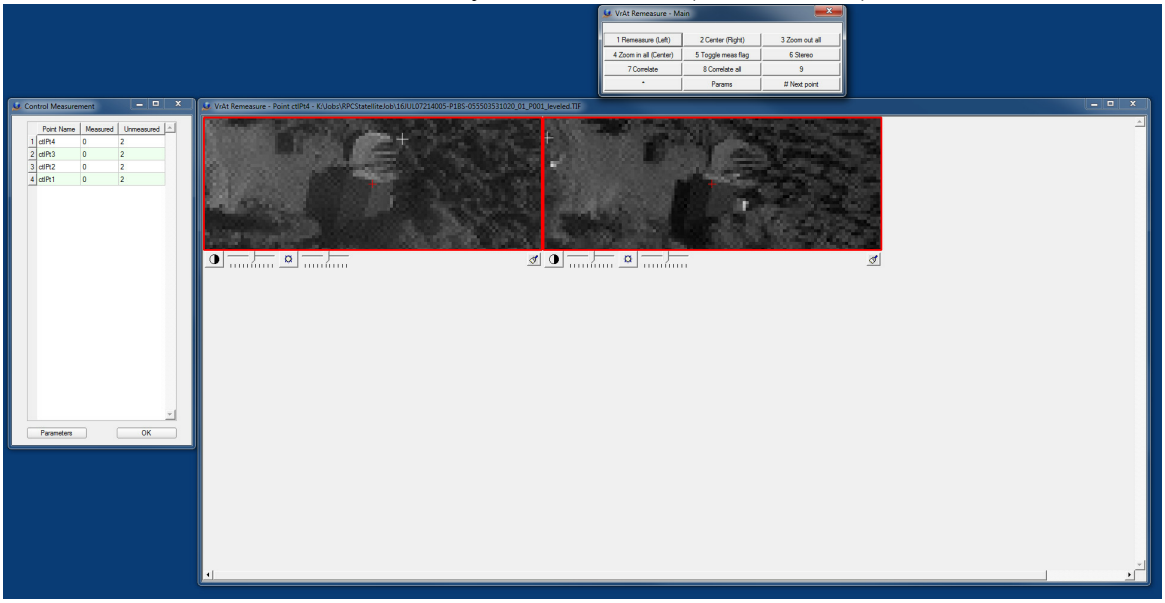
in the trees. However, the matches will not be as precise. Small patches (10-40) will not be as numerous, but the precision will be better. For this example a patch size on the larger end of small (41) was used.

Measuring Control

RPC images always start with exterior orientations so it is possible to drive to the control and measure it immediately after setting up the project. To open the drive control environment click on the button '6 Drive control' on the layout Points menu (Main->Points).



The two windows on the right of the drive control environment are identical to the point remeasure environment save for the '# Next Point' button. This button, as the name implies, loops to the next control point rather than exiting (as it would in remeasure). Otherwise everything is the same. Points can be measured in mono, stereo, or auto correlated. The red image boundaries indicate that the image points are only approximate. They will turn green as they are measured.

The table on the left provides overview and navigation. It lists all the control points, how many measurements there are of that point, and how many more measurements are possible. Clicking on column headers will resort the point order. Clicking on a point name will open that point for measurement. Clicking on the 'OK' button will exit the drive control environment.

Bundle Adjustment

To bundle in RPC mode use the command 'BunRpc'. The bundle interface has only two parameters:

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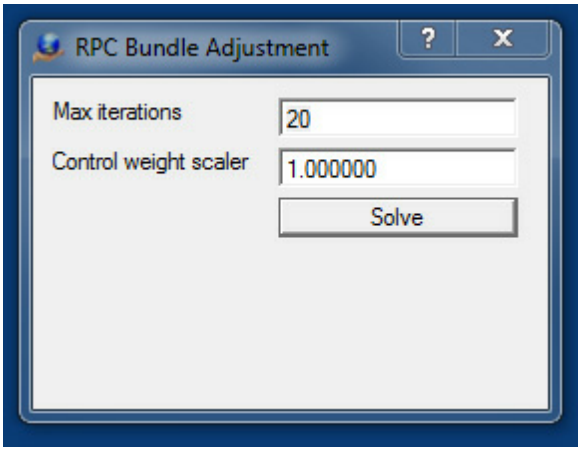

The 'Max iteration' can usually be left at default (20). The 'Control weight scalar' requires a little more explanation. A good way to think about is to remember that the error in the system does not go away when you bundle. It gets minimized, and the weights control how it minimized. In effect they allow the user to control how much error will show in the control matches as opposed to the tie points. The higher the 'Control weight scalar' the less error will be shown in the control point matches. However, error doesn't just go away. In this case it gets moved into the tie point matches, and high tie point errors can result in deformed models and Y-parallax in stereo viewing. So there is judgment required.

Here is an example of the output when running the bundle.

iter:0 maxCor:4.356907 RMSECtl:0.000000 RMSEtie:1.509726 VtPV:2.01e-005
Tie Res Percentile 0.1: 0.006578
Tie Res Percentile 0.2: 0.013701
Tie Res Percentile 0.3: 0.022311
Tie Res Percentile 0.4: 0.034669
Tie Res Percentile 0.5: 0.061657
Tie Res Percentile 0.6: 0.120365
Tie Res Percentile 0.7: 0.216336
Tie Res Percentile 0.8: 0.356033
Tie Res Percentile 0.9: 0.635720
Tie Res Percentile 1.0: 38.574399
iter:1 maxCor:0.743001 RMSECtl:0.000000 RMSEtie:1.514684 VtPV:1.56e-005
Tie Res Percentile 0.1: 0.004659
Tie Res Percentile 0.2: 0.009515
Tie Res Percentile 0.3: 0.015311
Tie Res Percentile 0.4: 0.023902
Tie Res Percentile 0.5: 0.038142
Tie Res Percentile 0.6: 0.071294
Tie Res Percentile 0.7: 0.138078
Tie Res Percentile 0.8: 0.223803
Tie Res Percentile 0.9: 0.426429
Tie Res Percentile 1.0: 39.331256
iter:2 maxCor:0.089789 RMSECtl:0.000000 RMSEtie:1.518507 VtPV:1.08e-005

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Tie Res Percentile 0.1: 0.005192
Tie Res Percentile 0.2: 0.009886
Tie Res Percentile 0.3: 0.015313
Tie Res Percentile 0.4: 0.023956
Tie Res Percentile 0.5: 0.045626
Tie Res Percentile 0.6: 0.073249
Tie Res Percentile 0.7: 0.140855
Tie Res Percentile 0.8: 0.221256
Tie Res Percentile 0.9: 0.408954
Tie Res Percentile 1.0: 39.641716
iter:3 maxCor:0.011670 RMSECtl:0.000000 RMSEtie:1.520125 VtPV:1.02e-005
Tie Res Percentile 0.1: 0.004873
Tie Res Percentile 0.2: 0.009263
Tie Res Percentile 0.3: 0.014500
Tie Res Percentile 0.4: 0.023320
Tie Res Percentile 0.5: 0.033347
Tie Res Percentile 0.6: 0.067072
Tie Res Percentile 0.7: 0.129767
Tie Res Percentile 0.8: 0.209612
Tie Res Percentile 0.9: 0.398724
Tie Res Percentile 1.0: 39.849355
iter:4 maxCor:0.009927 RMSECtl:0.000000 RMSEtie:1.520495 VtPV:9.88e-006
Tie Res Percentile 0.1: 0.004656
Tie Res Percentile 0.2: 0.008936
Tie Res Percentile 0.3: 0.014276
Tie Res Percentile 0.4: 0.023103
Tie Res Percentile 0.5: 0.031537
Tie Res Percentile 0.6: 0.067422
Tie Res Percentile 0.7: 0.126841
Tie Res Percentile 0.8: 0.206983
Tie Res Percentile 0.9: 0.395114
Tie Res Percentile 1.0: 40.022998
iter:5 maxCor:0.008640 RMSECtl:0.000000 RMSEtie:1.520760 VtPV:9.75e-006
Tie Res Percentile 0.1: 0.004602
Tie Res Percentile 0.2: 0.008781
Tie Res Percentile 0.3: 0.014079
Tie Res Percentile 0.4: 0.022868
Tie Res Percentile 0.5: 0.030859
Tie Res Percentile 0.6: 0.065259
Tie Res Percentile 0.7: 0.123472
Tie Res Percentile 0.8: 0.206683
Tie Res Percentile 0.9: 0.394793
Tie Res Percentile 1.0: 40.192478
iter:6 maxCor:0.007140 RMSECtl:0.000000 RMSEtie:1.520989 VtPV:9.67e-006

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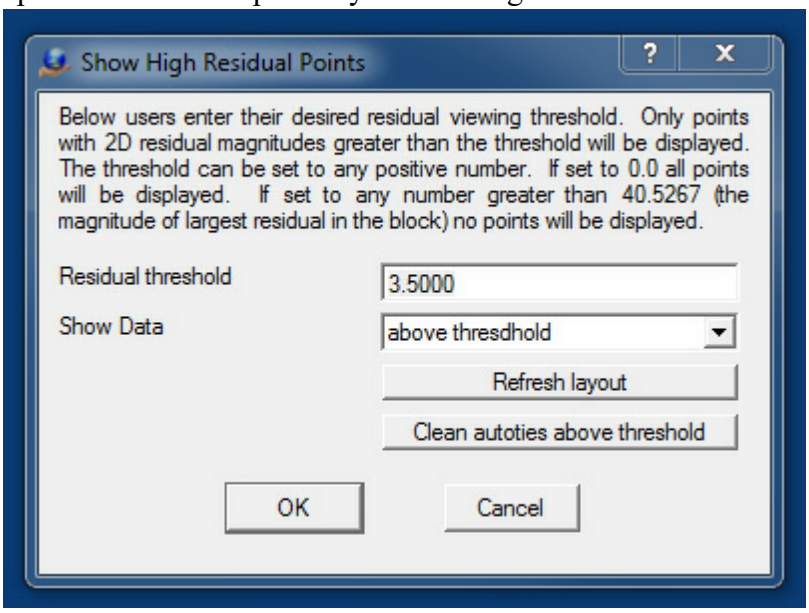
Tie Res Percentile 0.1: 0.004453
Tie Res Percentile 0.2: 0.008742
Tie Res Percentile 0.3: 0.013954
Tie Res Percentile 0.4: 0.022851
Tie Res Percentile 0.5: 0.030597
Tie Res Percentile 0.6: 0.064318
Tie Res Percentile 0.7: 0.122338
Tie Res Percentile 0.8: 0.204505
Tie Res Percentile 0.9: 0.392674
Tie Res Percentile 1.0: 40.360051

'Tie Res' refers to the 2D error in the image point ties in pixels. Note first that the residuals are small. The 90th percentile (Tie Res Percentile 0.9) is less than half a pixel. Also, note that the median (Tie Res Percentile 0.5) starts at 0.06 and is reduced to 0.03. There are some large residuals (the max is 40.36 in this example). To eliminate the large residuals X out of the BunRPC gui. And go to layout Main->Points. On this menu the button '8 Show blunder points' opens a tool to view points by residual magnitude.



The 'Residual threshold' is the cut off for displaying points. 'Show data' allows the user to choose between showing data above the threshold (high residual data) or below the threshold (low residual data). The 'Refresh layout' button updates the layout view based on the threshold and above/below settings. 'Clean auto ties above threshold' deletes all auto ties with residuals above the threshold. Thus, viewing data above a threshold shows what data is to be deleted when cleaning. Showing data below the threshold shows the data that will remain after cleaning.

The following work flow is recommended.
1. Select a threshold that is high enough for the error to be obvious to the human eye (e.g. 5).
2. Refresh the layout to show points with residuals above the threshold.
3. Use the button '9 Remeasure point' to visually inspect some the points displayed. To do this click on the button and then double click a point. The remeasure window will open and display

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thumbnails of the point in all images. There is no need to actually fix the measurements. The whole intent is to determine if the points that the software is reporting as being in error actually are in error. To determine this, it is only necessary to sample a few points. If the points do not appear to be in error then there is likely insufficient data in the bundle or some other input issue. Assuming that the residuals reasonably reflect the apparent error continue to step 4.
4. Reset the 'Residual threshold' as desired. Use the display to check the point distribution, etc. When satisfied 'Clean autoties above threshold'. And 'OK' to exit. The general recommendation is to use a threshold somewhere at or above the 90th percentile. This gives a range of 0.4-40 pixels in this example.
5. Rerun the bundle (BunRPC) to see how the statistics have changed.
6. If desired repeat steps 1-5

After the bundle runs satisfactorily save the results ('Save' button). New RPCs will be saved to the image vim files (original files are not overwritten). The VrAt Project file (.atp) can now be opened in Vr Model Set and images setup for on-the-fly stereo viewing. Note, as the vim files are directly updated by BunRPC there is no need to import EOs in Vr Model Set.

3.8 Tutorial Single Model Orientation

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrTwo Orientation - Single Model

Overview
Section 1 Project Setup
Section 2 Interior Orientation
Section 3 Relative Orientation
Section 4 Absolute Orientation
Section 5 Opening Model in VrTwo

Overview

VrTwo Orientation creates stereo image pairs (or models) for viewing in VrTwo and VrLite.

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Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model or multiple models in a batch mode. Models may be imported from aerial triangulation using exterior orientations or the measurements used to tie images and strips together.

Cardinal Systems provides a sample data set for use with this tutorial on single model orientation. Please see Sample Data Set to download the sample data. Contact Cardinal Systems for the username and password for the download.

Requirements to Complete a Single Model Orientation

1. **Camera File** - The camera file may either be imported or generated from a camera calibration report.
2. **Ground Control File** - The ground control file contains points obtained from sources like ground surveys.
3. **Images** - Images are raw, unedited, unmodified image files.
4. **Correct Image Overlap** - The image overlap must be on inside of images or in ortho mode. Images may need to be rotated to fulfill this criterion. Image rotation should be done before Interior Orientations are performed. If image rotation is required, this task can be performed in batch using the Vr Image Utility program.



An example of photo overlap to the inside (ortho)

Section 1 Project Setup

Creating or Editing the Camera File

New Camera (NewCam)

Allows the user to create and edit a new camera calibration file. Prompts user for the new camera's file name. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file. If a preexisting camera file exists, this

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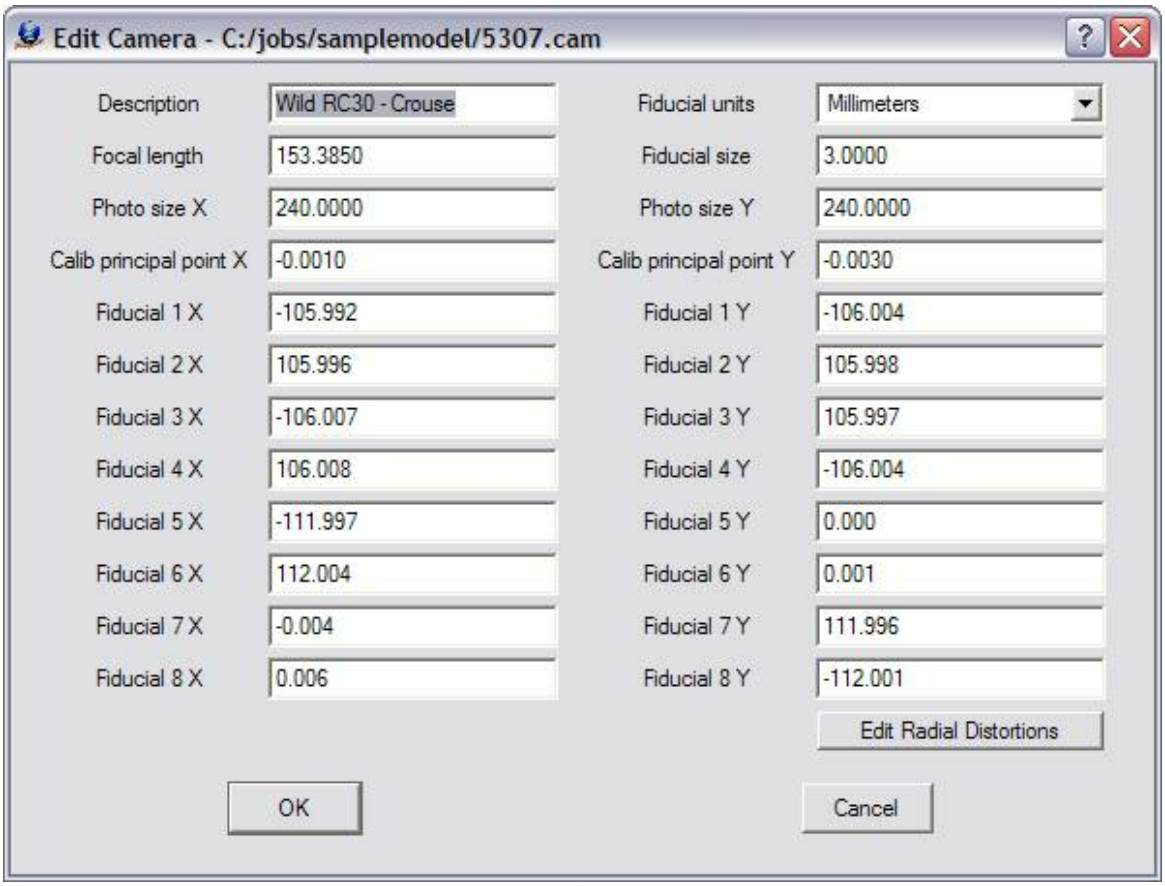
feature may not be needed.

Creating the Camera File

From the "Camera" dropdown menu, click on either "New Camera" or "Edit Camera".



The Edit Camera dialog box

Creating or Editing a Control File

If one does not already exist, create a new coordinate file. From the "Coordinates" dropdown menu, click on "New Coordinate File". Please see VrTwo Orientation New Coordinate File for more information.

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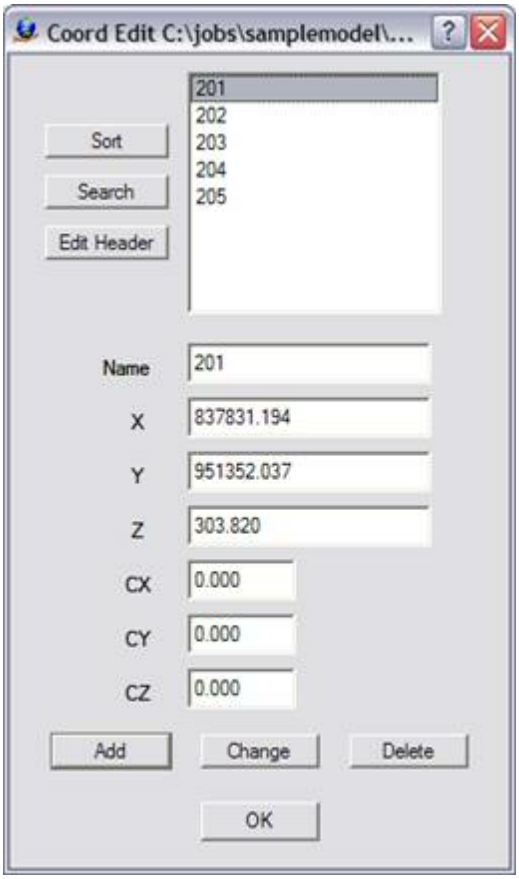

The Edit Control dialog box

If a control file exists and contains the PointName X Y Z fields, it can be used directly by Vr Mapping programs. Simply rename the file by replacing the file postfix with .cor. For example, if there were a coordinate file named TheCoords.txt which contained the PointName XYZ fields, it could be renamed TheCoords.cor and be used by VrTwo Orientation.

The following is an example of a contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The first field is the point name. The following fields are the X, Y and Z coordinates.

Creating or Editing the Project

The following steps create the project:

1. **Create a New Project File** - From the "Project" dropdown window, click on either "New

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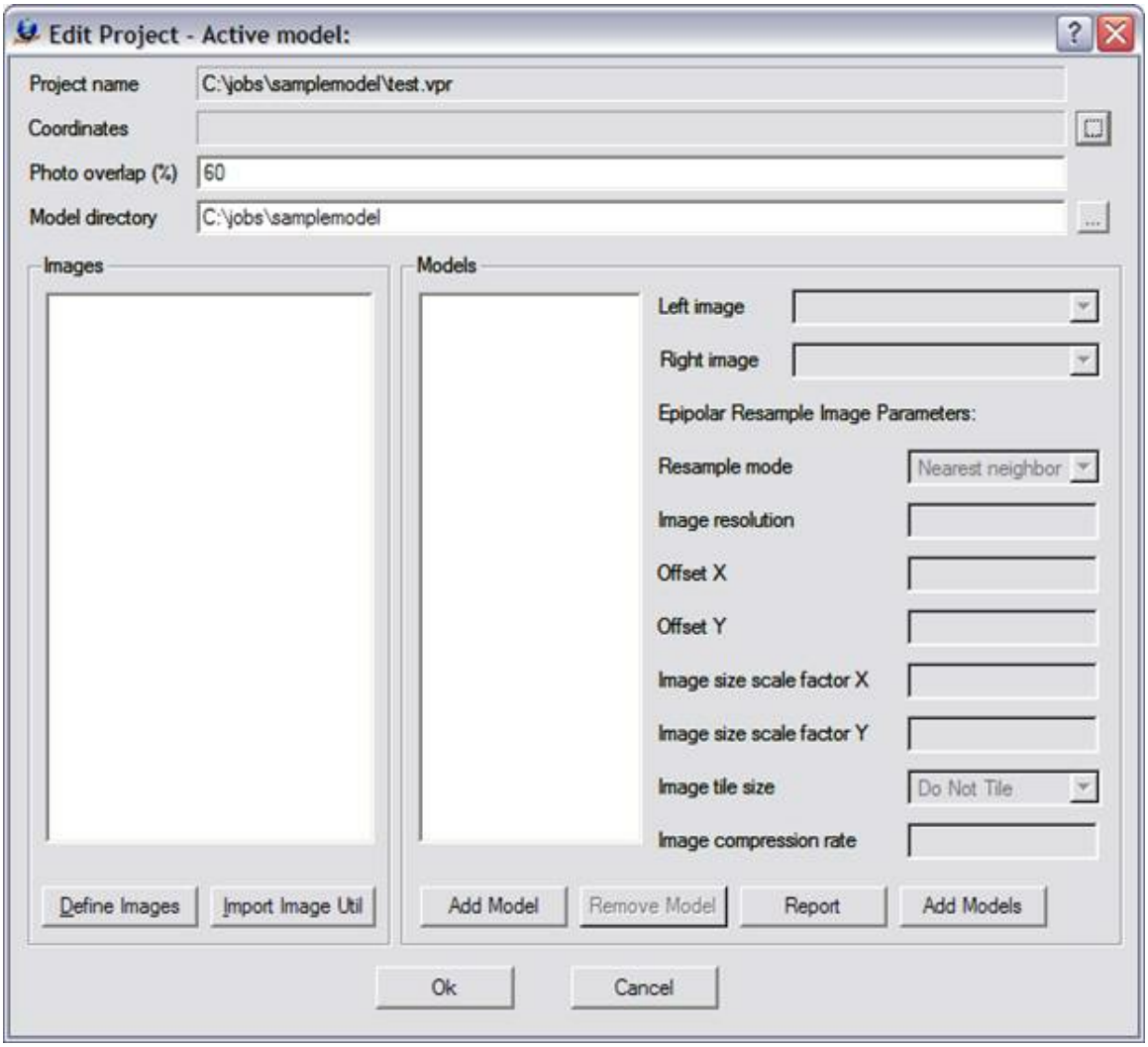
Project" or "Edit Project".

2. **Add Coordinate File** - Click the button to the right of the "Coordinates" box to add the coordinate file name.



The Edit Project dialog box prior with no parameters defined

3. **Define Images** - Click the "Define Images" button in the "Edit Project" dialog box. The "Edit Project - Define Images" dialog box allows the definition of multiple image files. Each image file has a Photo Name Format, which are parameters that define the strip and photo number from an image file name. Strip direction, pixel size and the "Open in Layout" flag may also be defined for each image. The top portion of the dialog box is a template of these parameters. This template may be copied to an image or a group of images by selecting the desired file(s) then pressing the "Apply" button.

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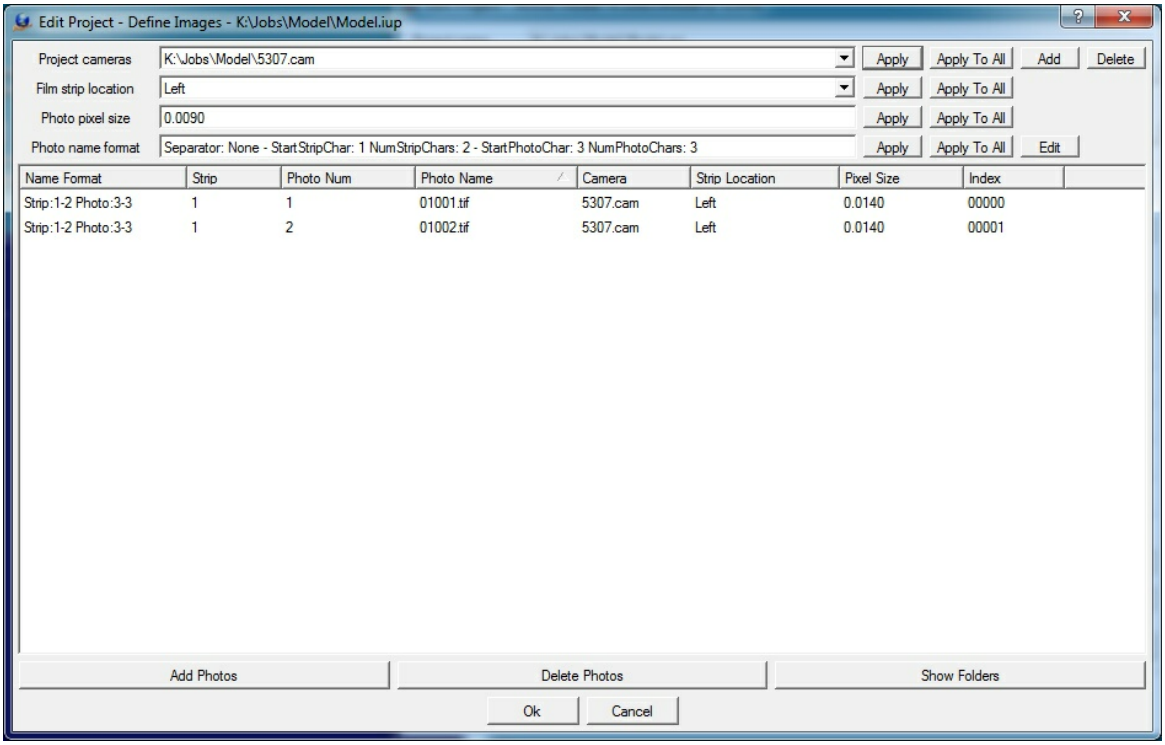

The Edit Project - Define Images dialog box

The following are descriptions of the parameters in the "Edit Project - Define Images" dialog box:

Project Camera
Project cameras (.cam) are assigned to individual images. Up to 10 camera files may be defined.

Film Strip Location

Defines the direction flight. For more information please see VrTwo Orientation - Film Strip Direction.

Photo Pixel Size
The photo pixel size is in the same fiducial units (millimeters, inches, or pixels) defined by the Camera file. If this value is unknown, it can be computed after reading three points in Inner Orientation at the bottom left of the Interior Orientation window.

Add Photos
Adds images to the project.

Photo Name Format
Sets the parameters that define the strip and photo number from an image file name. For more Information please see VrTwo Orientation - Photo Name Format.

4. **Create Model Names**
Click "Add Model" to create a new model. Pressing this button allows a single model to be added to the list of models. After the model is added, the left and right images must be selected and the epipolar re-sampling image parameters must be set.

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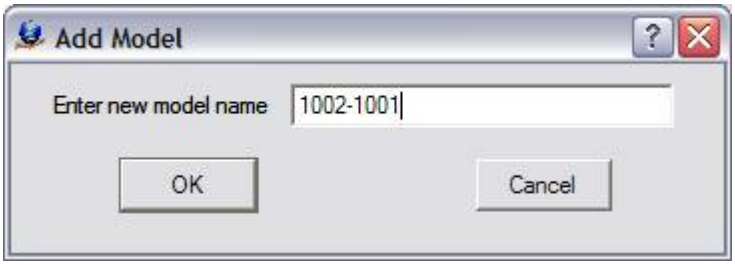
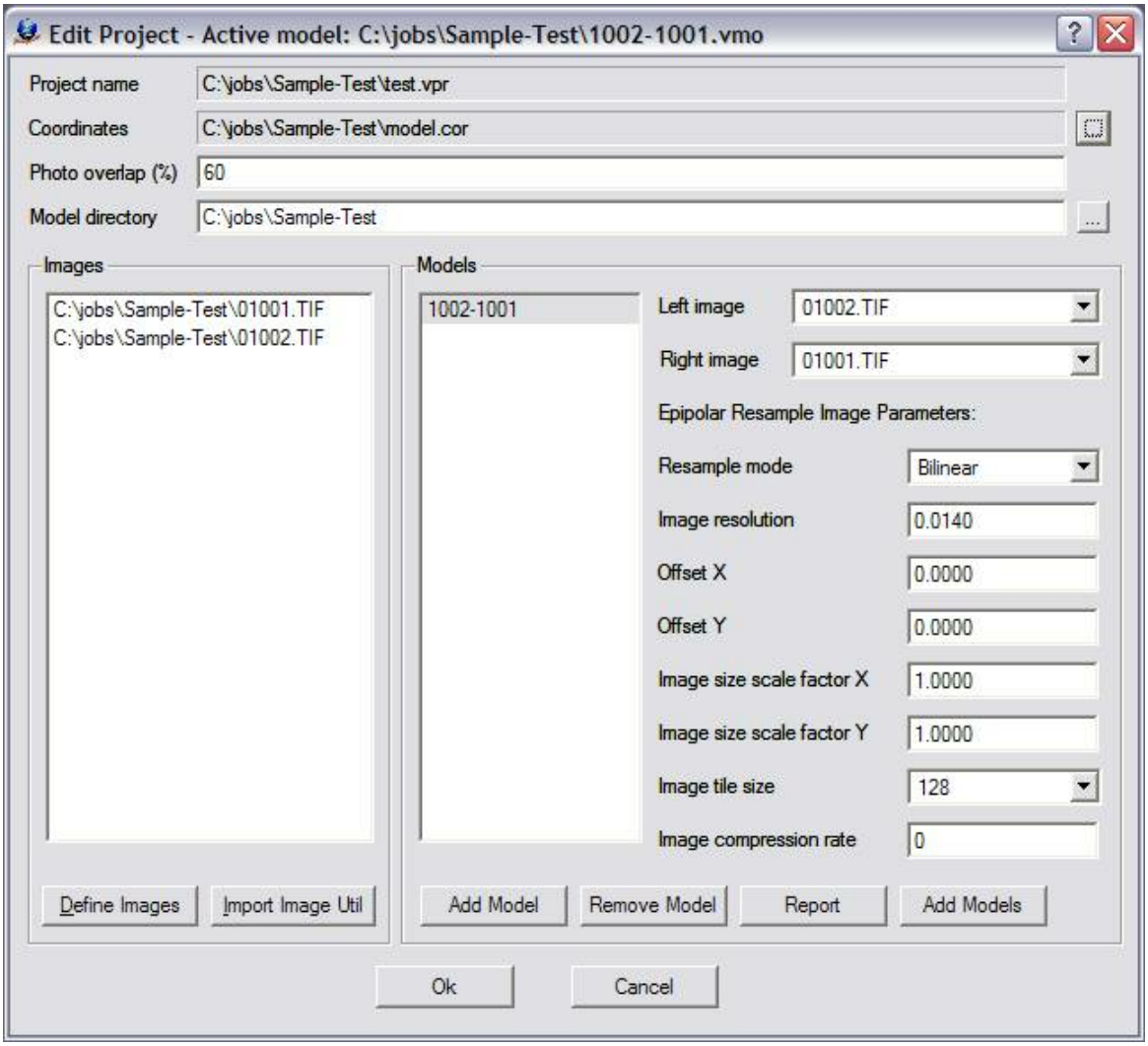


The Add Model dialog box



The Edit Project dialog box showing Model 1002-1001

Please see VrTwo Orientation - Project for more information.

Section 2 Interior Orientation

Interior Orientation determines the interior perspective of an image by assigning a coordinate system and applying the camera calibration. This is normally done with a least-squares adjustment between known and measured fiducial point coordinates. When using film, the

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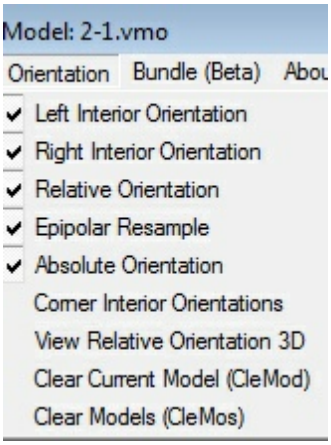
interior orientation compensates for film shrinkage or expansion. Camera calibration information is required by Interior Orientation. There are four methods of performing interior orientations in the VrTwo Orientation program.

- **Automatic** - Auto-correlated automatic interior orientation processing is available in the Vr Image Utility - Automatic Interior Orientation (imageutill.exe) program for metric cameras with fiducial marks.
- **Importing Orientations** - Interior orientations can be imported from several Aerial Triangulation packages.
- **Corner Interior Orientations** - This method uses the the four corners of the images to create an Interior Orientation. This method is for non-metric cameras without fiducial marks.
- **Manual** - Fiducials may be measured manually. This is the method that will be used in this tutorial..

To begin the Left Interior Orientation process, select "Left Interior Orientation" from the "Orientation" dropdown menu. Note that checkmarks appear next to each orientation step after it is performed. When the orientation process is fully completed, each step will have a checkmark next to it.



The Orientation pull-down showing a completed orientation

Measuring Fiducials

5. Measure the fiducials that were entered into the VrTwo Orientation camera file.
On a standard camera (with eight fiducials), it is recommended that all eight be measured. Measuring fiducials requires some or all of the following steps:

- Center the floating mark over a fiducial then right mouse click to center the image.
- Press the page down button on the keyboard to zoom in.
- Left mouse click to measure a fiducial. If "Advance after measurement" is checked, VrTwo will zoom to the next fiducial. Once three fiducials are measured, VrTwo Orientation will drive to where it believes the next point is based on the settings in the camera file.

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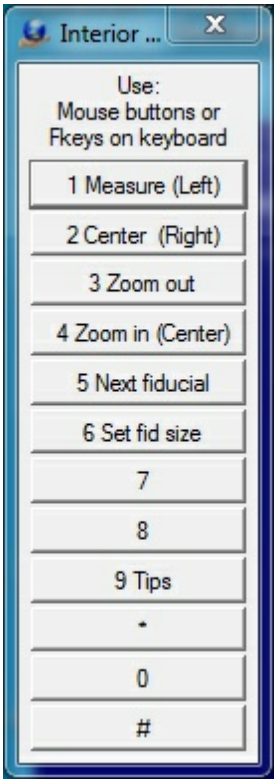
These functions can be seen in the "Interior Orientation Menu Keys" dialog box. Use mouse buttons instead of the box to more effectively measure and view fiducials.



Interior Orientation Menu Keys

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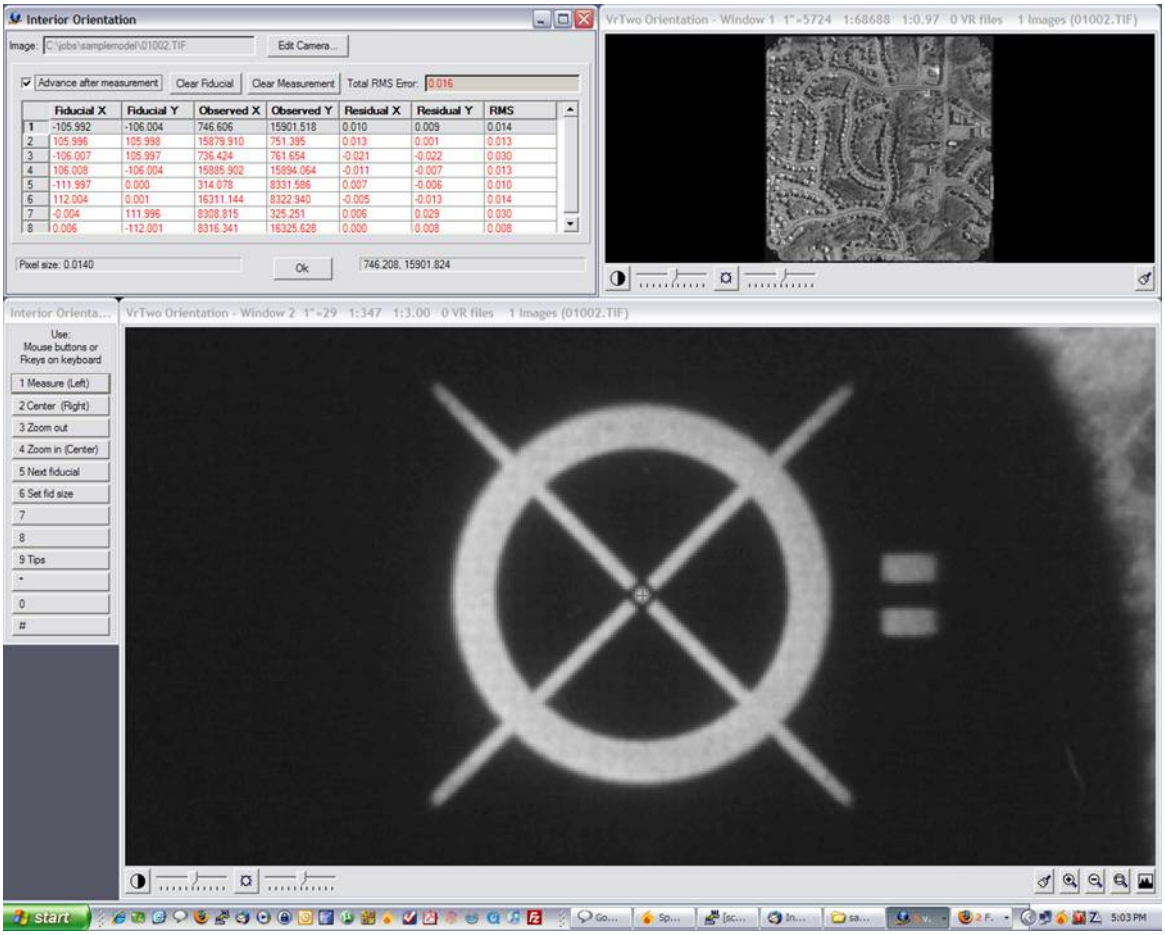

The manual Interior Orientation environment

6. Continue this process until all fiducials have been measured. The "Interior Orientation" dialog box will display the residual for each point and the total RMS error.



The Interior Orientation dialog box showing point residuals and the total RMS error

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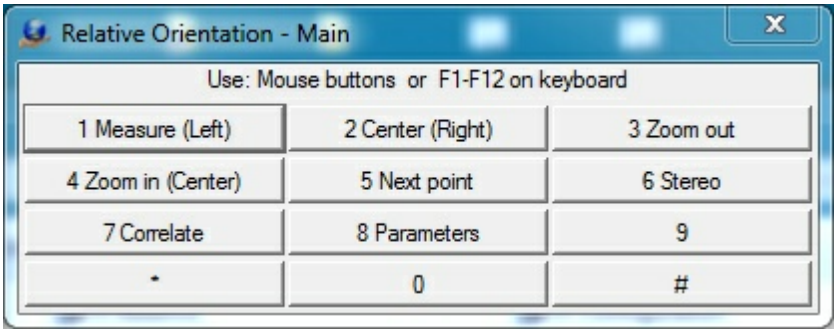
7. To begin the right interior orientation process, select "Right Interior Orientation" from the "Orientation" dropdown menu. Repeat steps 5 and 6 (as shown above) for the right image.

For more information please see VrTwo Orientation - Interior Orientation.

Section 3 Relative Orientation

Relative Orientation aligns the two images of a stereo pair so they can be viewed in 3D. This is done by observing common points on each image and, in effect, tying the images together. Another least-squares adjustment is performed on these observed points. Relative orientation requires an Interior Orientation. Three methods exist to measure points. All three methods are available for each point. Because ground features change from point to point (one point may be on a city street and the next in trees), one method of measurement will not suit all situations. The measurement methods are:

- **Mono-comparator** - A common point is selected in the left image. The same point is selected on the right image. "Measure" (left mouse or button 1) is used to measure the point on the left and right images.
- **Semi-automatic correlation assist** - The cursor is positioned on one photo and its corresponding location is found on the other photo by pressing the "Correlate" button (system keyboard F7 or button 7). When using correlation assist, the cursor is positioned (without any button presses) in one of the measurement windows. "Correlate" is then engaged to find the corresponding point in the other photo. The matching point is displayed in the other measurement window. The cursor may be placed in the left or right measurement window. After correlation, the results are displayed in the At Measure dialog box and in the Menu Keys dialog box. A result of 0.9 to 1.0 is good; 0.8 to 0.9 acceptable: 0.7 to 0.8 poor; less than 0.7 should lead to rejection of the correlation.
- **Stereo** - The two images are displayed in stereo and parallax is cleared at the point location. This operation is similar to the method used on analytical stereo-plotters. Options in this mode include image correlation, dove prism adjustment (rotation of one photo), and photo scale factor adjustment (changing the scale of one photo).



The Relative Orientation Menu Keys dialog box

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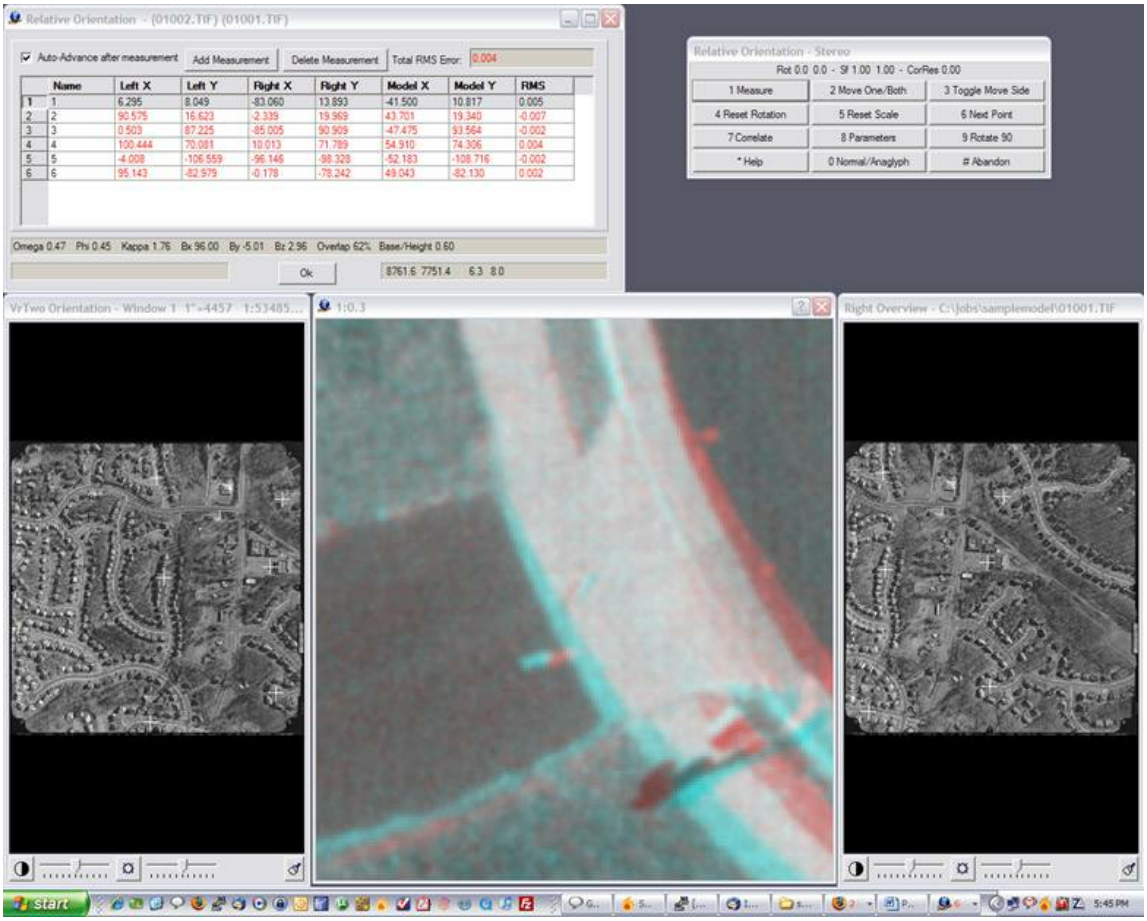

Measuring a point in Relative Orientation using the stereo method (Anaglyph)

Please see VrTwo Orientation - Relative Orientation for more information.

When all the points in Relative Orientation have been measured and are acceptable, the OK button may be pressed. Epipolar images may now be created from the results of Relative Orientation. Epipolar images are stereo viewable images with a common scale. They have their image rotations removed and make stereo viewing comfortable for the operator.

If epipolar images are not desired at this point, this step may be skipped and epipolar images may be created later from the Orientation menu.

Please see VrTwo Orientation - Epipolar Images for more information.

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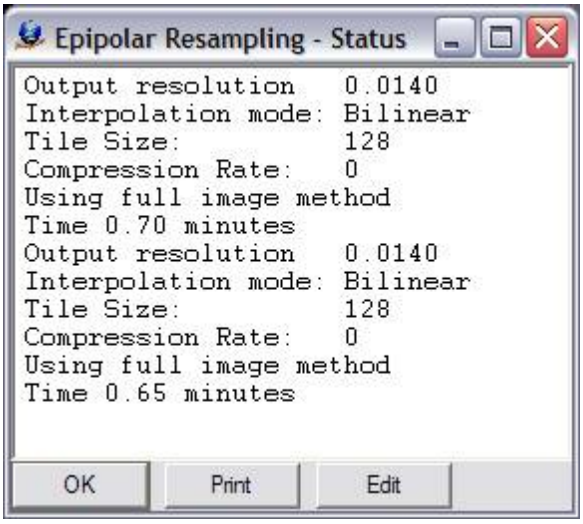

The information window displayed during epipolar image generation

Section 4 Absolute Orientation

Absolute Orientation defines the transformations between the model space achieved through relative orientation and a known ground or object space coordinate system. Again, a least-squares adjustment is performed to obtain these transformations. An exterior orientation is created for each image. A relative orientation solution and control point file in the project coordinate system is required to perform an Absolute Orientation.

There are two stereo viewing modes available in Absolute Orientation: static and roaming. In static mode, the images remain stationary and the cursor moves. In roaming mode, the images move and the cursor stays in the middle of the stereo window.

To set the stereo viewing mode to roaming, click File -> Preferences and set "Use roaming mode in Absolute?" to "Yes".

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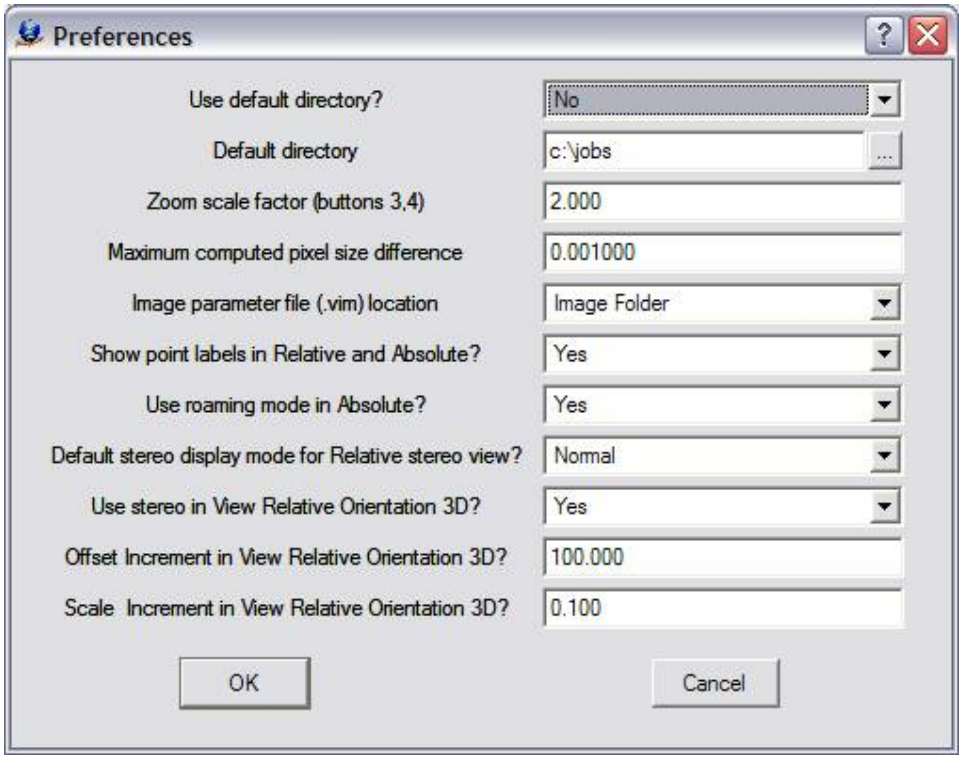

VrTwo Orientation preferences dialog box

Measuring Absolute Orientation Points

In the Absolute Orientation process, known ground control points are measured.

1. Click Orientation -> Absolute Orientation from the main window.

2. Locate the first on the image (please see control diagram below).

3. Use the wheel on the mouse to adjust the Z value of the floating mark to the ground or target. Note that holding the Shift key or Control key while moving the wheel will increase the speed of the Z movement.

4. Center the cursor over the point location and press the left mouse button. This will measure the point. If "Auto-Advance after measurement" is checked, VrTwo will drive to the next point in the control file.

5. Move to the next point and repeat the measurement process. Continue the measurement process until all of the control points that fall within the model have been measured.

6. Once enough control points have been measured, point and overall residuals will be displayed in the "Absolute Orientation" dialog box. Pressing "Ok" in this dialog box saves the orientation and exits Absolute Orientation.

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	Name	Ground X	Ground Y	Ground Z	Measured X	Measured Y	Measured Z	Res X	Res Y	Res Z
1	201	837831.194	951352.037	303.820	-51.604	62.742	-160.131	-0.012	0.019	0.054
2	202	836399.079	951266.643	337.680	-45.505	-63.486	-158.195	0.000	0.079	-0.046
3	203	837994.618	950634.952	299.600	11.704	76.434	-160.032	-0.084	-0.045	-0.064
4	204	836711.671	950565.199	326.320	16.573	-36.659	-158.638	0.184	-0.008	0.074
5	205	836018.411	950724.804	309.290	1.840	-97.515	-160.737	-0.088	-0.045	-0.017

Measured control points with residuals in the Absolute Orientation dialog box

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Control points diagram overview



Location of ground control point 201



Location of ground control point 202



Location of ground control point 203

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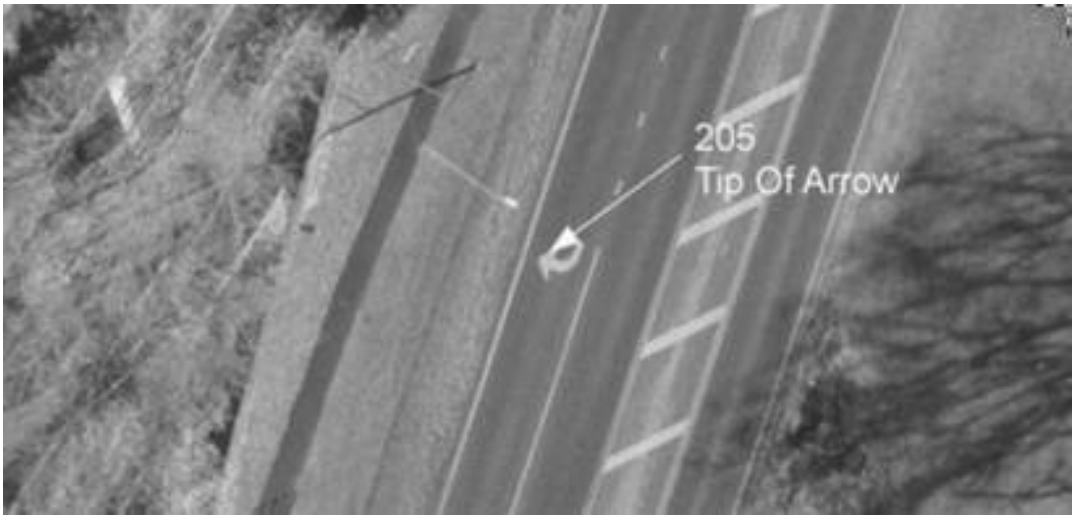
Location of ground control point 204



Location of ground control point 205

For more information please see VrTwo Orientation - Absolute Orientation.

Section 5 Opening the Model in VrTwo

1.Start VrTwo.

2.Click on File -> Open Model or use the Open Model (OpeMod) command. Navigate to the location of the project folder by double clicking the far left hand box.

3.Double click the VrTwo Model File (yourfilename.vmo) and press "OK".

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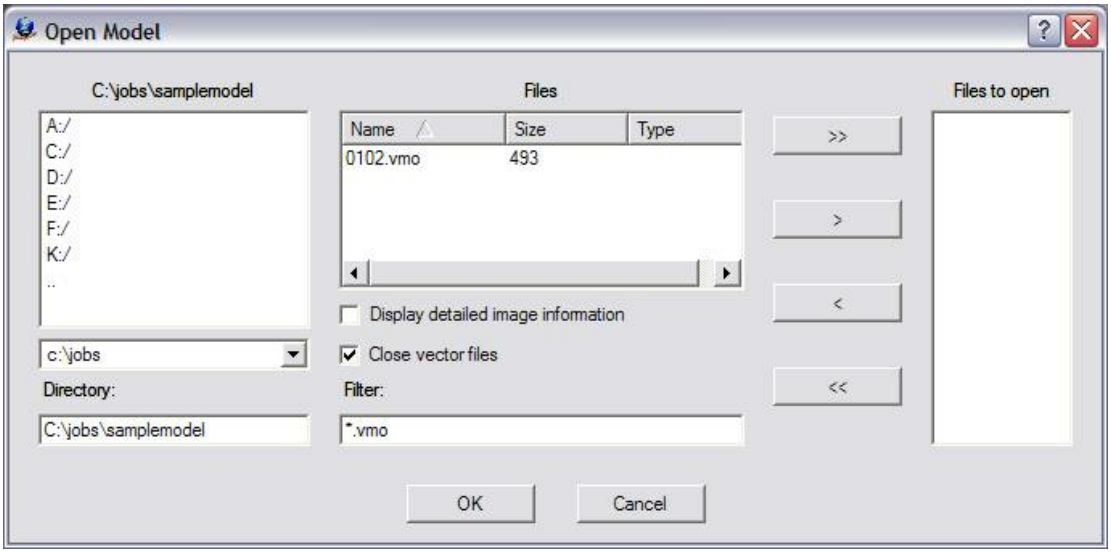

The VrTwo Open Model dialog box

4. VrTwo will generate pyramids for the epipolar images if they do not already exist.

5.Open a VrOne File by clicking on File -> Open Vr File or using the Open VrOne File (OpeVr) command. Navigate to the project folder by double clicking the far left hand box.

6. Double click on the model.vr file supplied with the sample data.

The stereo model should open and the stereo model and vectors should be seen on the screen. If the stereo window does not show a stereo image and vectors try using the Drive Control (Cd) command. Typing "Cd 1" will drive to the first control point in the model. For more information, please see the Getting started with VrOne/VrTwo tutorial, which covers the basics of data collection and editing.

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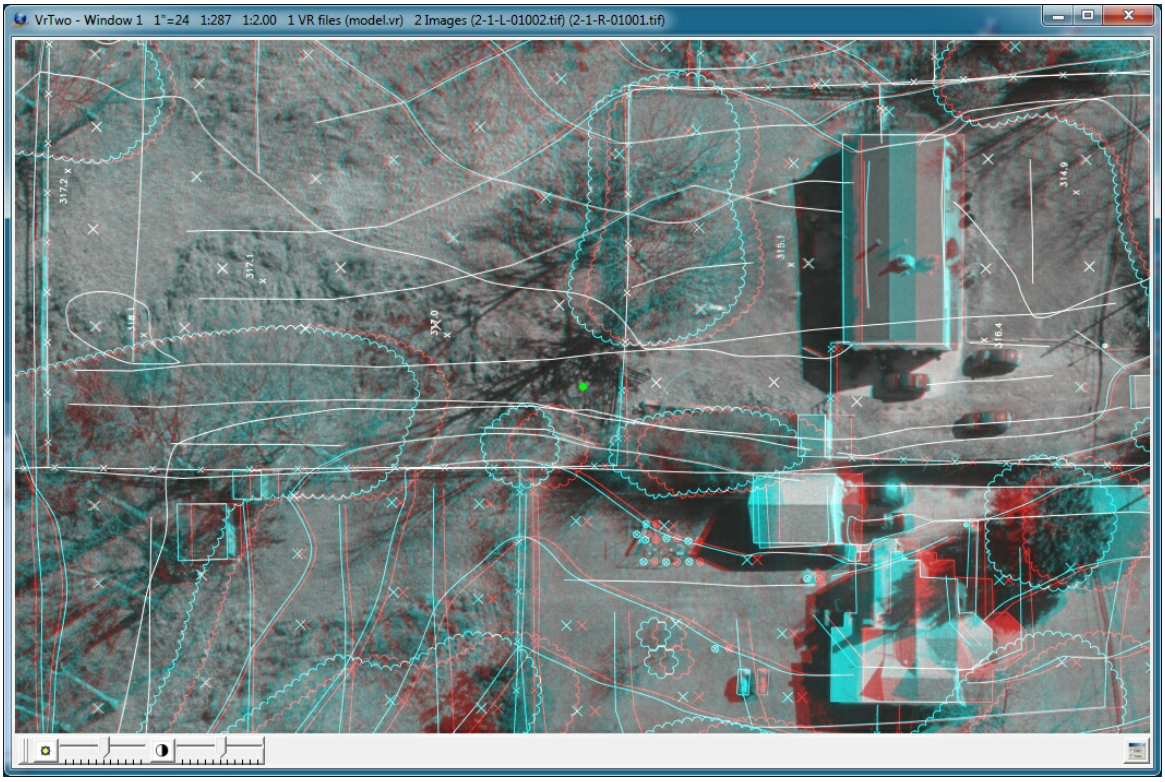

The VrTwo graphics window showing the stereo model (Anaglyph)

VrTwo Orientation Video

To view the video demonstrating the orientation process described above see VrTwo Orientation .

3.9 Tutorial ISAT Single Model Measurement

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

VrTwo Orientation - Single Model

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Import of ISAT Measurements

Overview
Section 1 Project Setup
Section 2 Importing Orientations
Section 3 Verifying Orientations
Section 4 Opening Model in VrTwo

Overview

VrTwo Orientation creates stereo image pairs (or models) for viewing in VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model or multiple models in a batch mode. Models may be imported from aerial triangulation using exterior orientations or the measurements used to tie images and strips together.

Requirements to Complete a Single Model Import of ISAT Measurements

1. **Camera File** - The camera file may either be imported or generated from a camera calibration report.
2. **Ground Control File** - The ground control file contains points obtained from sources like ground surveys.
3. **Images** - Images are raw, unedited, unmodified image files.
4. **Correct Image Overlap** - The image overlap must be on inside of images or in ortho mode. Images may need to be rotated to fulfill this criterion. Image rotation should be done before Interior Orientations are performed. If image rotation is required, this task can be performed in batch using the Vr Image Utility program.

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An example of photo overlap to the inside (ortho)

Section 1 Project Setup

Creating or Editing the Camera File

New Camera (NewCam)

Allows the user to create and edit a new camera calibration file. Prompts user for the new camera's file name. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file. If a preexisting camera file exists, this feature may not be needed.

Creating the Camera File

From the "Camera" dropdown menu, click on either "New Camera" or "Edit Camera".

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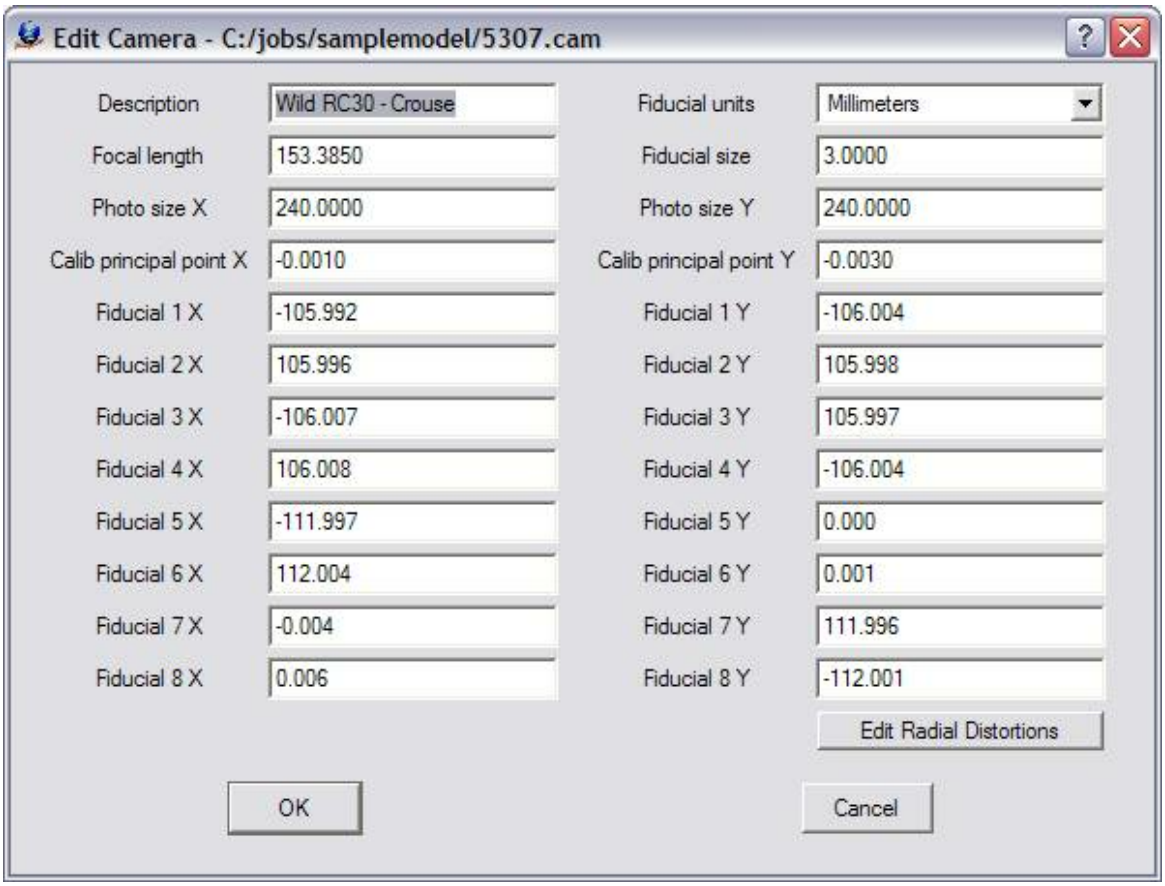

The Edit Camera dialog box

Creating or Editing a Control File

If one does not already exist, create a new coordinate file. From the "Coordinates" dropdown menu, click on "New Coordinate File". Please see VrTwo Orientation New Coordinate File for more information.

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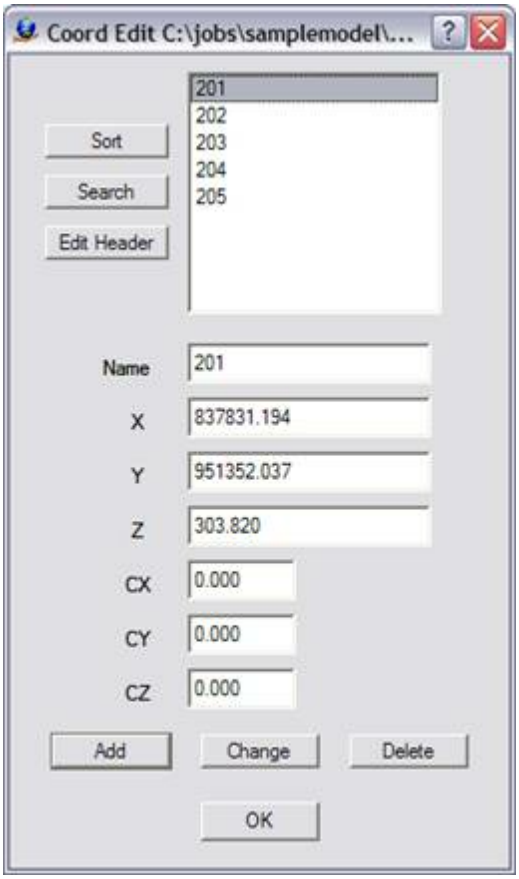

The Edit Control dialog box

If a control file exists and contains the PointName X Y Z fields, it can be used directly by Vr Mapping programs. Simply rename the file by replacing the file postfix with .cor. For example, if there were a coordinate file named TheCoords.txt which contained the PointName XYZ fields, it could be renamed TheCoords.cor and be used by VrTwo Orientation.

The following is an example of a contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The first field is the point name followed by the X, Y and Z coordinates.

Creating or Editing the Project

The following steps create the project:

1. **Create a New Project File** - From the "Project" dropdown window, click on either "New

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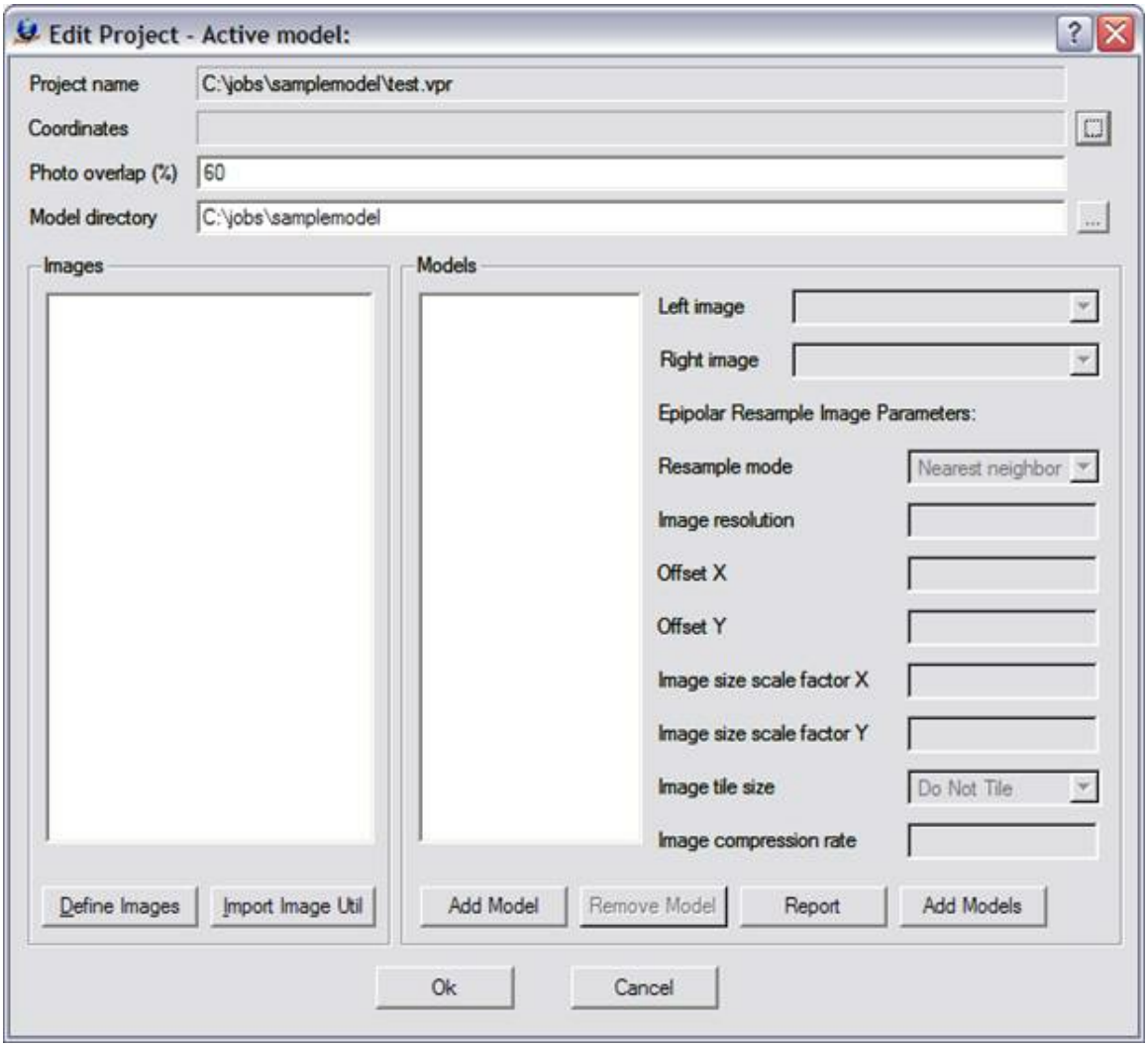
Project" or "Edit Project".

2. **Add Coordinate File** - Click the button to the right of the "Coordinates" box to add the coordinate file name.



The Edit Project dialog box prior with no parameters defined

3. **Define Images** - Click the "Define Images" button in the "Edit Project" dialog box. The "Edit Project - Define Images" dialog box allows the definition of multiple image files. Each image file has a Photo Name Format, which are parameters that define the strip and photo number from an image file name. Strip direction, pixel size and the "Open in Layout" flag may also be defined for each image. The top portion of the dialog box is a template of these parameters. This template may be copied to an image or a group of images by selecting the desired file(s) then pressing the "Apply" button.

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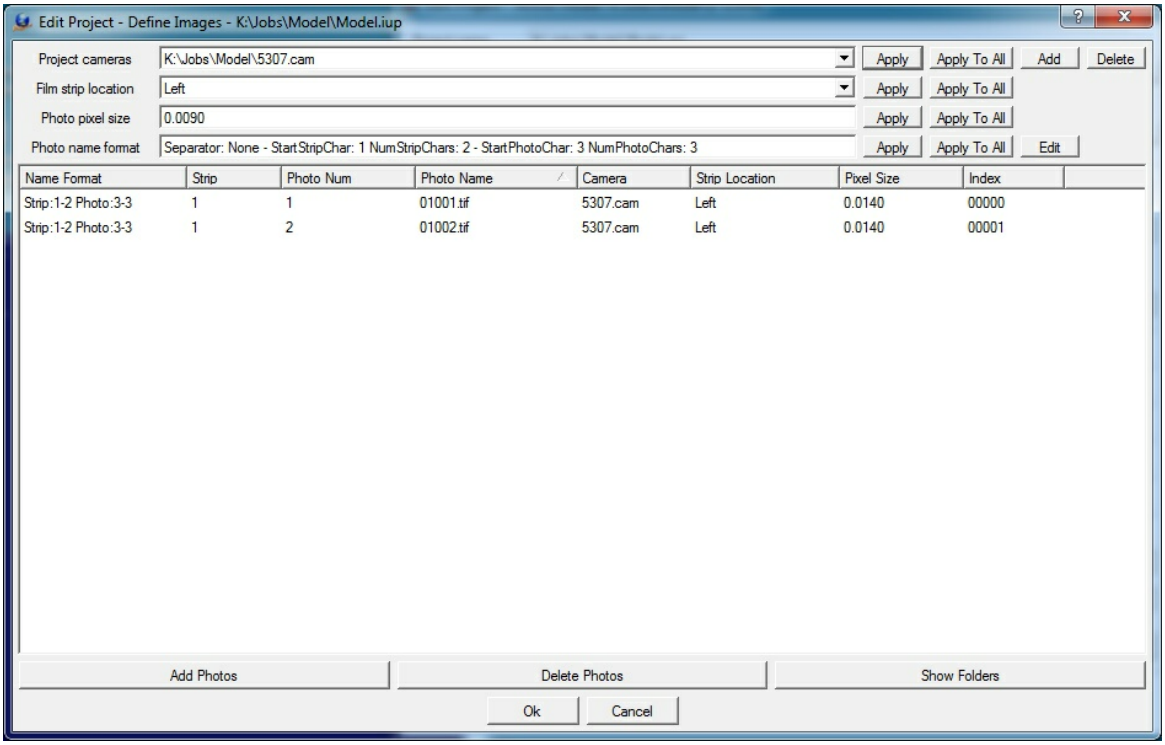

The Edit Project - Define Images dialog box

The following are descriptions of the parameters in the "Edit Project - Define Images" dialog box:

Project Camera
Project cameras (.cam) are assigned to individual images. Up to 10 camera files may be defined.

Film Strip Location

Defines the direction flight. For more information please see VrTwo Orientation - Film Strip Direction.

Photo Pixel Size
The photo pixel size is in the same fiducial units (millimeters, inches, or pixels) defined by the Camera file. If this value is unknown, it can be computed after reading three points in Inner Orientation at the bottom left of the Interior Orientation window.

Add Photos
Adds images to the project.

Photo Name Format
Sets the parameters that define the strip and photo number from an image file name. For more Information please see VrTwo Orientation - Photo Name Format.

4. **Create Model Names**
Click "Add Model" to create a new model. Pressing this button allows a single model to be added to the list of models. After the model is added, the left and right images must be selected and the epipolar re-sampling image parameters must be set.

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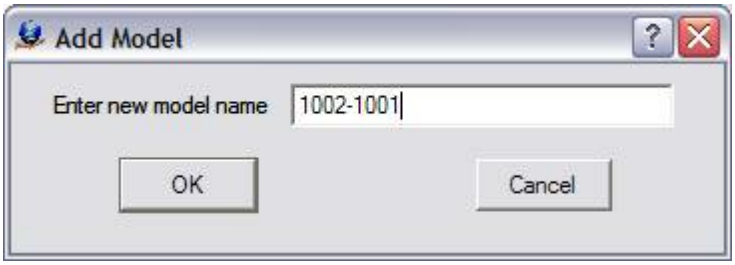
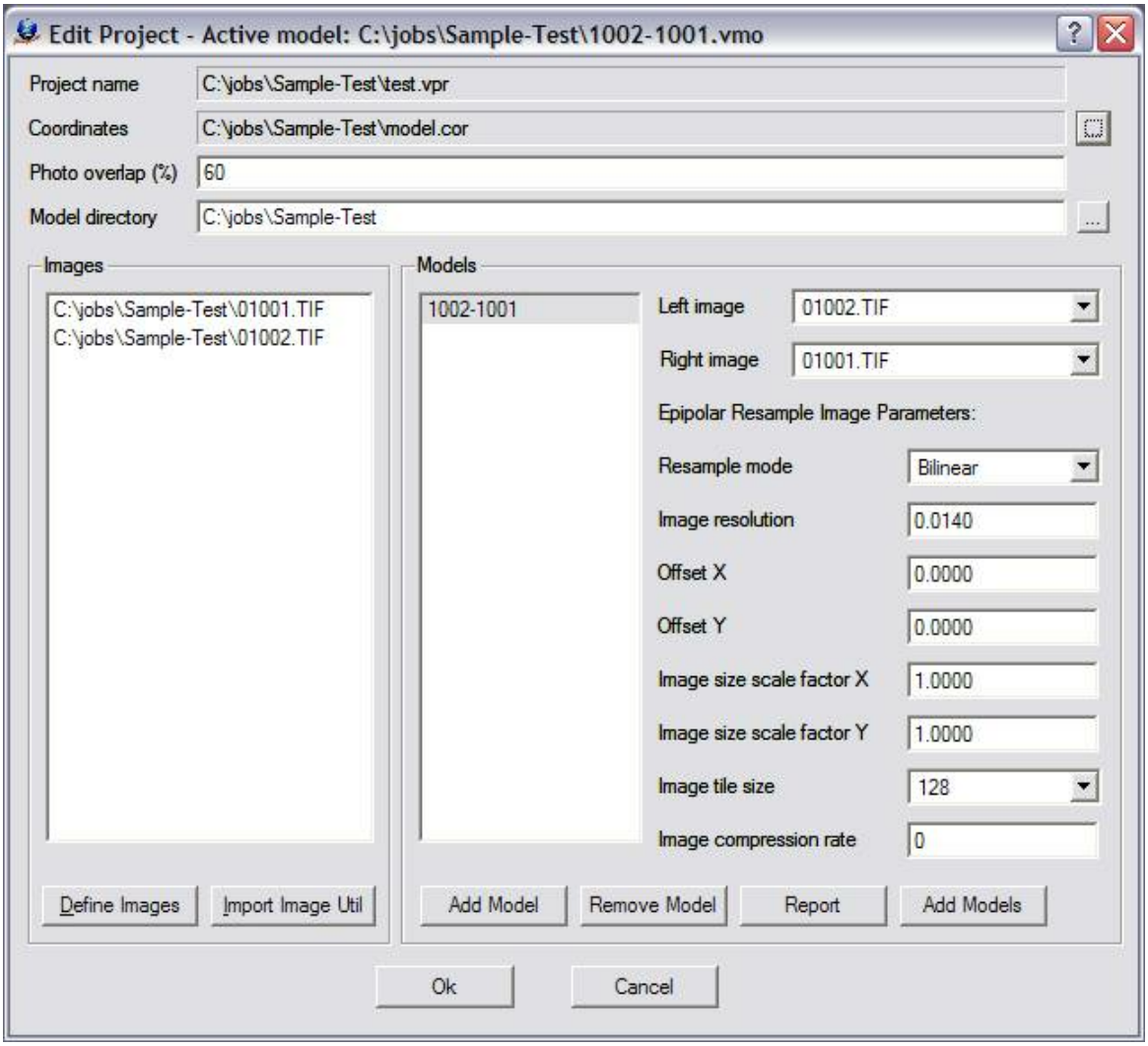


The Add Model dialog box



The Edit Project dialog box showing Model 1002-1001

Please see VrTwo Orientation - Project for more information.

Section 2 Importing Orientations

Part 1 Importing ISAT Interior and Measurement

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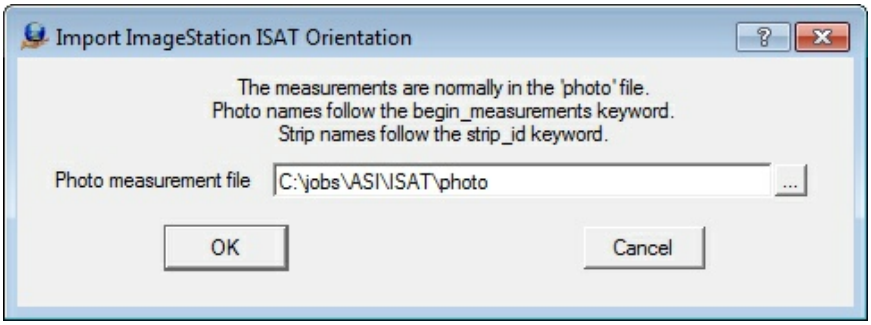
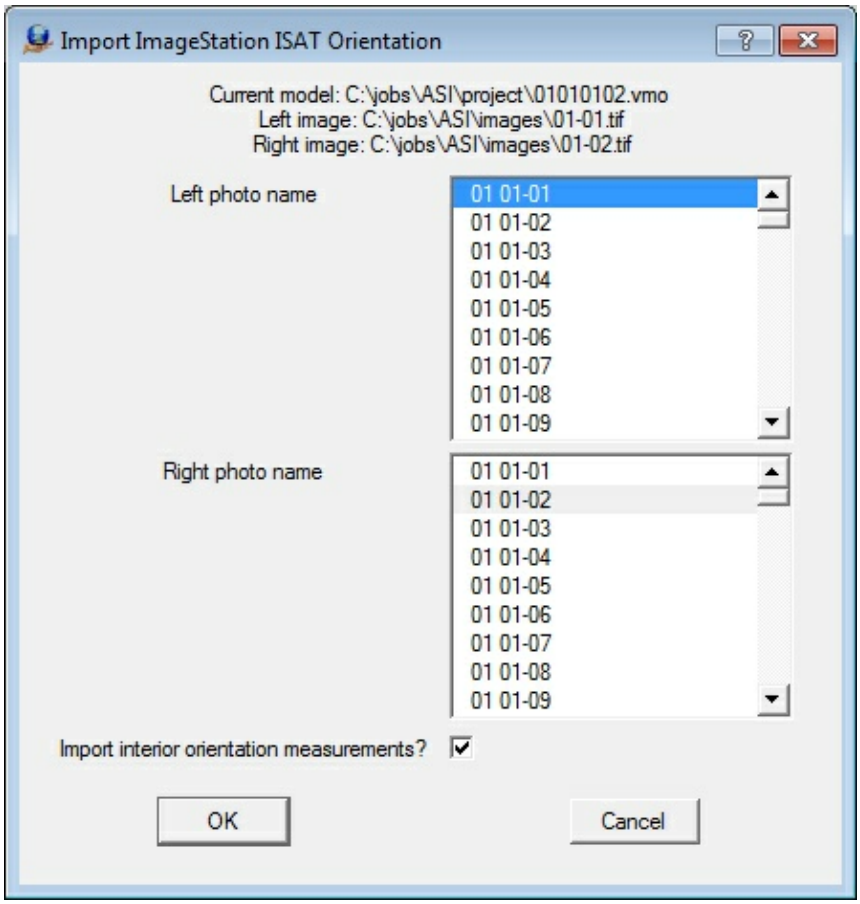
Orientations

1. Select "Measurement Orientation - Single" from the "Import" dropdown menu. Click "ISAT Orientation".



The Import dialog box requesting the photo measurement file

2. Select the current location of the ISAT Photo file then press "OK".
3. Select the left and right photo names



The Import dialog box for the definition of the left and right images that make the single model

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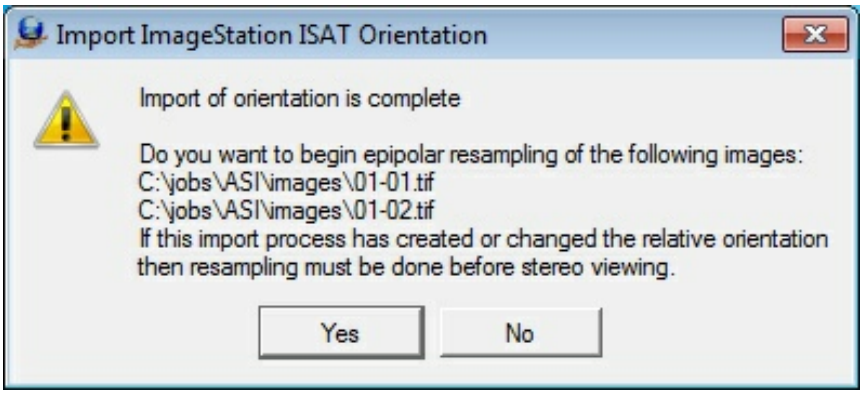
3. Check "Import interior orientation measurements?" to include the Interior Orientations in the import.

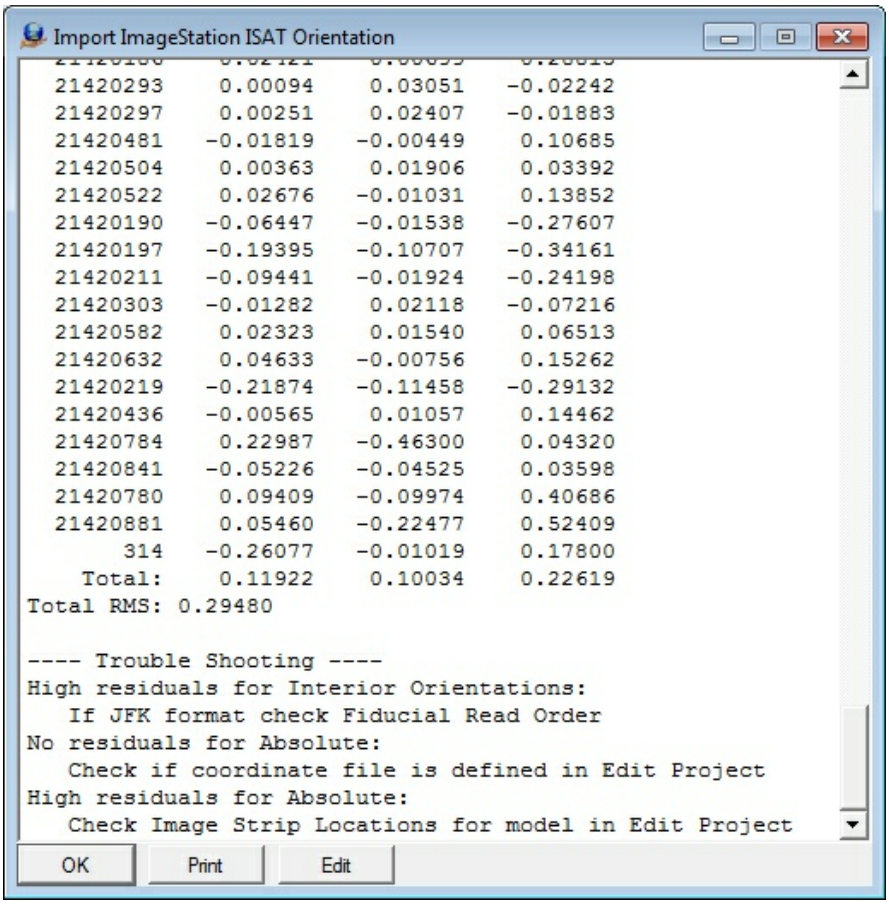
4. Click "OK" to start the import process.

5. When asked to create epipolar images, move this dialog box off to the side until the results of the import are reviewed.



This dialog box is used to start the epipolar re-sampling process

6. Review residuals for Interior, Relative and Absolute Orientation.



Dialog box showing the results after the Import process has completed.

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Detailed results found in the results dialog box are shown below. The Total RMS values should be reviewed to verify that the import was successful. The following shows the results of the import of one model:

```
Import ImageStation ISAT Orientation

Left photo:  01-01
Right photo: 01-02

LEFT INTERIOR ORIENTATION
1  -0.0031  -0.0014
2   0.0079  -0.0045
3  -0.0013   0.0024
4   0.0043   0.0002
5  -0.0013  -0.0018
6  -0.0175   0.0034
7   0.0028   0.0013
8   0.0082   0.0003
Total RMS: 0.0063

RIGHT INTERIOR ORIENTATION
1  -0.0078  -0.0041
2   0.0052  -0.0060
3  -0.0011   0.0063
4   0.0059   0.0021
5  -0.0038  -0.0034
6  -0.0234   0.0026
7   0.0096   0.0002
8   0.0155   0.0024
Total RMS: 0.0104

Left photo:  01-01 - 54 points
Right photo: 01-02 - 66 points

RELATIVE ORIENTATION
47 common points:
     Point    X Left    Y Left   X Right   Y Right   Residual
  21370307    76.838   -58.782   -12.314   -61.251      0.003
  21370297    85.825   -65.500    -3.302   -68.079      0.002
  21370317    83.828   -72.720    -5.238   -75.449     -0.001
  21370322    74.673   -66.273   -14.482   -68.898      0.000
  21419889   101.238   -97.322    13.071  -100.508     -0.006
  21370632    65.755   -78.462   -23.557   -81.364     -0.001
  21370720    26.827   -82.479   -63.209   -85.590      0.006
  21370731    23.507   -88.196   -66.359   -91.422      0.003
  21370828    -2.013   -69.690   -93.072   -72.640     -0.006
  21370829    11.326   -94.092   -78.615   -97.468      0.002
  21370830    11.604   -93.239   -78.348   -96.594     -0.001
  21370845    15.827   -85.375   -74.218   -88.572      0.008
  21370874    10.198   -79.657   -80.488   -82.770      0.004
  21371323    -9.193   -98.001  -100.043  -101.521     -0.007
  21420055   -19.133   -70.636  -110.413   -73.660     -0.003
```

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21420036	21.328	-99.691	-68.570	-103.161	0.005
21370822	-1.640	-66.162	-92.843	-69.054	0.001
21371192	-9.285	-70.099	-100.290	-73.082	0.000
21371201	-17.042	-67.686	-108.466	-70.654	-0.001
21371281	-13.107	-97.296	-103.930	-100.807	-0.010
21420086	-10.797	-101.948	-101.661	-105.559	0.001
21419400	91.047	-29.798	2.132	-31.637	-0.002
21419398	72.444	-27.777	-16.808	-29.642	-0.012
21419505	93.223	-5.438	4.274	-6.807	-0.005
21419426	92.268	62.222	2.501	61.986	0.004
21419442	84.237	73.560	-5.805	73.451	0.006
21419552	95.450	66.551	5.779	66.399	0.006
21419425	89.979	48.838	0.392	48.386	-0.005
21420186	-6.042	-3.548	-97.488	-5.344	0.004
21420293	19.608	-12.081	-70.677	-13.892	-0.002
21420297	25.126	31.686	-64.865	30.626	-0.005
21420481	38.477	-22.157	-51.118	-24.075	0.013
21420504	29.273	7.850	-60.614	6.422	-0.000
21420522	43.859	36.102	-46.476	35.200	-0.003
21420190	0.187	51.721	-90.897	50.819	0.004
21420197	-13.728	81.544	-105.063	80.980	-0.004
21420211	2.223	69.050	-88.593	68.407	-0.000
21420303	19.382	55.809	-71.152	55.068	0.007
21420582	32.817	51.008	-57.818	50.275	-0.000
21420632	45.044	66.938	-45.236	66.510	0.000
21420219	-13.615	91.103	-104.906	90.653	0.006
21420436	26.879	103.898	-64.110	103.883	-0.013
21420784	89.093	-91.840	0.274	-94.964	0.006
21420841	91.747	29.262	2.144	28.497	-0.010
21420780	77.551	83.696	-12.886	83.704	0.001
21420881	106.351	60.663	16.796	60.480	0.005
314	91.421	18.120	2.028	17.154	-0.000

Total RMS error: 0.004

ABSOLUTE ORIENTATION
47 points for absolute
Residuals:

Point	X	Y	Z
21370307	0.09121	-0.15773	-0.02738
21370297	0.47488	0.10994	-0.97399
21370317	-0.04852	-0.21873	0.28873
21370322	0.22286	-0.23109	-0.46047
21419889	0.17087	-0.13348	0.20637
21370632	0.24575	-0.16939	-0.42096
21370720	-0.01601	0.05894	0.07782
21370731	0.20960	0.01725	-0.32742
21370828	0.02789	-0.01199	-0.04135
21370829	0.31629	-0.01241	-0.41290
21370830	0.09911	0.02299	-0.10681
21370845	0.08229	0.05546	-0.11787
21370874	0.29524	0.04906	-0.43645
21371323	-0.27010	0.27783	0.41862
21420055	-0.07321	0.16779	0.16120

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```
  21420036    0.05955    0.09885   -0.02240
  21370822   -0.26718    0.30929    0.50870
  21371192   -0.24230    0.19606    0.42478
  21371201   -0.17005    0.15885    0.33385
  21371281   -0.14711    0.33623    0.30999
  21420086   -0.11624    0.20739    0.31634
  21419400   -0.01091   -0.13209    0.19414
  21419398   -0.06127   -0.03391   -0.04427
  21419505   -0.00556   -0.11936    0.16632
  21419426   -0.18176    0.06995   -0.15057
  21419442   -0.01296   -0.00932    0.07857
  21419552   -0.09587    0.04550   -0.04733
  21419425   -0.16139    0.05593   -0.17315
  21420186    0.02421   -0.00699   -0.28813
  21420293    0.00094    0.03051   -0.02242
  21420297    0.00251    0.02407   -0.01883
  21420481   -0.01819   -0.00449    0.10685
  21420504    0.00363    0.01906    0.03392
  21420522    0.02676   -0.01031    0.13852
  21420190   -0.06447   -0.01538   -0.27607
  21420197   -0.19395   -0.10707   -0.34161
  21420211   -0.09441   -0.01924   -0.24198
  21420303   -0.01282    0.02118   -0.07216
  21420582    0.02323    0.01540    0.06513
  21420632    0.04633   -0.00756    0.15262
  21420219   -0.21874   -0.11458   -0.29132
  21420436   -0.00565    0.01057    0.14462
  21420784    0.22987   -0.46300    0.04320
  21420841   -0.05226   -0.04525    0.03598
  21420780    0.09409   -0.09974    0.40686
  21420881    0.05460   -0.22477    0.52409
       314   -0.26077   -0.01019    0.17800
    Total:    0.11922    0.10034    0.22619
Total RMS: 0.29480
```

7. When the orientation results are acceptable, press the "OK button". Epipolar images will now be created from the results of the orientation. Epipolar images are rotation-removed, stereo-viewable images with a common scale. They make stereo viewing comfortable for the operator. The VrTwo Orientation main window will display status of the epipolar generation process on the bottom line. Epipolar results will be displayed in the same dialog that presented the Import RMS values

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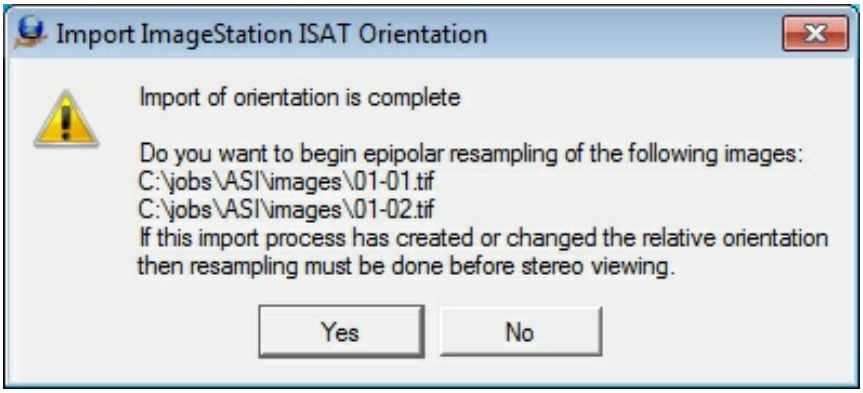
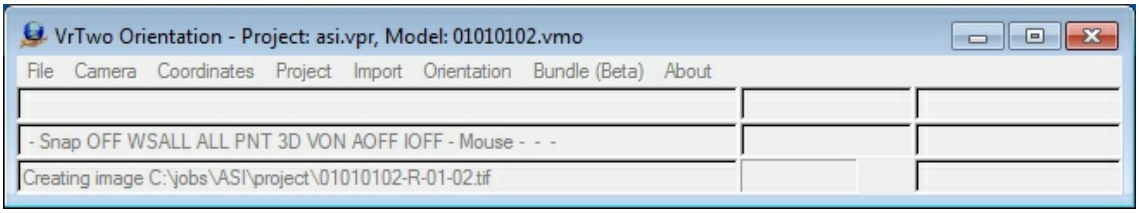
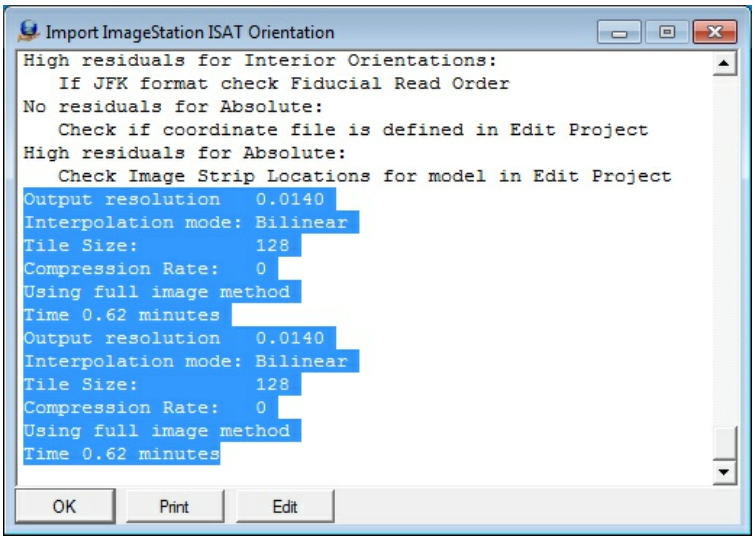


This dialog box is used to start the epipolar re-sampling process



VrTwo Orientation main window shown starting the epipolar process on image 10-02.tiff



Results of the epipolar process.

Section 3 Verifying Orientations (Optional)

1. Since measurements were imported, relative and absolute orientations may be viewed. To begin, select "Absolute Orientation" from the "Orientation" dropdown menu. This process can be used to verify the locations of the control, pass, and tie points in the Stereo Model. This process can also be used to visually inspect known ground control points for offset.
2. Click the first point in the results main window. To toggle roaming, press the Insert button on the keyboard.
3. To advance to the next point in orientation, press "Next point" (button 5). All visually

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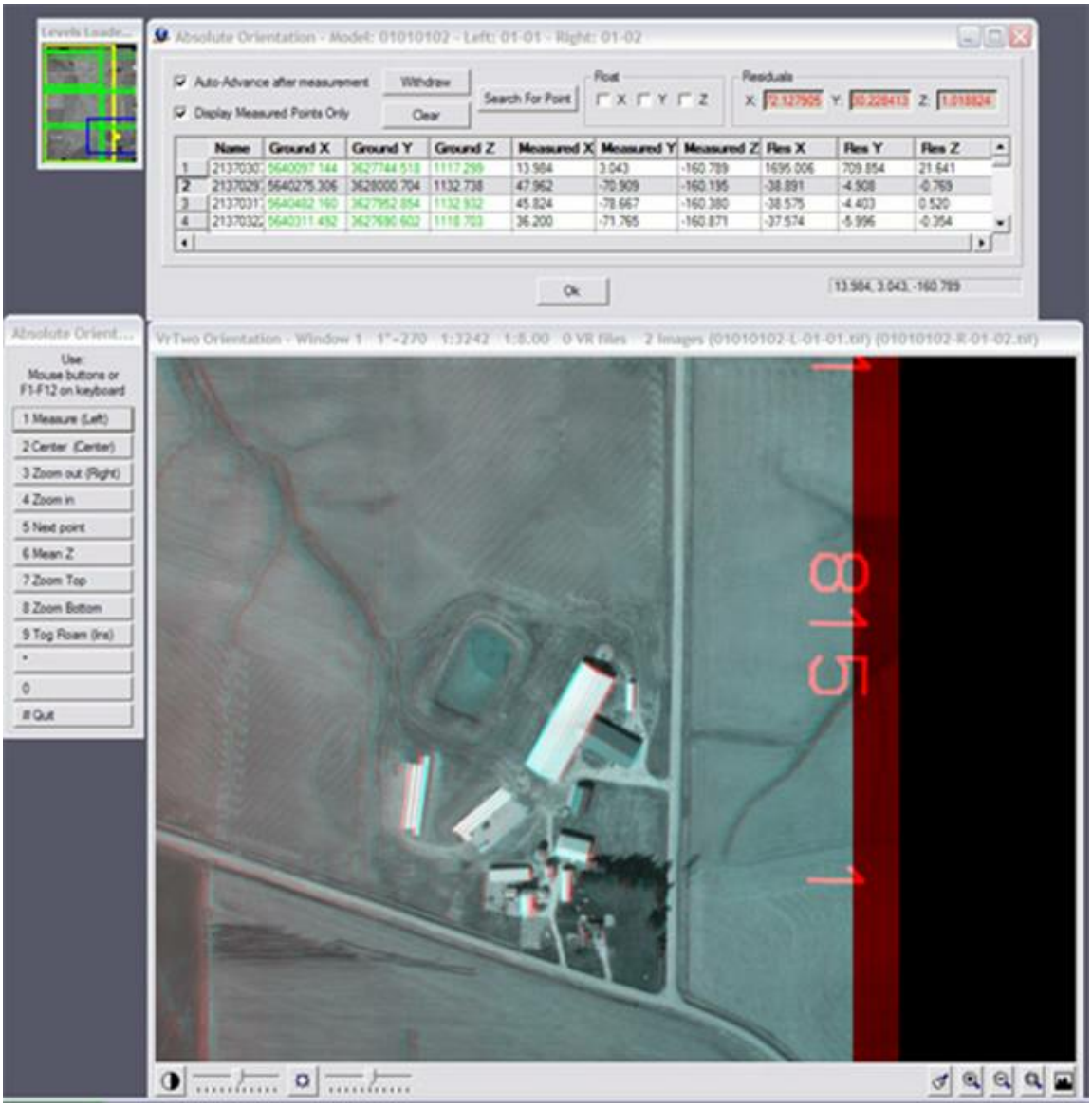
identifiable ground control points can be verified using this method.



The VrTwo Orientation Absolute Orientation environment

Section 4 Opening Model in VrTwo

1.Start VrTwo.

2.Click File -> Open Model or use the Open Model (OpeMod) command. Navigate to the location of the project folder by double clicking in the far left hand box.

3.Double click the VrTwo Model (.vmo) file and press OK.

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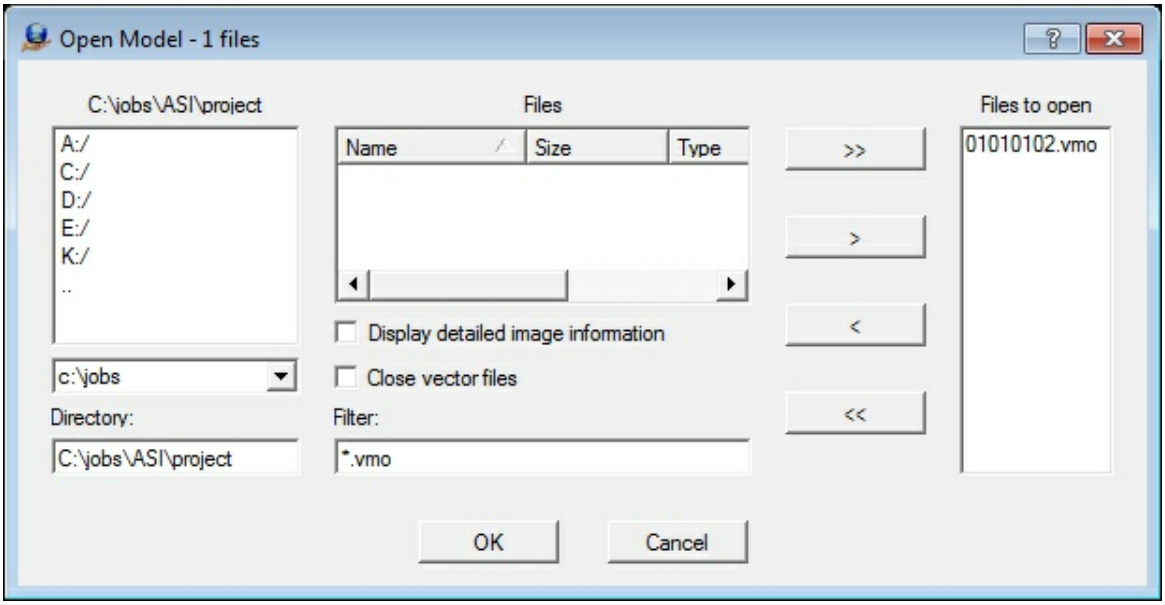

The Open Model dialog box

4 VrTwo will now generate pyramids for the epipolar images if they do not already exist.

5.Open a VrOne File by clicking on File -> Open Vr File or by using the Open VrOne File (OpeVr) command. Navigate to the project folder by double clicking in the far left hand box.

6. Double click the VrOne (.vr) file.

The stereo model should open. The stereo model and vectors should be seen on the screen. If the stereo window does not show a stereo image and vector,s try using the Drive Control (Cd) command. Typing "Cd 1" will drive to the first control point in the model. Please see the Getting started with VrOne/VrTwo tutorial, which covers basics of data collection and editing, for more information.

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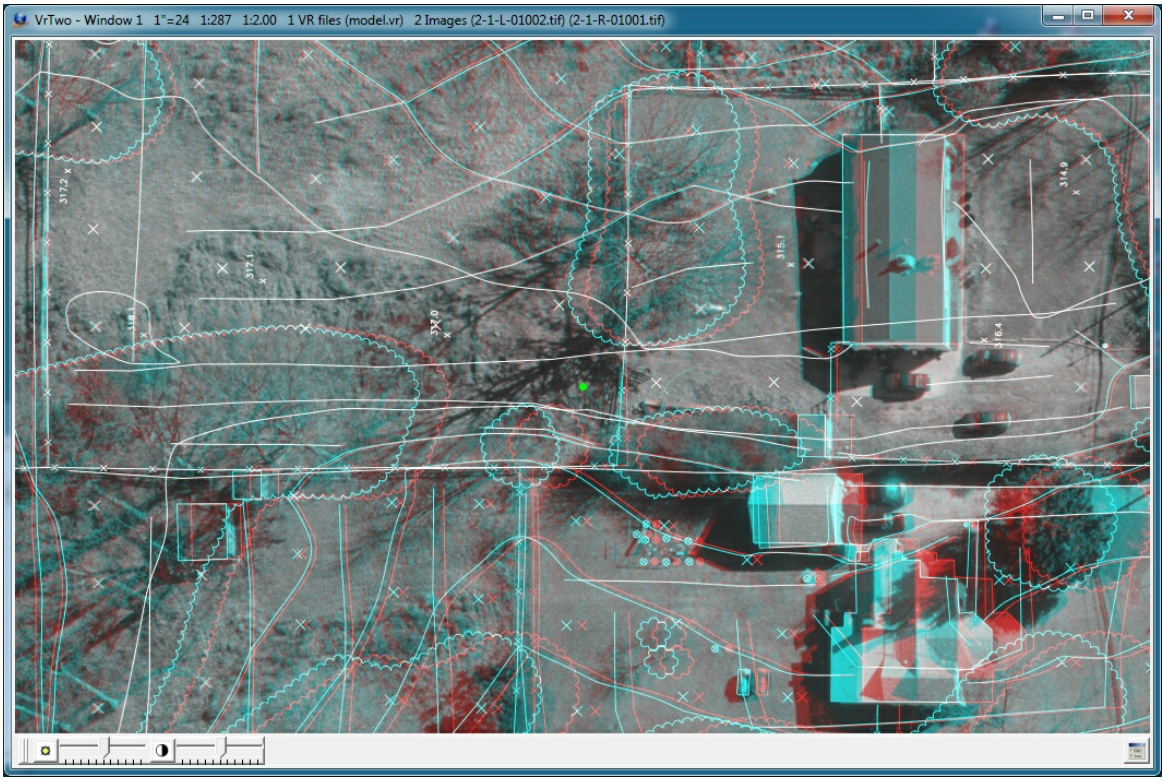

The VrTwo graphics window showing the stereo model (Anaglyph)

3.10 Tutorial ISAT Single Model EO

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VrTwo Orientation - Single Model Import of ISAT Exterior Orientations

VrTwo Orientation Tutorial Manual Import Exterior Orientation Method

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- Overview
- Section 1 Project Setup
- Section 2 Importing Orientations
- Section 3 Opening Model in VrTwo

Overview

VrTwo Orientation creates stereo image pairs (or models) for viewing in VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model or multiple models in a batch mode. Models may be imported from aerial triangulation using exterior orientations or the measurements used to tie images and strips together. This tutorial will address importing orientations for a single model using the ISAT exterior orientation file.

Section 1 Project Setup

Creating or Editing the Camera File

New Camera (NewCam)

Allows the user to create and edit a new camera calibration file. Prompts user for the new camera's file name. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file. If a preexisting camera file exists, this feature may not be needed.

Creating the Camera File

From the "Camera" dropdown menu, click on either "New Camera" or "Edit Camera".

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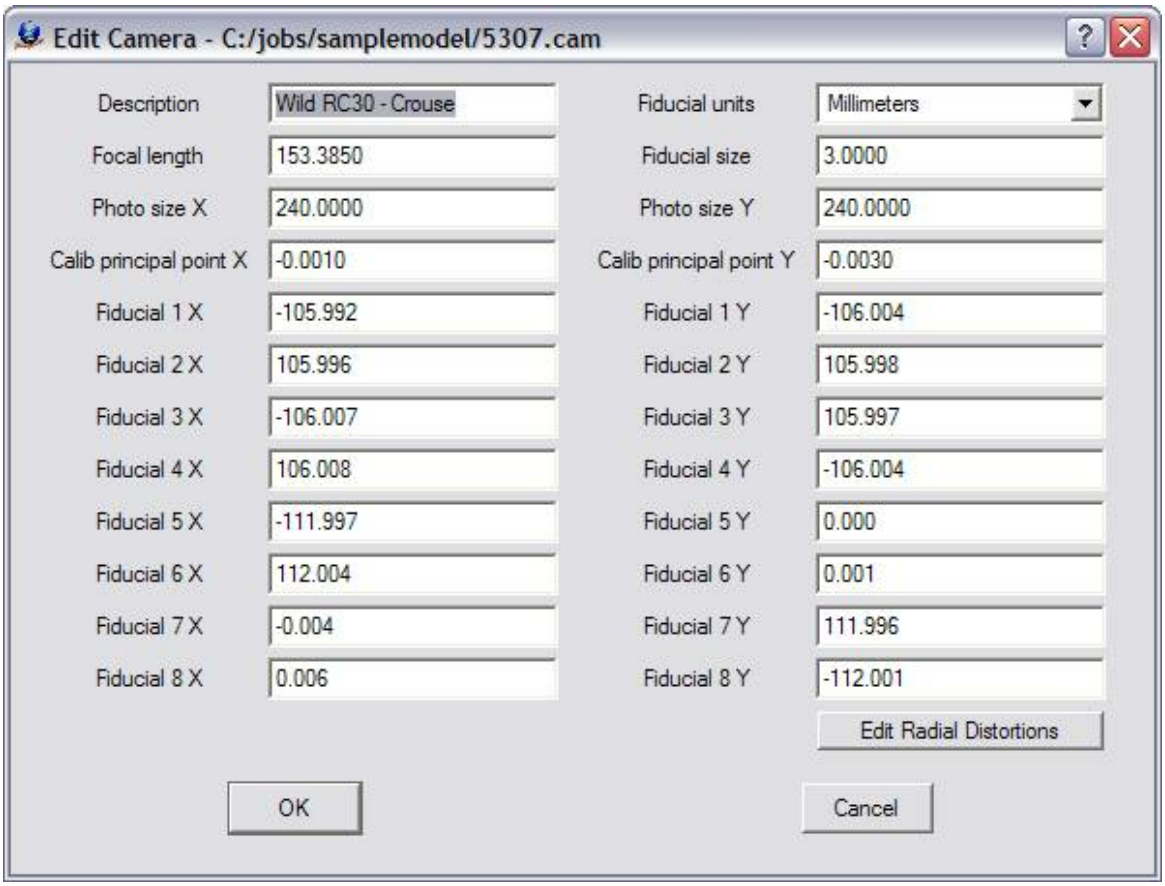

The Edit Camera dialog box

Creating or Editing a Control File

If one does not already exist, create a new coordinate file. From the "Coordinates" dropdown menu, click on "New Coordinate File". Please see VrTwo Orientation New Coordinate File for more information.

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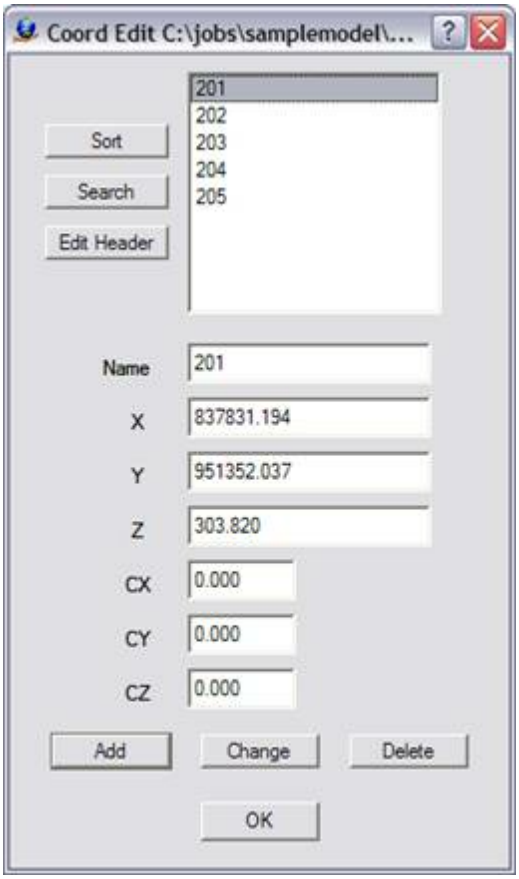

The Edit Control dialog box

If a control file exists and contains the PointName X Y Z fields, it can be used directly by Vr Mapping programs. Simply rename the file by replacing the file postfix with .cor. For example, if there were a coordinate file named TheCoords.txt which contained the PointName XYZ fields, it could be renamed TheCoords.cor and be used by VrTwo Orientation.

The following is an example of a contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The first field is the point name followed by the X, Y and Z coordinates.

Creating or Editing the Project

The following steps create the project:

1. **Create a New Project File** - From the "Project" dropdown window, click on either "New

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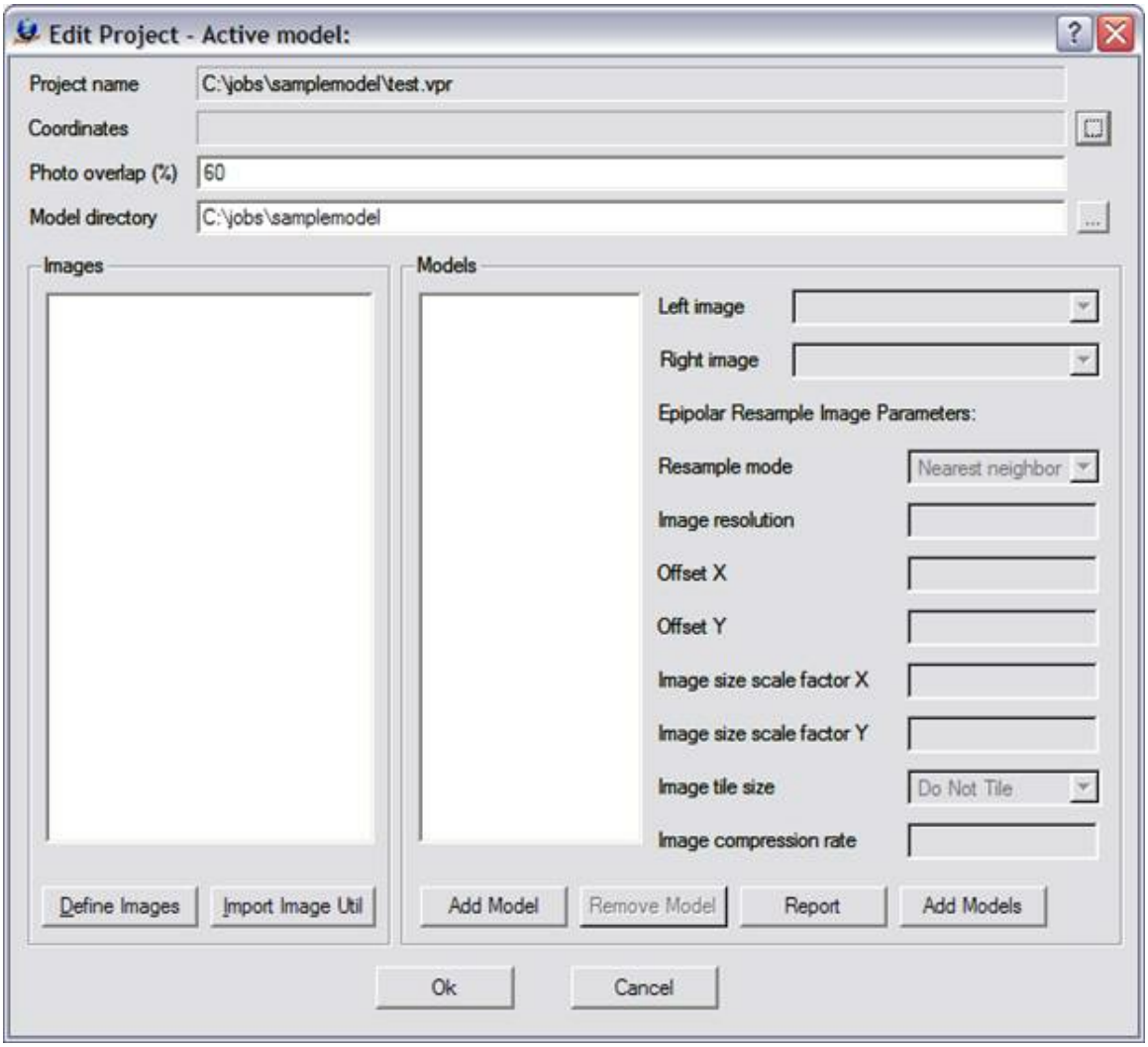
Project" or "Edit Project".

2. **Add Coordinate File** - Click the button to the right of the "Coordinates" box to add the coordinate file name.



The Edit Project dialog box prior with no parameters defined

3. **Define Images** - Click the "Define Images" button in the "Edit Project" dialog box. The "Edit Project - Define Images" dialog box allows the definition of multiple image files. Each image file has a Photo Name Format, which are parameters that define the strip and photo number from an image file name. Strip direction, pixel size and the "Open in Layout" flag may also be defined for each image. The top portion of the dialog box is a template of these parameters. This template may be copied to an image or a group of images by selecting the desired file(s) then pressing the "Apply" button.

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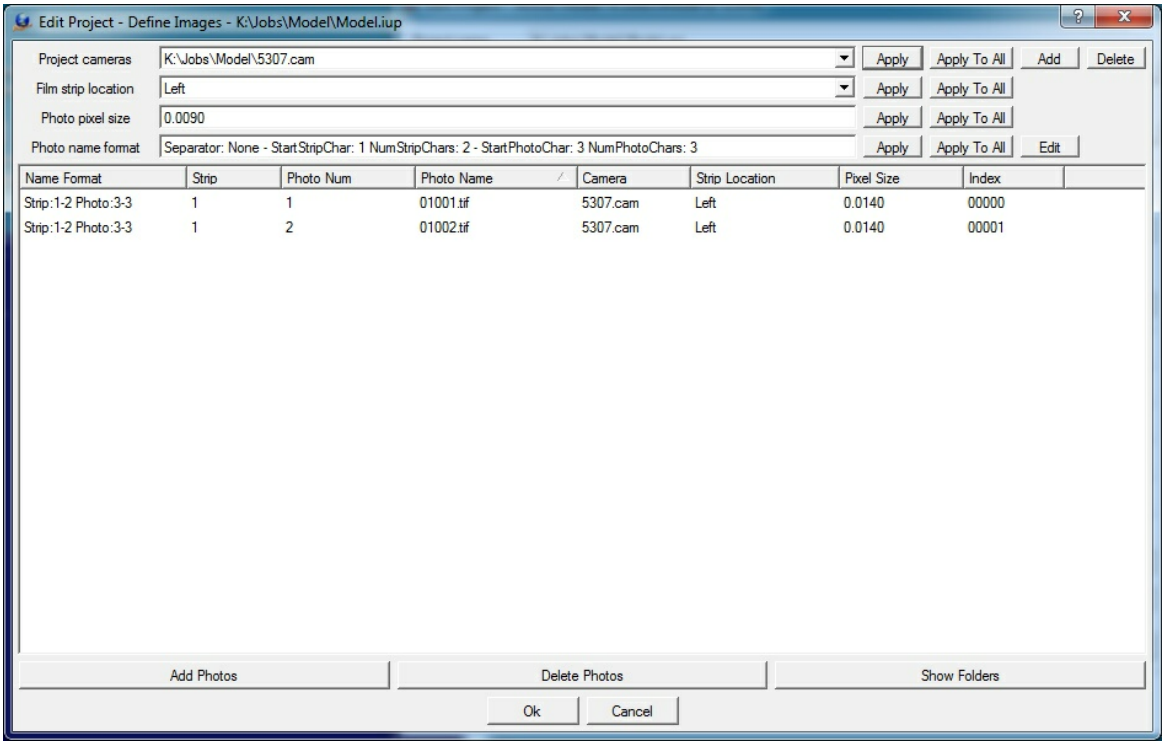

The Edit Project - Define Images dialog box

The following are descriptions of the parameters in the "Edit Project - Define Images" dialog box:

Project Camera
Project cameras (.cam) are assigned to individual images. Up to 10 camera files may be defined.

Film Strip Location

Defines the direction flight. For more information please see VrTwo Orientation - Film Strip Direction.

Photo Pixel Size
The photo pixel size is in the same fiducial units (millimeters, inches, or pixels) defined by the Camera file. If this value is unknown, it can be computed after reading three points in Inner Orientation at the bottom left of the Interior Orientation window.

Add Photos
Adds images to the project.

Photo Name Format
Sets the parameters that define the strip and photo number from an image file name. For more Information please see VrTwo Orientation - Photo Name Format.

4. **Create Model Names**
Click "Add Model" to create a new model. Pressing this button allows a single model to be added to the list of models. After the model is added, the left and right images must be selected and the epipolar re-sampling image parameters must be set.

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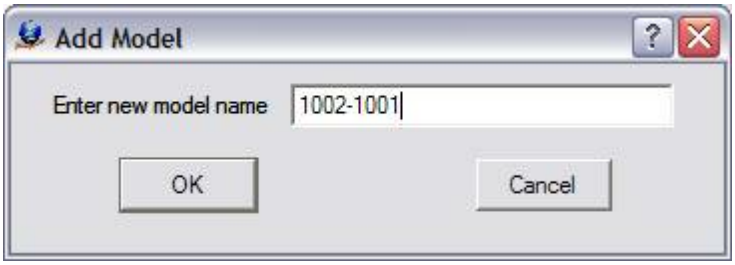
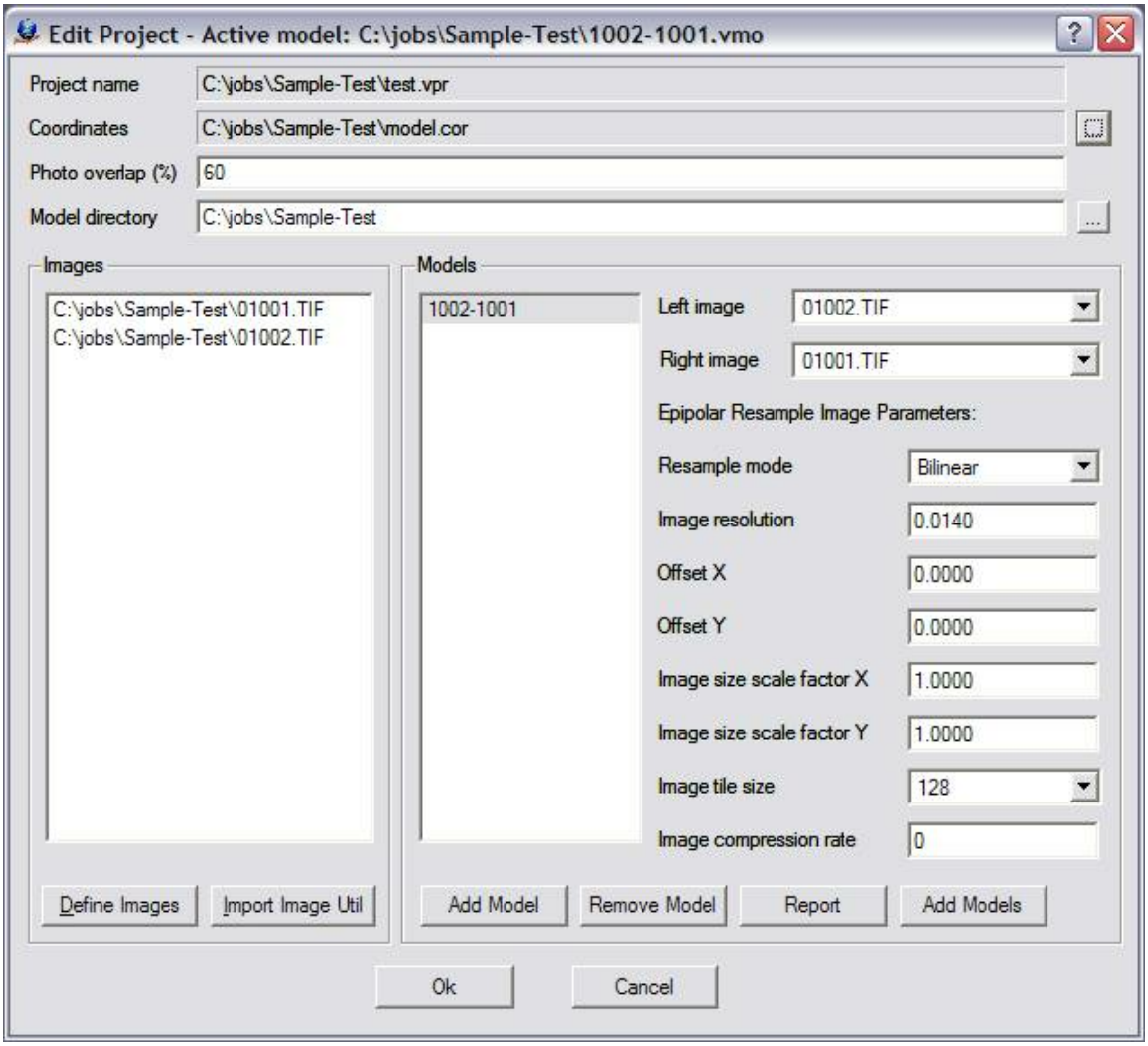


The Add Model dialog box



The Edit Project dialog box showing Model 1002-1001

Please see VrTwo Orientation - Project for more information.

Section 2 Importing Orientations

Importing Interior Orientations in Batch Mode

Although this tutorial describes the import of a single model from Exterior Orientations, it is

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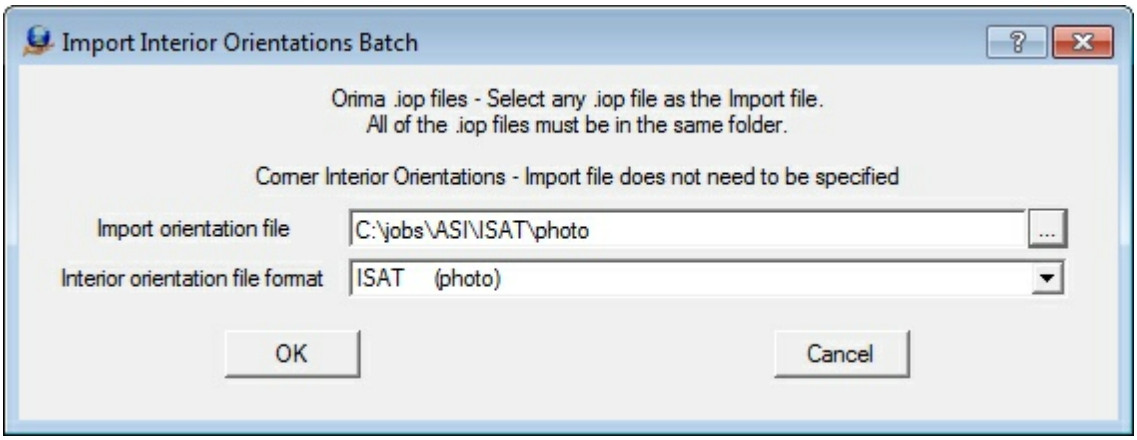
possible to import Interior Orientations in a batch mode.

1. Select "Import Interior Orientations Batch" from the "Import" dropdown menu.

2. Select the ISAT Photo File name and Interior Orientation file format.



The Import Interior Orientations Batch dialog box

Import Orientation File - Defines the name of the ISAT parameter file that contains orientation parameters. This file is normally named "photo".

Interior Orientation File Format - Defines the input format. Should be "ISAT (photo)".

3. Select the strip number location, which defines the location of the strip number in the "photo" file. Review the ISAT photo file to see if the strip number is encoded with the photo name after the "photo_measurements" keyword or follows the "strip_id" keyword. In the example below the strip number is part of the photo name . For more information, see ISAT Photo File Format.

```
begin photo_measurements 01-02   strip_id 01   version 2.0
 21370307 -12.313744  -61.250663  -12.312909   -61.246508  1 85
 21370297 -3.3020941  -68.078501  -3.3018724   -68.073928  1 85
 21370317 -5.2376813  -75.449179  -5.2373545   -75.44447   1 85
 21370322 -14.481854  -68.898072  -14.480887   -68.89347   1 85
 21370344 -0.68857854 -82.631939  -0.68853523  -82.626727  1 85
```

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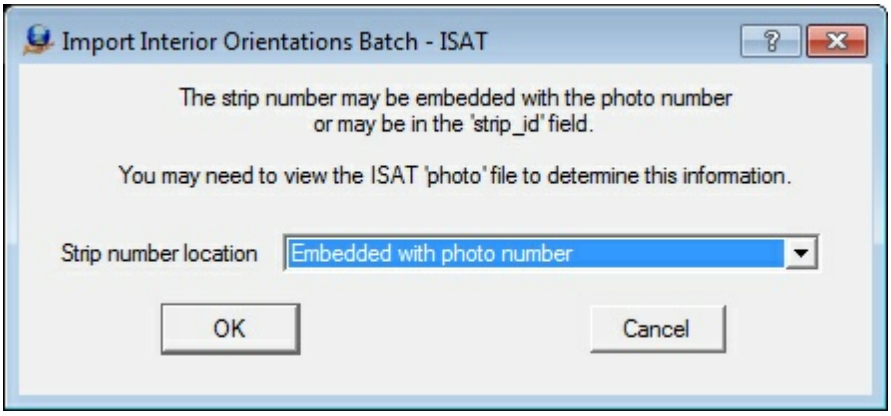
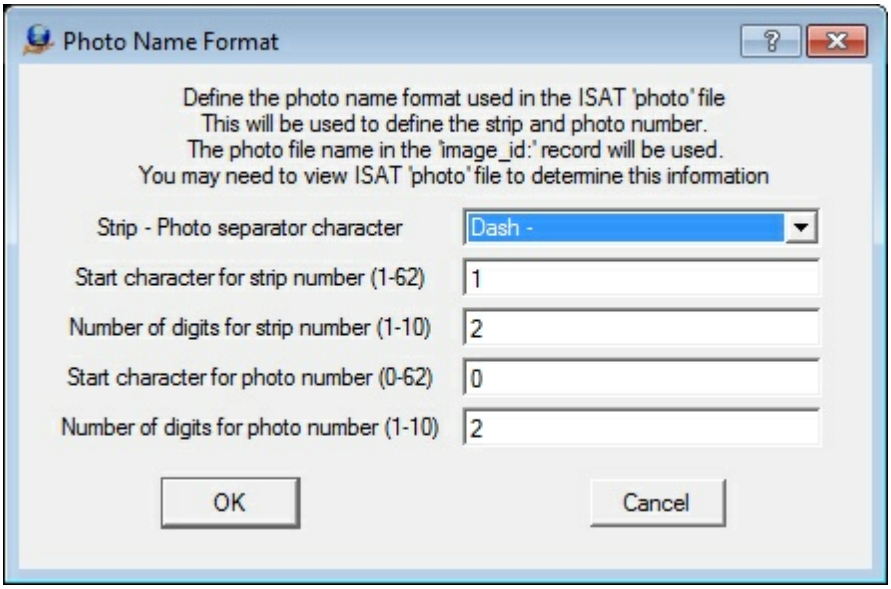


Defining the location of the strip number in the "photo" file

5. **Set Strip Photo Separator** - Defines the file format of the image names and determines how the strip and photo number are parsed by VrTwo Orientation. The Photo Name Format dialog is displayed if the Strip Number Location is set to "Embedded with photo number" in the previous prompt. For more information see Photo Name Format.



The Photo Name Format dialog box

6. **Select Photos To Import** - Sets the photos to be used in the model.

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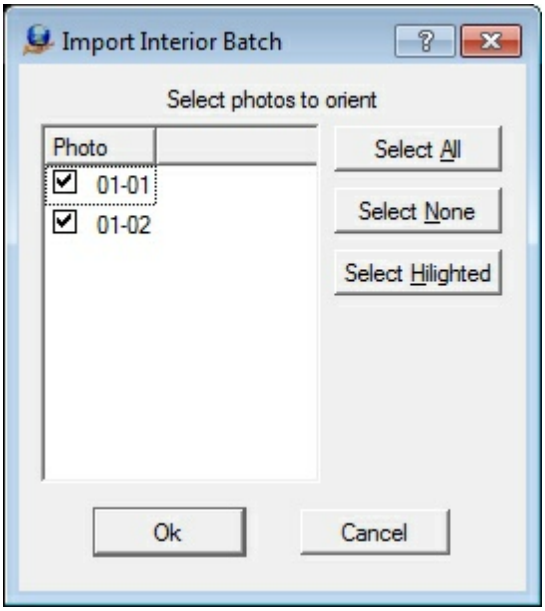
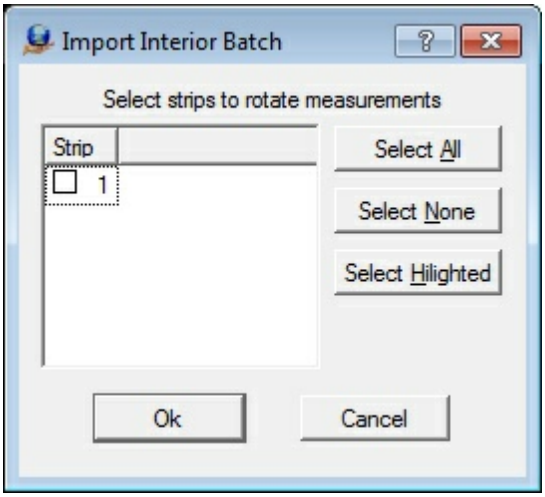


7. **Select Strip Reversal** - If a strip is checked, its measurements are rotated 180 degrees. This may be necessary for strips with Strip Location to the right.



8. Start the Import by clicking "OK". Results and residuals will be presented as shown below.
9.

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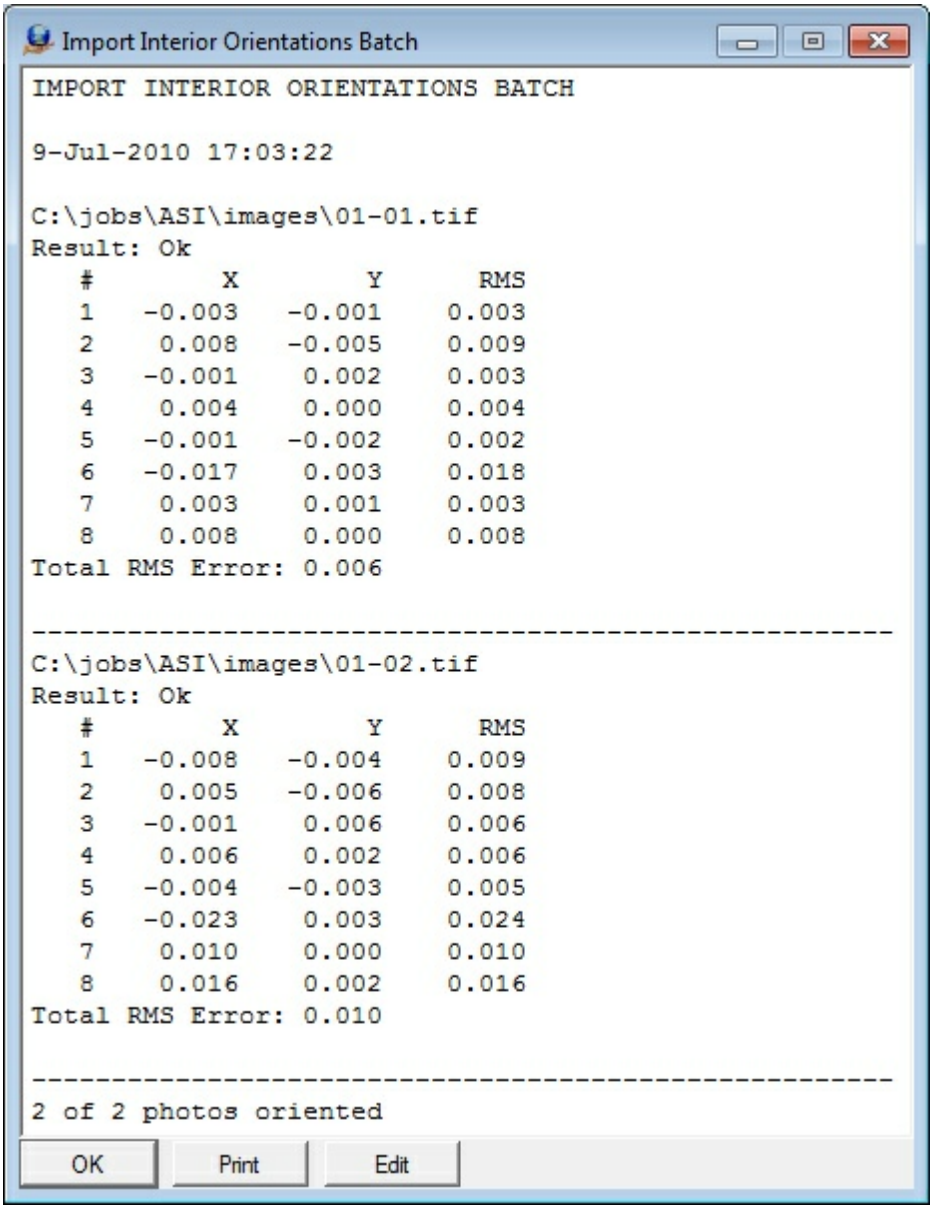

Importing Exterior Orientations

1. Select "Import" from the "Exterior Orientation Single" dropdown menu.
2. Set "Exterior orientation file format" to "ISAT 'photo' file".
3. Select the Exterior Orientation file or Photo file.

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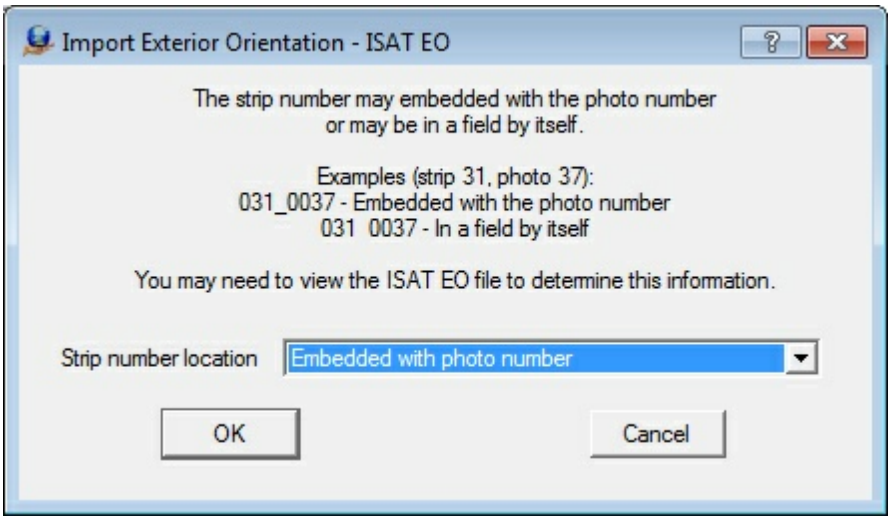
4. **Select Strip Number Location** - Specifies whether the strip number is embedded with the photo name. Review the ISAT photo file to see if the strip number is embedded with the photo number. In the example below, the strip number is part of the photo name. For more information, please see ISAT photo file format.

```
begin photo_measurements 01-02  strip_id 01  version 2.0
 21370307   -12.313744  -61.250663  -12.312909  -61.246508  1 85
 21370297   -3.3020941  -68.078501  -3.3018724  -68.073928  1 85
 21370317   -5.2376813  -75.449179  -5.2373545  -75.44447   1 85
 21370322   -14.481854  -68.898072  -14.480887  -68.89347   1 85
 21370344   -0.68857854 -82.631939  -0.68853523 -82.626727  1 85
```



The Import exterior Orientation dialog box that defines the location of the strip number in the ISAT 'photo' file

5. **Set Strip Photo Separator** - Defines the file format of the image names and determines how strip and photo number are parsed by VrTwo Orientation.

For more information, please see Photo Name Format.

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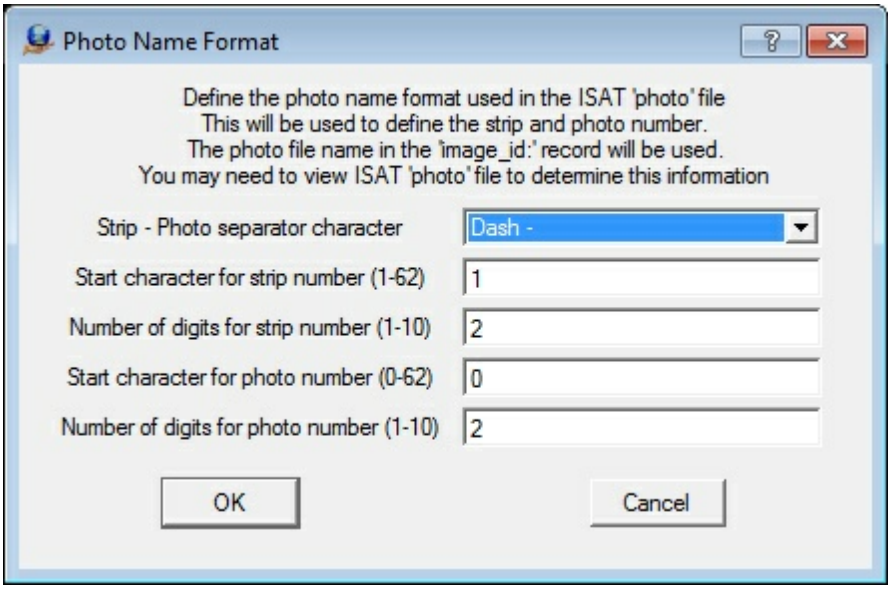

The Photo Name Format definition dialog box

6. The two images to use for orientation are selected by choosing the "Left photo" and "Right photo. The exterior orientation file and number of images read is shown along with the current model at the top of the dialog box.

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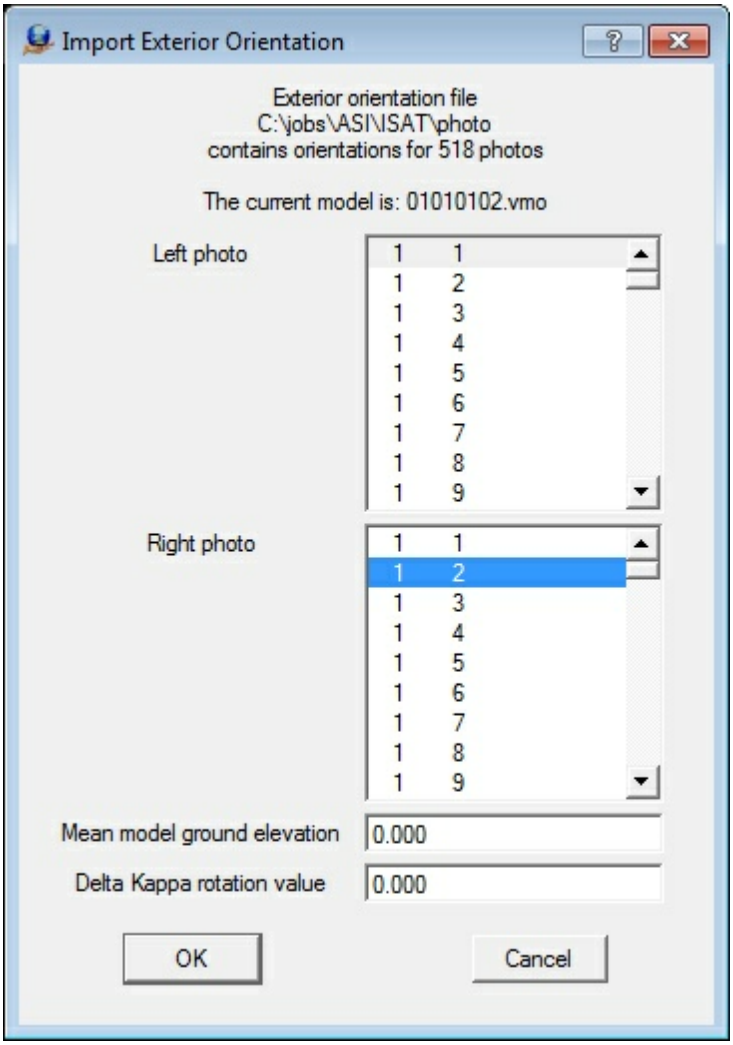

The Import Exterior Orientation photos selection dialog box

Following are the definitions for the two fields below the image selection area in the Import Exterior Orientation dialog box.

Mean Model Ground Elevation
Defines the average ground elevation of the model or job. This may be approximate.

Delta Kappa Rotation Value
Some situations require a rotation angle to be added to the Kappa (rotation about the Z axis) value in the exterior orientation file. This will be required if the images were rotated from their original positions. It is suggested that an angle of zero is first attempted. If the import does not produce a viewable stereo model, a rotation value of 180 should be entered. The possible rotation values are 0, 90, 180, and 270 degrees.

7. Review the Orientation Results provided in the dialog box and click "Yes" to create epipolar images and epipolar image image pyramids.

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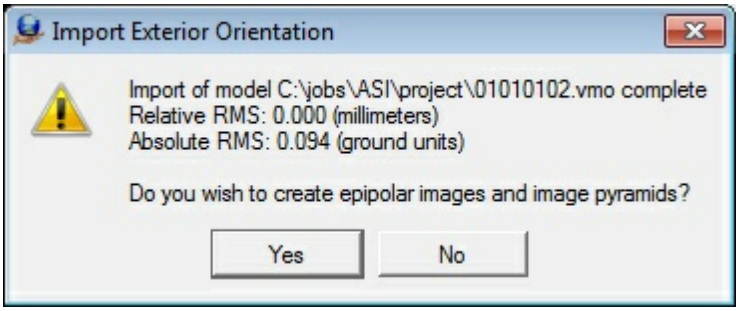
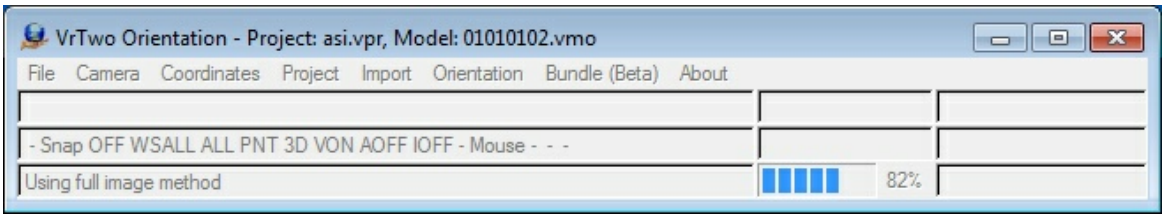


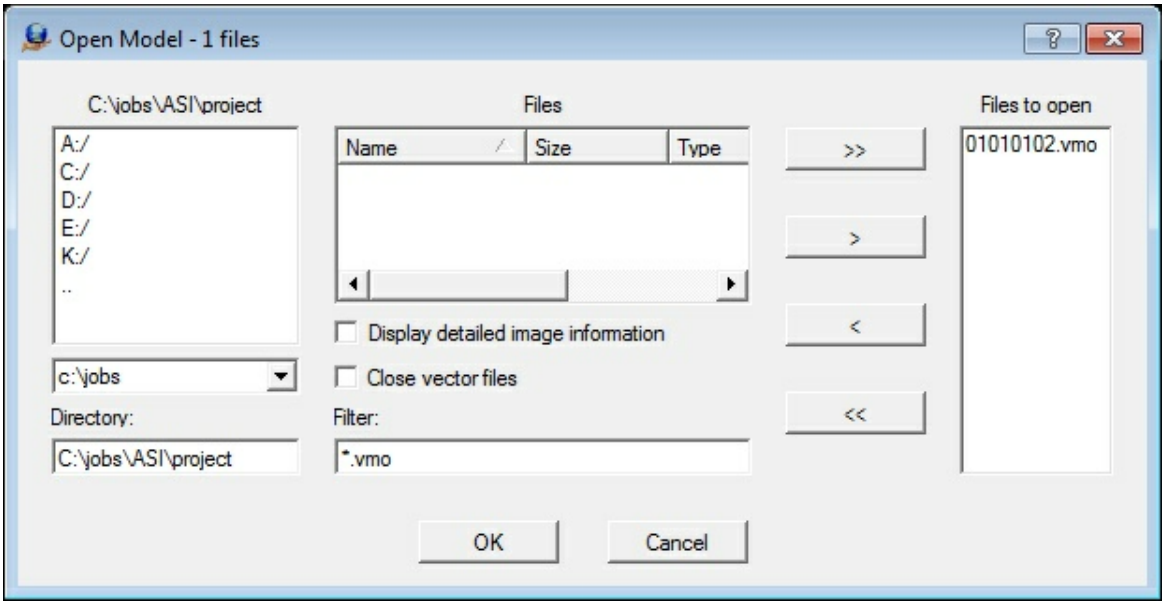
The Main Window will display the progress of the epipolar image creation.



VrTwo Orientation creating Epipolar images.

Section 3 Opening Model in VrTwo

1. Start VrTwo.
2. Click on File -> Open Model or use the Open Model (OpeMod) command. Navigate to the location of the project folder by double clicking the far left hand box.
3. Double click the VrTwo Model (.vmo) file then press "OK".



The Open Model dialog box

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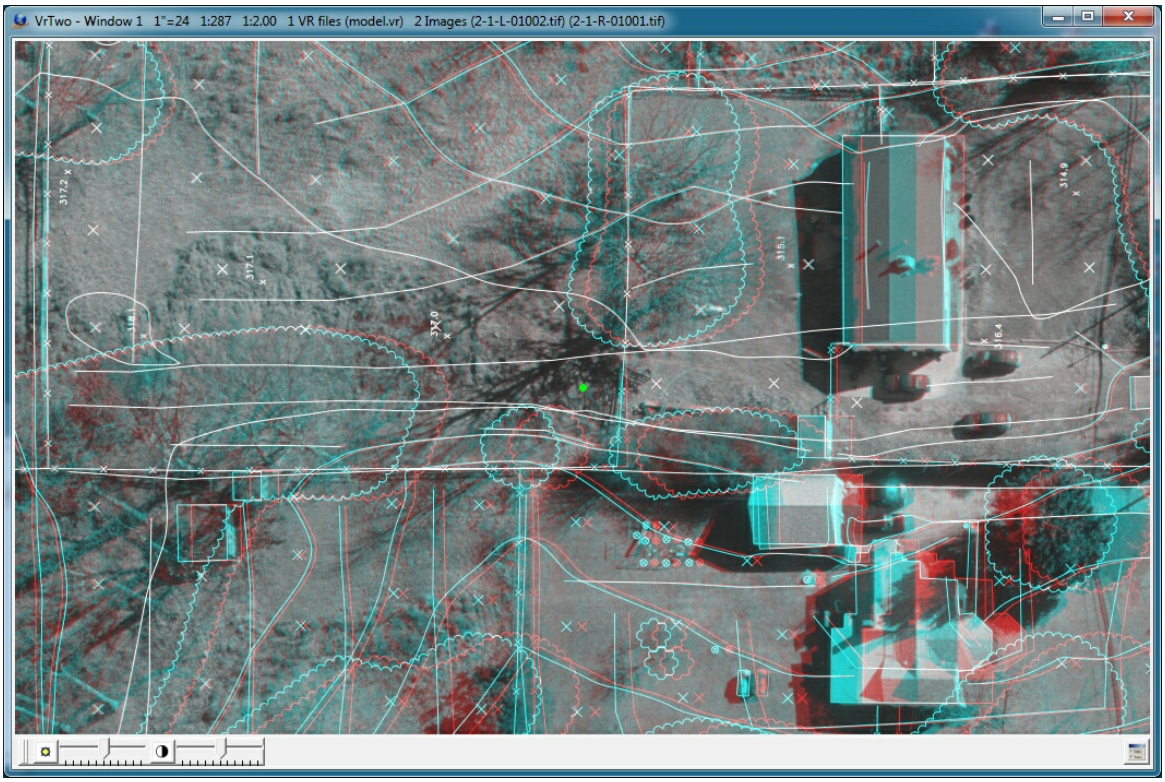
4. VrTwo will now generate pyramids for the epipolar images if they do not already exist.

5. Open a VrOne File by clicking on File -> Open Vr File or by using the Open VrOne File (OpeVr) command. Navigate to the project folder by double clicking in the far left hand box.

6. Double click the VrOne (.vr) file and press "OK".

The stereo model should open. The stereo model and vectors should be seen on the screen. If the stereo window does not show a stereo image and vectors, try using the Drive Control (Cd) command. Typing "Cd 1" will drive to the first control point in the model. For more information, please see the Getting started with VrOne/VrTwo tutorial, which covers basics of data collection and editing.



The VrTwo graphics window showing the stereo model (Anaglyph)

3.11 Tutorial ISAT Batch Model Measurement

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Mapping

VrTwo Orientation - Batch Import of ISAT Measurements

VrTwo Orientation Tutorial Batch Import Measurement Method (vr2ori.exe)

Overview
Section 1 Project Setup
Section 2 Importing Orientations
Section 3 Verifying Orientations
Section 4 Opening Models in VrTwo

Overview

VrTwo Orientation is used to create stereo image pairs (or models) for viewing in VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model or multiple models may be oriented in a batch mode. The importing of models from aerial triangulation may be performed from the exterior orientations or from the measurements used to tie images and strips together. This tutorial will address Importing Orientations for multiple models using the ISAT measurement photo file.

Section 1 Project Setup

Creating or Editing the Camera File

New Camera (NewCam)

Allows the user to create and edit a new camera calibration file. Prompts user for the new camera's file name. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file. If a preexisting camera file exists, this feature may not be needed.

Creating the Camera File

From the "Camera" dropdown menu, click on either "New Camera" or "Edit Camera".

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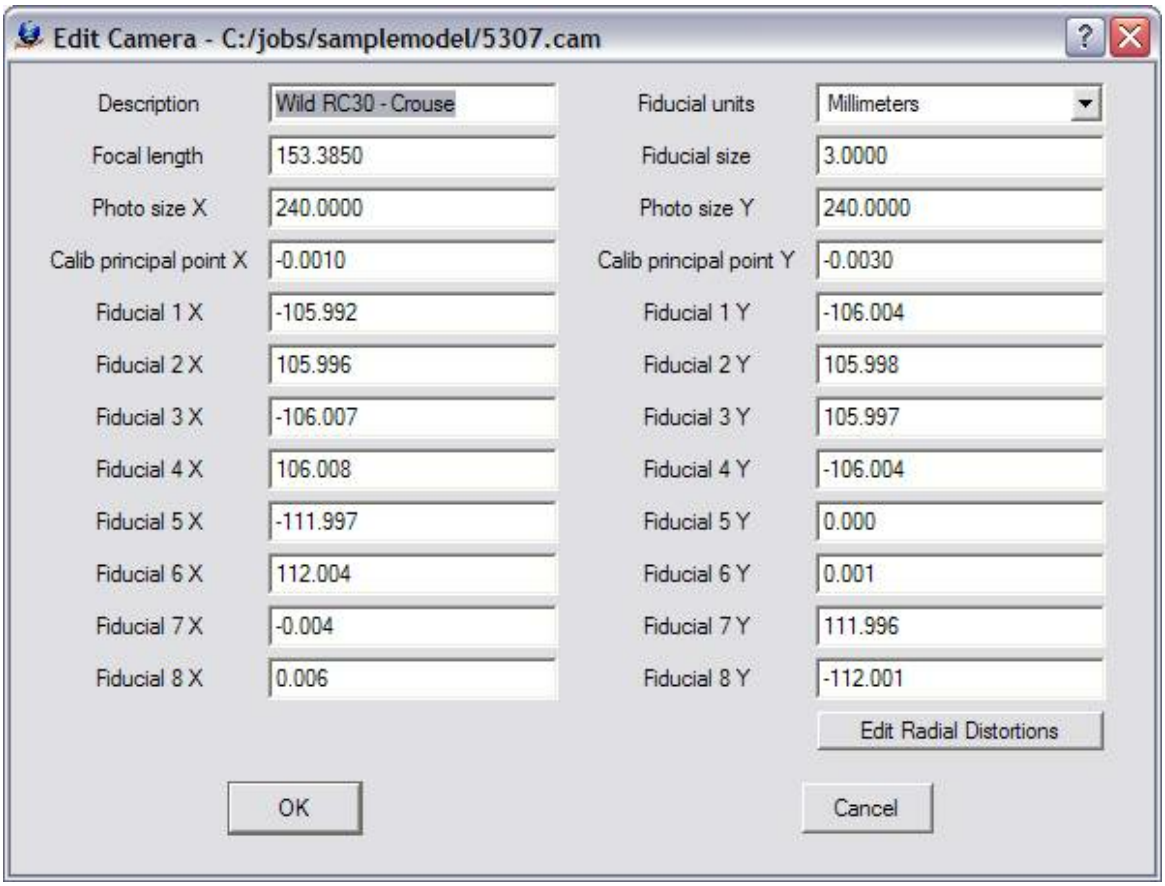

The Edit Camera dialog box

Creating or Editing a Control File

If one does not already exist, create a new coordinate file. From the "Coordinates" dropdown menu, click on "New Coordinate File". Please see VrTwo Orientation New Coordinate File for more information.

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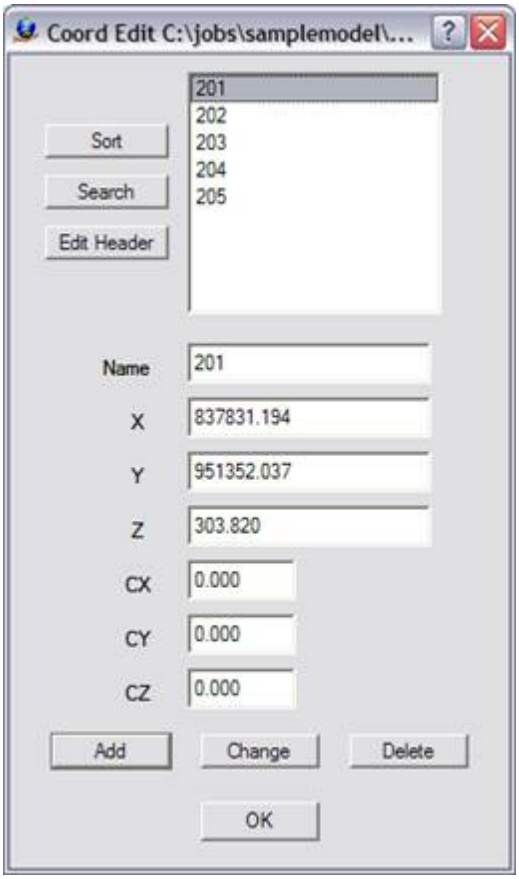

The Edit Control dialog box

If a control file exists and contains the PointName X Y Z fields, it can be used directly by Vr Mapping programs. Simply rename the file by replacing the file postfix with .cor. For example, if there were a coordinate file named TheCoords.txt which contained the PointName XYZ fields, it could be renamed TheCoords.cor and be used by VrTwo Orientation.

The following is an example of a contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The first field is the point name followed by the X, Y and Z coordinates.

Creating or Editing the Project

The following steps create the project:

1. **Create a New Project File** - From the "Project" dropdown window, click on either "New

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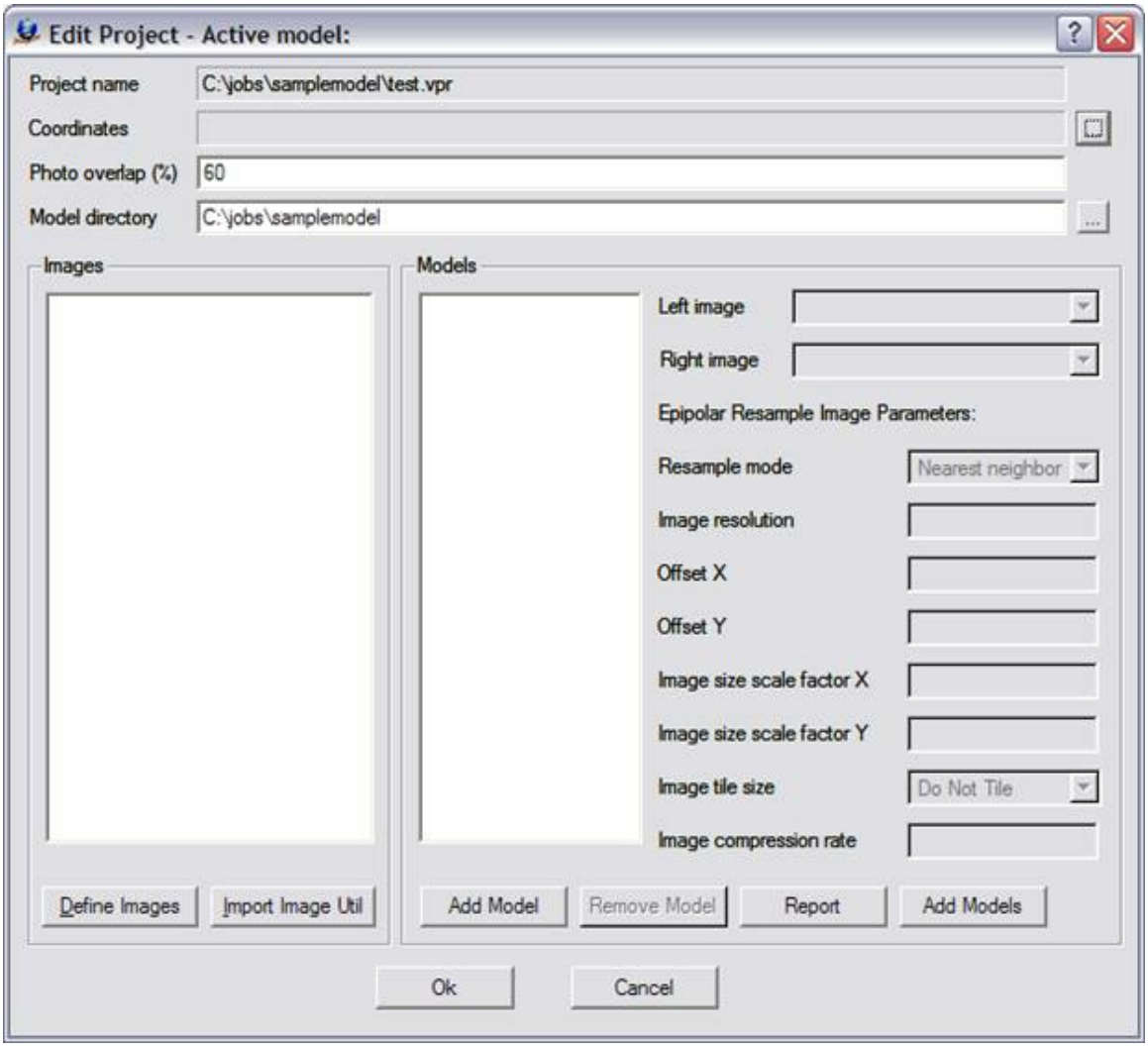
Project" or "Edit Project".

2. **Add Coordinate File** - Click the button to the right of the "Coordinates" box to add the coordinate file name.



The Edit Project dialog box prior with no parameters defined

3. **Define Images** - Click the "Define Images" button in the "Edit Project" dialog box. The "Edit Project - Define Images" dialog box allows the definition of multiple image files. Each image file has a Photo Name Format, which are parameters that define the strip and photo number from an image file name. Strip direction, pixel size and the "Open in Layout" flag may also be defined for each image. The top portion of the dialog box is a template of these parameters. This template may be copied to an image or a group of images by selecting the desired file(s) then pressing the "Apply" button.

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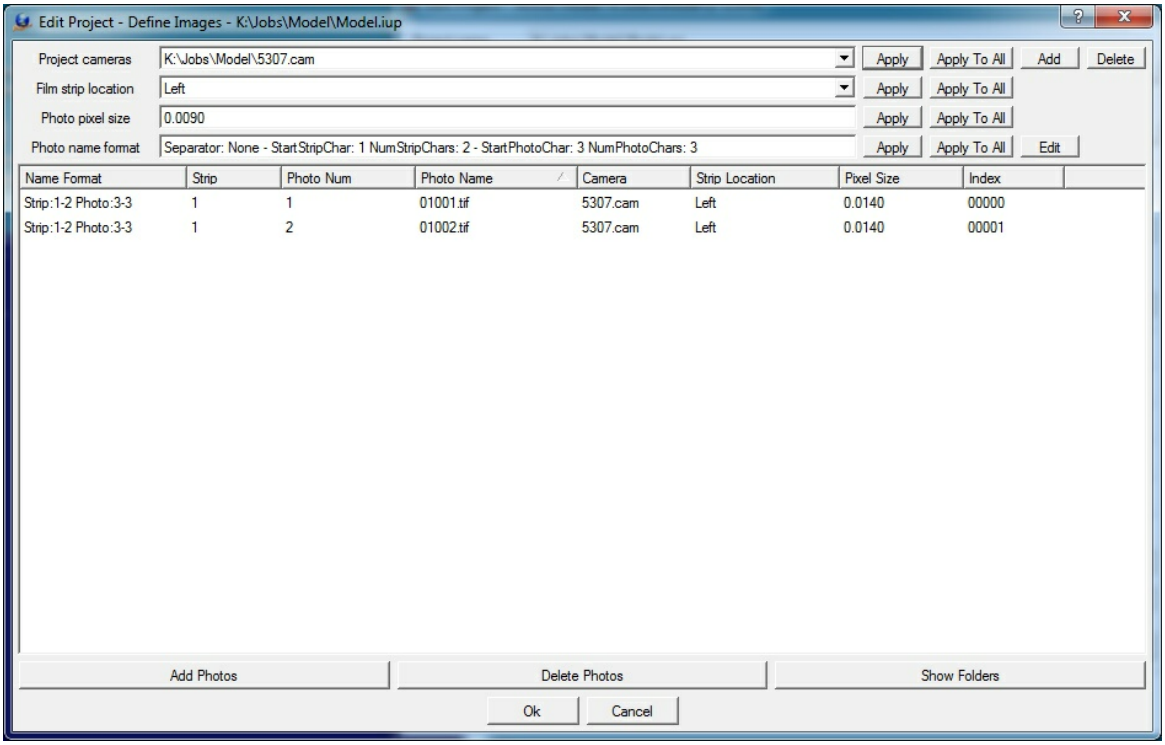

The Edit Project - Define Images dialog box

The following are descriptions of the parameters in the "Edit Project - Define Images" dialog box:

Project Camera
Project cameras (.cam) are assigned to individual images. Up to 10 camera files may be defined.

Film Strip Location

Defines the direction flight. For more information please see VrTwo Orientation - Film Strip Direction.

Photo Pixel Size
The photo pixel size is in the same fiducial units (millimeters, inches, or pixels) defined by the Camera file. If this value is unknown, it can be computed after reading three points in Inner Orientation at the bottom left of the Interior Orientation window.

Add Photos
Adds images to the project.

Photo Name Format
Sets the parameters that define the strip and photo number from an image file name. For more Information please see VrTwo Orientation - Photo Name Format.

4. **Create Model Names**
Click "Add Model" to create a new model. Pressing this button allows a single model to be added to the list of models. After the model is added, the left and right images must be selected and the epipolar re-sampling image parameters must be set.

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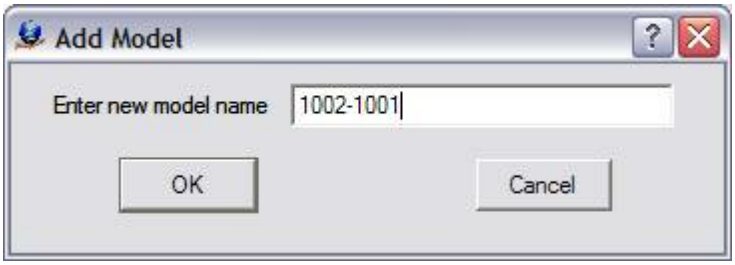
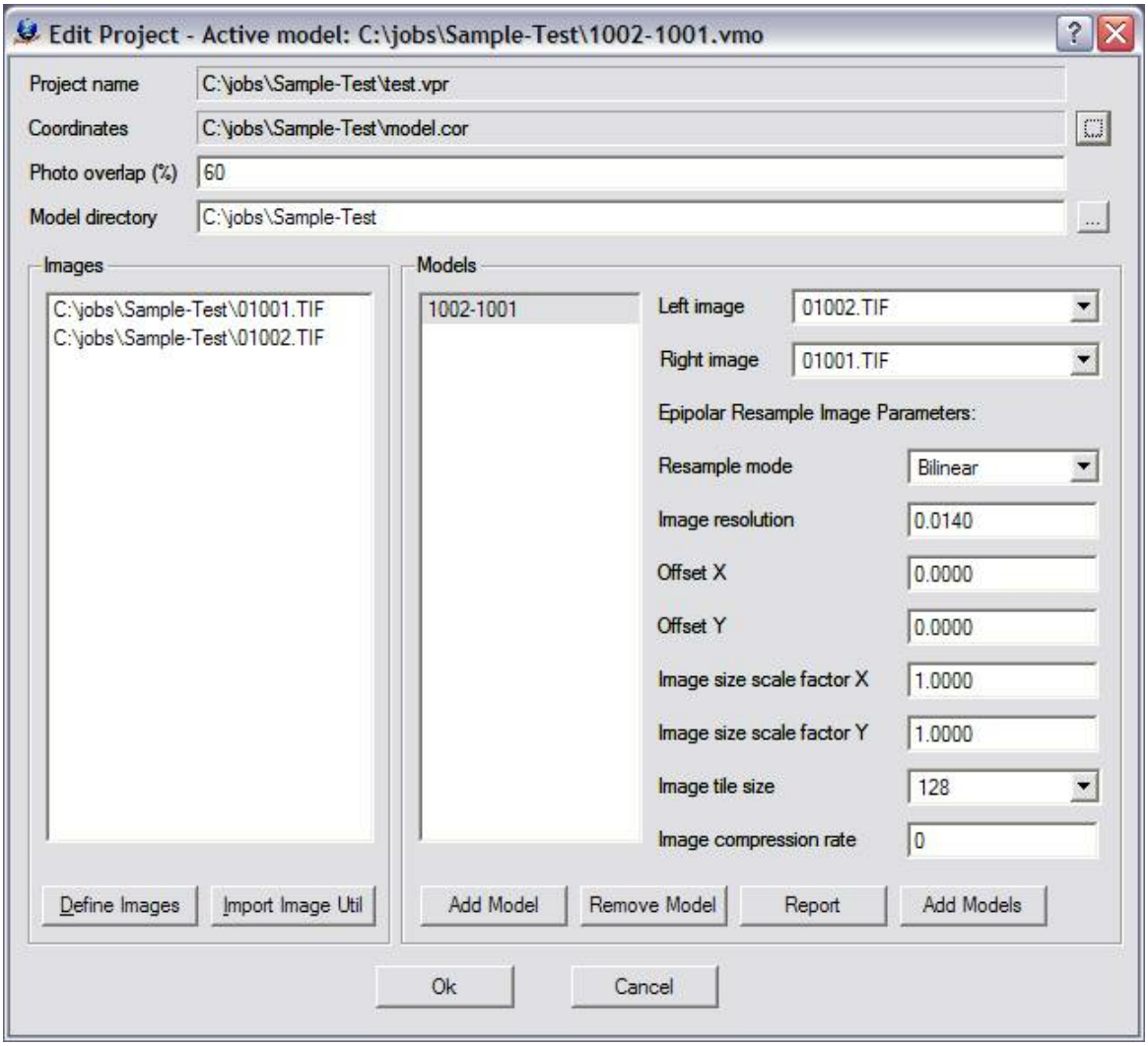


The Add Model dialog box



The Edit Project dialog box showing Model 1002-1001

Please see VrTwo Orientation - Project for more information.

Section 2 Importing Orientations

Importing Measurement Orientations Batch

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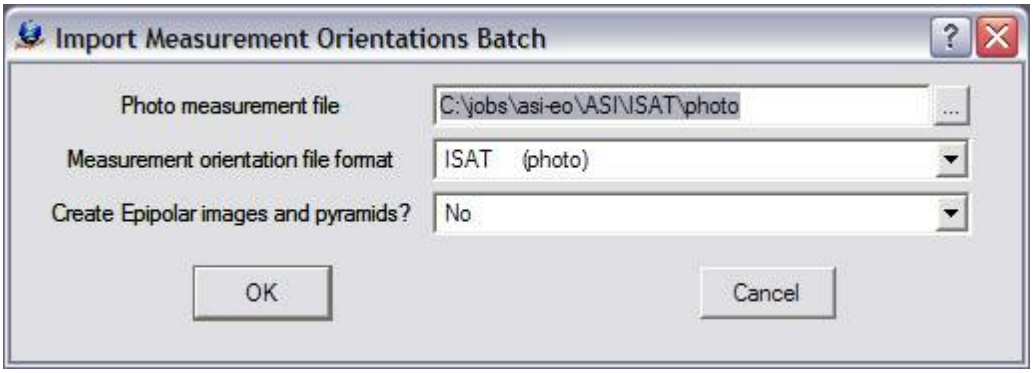
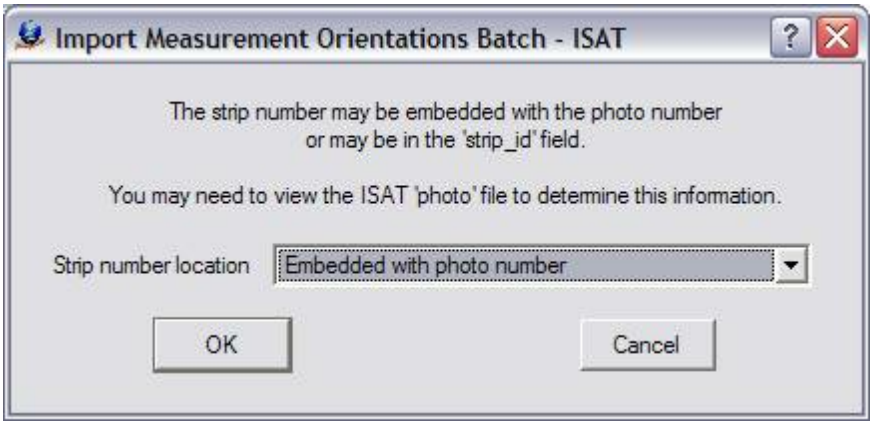
1. Select "Measurement Orientation Batch" from the "Import" dropdown menu.
2. Select the ISAT Photo File. Set the "Measurement orientation file format" to "ISAT (photo)"
3. Set "Create Epipolar Images and pyramids?" to "No".



4. **Select Strip Number Location** - Specifies whether the strip number is embedded with the photo name. Review the ISAT photo file to see if the strip number is embedded with the photo number. In the example below, the strip number is part of the photo name. For more information, please see the ISAT photo File format.

```
begin photo_measurements 01-02      strip_id 01 version 2.0
 21370307   -12.313744  -61.250663  -12.312909  -61.246508  1 85
 21370297   -3.3020941  -68.078501  -3.3018724  -68.073928  1 85
 21370317   -5.2376813  -75.449179  -5.2373545  -75.44447   1 85
 21370322   -14.481854  -68.898072  -14.480887  -68.89347   1 85
 21370344   -0.68857854 -82.631939  -0.68853523 -82.626727  1 85
```



5. **Set Strip Photo Separator** - Defines the file format of the image names and determines how the strip and photo number are parsed by VrTwo Orientation.

For more information, please see Photo Name Format.

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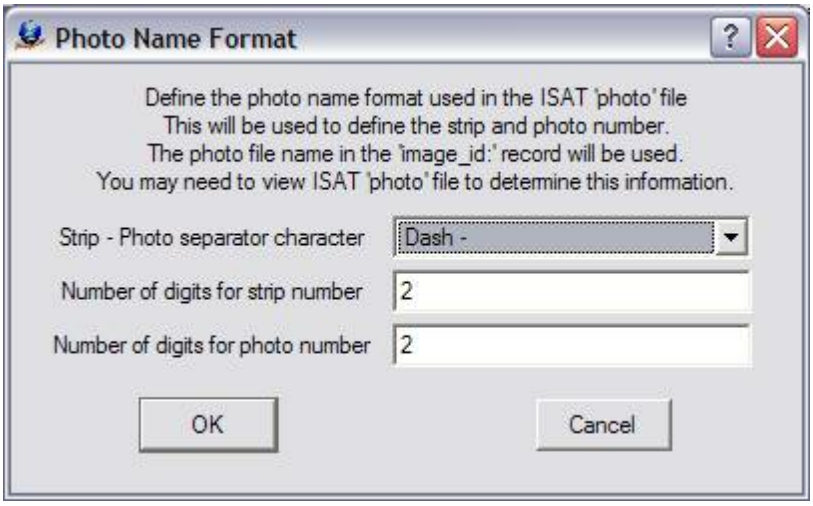
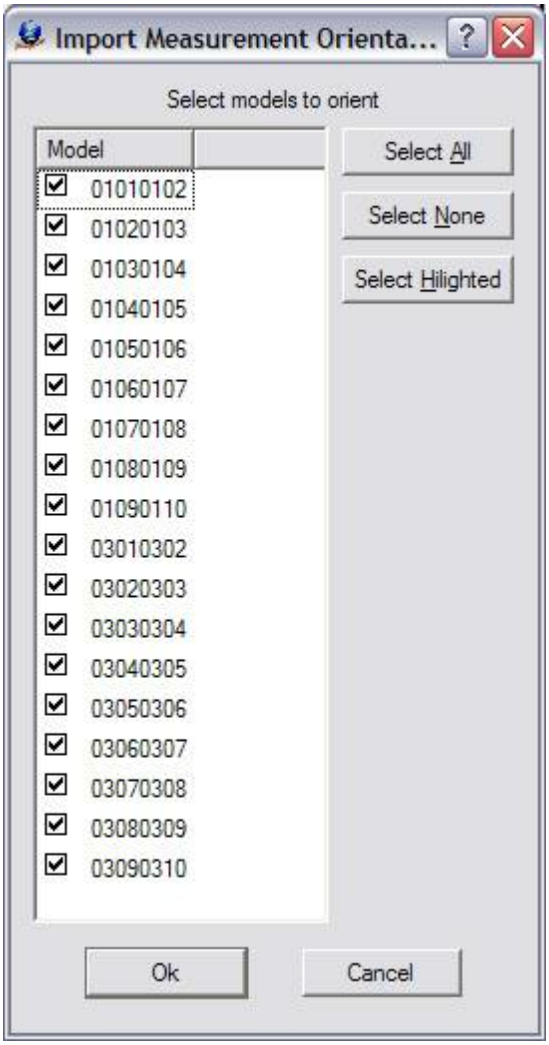


The Photo Name Format definition dialog box

6. Select models to orient then press "OK" to start the import process.



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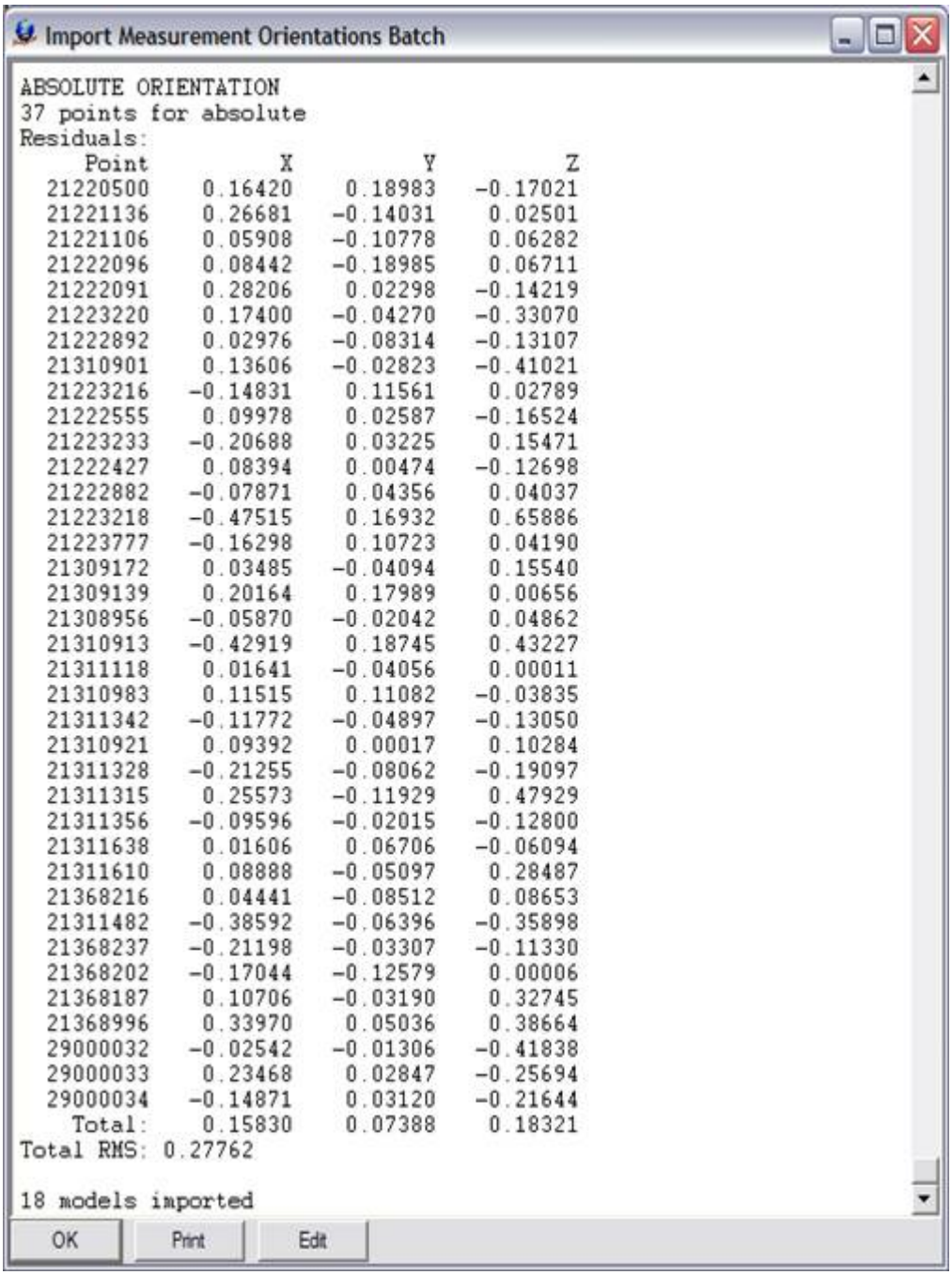
7. Review Import Results and Total RMS Values for Absolute and Relative Orientations. The Total RMS values should be reviewed to verify that the import was successful. When finished, click "OK" to continue.



8. Select "Create epipolar images batch" from the "Import" dropdown menu.

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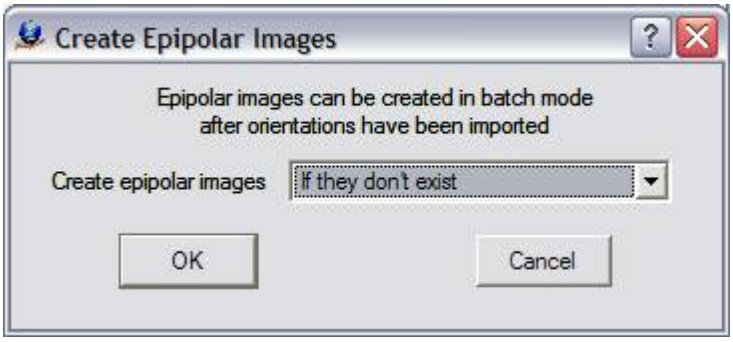
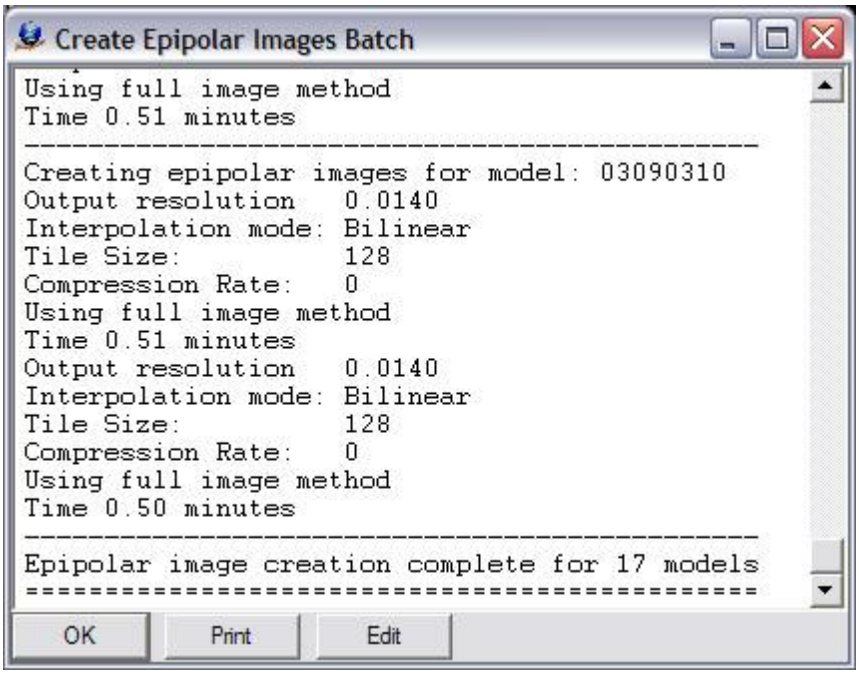


9. Click the OK button, then take a break while the epipolar images are being built.

10. Click the OK button again when the epipolar batch process is finished.



Section 3 Verifying Orientations (Optional)

1. Since measurements were imported, Relative and Absolute orientations may be viewed. This can be used to verify the locations of the control, pass, and tie points in the Stereo Model and visually inspect known ground control points for offset. To begin, select "Absolute orientation" from the "Orientation" dropdown menu.
2. Click the first point in the results main window. To toggle roaming, press the Keyboard Insert button.
3. To advance to the next point in orientation, press "Next point" (button 5). All visually identifiable ground control points can be verified using this method.

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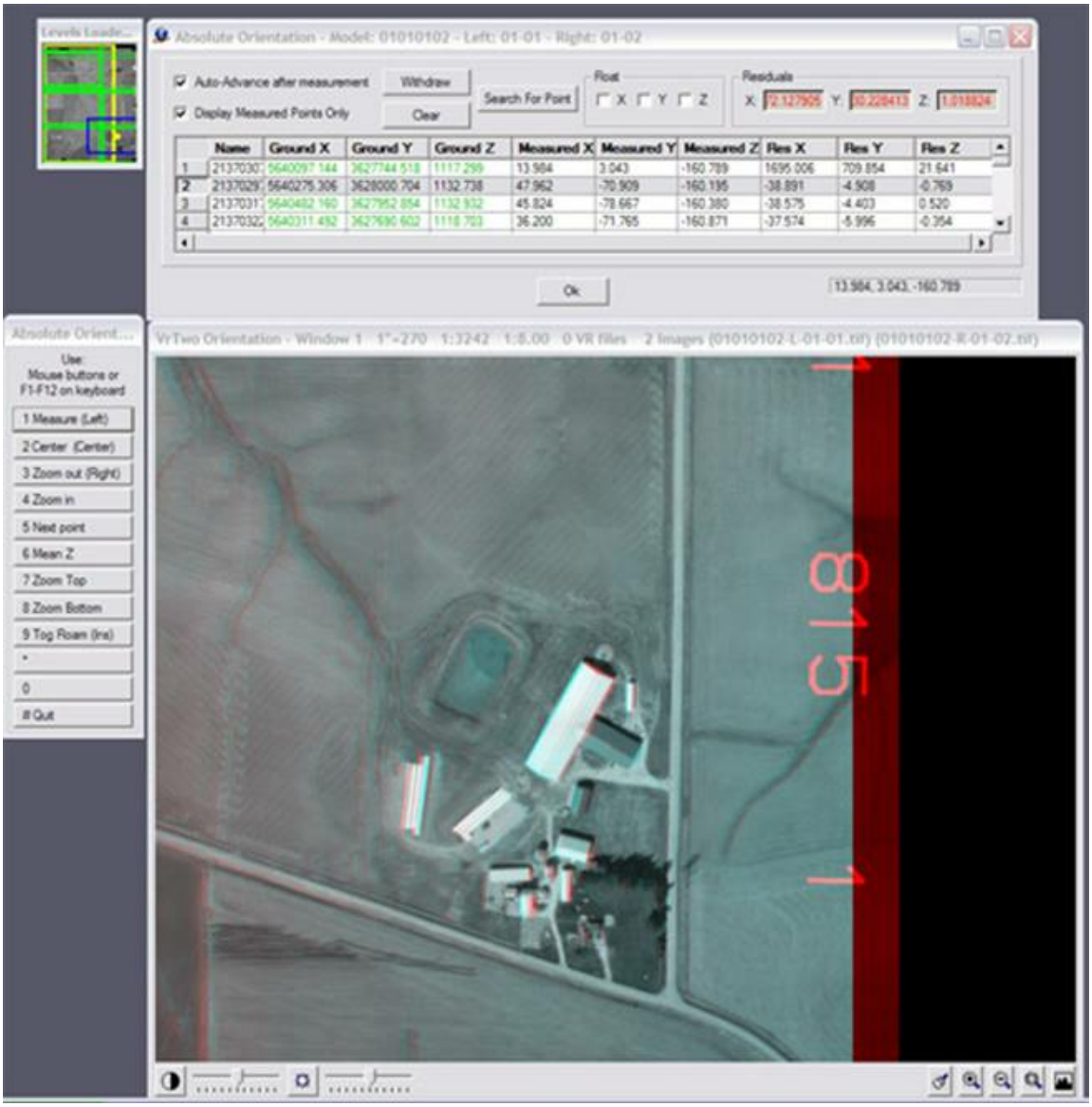

The VrTwo Orientation Absolute Orientation environment

Section 4 Opening Model in VrTwo

1. Start VrTwo from the Vr Mapping folder on the desktop by double clicking on the VrTwo icon.

2. Click on File -> Open Model or use the Open Model (OpeMod) command. Navigate to the location of the project folder by double clicking in the far left hand box.

3. Double click on the VrTwo Model (.vmo) file and press OK.

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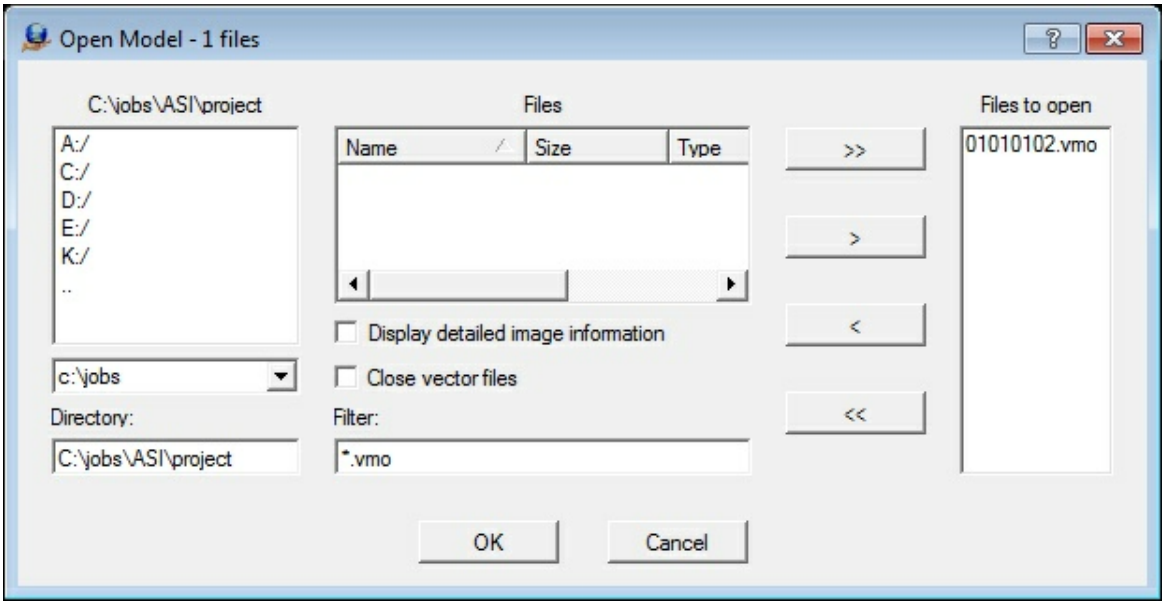

The Open Model dialog box

4. VrTwo will now generate pyramids for the epipolar images if they do not already exist.

5. Open a VrOne File by clicking on File -> Open Vr File or by using the Open VrOne File (OpeVr) command. Navigate to the project folder by double clicking in the far left hand box.

6. Double click on the VrOne (.vr) file.

The stereo model should open and the stereo model and vectors should be seen on the screen. If the stereo window does not show a stereo image and vectors try using the Drive Control (Cd) command. Typing "Cd 1" will drive to the first control point in the model. For more information please see the Getting started with VrOne/VrTwo tutorial which covers basics of data collection and editing.

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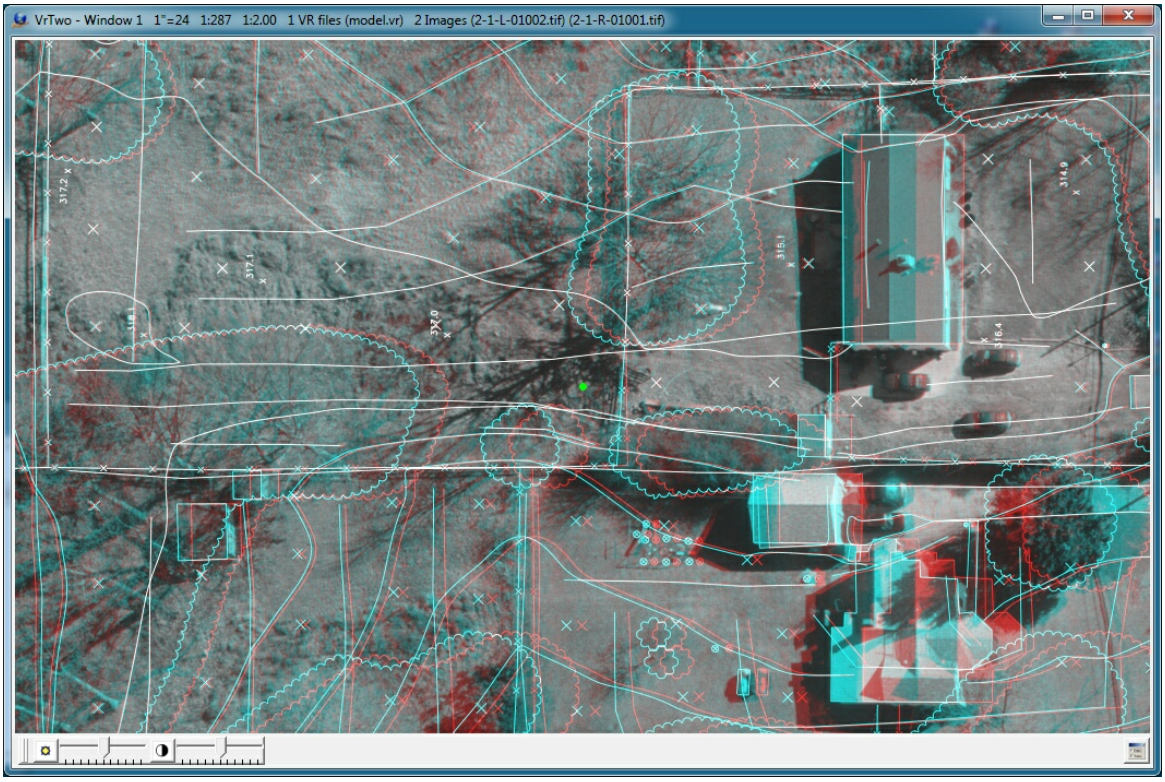

The VrTwo graphics window showing the stereo model (Anaglyph)

3.12 Tutorial ISAT Batch Model EO

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VrTwo Orientation - Batch Import of ISAT Exterior Orientations

VrTwo Orientation Tutorial describing the importing of Exterior Orientations using the ISAT parameter file in batch mode.

- Overview

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- Section 1 Project Setup
- Section 2 Importing Orientations
- Section 3 Opening Models in VrTwo

Overview

VrTwo Orientation creates stereo image pairs or models for viewing in the VrTwo and VrLite. Stereo models may be generated manually or by importing the results from various aerial triangulation programs. Orientations may be performed on a single model, or multiple models may be oriented in a batch mode. The importing of models from aerial triangulation may be performed from the exterior orientations or from the measurements used to tie images and strips together. This tutorial will address importing orientations for multiple models using the ISAT exterior orientation file.

Section 1 Project Setup

Creating or Editing the Camera File

New Camera (NewCam)

The New Camera function allows the user to create and edit a new camera calibration file. The user will be prompted for the file name for the new camera. Camera files in Vr Mapping have the .cam file name extension. See Edit Camera below for information on editing a camera file. Please note that this feature may not be required if a preexisting camera file is present.

Creating the Camera File

1. Click "Camera" then "New Camera" or "Edit Camera".

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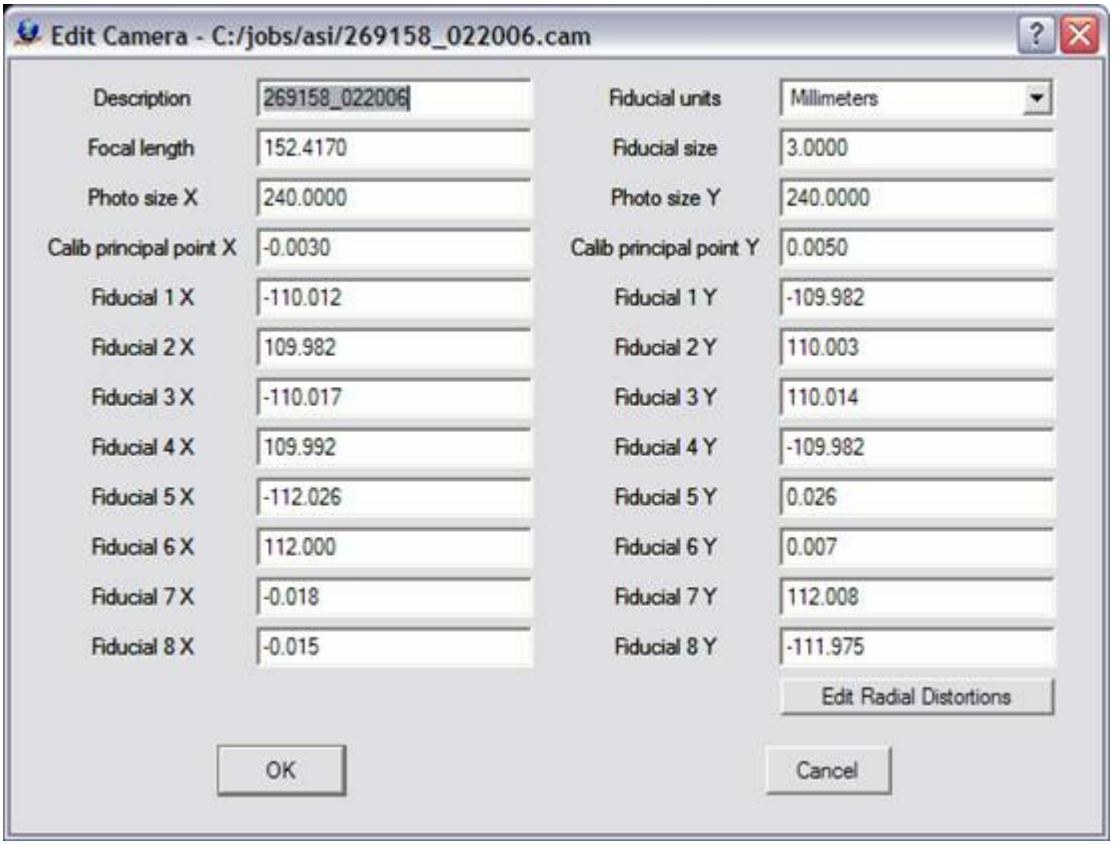

Please see Reference information for more information on the section.

Creating a Control File (NewCoo)

Create a new coordinate file if one does not exist. Click on "Coordinates" then "New Coordinate File".

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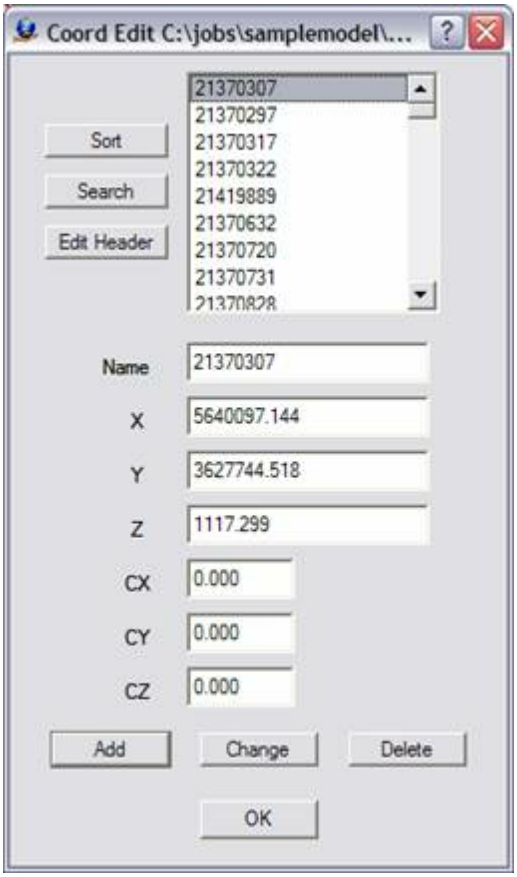

If a control file exists and contains the PointName X Y Z fields, it can be used directly by Vr Mapping programs. Simply rename the file by replacing the file postfix with .cor. For example, if a coordinate file named TheCoords.txt contained the PointName X Y Z fields, then it could be renamed TheCoords.cor and be used by VrTwo Orientation.

The following is an example of contents of a coordinate file compatible with Vr Mapping:

```
201    837831.194130    951352.037020    303.8200
202    836399.079330    951266.642540    337.6800
203    837994.618340    950634.951710    299.6000
204    836711.670600    950565.198920    326.3200
205    836018.411470    950724.804370    309.2900
```

The coordinate file comprises the point name followed by the X, Y and Z coordinates.

Creating or Editing the Project

The following steps are required to create the project:

1. **Create a New Project File** - Click on "Project", then "New Project" or "Edit Project".
2. **Add Coordinate File** - Click the button to the right of the “Coordinates” box to add the

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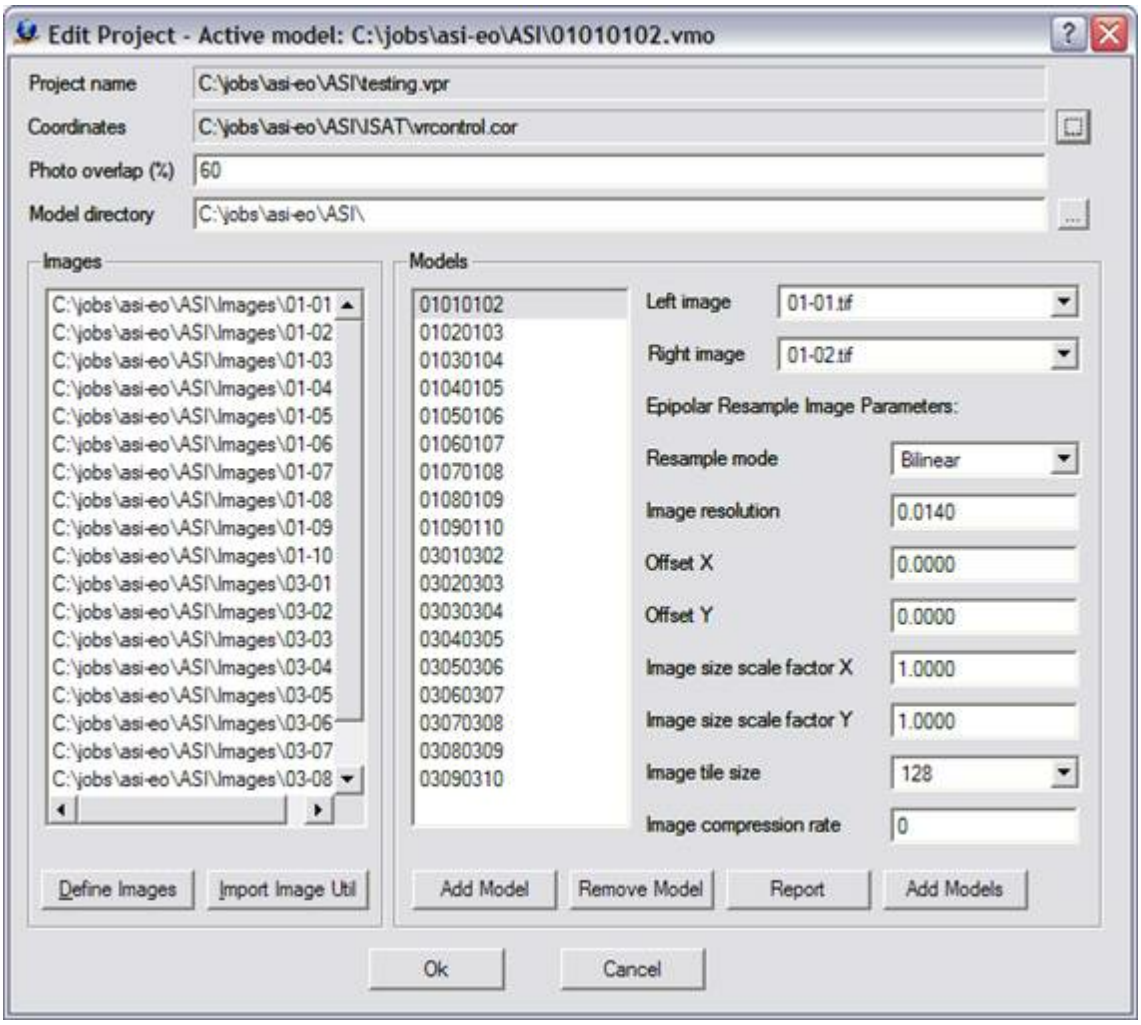
Coordinate file.



A example of the Edit Project dialog box.

3. **Define Images** - Click the "Define Images" button in the edit project dialog box. The "Edit Project - Define Images" dialog box allows definition of multiple image files. Each image file has a Photo Name Format, which are parameters that define the strip and photo number from an image file name. Strip direction, pixel size and the "Open In Layout" flag are also defined for each image. The top portion of the dialog box is a template of these parameters that may be copied to an image or group of images by selecting an image or dragging the cursor over a group of image rows then pressing the Apply button for that item.

4. Click on the "OK" button to return to the main project setup dialog box.

5. **Create Model Names** - Click the "add models" button to create models. Pressing this button allows the batch creation of the VrTwo Orientation model files. Model name format is used to set the parameters that define the strip and photo number from an image file name.

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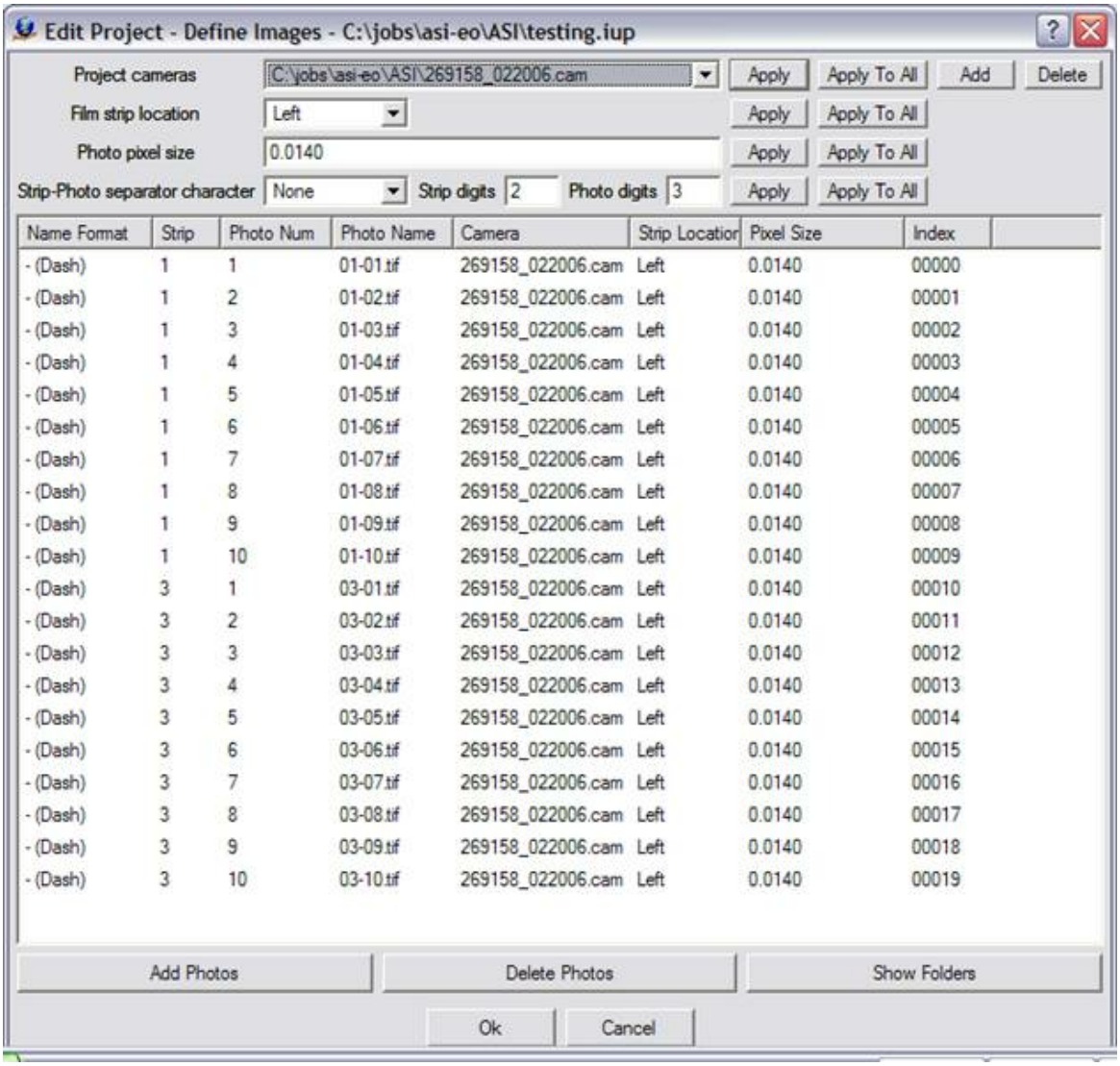
For more information, please see VrTwo Orientation - Photo Name Format.



A Example of the define images dialog box.

The following are descriptions of the parameters in the Edit Project - Define Images dialog box:

Project Camera

The Project cameras (.cam) files are assigned to individual images. Up to 10 camera files may be defined.

Film Strip Location

The film strip location defines the direction flight. For more information, please see VrTwo Orientation - Film Strip Direction.

Photo Pixel Size

The photo pixel size is in the same fiducial units (millimeters, inches, or pixels) as the Camera file. If this value is unknown, it can be computed after reading three points in Inner Orientation at the bottom left of the Interior Orientation window.

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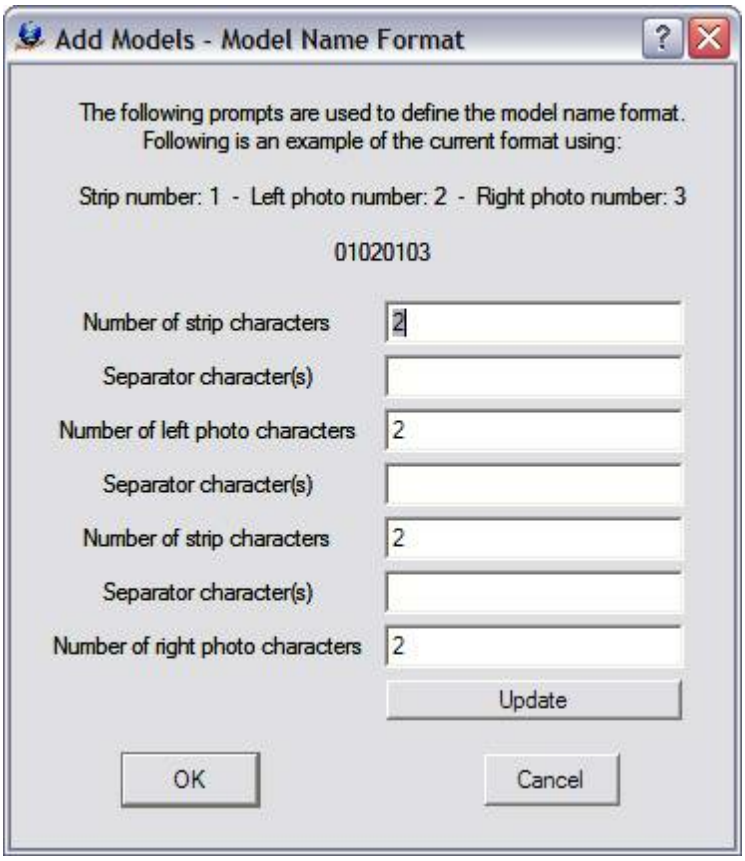
Add Photos
Adds images to the project.

Photo Name Format
Sets parameters that define the strip and photo numbers from an image file name. For more information, please see VrTwo Orientation - Photo Name Format.



6. Press "OK" when complete.

7. **Epipolar Resampling Parameters** - Enter the epipolar resampling parameters for the batch configuration of all models. See VrTwo Orientation for more information on epipolar resampling methods.

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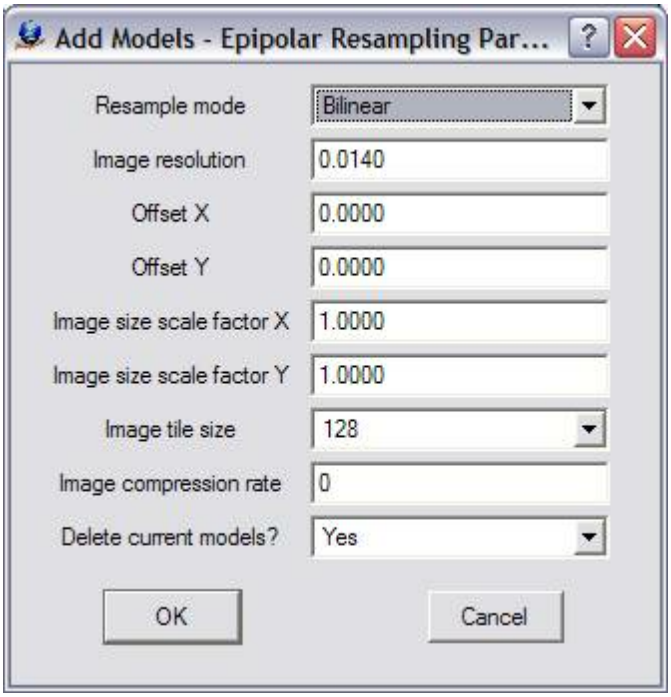
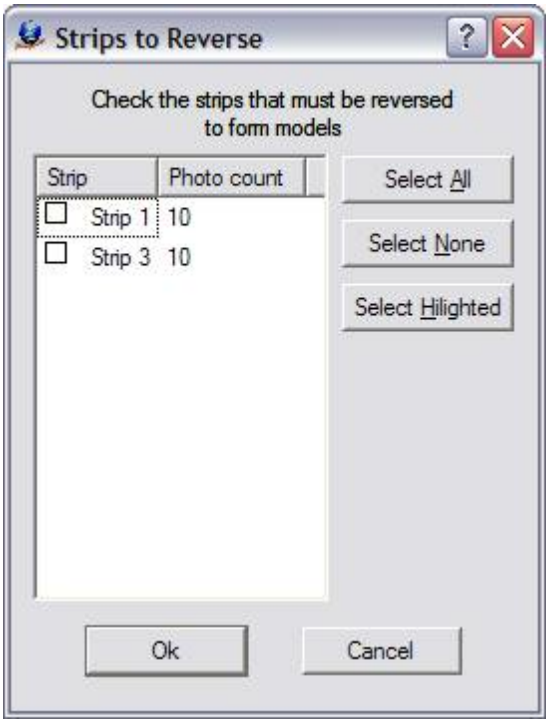


8. **Select Strip Reversal** - If a strip is checked, its measurements are rotated 180 degrees from their original orientation. This may be required for a strip whose Strip Location is to the right.



9. Click "OK" to start the model generation process.

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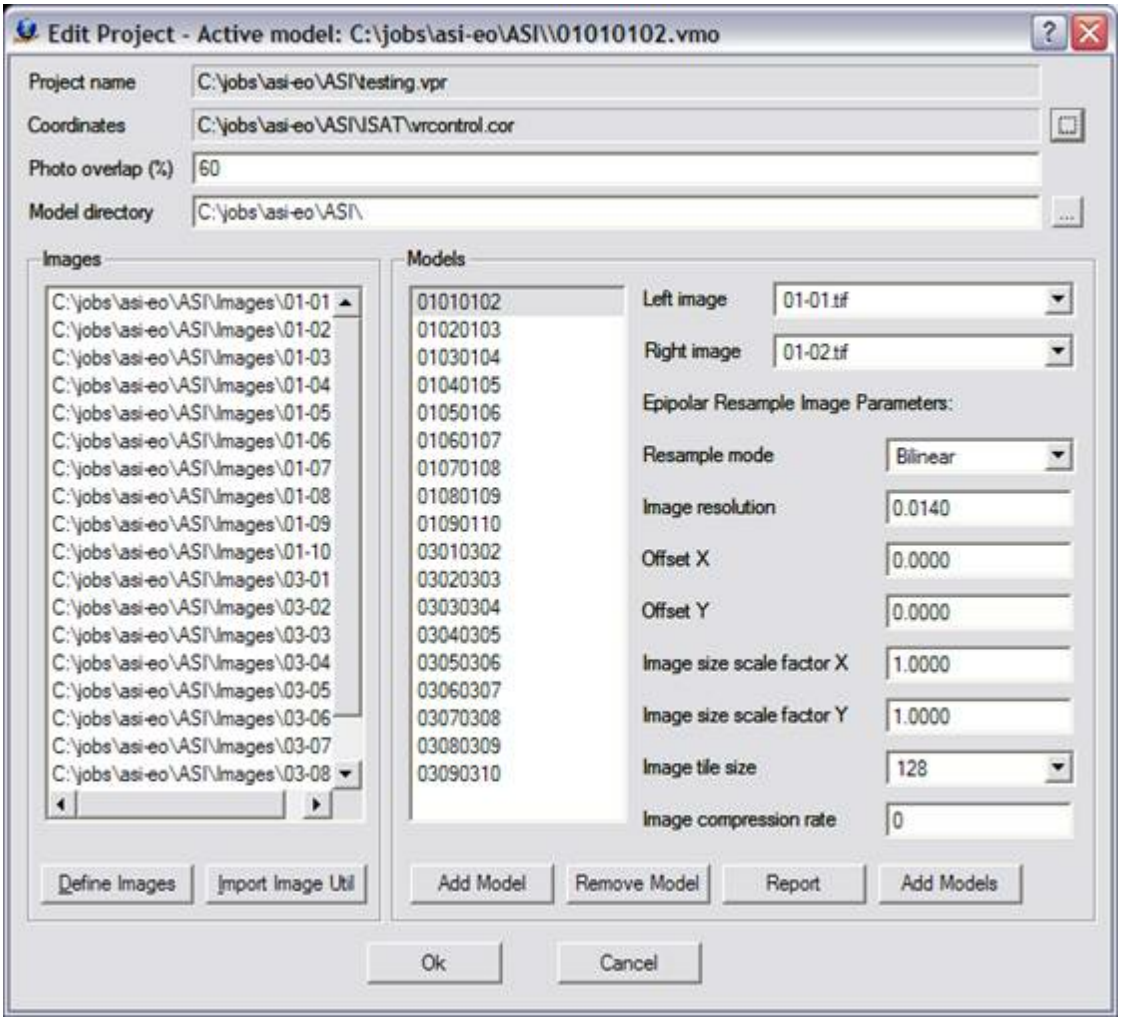

Section 2 Importing Orientations

Importing Interior Orientations in Batch Mode

1. Click Import -> Import Interior Orientations Batch from the VrTwo Orientation main window.
2. Select the ISAT photo file name and Interior Orientation file format.

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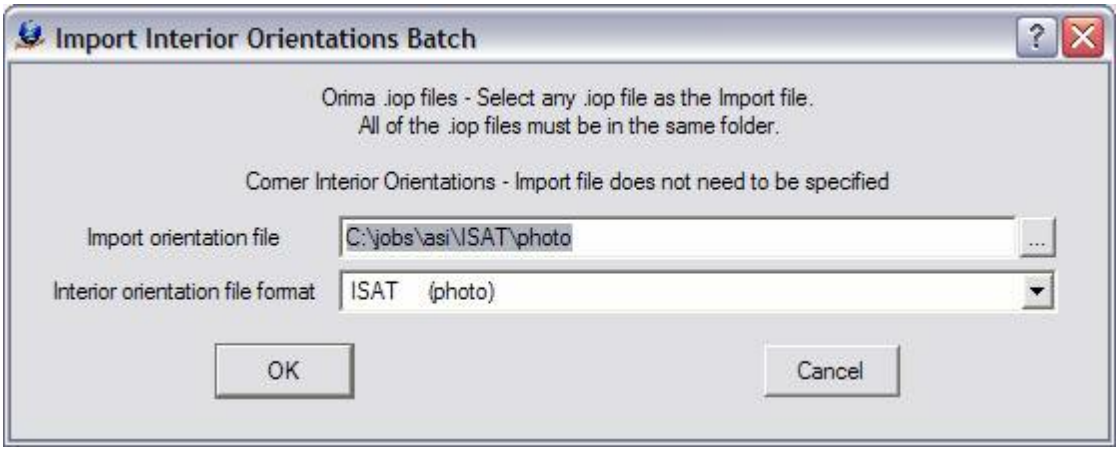
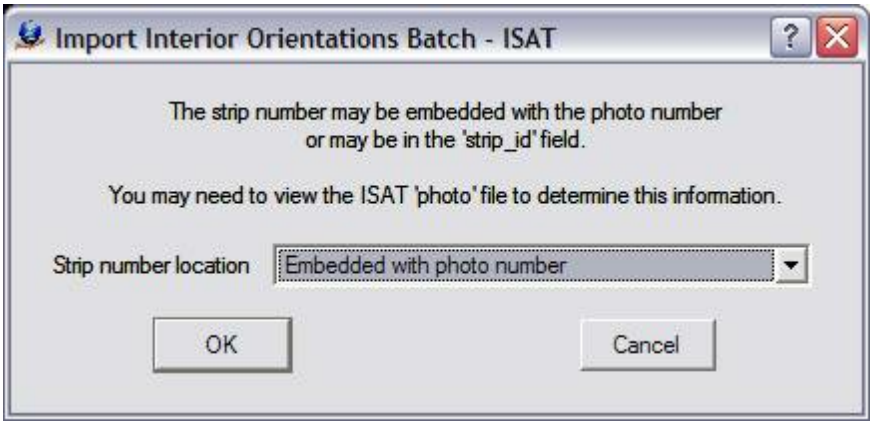


Import Orientation File
Defines the ISAT parameter file name that contains the orientation parameters. This file is normally named "photo".

Interior Orientation File Format
Defines the input format. Should be "ISAT (photo)".

3. Select the strip number location, which defines the location of the strip number in the "photo" file. Review the ISAT photo file to see how the strip number is encoded. It may be encoded within the photo name after the "photo_measurements" keyword. Alternately, it may follow the "strip_id" keyword. In the example below, the strip number is part of the photo name. For more information, see ISAT Photo File Format.

```
begin photo_measurements 01-02   strip_id 01    version 2.0
 21370307     -12.313744    -61.250663   -12.312909    -61.246508    1 85
 21370297     -3.3020941    -68.078501   -3.3018724    -68.073928    1 85
 21370317     -5.2376813    -75.449179   -5.2373545    -75.44447     1 85
 21370322     -14.481854    -68.898072   -14.480887    -68.89347     1 85
 21370344     -0.68857854   -82.631939   -0.68853523   -82.626727    1 85
```



Defining the location of the strip number in the "photo" file

4. **Set Strip Photo Separator** - This defines the file format of the image names and how the

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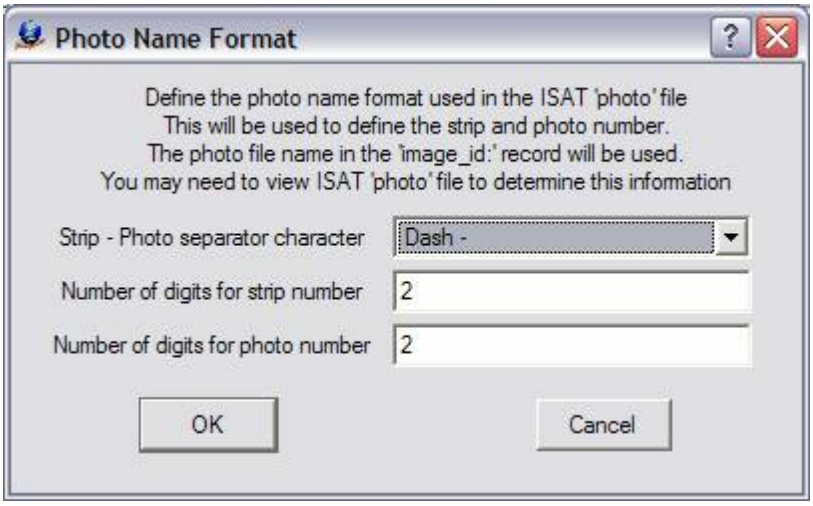
strip and photo number are parsed by VrTwo Orientation. The Photo Name Format dialog will be displayed if the strip number location is set to "Embedded with photo number" in the previous prompt. For more information see Photo Name Format.



5. Press "OK" to advance to the next step.

6. **Select Photos To Import** - Sets the photos to be used in the Interior orientation.

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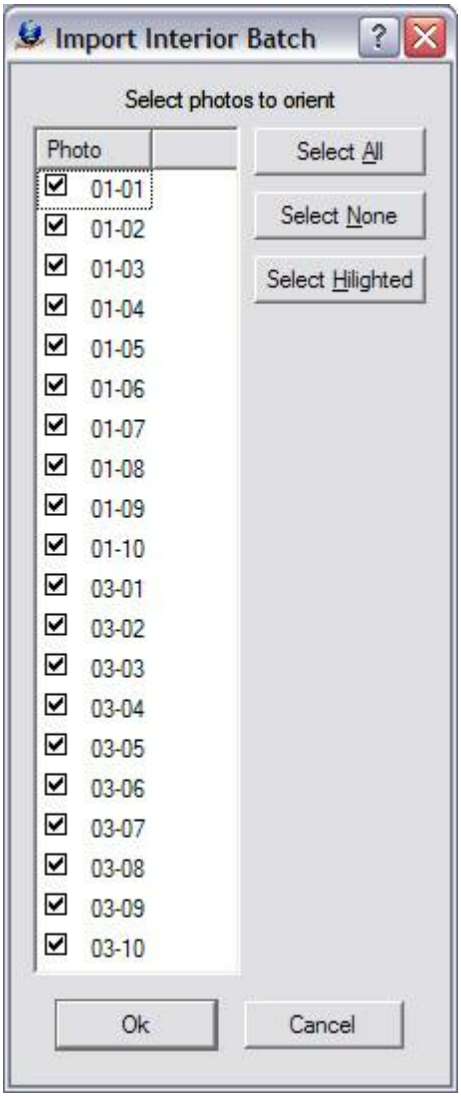

7. **Select Strip Reversal** - If a strip is checked, its measurements are rotated 180 degrees from their original orientation. This may be necessary for any strip whose Strip Location is to the right.

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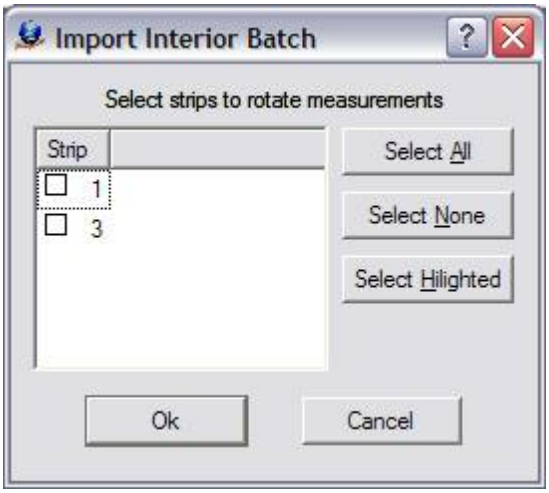
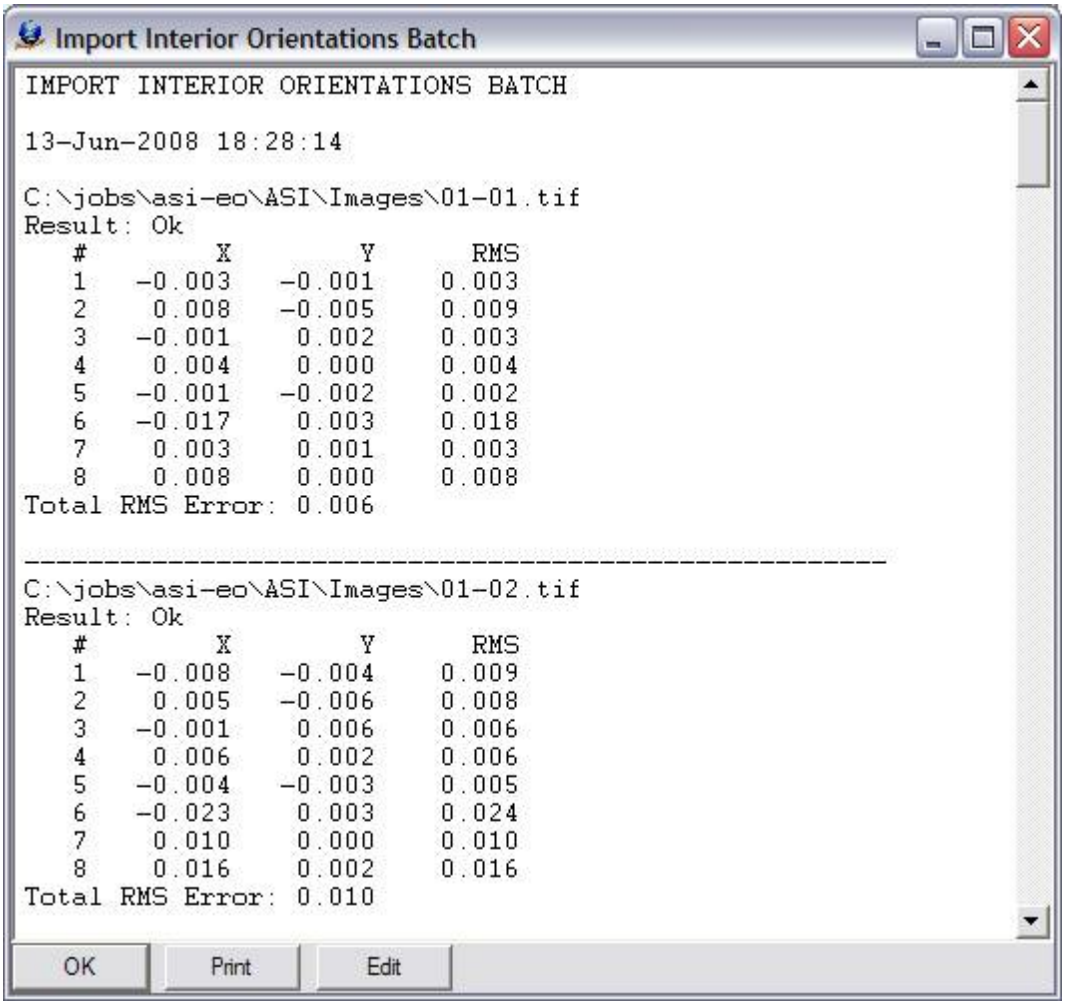


8. Start the Import by clicking "OK". Results and residuals will be presented as shown below.



Importing Exterior Orientations Batch

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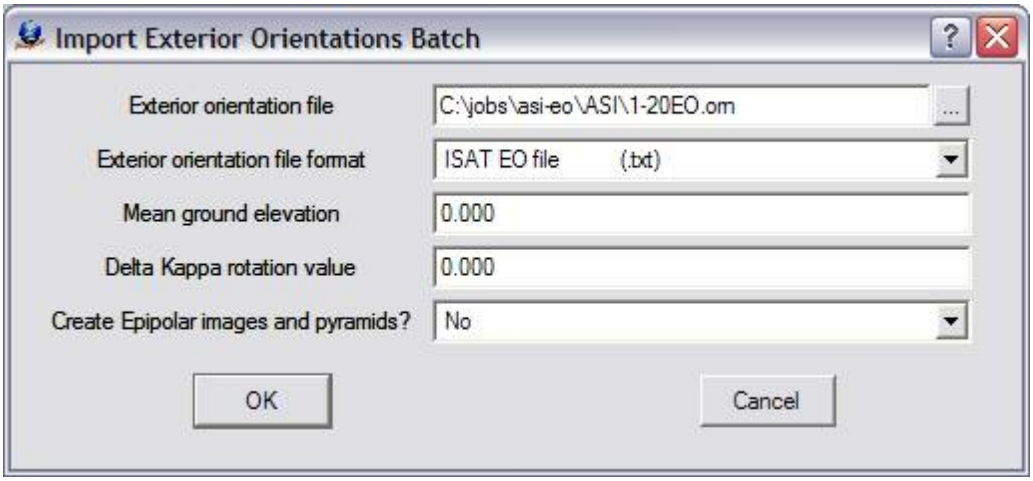
1. Click Import -> Exterior Orientation Batch.
2. Select Exterior Orientation File Format -> ISAT photo file, or ISAT EO file (.txt).
3. Select the Exterior orientation file or ISAT photo file .



Mean Model Ground Elevation
Defines the average ground elevation of the model or job. This value may be approximate.

Delta Kappa Rotation Value
Some situations require a rotation angle to be added to the Kappa (rotation about the Z axis) value in the exterior orientation file. This action is required if the images were rotated from their original positions. It is suggested that an angle of zero is first attempted. If the import does not produce a viewable stereo model, an import with a rotation value of 180 should be performed. The possible rotation values are 0, 90, 180 and 270 degrees.

4. **Select Strip Number Location** - Specifies whether the strip number is embedded within the photo name. Review the ISAT EO file to see if the strip number is embedded within the photo number.

```
1       01 863230.000000 386737.000000   4228.000000      0.000000      0.000000
1       02 863240.735165 386879.525737   4209.111350      0.202415     -0.935304
1       03 862429.391346 386476.275096   4221.006168     -0.398444     -0.795670
1       04 861603.826122 386093.443243   4225.211811     -1.267587     -1.013214
1       05 860778.552256 385723.782038   4211.906057     -0.938446     -1.254254
```

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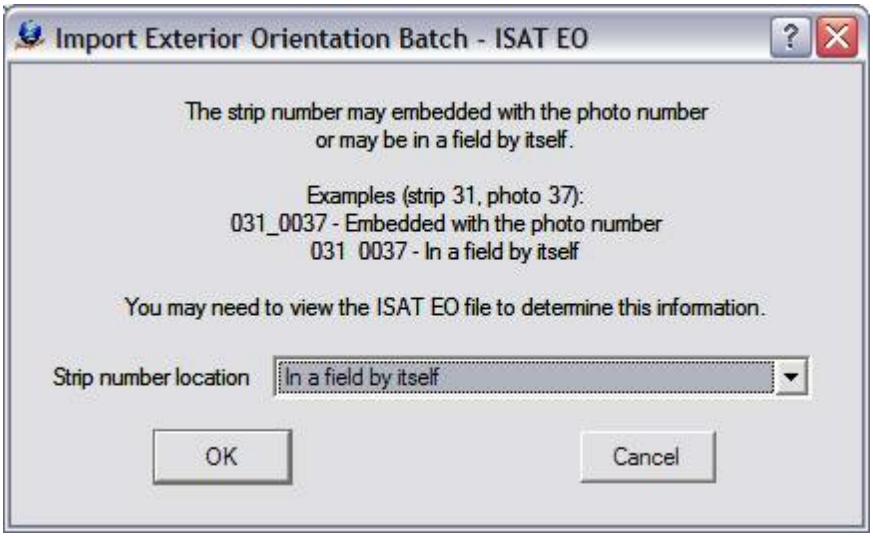
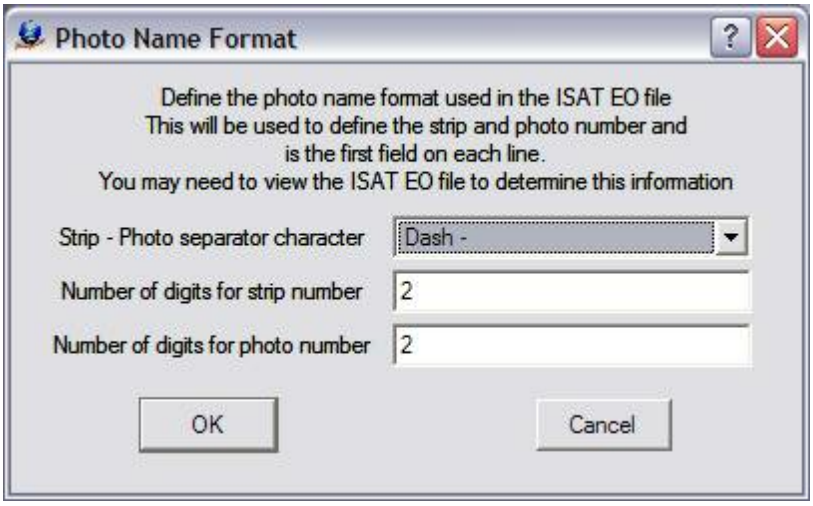


5. Set Strip Photo Separator - Defines the file format of the image names and specifies how the strip and photo number are parsed by VrTwo Orientation.

For more information, please see Photo Name Format.



The Photo Name Format definition dialog box

6. Select models to orient then press "OK" to start the import process.

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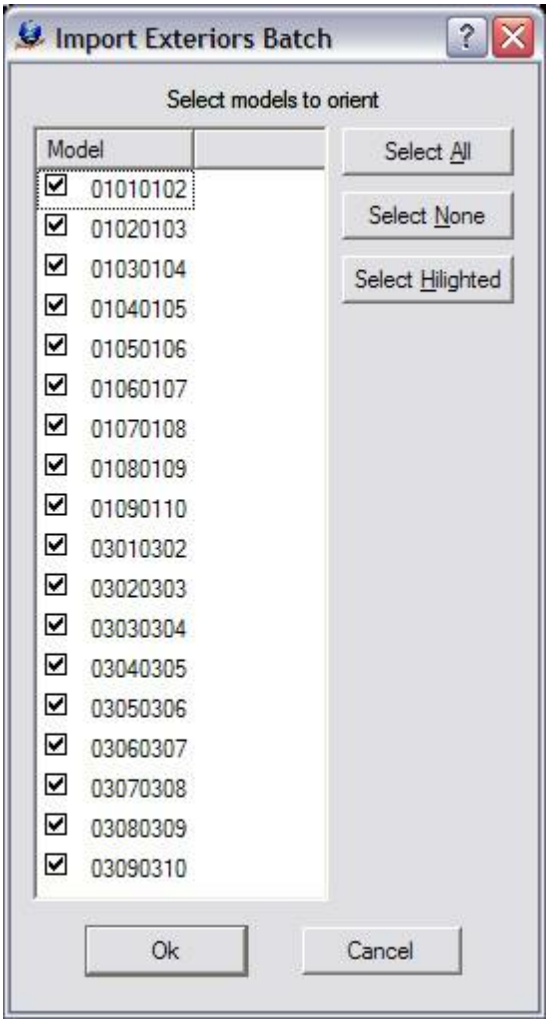

7. Review import results and total RMS values for Absolute and Relative orientations. The total RMS values should be reviewed to verify that the import was successful. When finished, click "OK" to continue.

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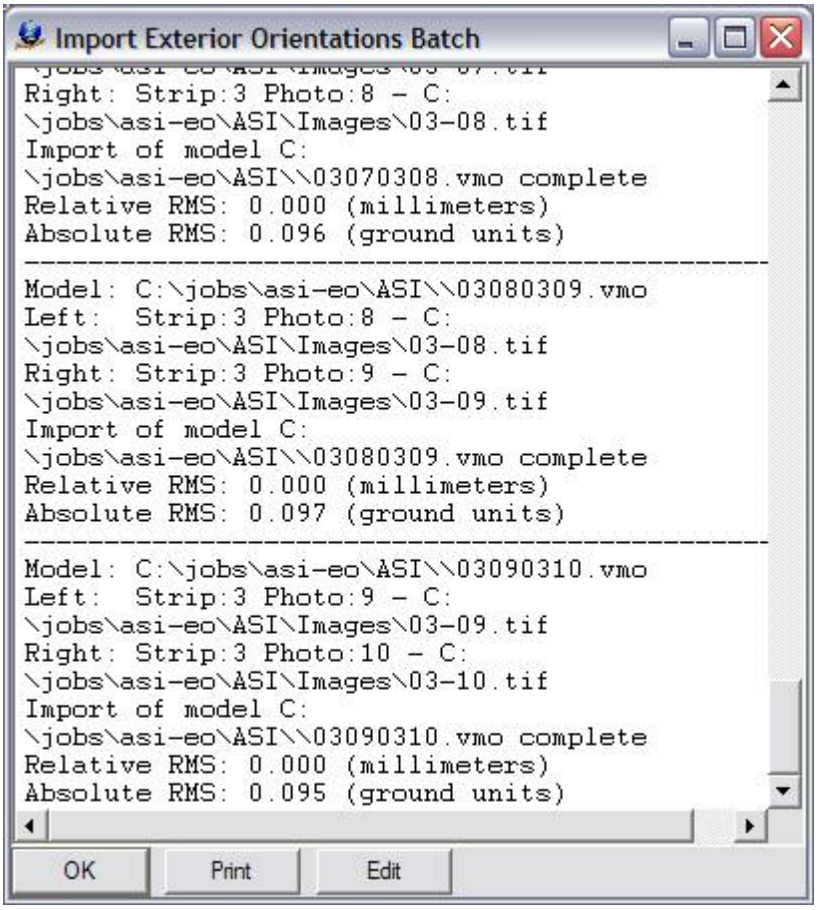
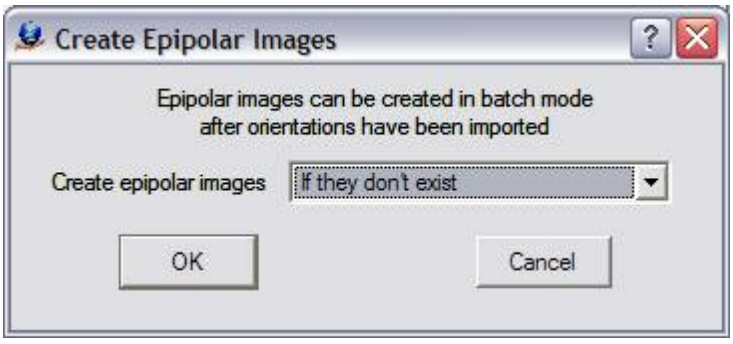


8. Click on Import -> Create epipolar images batch.



9. Click "OK". The process can be lengthy, so feel free to take a break while the epipolar images are being built.

10. Click "OK" again when the epipolar batch process is finished.

Section 3 Opening Models in VrTwo

1. Start VrTwo.

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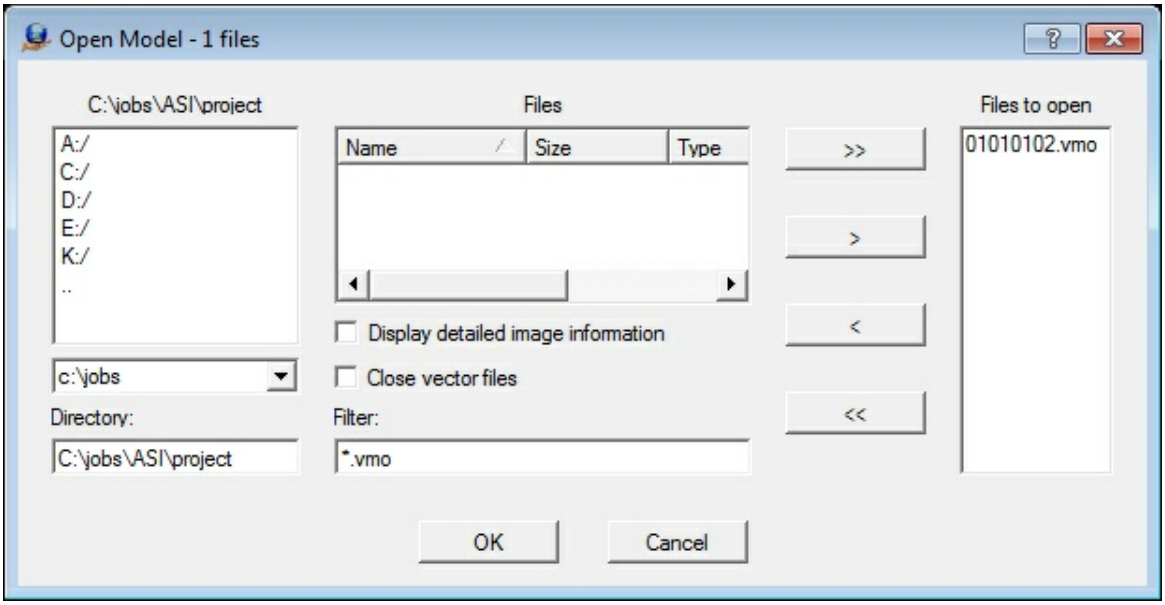
2. Click on File -> Open Model or use the Open Model (OpeMod) command. Navigate to the location of the project folder by double clicking the far left hand box.

3. Double click on the VrTwo Model (.vmo) file and press "OK".



The Open Model dialog box

4. VrTwo will now generate pyramids for the epipolar images if they do not already exist.

5. Open a VrOne File by clicking on File -> Open Vr File or by using the Open VrOne File (OpeVr) command. Navigate to the project folder by double clicking the far left hand box.

6. Double click the VrOne (.vr) file.

The stereo model should open and the stereo model and vectors should be seen on the screen. If the stereo window does not show a stereo image and vectors, try using the Drive Control (Cd) command. Typing "Cd 1" will drive to the first control point in the model. For more information, please see the Getting started with VrOne/VrTwo tutorial, which covers basics of data collection and editing.

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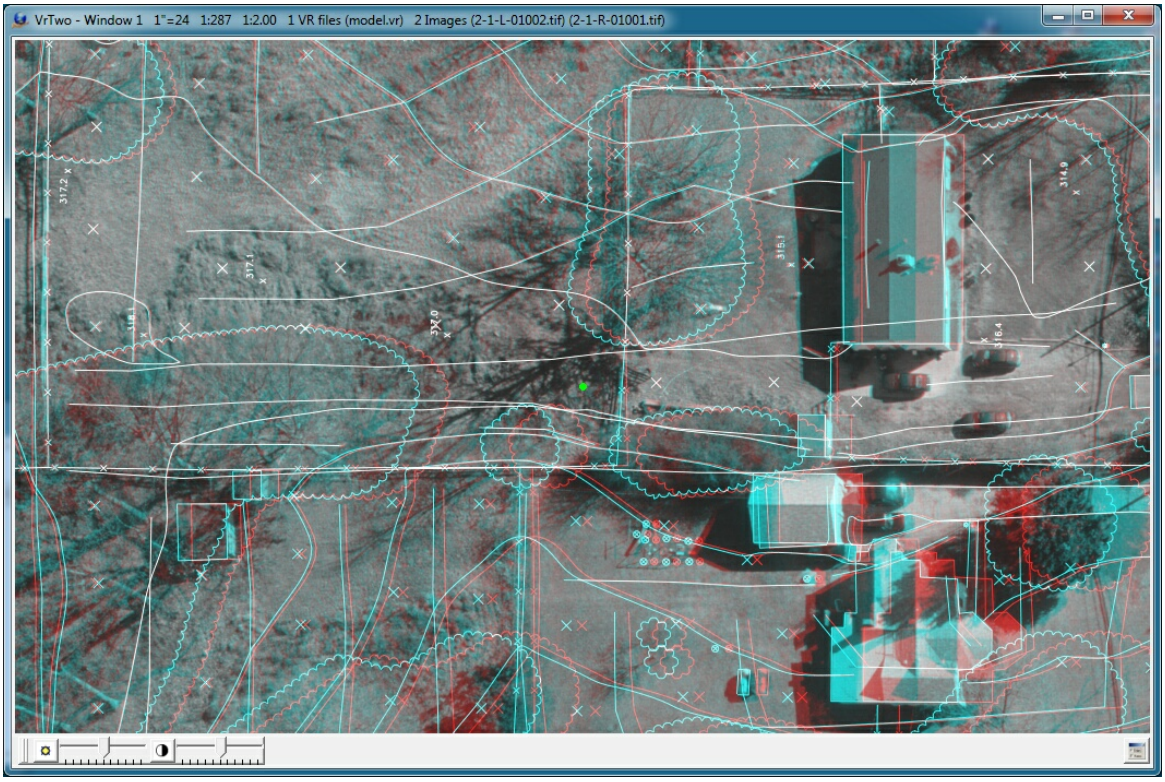

The VrTwo graphics window showing the stereo model (Anaglyph)

3.13 Tutorial Make Polygons Video

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Make Polygons Video

This video tutorial demonstrates using Make Polygons on a small sample data set. This is best viewed with your browser in full screen mode (F11 in most browsers).

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3.14 Tutorial Function Keys

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Vr Mapping

Function Keys

"The art of mapping is the art of organizing complexity."
- Anonymous

Function keys are the most important aspect of VrOne data collection. Taking the time to properly set up function keys before starting a project saves hundreds of hours of production time.

Function keys make a mapping system out of a CADD system. Instead of using Insert Line (InsLin) to place a road, an operator can use a mapping key such as PavedRoad. PavedRoad will assign all the desired parameters and behavior to Insert Line.

Function keys reduce the amount a mapping professional needs to know about VrOne. They simply choose the feature they want to collect and go.

Function keys are named. These names may be keyed in, placed in macros, or nested in other function keys.

The name of the function key file to use must be set in the VrOne configuration program (vrcfig). It is possible to have multiple function key files but only one can be active at a time.

Creating and Editing Function Keys

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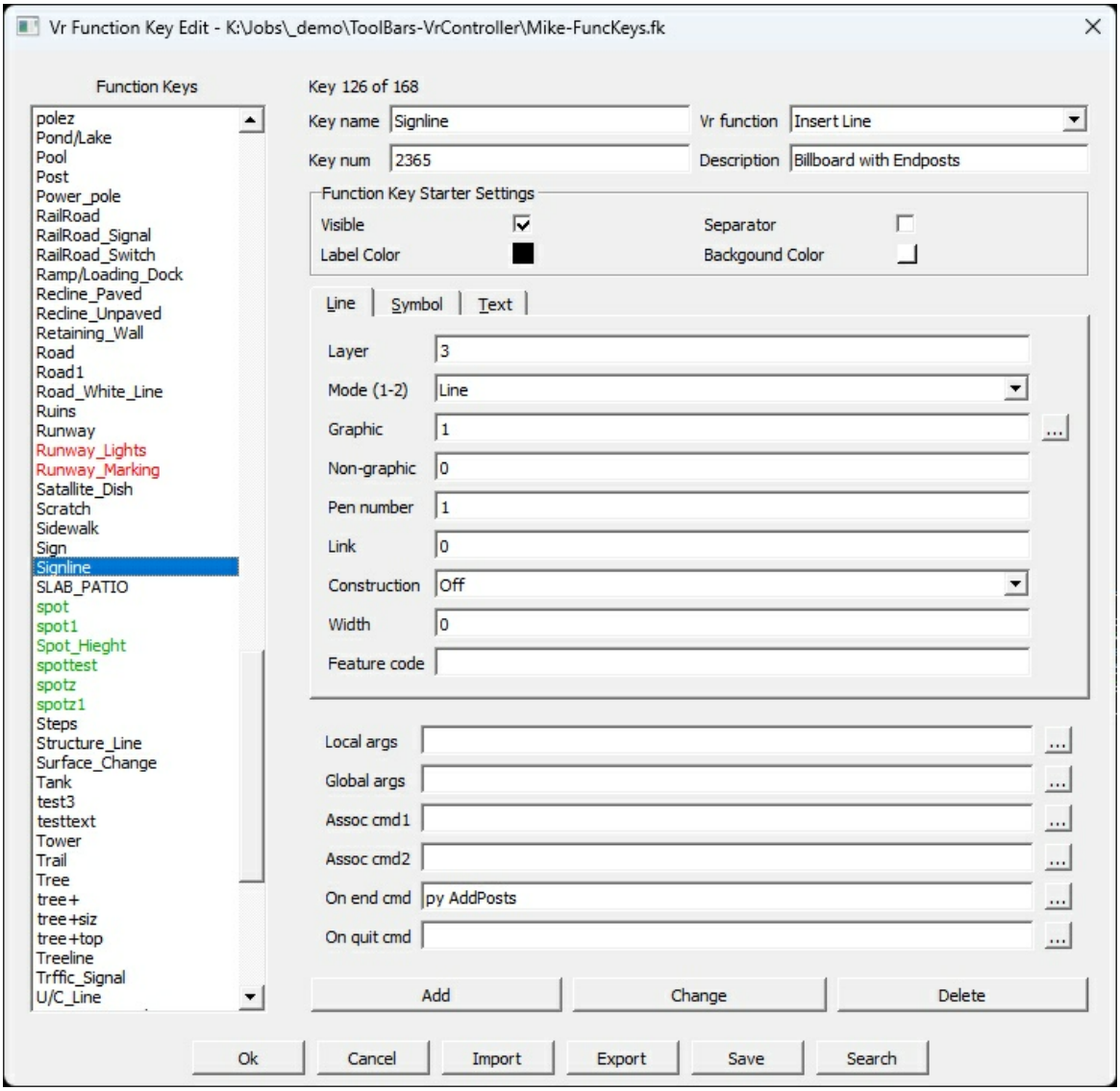

In the above dialog box, a function key called Spot1 is being created. This Function Key will place the 'X' symbol in layer 2 then will start the SpotZ1 Function Key which will place the spot elevation as a text label next to the 'X' symbol.

Function Keys

Lists the currently defined function keys. The parameters of a selected key are displayed to the right. If multiple keys are selected, the function key starter settings can be applied to all of the selected keys.

Key name

The reference name of the function key. This name may be keyed in, placed in a macro, or nested in another function key.

Vr function

The VrOne application to start when the key is executed. The proper Line, Symbol or Text tab will be selected depending on the type of VrOne command selected.

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Key num
The reference number of the function key. This number may be keyed in, placed in a macro, or nested in another function key.

Description
Function key description. This is for user information only.

Function key starter settings
The items in this section control the display of the labels in the function key starter dialog.

Line Tab
Line parameters that are assigned when the function key is executed.

Symbol Tab
Symbol parameters that are assigned when the function key is executed.

Text Tab
Text parameters that are assigned when the function key is executed.

Local Args
These commands are executed when the function key is started. Normally, local commands are placed here. For example, if the Insert Symbol command is started by a key and the symbol rotation needs to be turned on, ROTMODE=1 would be entered on the Arguments line. Multiple commands, each separated by a comma, may be entered.

Global Args
These commands are executed when the function key is started and when the function key is woken up after being overlaid. Normally, global commands are place here.

For example, consider the state of a global command such as snap:

- Contour is started and it sets snap to end point (SnaEnd).
- Drive overlays Contour and sets snap to intersect (SnaInt).
- Drive is terminated and Contour wakes up and becomes active.
- Since snap is global, the state is snap is now intersect. This is a state that Contour did not intend.

Placing SnaEnd in the Wake up command of Contour ensures the state of this global parameter is what is expected.

Assoc cmd1 and cmd2

Associate commands allow function keys to be linked. In many cases, there may be several function keys used to insert a certain map feature. One might put in a line and another may put in text.

For example, consider inserting a parking area. The parking lot comprises a line that will define the parking edge and a text label of "Parking Area". There are two function keys defined:

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ParkLine and ParkText. The associate command 1 of ParkLine has be set to ParkText as follows:

```
Assoc cmd1    Park Text
```

- ParkLine is started and the parking lot edge is collected.
- Ac1 is keyed in and the ParkText starts and “Parking Area” is labeled.
- ParkText is terminated and ParkLine continues collecting the parking lot edge.

On end cmd

The on-end command allows one function key to execute a key-in, macro, or another function key each time an entity is saved.

For example, consider a spot elevation. This feature consists of a symbol and a text label. There are two function keys defined as follows:

SpotX	Places the spot elevation X.
SpotElev	Places the elevation of the previously read symbol.

The On end command of SpotElev is set as follows:

```
On end cmd    SpotText
```

When the spot elevation symbol is placed, the On end command will start Spot Text.

The On end command of SpotText is set as follows:

```
On end cmd    Pop
```

The Pop command tells VrOne to terminate the current application (command) that is at the top of the application stack.

- SpotElev is started and the spot elevation location is digitized.
- SpotText starts automatically and the elevation of the first point is labeled.
- SpotText terminates due to the On end Pop statement
- SpotElev wakes up and the next spot elevation is ready to be read.

There are more parameters that would need to be set to make the spot elevation functions keys work as expected but the above example shows how to chain function keys together. See Tutorial On End Command for example uses of the On End Command.

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On quit cmd

The on-quit command allows one function key to execute a key-in, macro, or another function key when the function key is ended.

Import

The import button is used to import the function key definitions from a comma-delimited file. These files typically have a .csv extension.

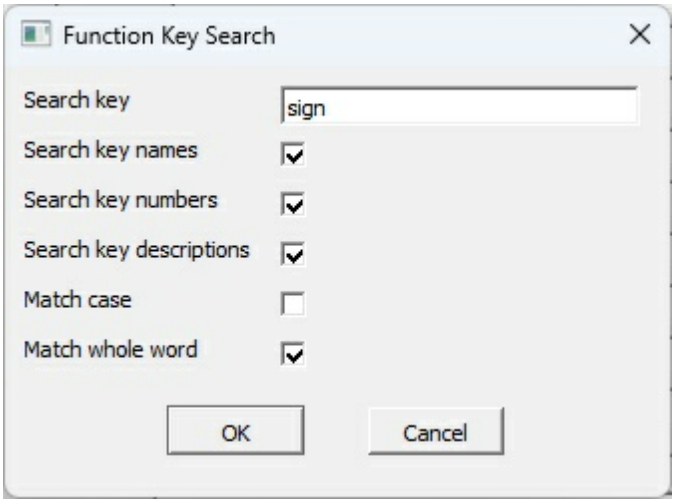
Export

The export button is used to export the function key definitions to a comma-delimited file, typically with a .csv extension. This file can be edited with a text editor or spreadsheet and then imported back in.

Save

Saves the current Function Keys to the current Function Keys file.

Search



The Edit Function Keys Search Dialog

Searches for user defined text in the Function Keys Names, Function Key Numbers, and(or) the Function Keys Descriptions. Searching starts at key names and then considers key numbers and then key descriptions if they are checked. When a match if found, that Function Key is displayed and its name is highlighted in the Function Keys name pane in the dialog.

- **Search key** - The text string to search for
- **Search key names** - If checked the Function Key Names will be searched.
- **Search key numbers** - If checked, the Function Key Numbers will be searched. The Search key must be a numeric value to search for a Function Key Number.

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- **Search key descriptions** - If checked, the Function Key Numbers will be searched.
- **Match case** - If checked, then the search is case sensitive. The upper and lower case characters in the Search key must match exactly.
- **Match whole word** - If checked, a whole word is searched for. For example if the Search key is 'sign' and this parameter is unchecked then the word 'sign pole' and 'signpole' would qualify with the first occurrence being used. If this parameter is checked then only 'sign pole' would qualify.

3.15 Tutorial On End Command

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
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On End Command Example

Detailed Description

A VrOne Function Key has the option of executing a key-in, macro and (or) another Function Key each time an entity is saved. Following are several examples for the use of the On End Command:

- Example 1 - Place a spot elevation consisting of an ‘X’ and a text elevation label. The text label is placed interactively.
- Example 2 - Place a spot elevation consisting of an ‘X’ and a text elevation label. The text label is placed automatically.
- Example 3 - Place a manhole symbol, the text "MH" and the manhole elevation. The text labels is placed interactively.
- Example 4 - Place a manhole symbol, the text "MH" and the manhole elevation. The text labels is placed automatically.

Example 1

Place a spot elevation consisting of an ‘X’ and a text

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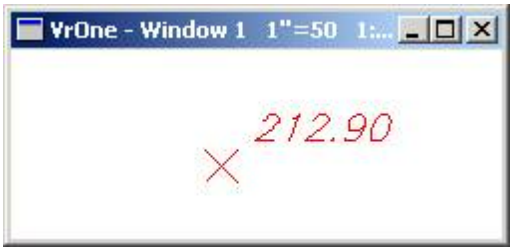
elevation label. The elevation text will be placed interactively.



This function will require two Function Keys. The first will place the spot elevation X; the second will place the spot elevation label. The Function Key to place the X symbol will be called “spot” and the Function Key to place the elevation label will be called “spotz”.

Definition of the Function Key “spot”:

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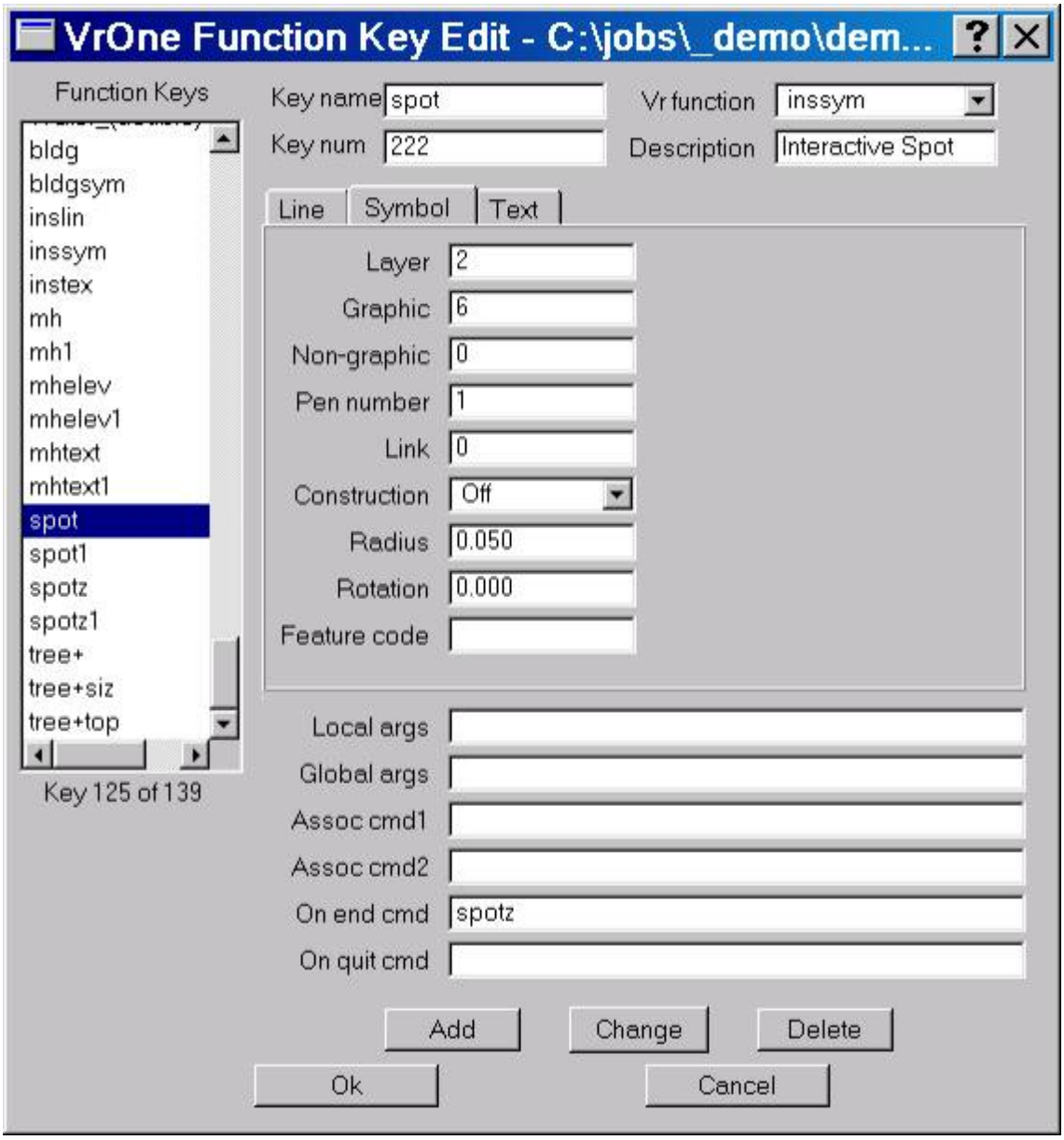

Notice the On end command starts the “spotz” function key.

Definition of the Function Key “spotz”:

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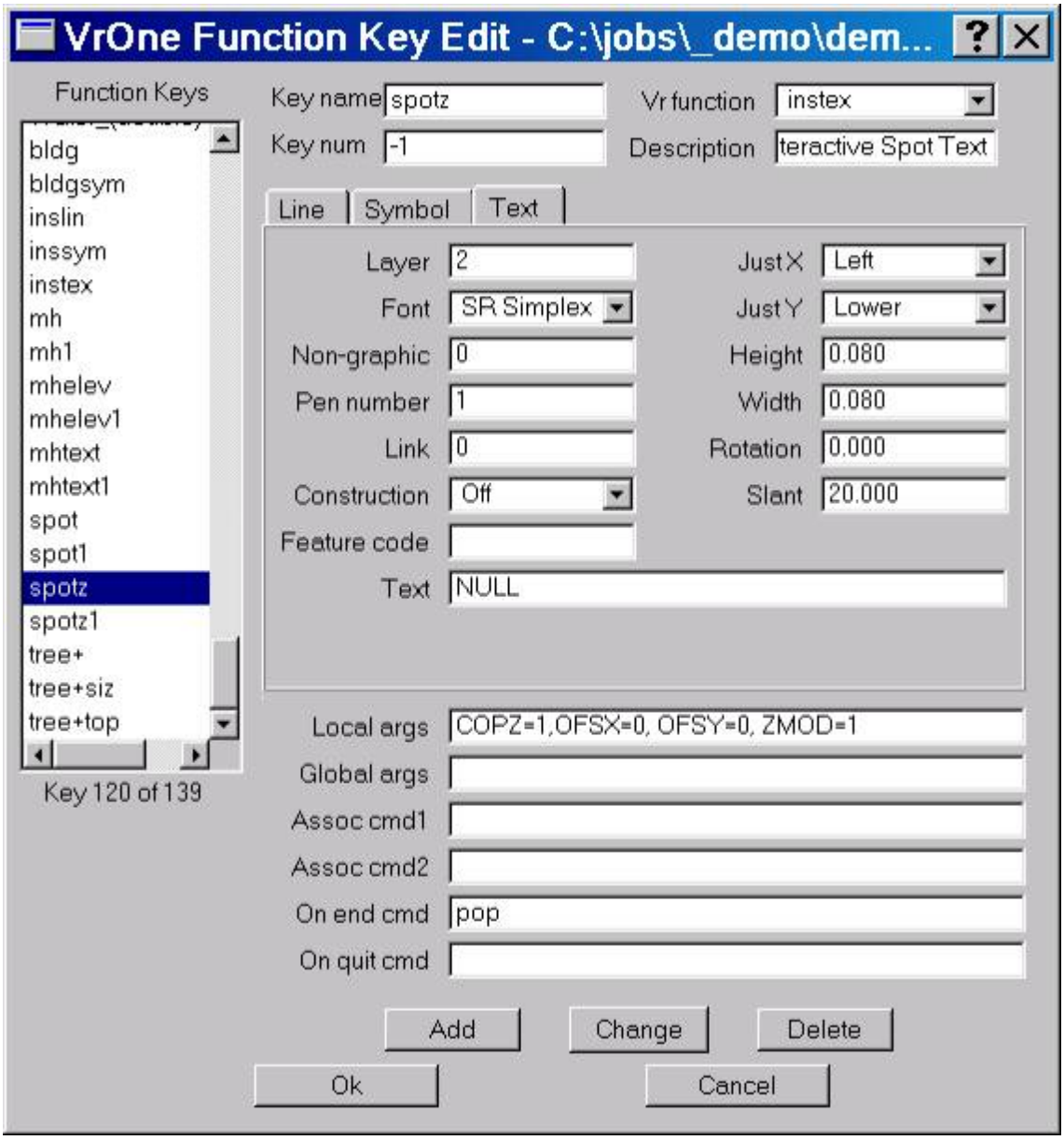

The Arguments line includes:

- **COPZ=1** – Copies the entity elevation to the text label.
- **OFSX=0** – Sets the X offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **OFSY=0** – Sets the Y offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **ZMOD=1** – Gets the entity elevation from the last saved coordinate. In this case, the entity elevation is the Z from the symbol digitized with the "spot" function key.

After the spot elevation text has been saved, "spotz" executes a "pop" command which

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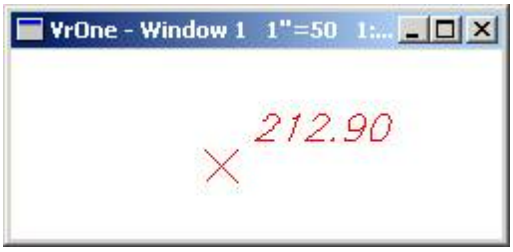
terminates this Function Key and returns to “spot” for the placement of the next spot elevation.

Example 2

Place a spot elevation consisting of an ‘X’ and a text elevation label. The elevation text will be placed automatically requiring only one key press to place the X and the elevation.



This function will require two Function Keys. The first will place the spot elevation X; the second will place the spot elevation label. The Function Key to place the X symbol will be called “spot1” and the Function Key to place the elevation label will be called “spotz1”.

Definition of the Function Key “spot1”:

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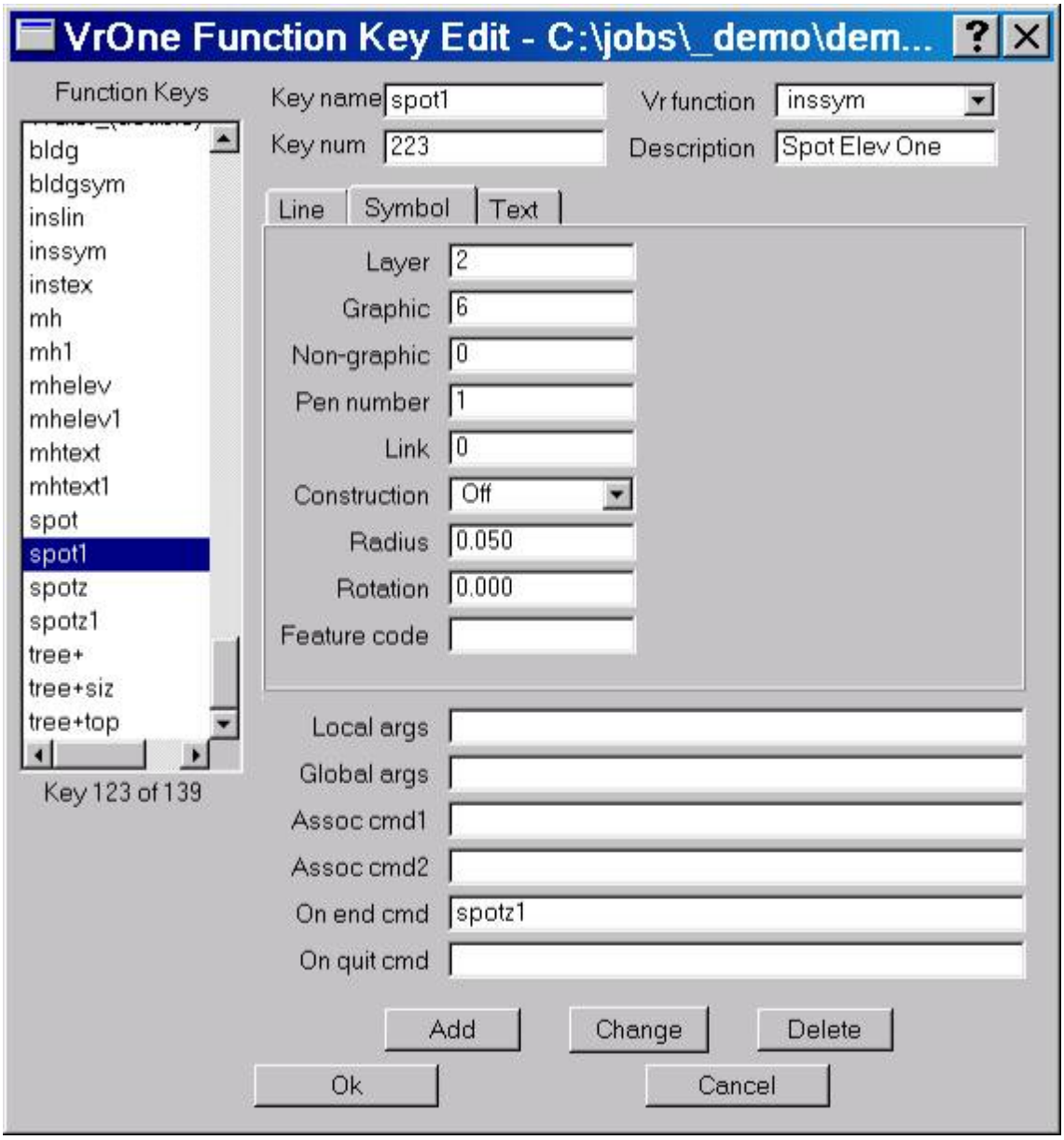

Note that the On end command starts the “spotz1” function key.

Definition of the Function Key “spotz1”:

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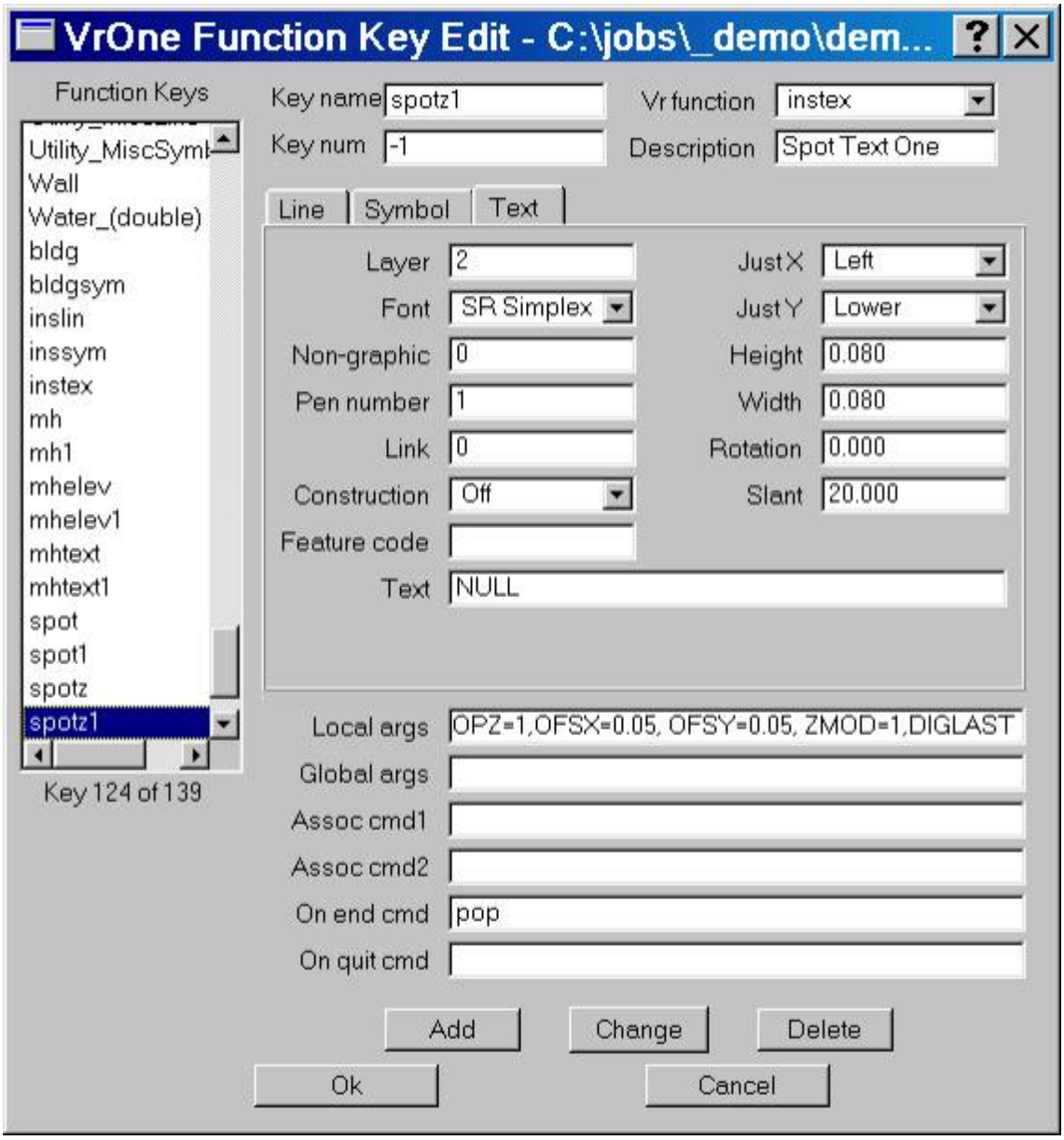

The Arguments line includes:

- **COPZ=1** – Copies the entity elevation to the text label.
- **OFSX=0.05** – Sets the X offset of the text label origin 0.05 inches (or millimeters) from the digitized location.
- **OFST=0.05** – Sets the Y offset of the text label origin 0.05 inches (or millimeters) from the digitized location.
- **ZMOD=1** – Gets the entity elevation from the last saved coordinate which in this case is the Z from the symbol digitized with the "spot1" function key.
- **DIGLAST** – Places text at the last saved coordinate, which is the symbol that was digitized

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with the “spot1” function key.

After the spot elevation text has been saved by the DIGLAST command, “spotz1” then executes a “pop” command which terminates this Function Key and returns to “spot1” for the placement of the next spot elevation.

Example 3

Place a manhole symbol, the text "MH", and the manhole elevation. The text labels are placed interactively.



This function will require three Function Keys. The first will place the manhole symbol; the second will place the elevation label; the third will place the text label “MH”. The Function Key to place the manhole symbol will be called “mh”, the Function Key to place the elevation label will be called “mhelev”, and the Function Key to place the “MH” label will be called “mhtext”.

Definition of the Function Key “mh”:

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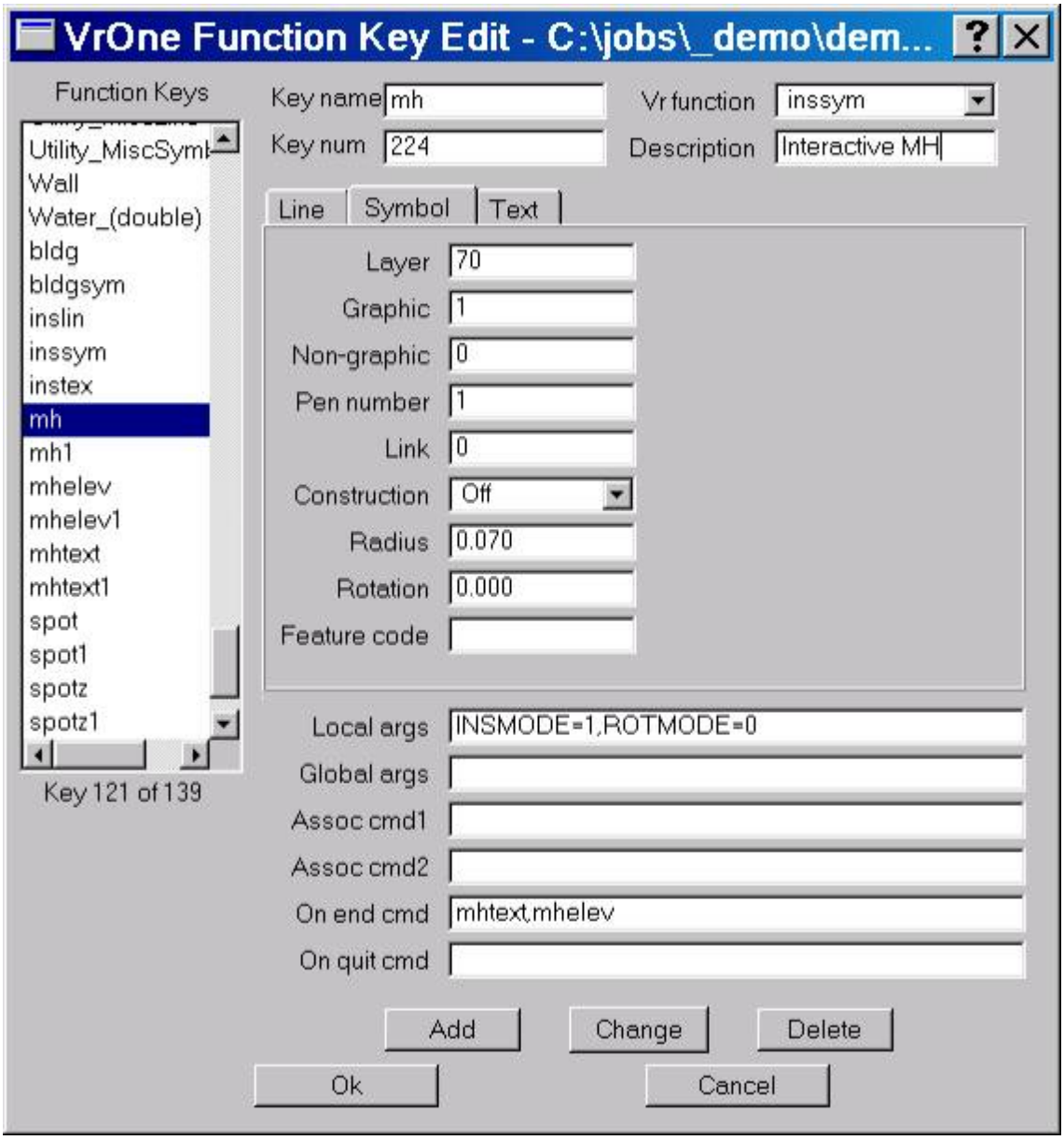

The Arguments line includes:

- **INSMODE**=1 – Defines the number of points to digitize to place the symbol.
- **ROTMODE=0** – Turns off interactive symbol rotation.

The On end command starts the “mhtext” and the “mhelev” function keys.

Definition of the Function Key “mhelev”:

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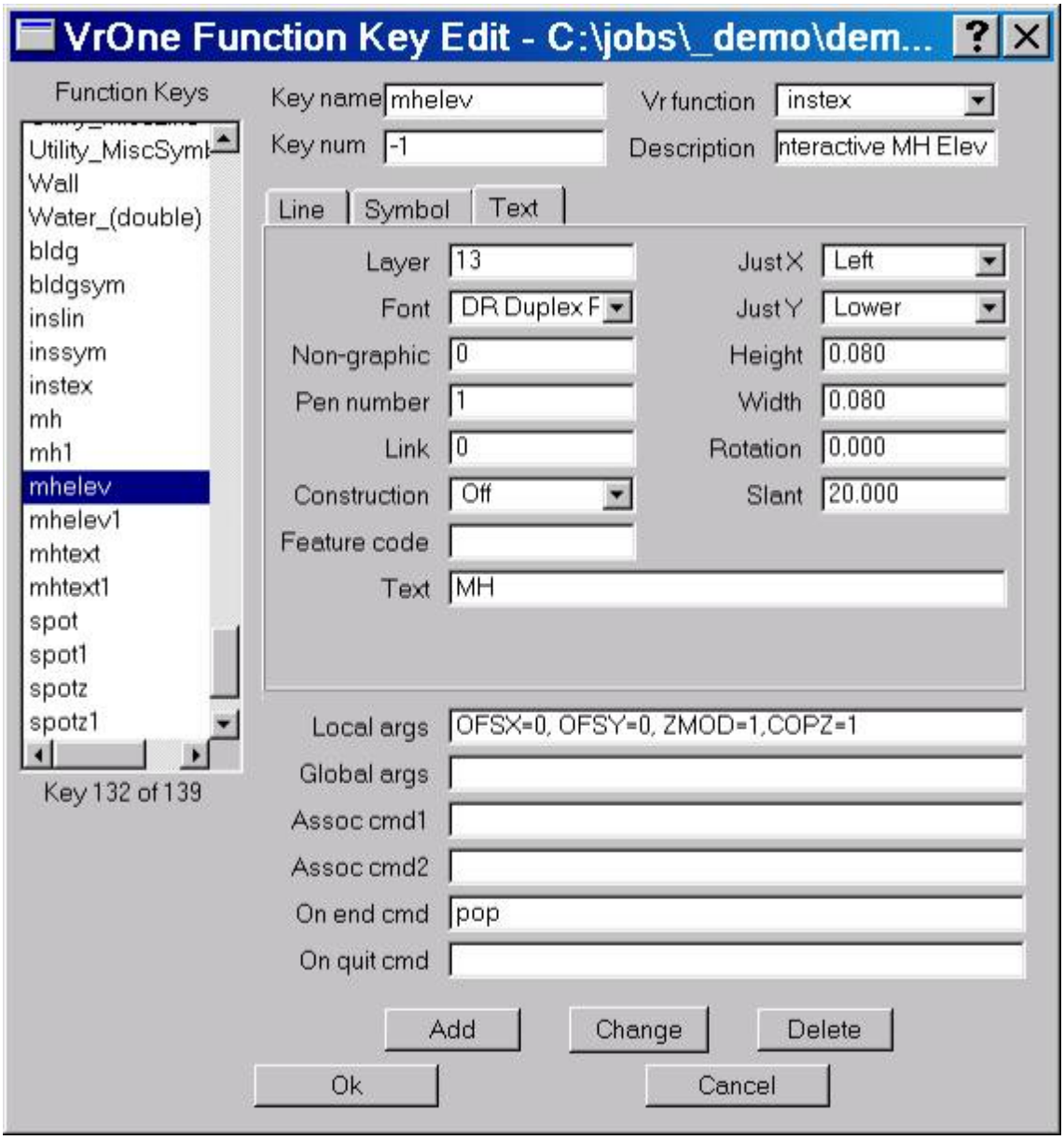

The Arguments line includes:

- **OFSX=0** – Sets the X offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **OFSY=0** – Sets the Y offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **COPZ=1** – Copies the entity elevation to the text label.
- **ZMOD=1** – Gets the entity elevation from the last saved coordinate. In this case, the entity elevation is the Z from the symbol digitized with the "spot" function key.

After the spot elevation text has been saved, "mhelev" executes a "pop" command, which

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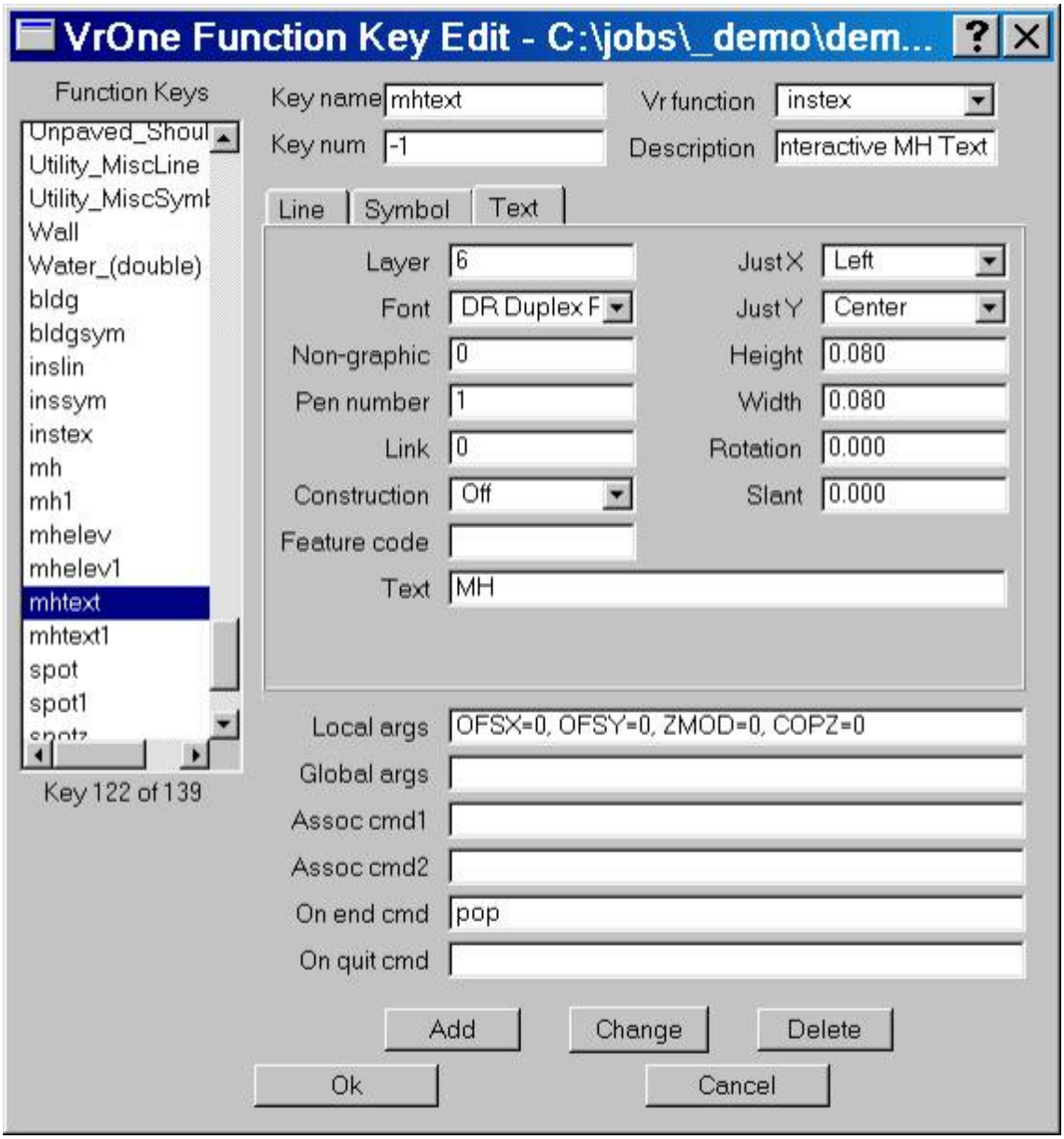
terminates this Function Key and returns to “mhtext” which was started by “mh”.

Definition of the Function Key “mhtext”:



The Arguments line includes:

- **OFSX=0** – Sets the X offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **OFSY=0** – Sets the Y offset of the text label origin 0 inches (or millimeters) from the digitized location.
- **ZMOD=0** – Uses the current elevation for the entity elevation.

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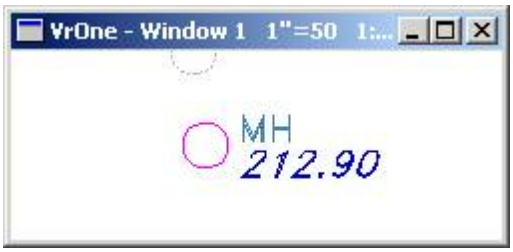
- **COPZ=0** – Does not copy the entity elevation to the text label, but uses the text defined in the Text field.

After the spot elevation text has been saved, “mhtext” executes a “pop” command, which terminates this Function Key and returns to “mh” for the placement of the next manhole.

Example 4

Place a manhole symbol, the text "MH", and the manhole elevation. The text labels are placed automatically.

This function will require three Function Keys. The first will place the manhole symbol, the second will place the elevation label, and the third will place the text label “MH”. The Function Key to place the manhole symbol will be called “mh1”. The Function Key to place the elevation label will be called “mhelev1”. The Function Key to place the “MH” label will be called “mhtext1”.



Definition of the Function Key “mh1”:

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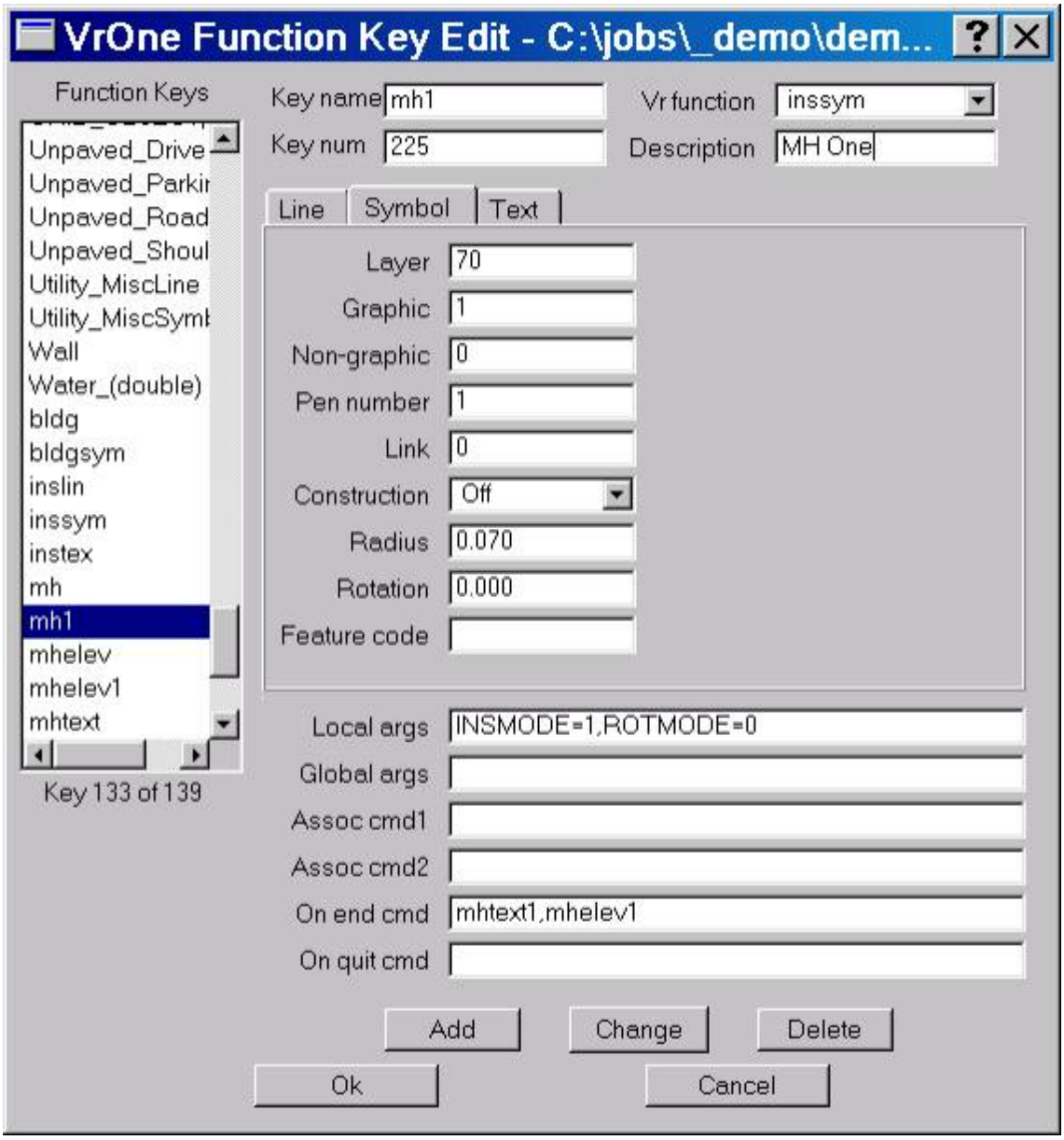

The Arguments line includes:

- **INSMODE=1** – Defines the number of points to digitize to place the symbol.
- **ROTMODE=0** – Turns off interactive symbol rotation.

The On-end command starts the "mhtext1" and then "mhelev1" function keys.

Definition of the Function Key "mhelev1":

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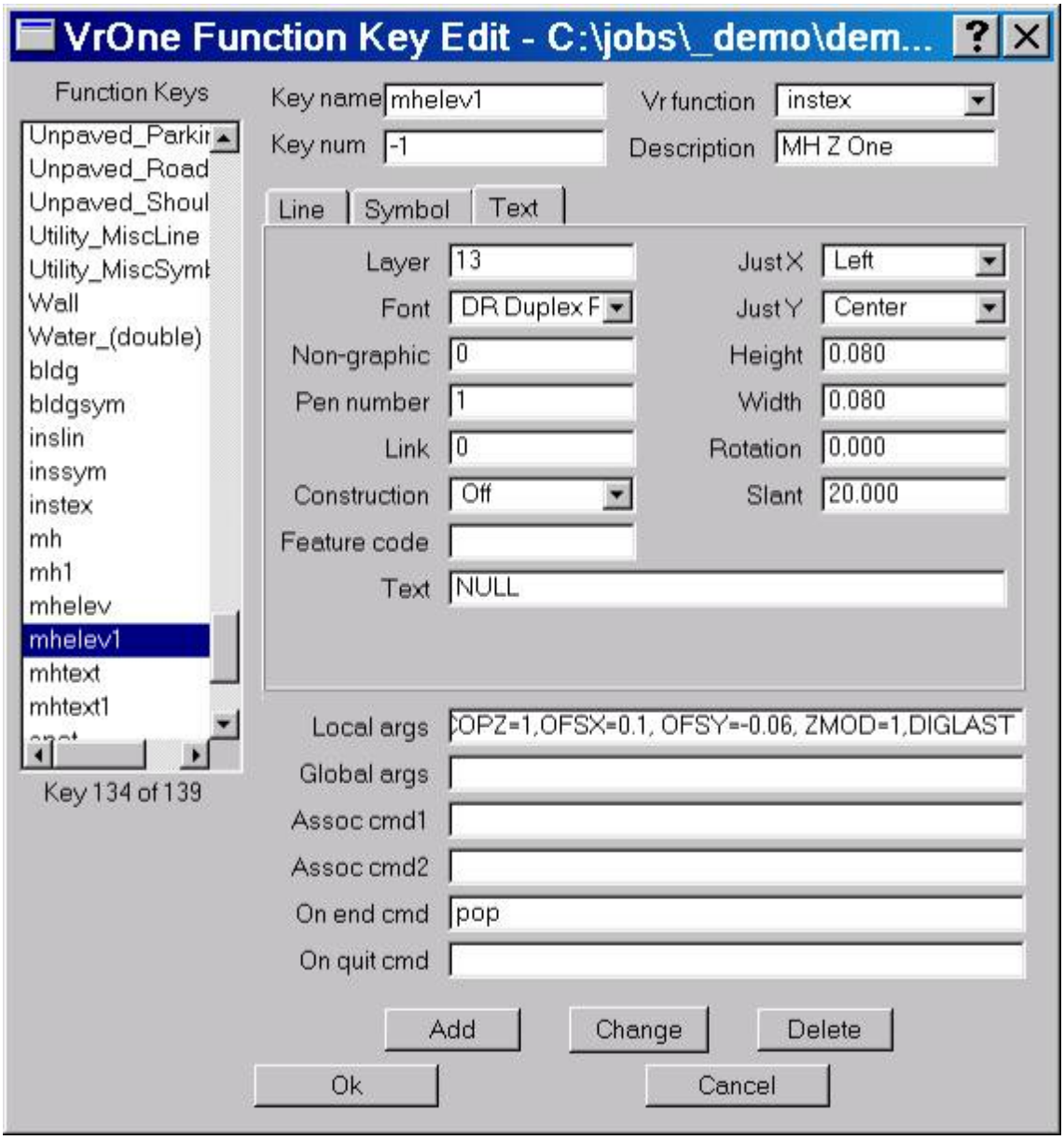

The Arguments line includes:

- **COPZ=1** – Copies the entity elevation to the text label.
- **OFSX=0.1** – Sets the X offset of the text label origin 0.1 inches (or millimeters) from the digitized location.
- **OFST=-0.06** – Sets the Y offset of the text label origin -0.06 inches (or millimeters) from the digitized location.
- **ZMOD=1** – Gets the entity elevation from the last saved coordinate. The entity elevation in this case is the Z from the symbol digitized with the "spot1" function key.
- **DIGLAST** – Places text at the last saved coordinate, which is the symbol digitized with the

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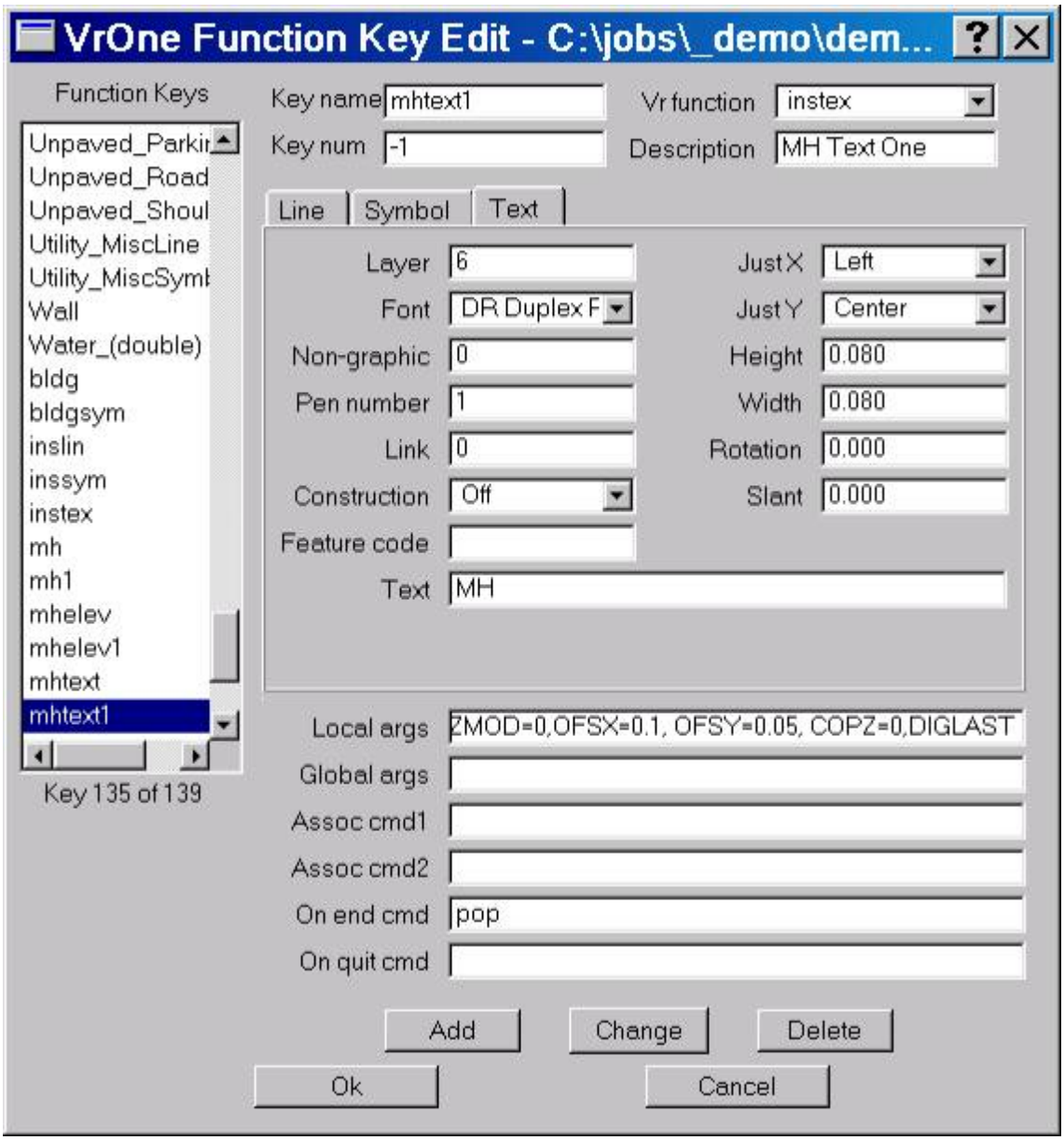
"mh1" function key.

After the spot elevation text has been saved by the DIGLAST command, "mhelev1" executes a "pop" command which terminates this Function Key and returns to "mhtex1t" for the placement of the "MH" label.

Definition of the Function Key "mhtext1":



The Arguments line includes:

- **ZMOD=0** – Uses the current elevation for the entity elevation.

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- **OFSX=0.1** – Sets the X offset of the text label origin 0.1 inches (or millimeters) from the digitized location.
- **OFST=-0.05** – Sets the Y offset of the text label origin 0.05 inches (or millimeters) from the digitized location.
- **COPZ=0** – Does not copy the entity elevation to the text label but uses the text defined in the Text field.
- **DIGLAST** – Places text at the last saved coordinate, which is the symbol that was digitized with the "mh1" function key.

After the spot elevation text has been saved by the DIGLAST command, "mhtext1" executes a "pop" command, which terminates this Function Key and returns to "mh1" for the placement of the next manhole.

3.16 Tutorial Vr Mosaic

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

VrMosaic Tutorial

This tutorial will walk you through all of the steps needed to create mosaic images using VrMosaic. This is not intended to demonstrate all of the features in VrMosaic, but will serve as a general guide to the mosaicing process. Please see the VrMosaic Documentation for detailed information on all VrMosaic features.

Getting Started (**Video**)

Setting Project Parameters (**Video**)

Preparing to Collect Seams (**Video**)

Collecting Seam Lines

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Collecting Using Open Seams
Collecting Strip to Strip Seam Lines (Video)
Collecting Image to Image Seam Lines (Video)
Collecting Using Closed Seams (Polygon Mode)

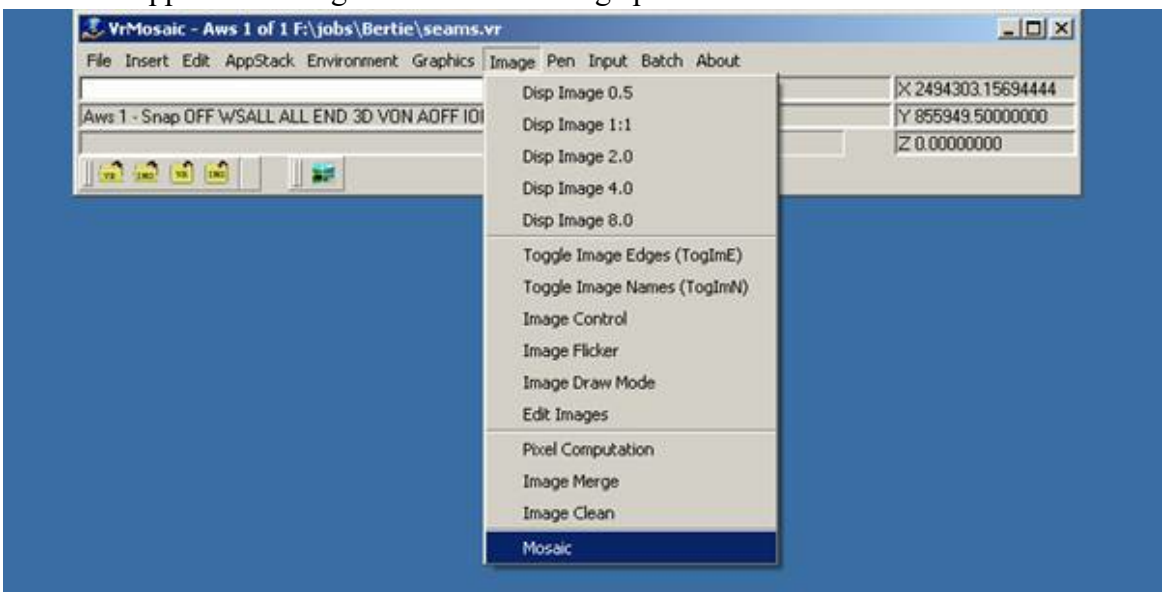
Editing Seam Lines
Editing Using Standard Mode
Editing Using Dynamic Mode

Creating Final Mosaics
Output Using Manual Mode
Output Using Batch Mode
Creating a Sheet Layout
Selecting Sheets to Output

Getting Started

In this section of the tutorial, you will launch VrMosaic and start the Mosaic application. It is assumed that the VrMosaic program has already been installed on the computer.

1. Select the Start->Programs->VrOne->Vr Mosaic menu item to launch the Vr Mosaic program. The VrMosaic main window should be displayed along with one graphics window.
2. Select "Mosaic" from the "Image" dropdown menu. Alternately, the command MOS can be entered to the command prompt area or the mosaic icon can be clicked. This displays the Mosaic application dialogs and two additional graphics windows.



Setting Project Parameters

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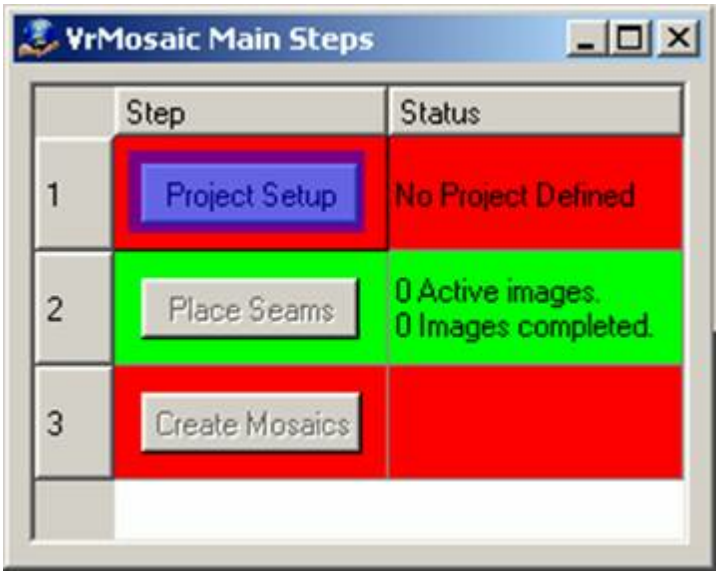
In this section of the tutorial, the Project Parameters dialog box will be used to define new project settings.

1. Select the “Project Setup” button in the VrMosaic Main Steps dialog or select “7. Enter Params” from the MenuKeys dialog. The project settings dialog box should be displayed. This dialog is separated into several tabbed pages that represent different areas of the project settings. Few items need to be changed in order to complete this tutorial. It is recommended that you become familiar with all project settings before completing the first mosaic project



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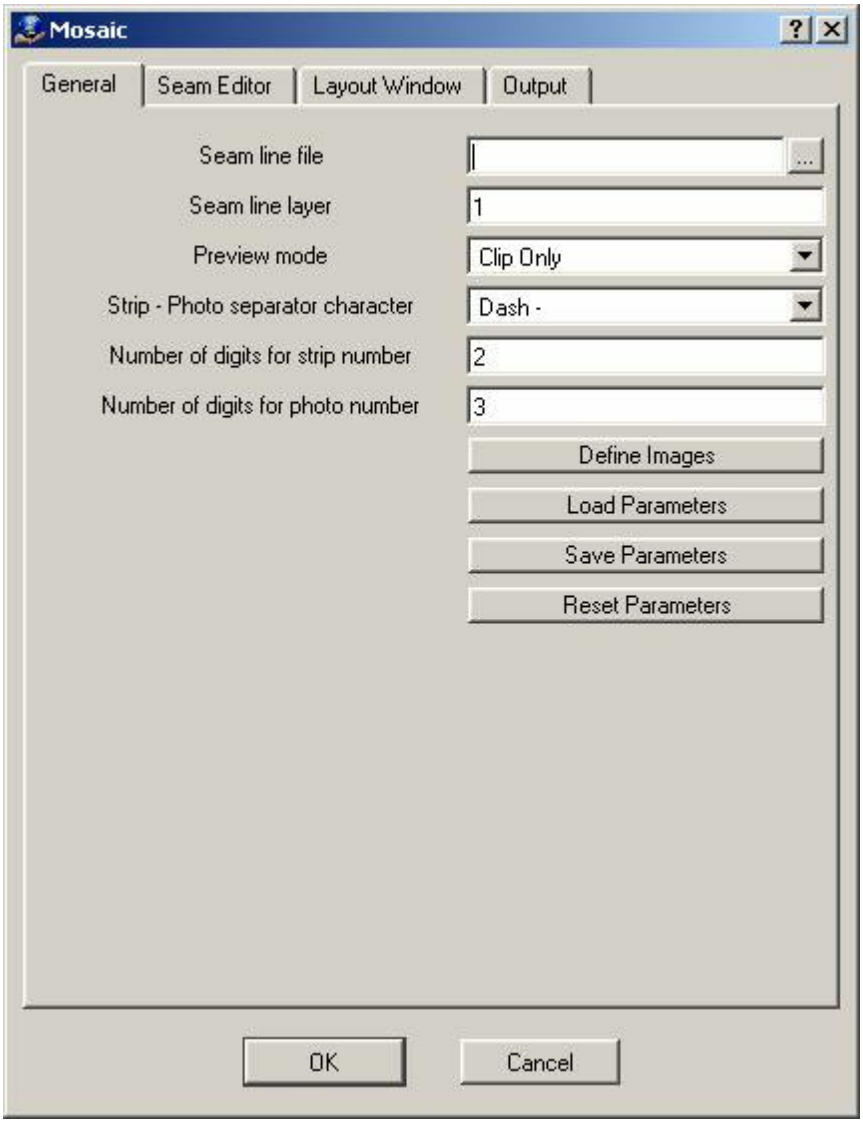

2. Select the "General" tab.

3. Set the "Seam line file" parameter to the following: x:\the_job_location\seams.vr.

NOTE: Replace x:\the_job_location\ with the location of an existing folder. Use the browse button (…) to select the location without having to type it in.

4. Set the "Strip-Photo separator character" to match the filename format of the ortho images.

5. Set the "Number of digits for strip number" and "Number of digits for photo number" to match the filename format of the ortho images.

6. Select the “Define Images” button. This will display the "Image Files' dialog, which allows ortho images to be added and removed from the project.

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7. Select the “Add…” button and use "Add Image Files" to add all of the ortho images to the project.



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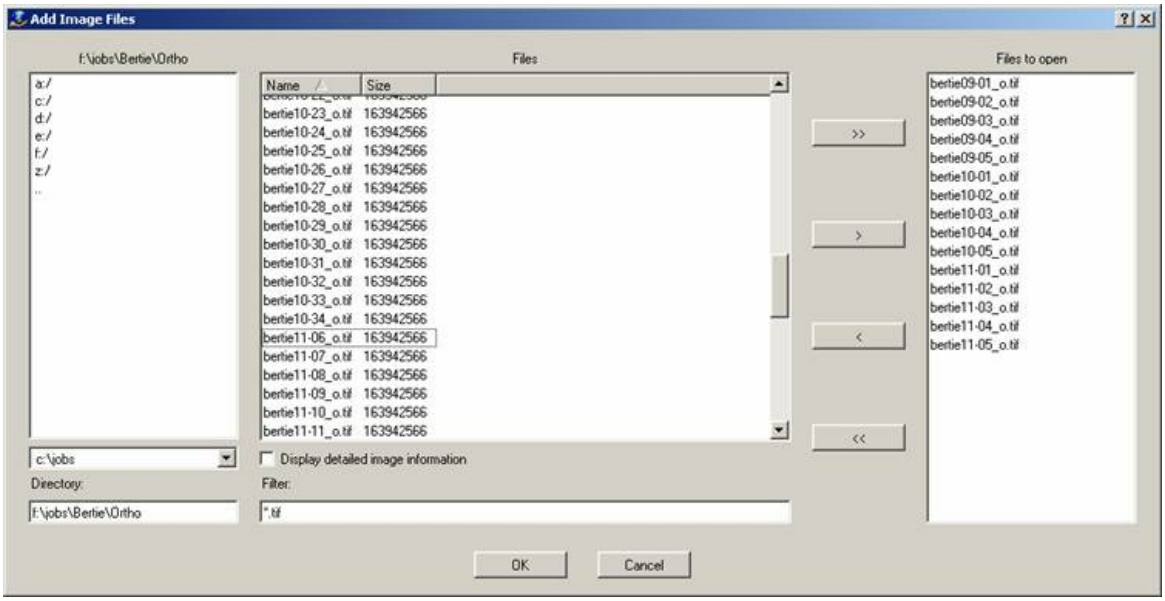
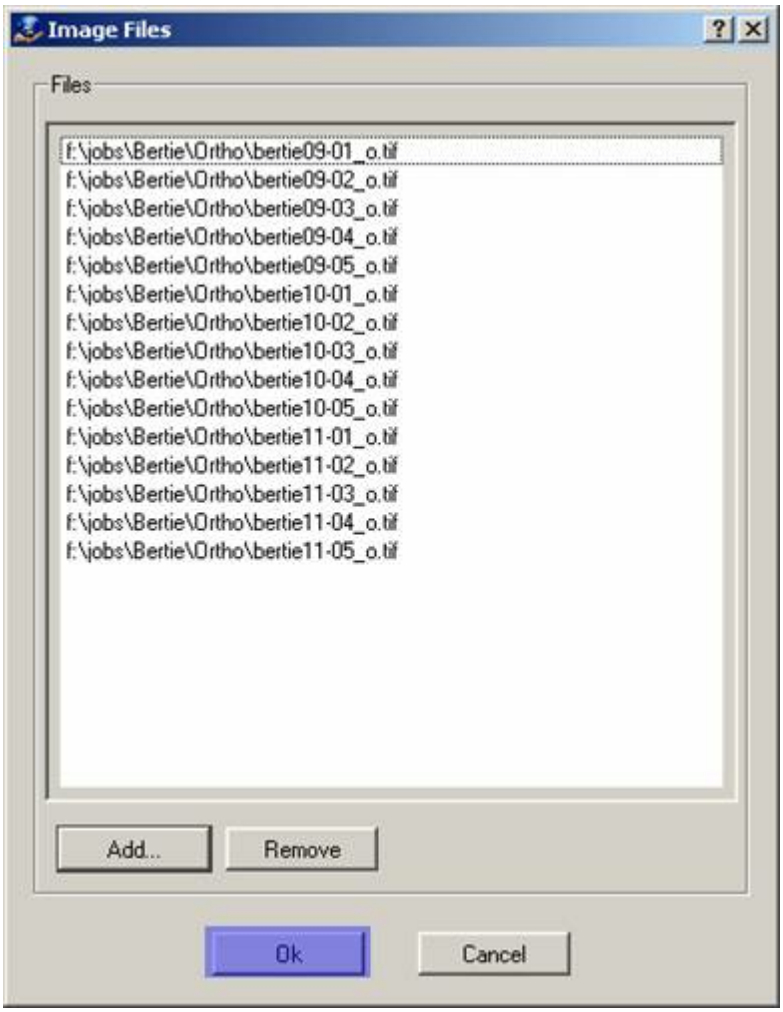


8. Select “OK” to close the "Add Image Files" dialog.



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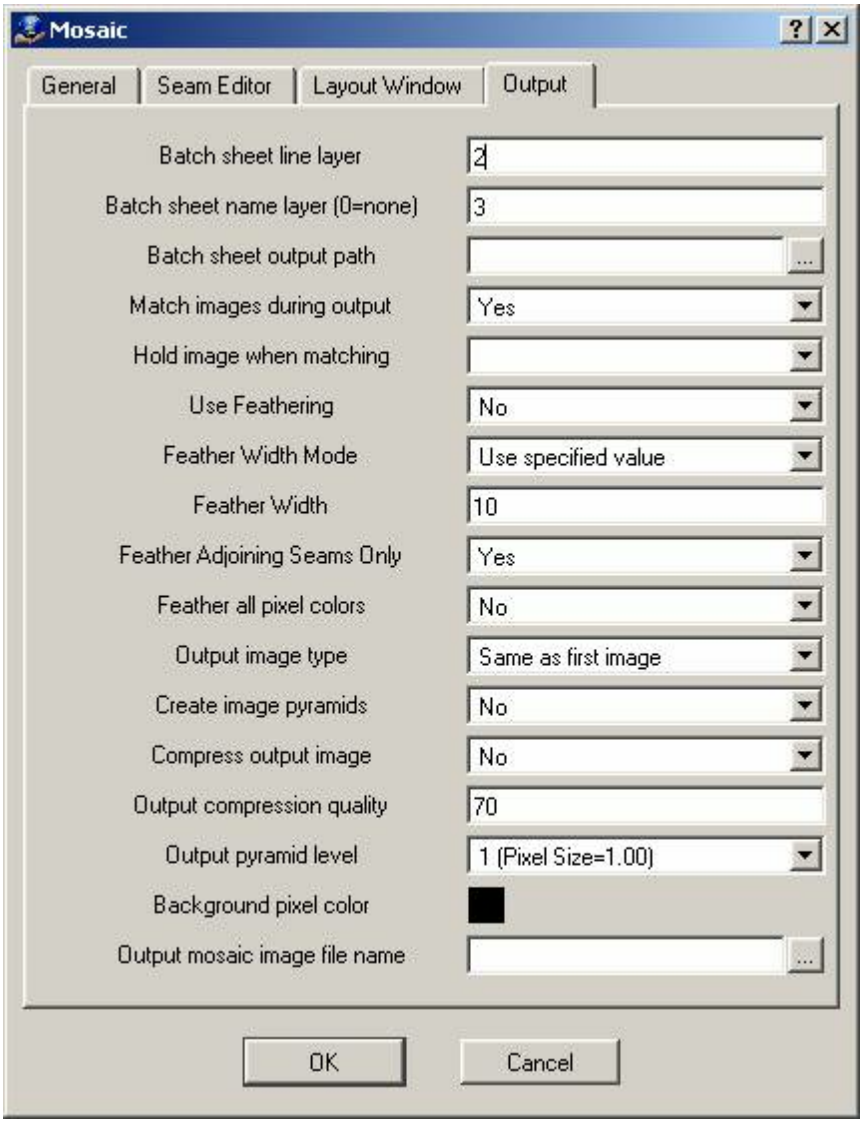
9. Select the "Output" tab.



10. Set the "Batch sheet output path to: x:\the_mosaic_output_location\

NOTE: Replace x:\the_mosaic_output_location with the location of an existing folder. Use the browse button (…) to select the location without having to type it in.

11. Set the Output mosaic image file name to: x:\the_job_location\mosaic1.tif.

NOTE: Replace x:\the_job_location\ with the location of an existing folder. Use the browse button (…) to select the location without having to type it in.

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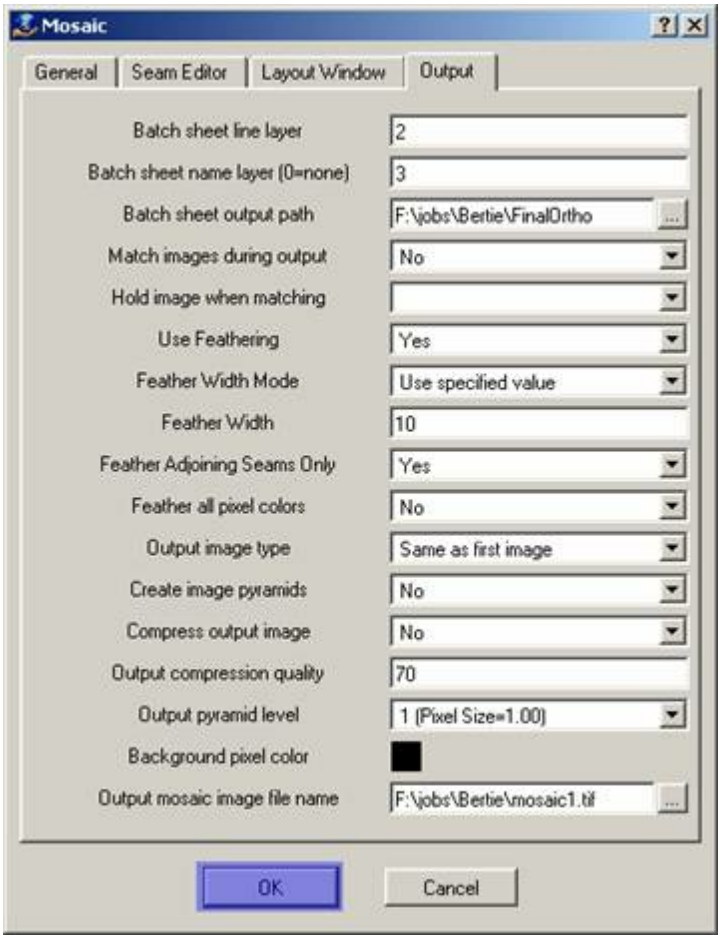
12. Select “OK”. You will be prompted to save the project settings to a file.



14. Type in a new filename for this project parameter file and click "Save". All of the images that were added to the project will now be opened. This may take a while if a large number of images were added and the images do not have pyramid files created yet. After the images have been opened, the results are displayed in all three graphics windows. By default the main graphics window (Window 1) will display images only in their true geographic location. The Overview window will show images and image borders in their true geographic location. The Layout window will show the image borders only in a default layout location with no images overlapping each other.

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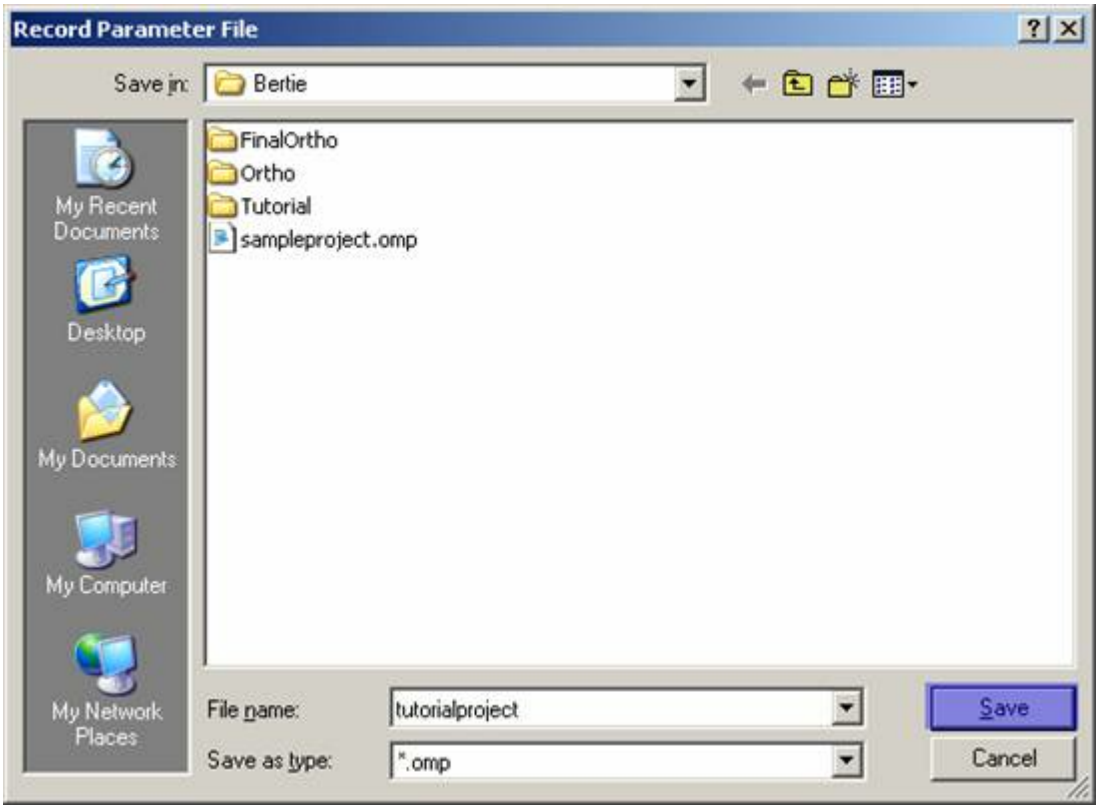

Preparing to Collect Seams

In this section of the tutorial, you will set up the project windows and activate a subset of the project images in preparation for collecting seam lines.

First, the windows should be arranged to make maximum use of the screen area.

1. Select “9. More options” from the MenuKeys dialog. This will display a new MenuKeys dialog.

2. Select “1. Reset Windows” from the MenuKeys dialog. This will display a confirmation dialog.

3. Select “Yes” in response to the Reset Window confirmation dialog.

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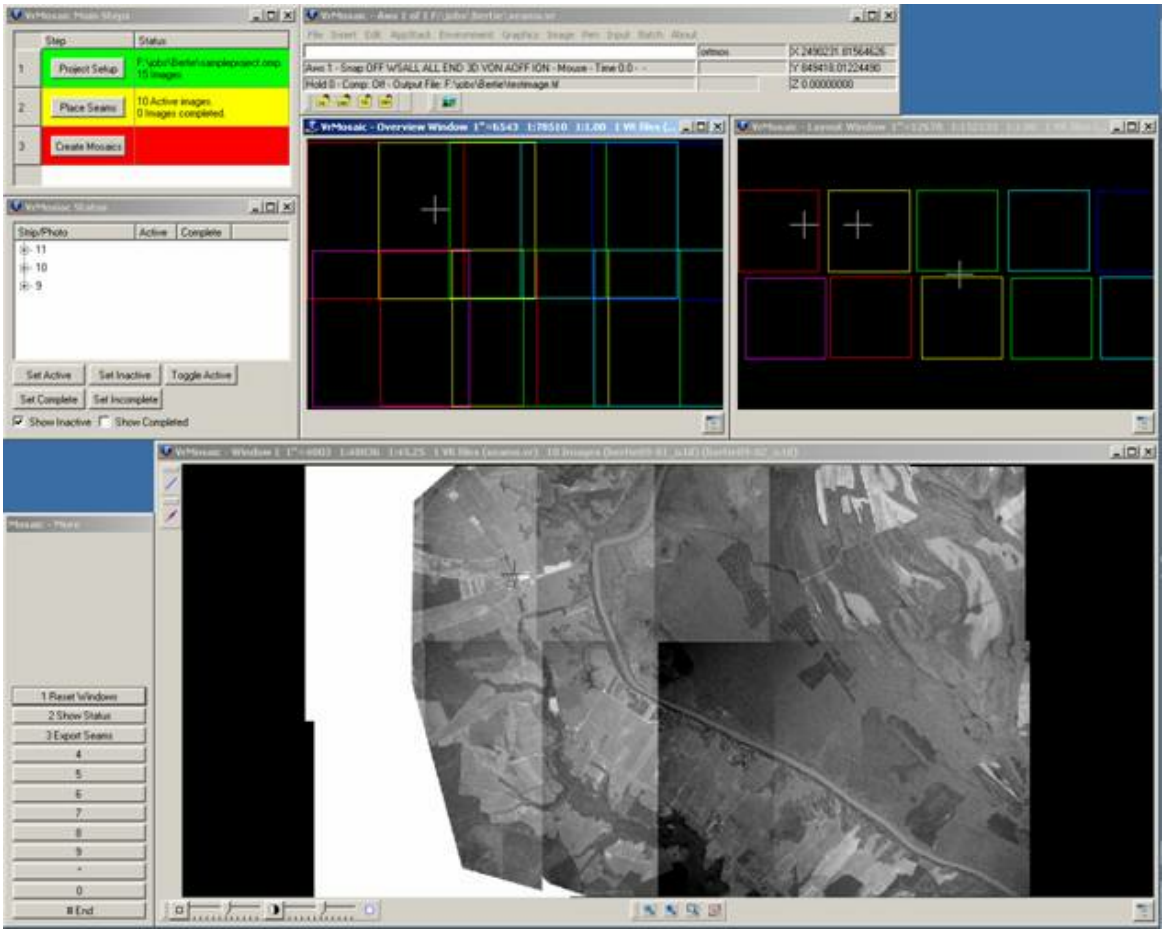

The next step is to deactivate all images that aren't needed when collecting the current seam line. On large projects, having all images open and active can cause the seam line collection process to very slow. In most cases, necessary images comprise the current image strip and the strips above and below it.

1. Highlight all image strips in the VrMosaic Status dialog. This can be done quickly be pointing to a single image strip and pressing Ctrl-A.

2. Select the "Set Inactive" button. All of the images in the project should close. The graphics windows should now be empty.

3. Highlight the first image strip in the project along with any adjacent image strip. If starting with an image strip at the edge of the project boundary, only one other image strip will need to be highlighted. Hold down the Ctrl key while selecting image strips to allow multiple individual strips to be selected.

4. Select the "Set Active" button. This will open the images in the selected image strips. The graphics windows should now be displaying the images in the selected image strips.

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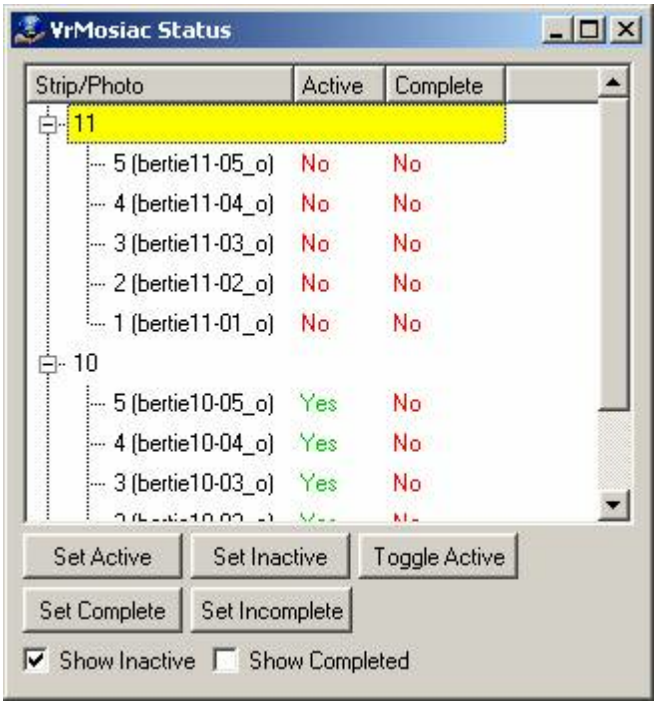

Collecting Seam Lines

In this section of the tutorial, seam lines will be collected using all collection methods.

Collecting Using Open Seams

Open seam lines are the primary method used to define seams in VrMosaic. Open seam lines are used to define a common seam between two overlapping images or two overlapping image strips. Open seam lines can be as simple as a two-point line, or can be very detailed containing thousands of points. The normal collection process consists of placing open seam lines between image strips, and then placing open seam lines between each image in the image strips.

Collecting Strip to Strip Seam Lines

In this section of the tutorial, you will collect two seam lines between two sets of image strips.

1. Select “Place Seams” on the VrMosaic Main Steps dialog or select “1 Place Seams” from the MenuKeys dialog. This will display a new MenuKeys dialog and the VrMosaic Place Seams Steps dialog. The layout window will highlight the active strips or images.

2. Make sure the status for step 1 (Toggle Seam Mode) in the VrMosaic Place Seams dialog is “Between Strips”. If not, press the “Toggle Seam Mode” button, or select “3 Tog Seam Mode” from the MenuKeys dialog.

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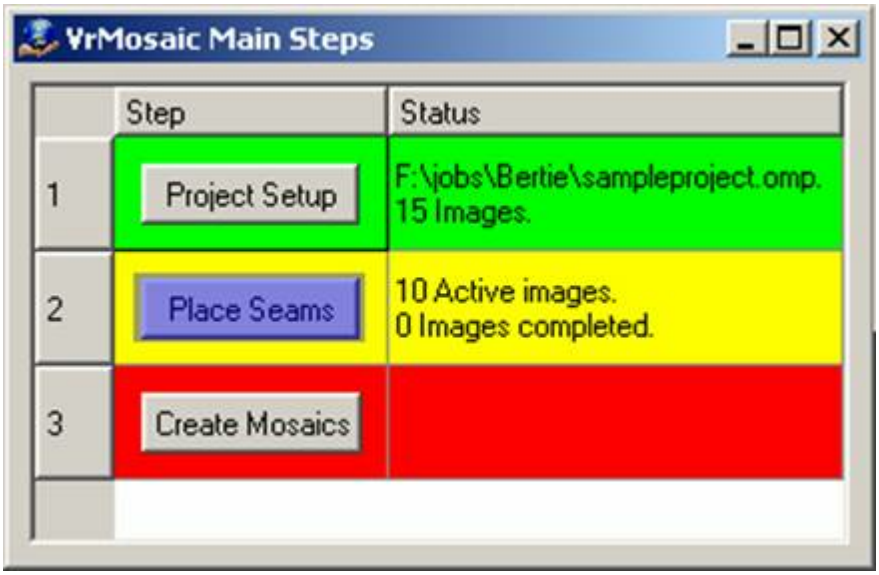
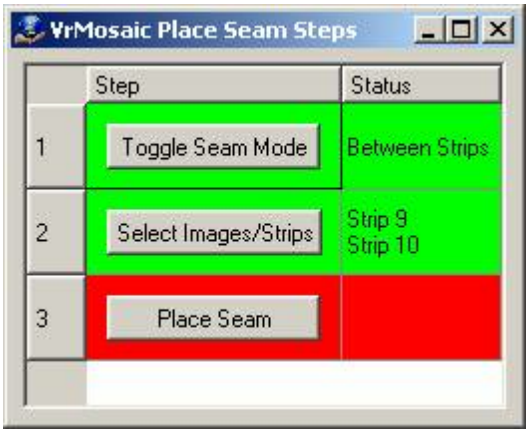


3. Image borders will be displayed for all active images in the Layout window. If not, type "ZOOA" in the command prompt area then select anywhere in the Layout window.

4. The first two strips should be surrounded with a dashed highlight line in the Layout window. If not, point to and select the first image strip using button 1 in the layout window. The first image strip should now be highlighted along with the next strip. If the next strip is not highlighted, point to and select the second image strip using button 2.



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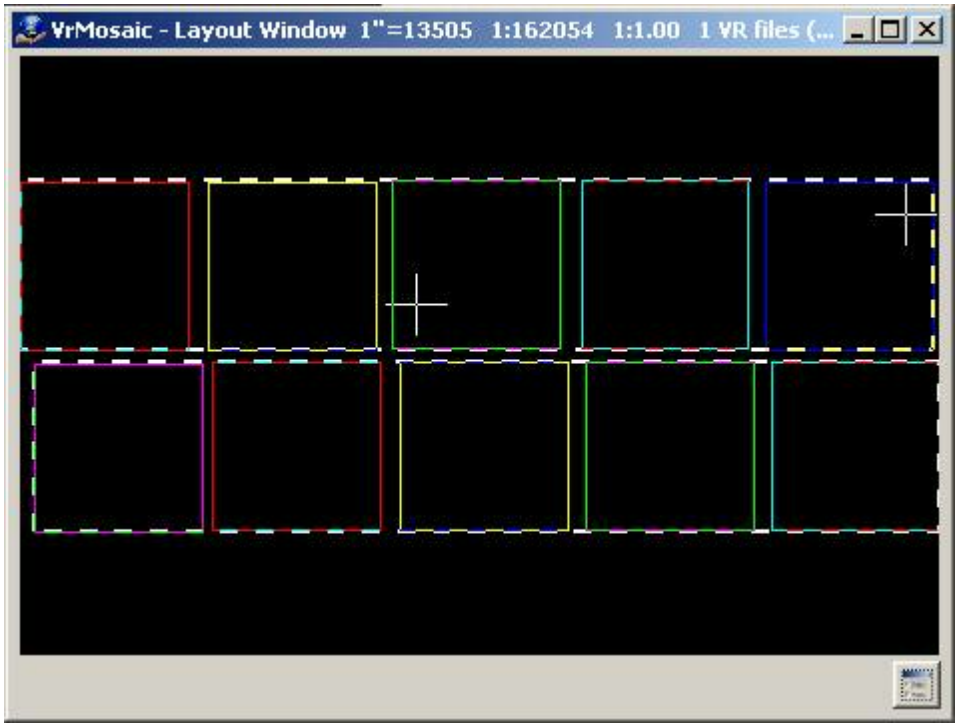

5. Make sure the status for step 2 (Select Images/Strips) in the VrMosaic Place Seams dialog displays the two strip numbers that you intend to place a seam line between. If not, follow the instructions in the previous step.

6. In graphics window 1, zoom close to one end of the image strips, and near the middle of the overlap area between the strips. This is can be done using the Zoom Window (ZOOWIN) command or by using the Home and Page Down keys to center and zoom in to the area.

NOTE: If using ZOOWIN, you will need to end the ZOOWIN command before continuing to the next step.

7. Select the "Place Seam" button on the VrMosaic Main Steps dialog or select "4 Place Seam" from the MenuKeys dialog. This will display a new MenuKeys dialog that provides options for collecting the seam line.

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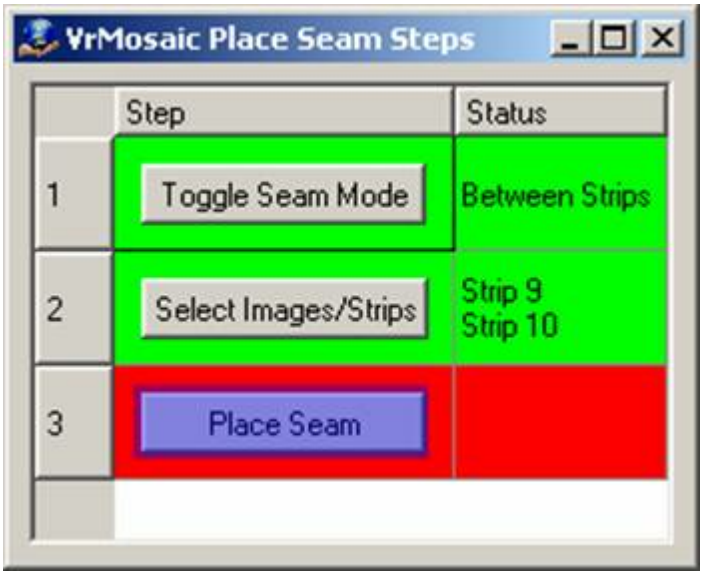
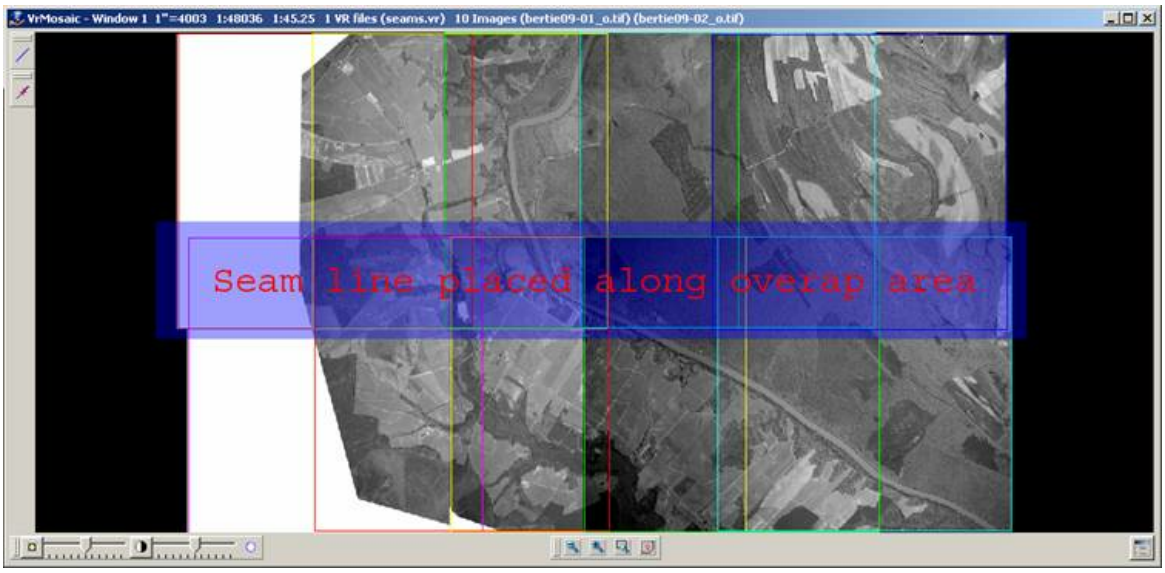


8.In graphics Window 1, position the cursor where you want the seam line to begin and press button 1 to digitize a point. A rubber-band line should be displayed from the point selected to the current cursor location.



9. Continue to use button 1 to digitize points along the seam line. Use the Zoom commands to zoom in and out as needed. You will notice that as each new point is added to the seam line, the image display changes to reflect how the images will be merged along the seam line. Use option "3 Backup" if you place a point in the wrong location.

10. If digitizing a large line, and there are many images in the project, the image update process

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may take a few second each time a new point is digitized. If this is the case, use “9 Tog Update”, to toggle the instant update feature off and on. Using this method several points can be digitized with update off, then turn update back on to see the results.

11. The Mosaic application will normally determine the direction (horizontal or vertical), and the image sides (left, right, top, or bottom) for the seam line. In some cases, the default settings may need to be changed. This can be done using options 6-8 on the MenuKeys dialog. Each seam line has one direction associated with it, either horizontal or vertical. Each seam has two sides associated with it, one for each image or strip that it divides. Seam line direction and side may need to be changed manually, for example, if seam lines occur along the edge of the project where there is no adjoining image or strip.

12. After all points have been digitized, select “4 End” from the MenuKeys dialog to end and save the seam line. The previous MenuKeys dialog will be displayed and the next two strips will be highlighted.

13. Repeat this process starting with step 5 until at least two strip-to-strip seam lines have been placed. The goal is to have one strip of images with a seam line on both sides of the strip.

Collecting Image to Image Seam Lines

In this section of the tutorial, you will collect seam lines between all of the images in a strip.

1. Make sure the "Open Seams" MenuKeys dialog is displayed. If not, select “Place Seams” on the VrMosaic Main Steps dialog or select “1 Place Seams” from the MenuKeys dialog. This will display a new MenuKeys dialog and the VrMosaic Place Seams Steps dialog. The layout window will highlight the active strips or images.

2. Make sure the status for step 1 (Toggle Seam Mode) in the VrMosaic Place Seams dialog is “Between Images”. If not, press “Toggle Seam Mode” or select “3 Tog Seam Mode” from the MenuKeys dialog.

3. Image borders for all active images will be displayed in the Layout window. If not, type “ZOOA” in the command prompt area and then select anywhere in the Layout window.

4. Two images should be surrounded with a dashed highlight line in the Layout window. If not, point to and select the first image in the image strip. The image strip should already have a seam line on both sides. The first image should now be highlighted along with the next image. If the next image is not highlighted, point to and select the second image using button 2.

5. Make sure the status for step 2 (Select Images/Strips) in the VrMosaic "Place Seams" dialog displays the numbers of the two image numbers between which a seam line should be placed. If not, follow the instructions in the previous step.

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6. In graphics window 1, zoom close to one end of the image, near the middle of the overlap area between the images. This is can be done using the Zoom Window (ZOOWIN) command or by using the Home and Page Down keys to center and zoom in to the area.

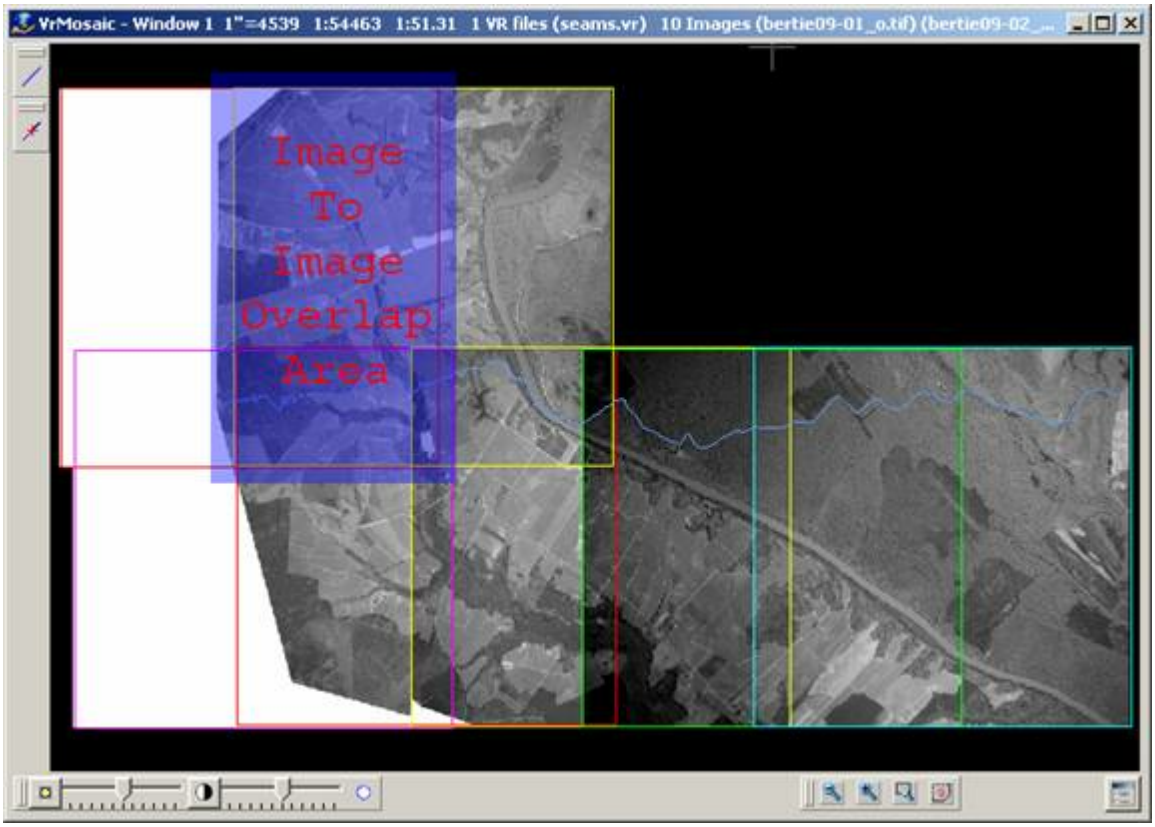
NOTE: If using ZOOWIN, the ZOOWIN command must be ended before continuing to the next step.

7. Select the "Place Seam" button on the VrMosaic Main Steps dialog, or select "4 Place Seam" from the MenuKeys dialog. This will display a new MenuKeys dialog that provides options for collecting the seam line.

8. Select "0 Tog Snap" (F11) to turn snap mode on. Verify that snap settings are set to snap to line points.

9. In graphics Window 1, position the cursor at the location where you want the seam line to begin, and press button 1 to digitize a point on the existing strip to strip seam line.

10. If snap verify is on, then accept the snap point (assuming it found appoint in the existing strip to strip seam line).



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11. A rubber-band line should be displayed from the point selected to the current cursor location.

12. Continue to use button 1 to digitize points along the seam line. Use the Zoom commands to zoom in and out as needed. Notice that as each new point is added to the seam line, the image display changes to reflect how the images will be merged along the seam line. Use option "3 Backup" if a point is placed in the wrong location.

13. If you are digitizing a large line and there are many images in the project, the image update process may take a few seconds each time a new point is digitized. If this is the case, use "9 Tog Update" to toggle the instant update feature. Using this method, several points can be digitized with update off, then update can be toggled once more to see the results.

14. The Mosaic application will normally determine the direction (horizontal or vertical), and the image sides (left, right, top, or bottom) for the seam line. The default settings can be changed using options 6-8 on the MenuKeys dialog. Each seam line has one direction associated with it, either horizontal or vertical. Each seam has two sides associated with it, one for each image or strip that it divides. Seam line direction and side may need to be changed manually, for example, to place seam lines along the edge of the project where there is no adjoining image or strip.

15. "0 Tog Snap" option can be used to turn snap mode on and snap to a point on the existing strip-to-strip seam line as the other side of the image is approached. A line that runs along the length of the overlap area between the two images, and begins and ends at points on the existing strip-to-strip seam lines should be displayed.

16. After snapping the final point, select "4 End" from the MenuKeys dialog to end and save the seam line. The previous MenuKeys dialog will be displayed. The next two images in the strip will be highlighted.

17. Repeat this process starting with step 5 until seam lines for all images in the strip have been placed.

18. Select "# End" on the Open Seam MenuKeys dialog to return the Main MenuKeys dialog.

19. Select "4 Tog preview" to view how the entire strip looks with all images cut to the seam lines.

NOTE 1: It may be helpful to temporarily turn off the seam line layer (Ex. LAYOFF 1) when viewing the image preview.

NOTE 2: Image preview mode does not reflect seam line feathering. This is only done in the final output stage.

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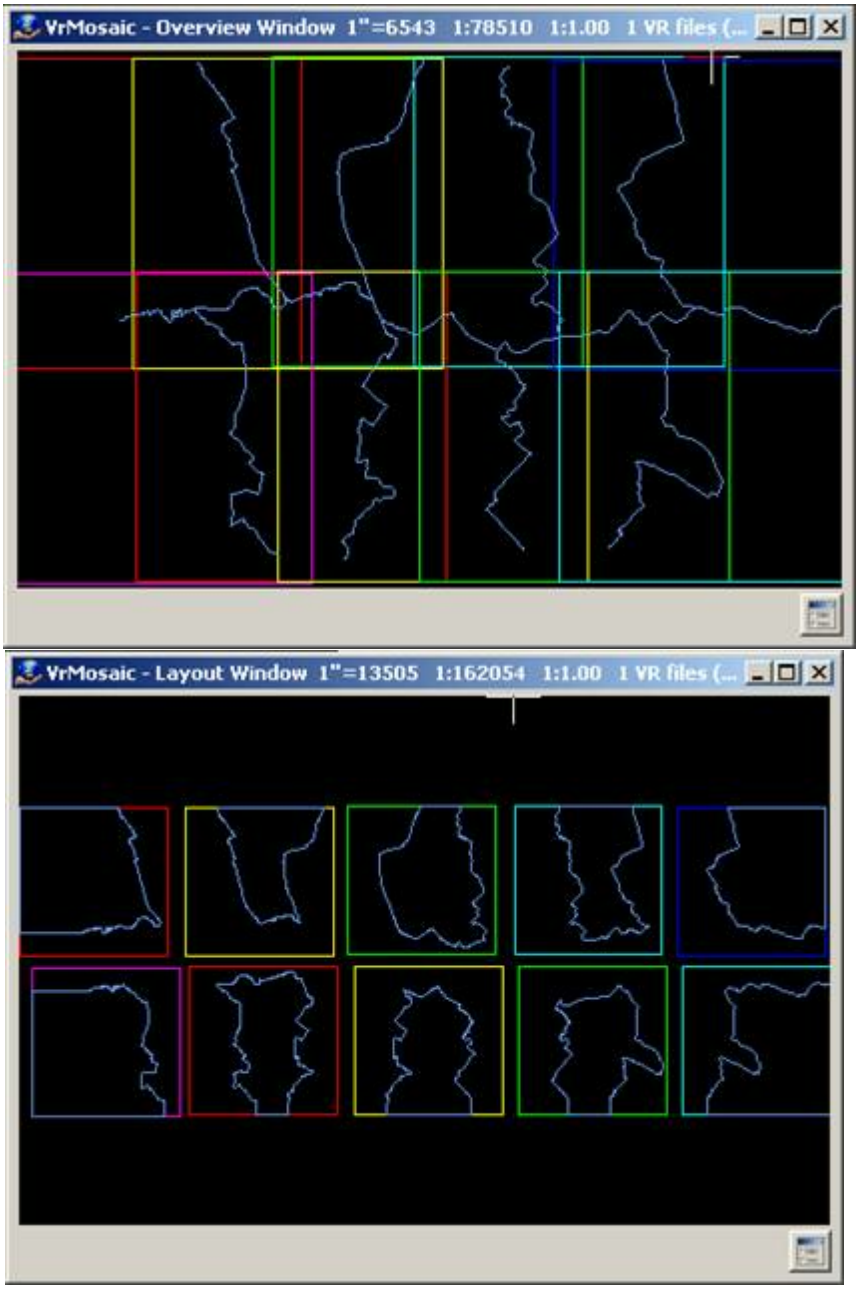

Finished seams for two image strips. Layout view shows area that will be cut from each image.

Collecting Using Closed Seams (Polygon Mode)

In this section of the tutorial, a closed seam line around a feature in a single image will be collected.

1.Select “8 Polygon Mode” from the MenuKeys dialog. This will display the Closed Seams MenuKeys dialog. The layout window will highlight the active image.

2.Image borders for all active images in the Layout window will be displayed. If not, type

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“ZOOA” in the command prompt area then select anywhere in the Layout window.

3.One of the images should be surrounded with a dashed highlight line in the Layout window. If this is not the correct image to place a seam line on, then point to and select another image using button 1 in the layout window.



4. In graphics window 1, zoom in close to the area where the seam line is to be placed. This is can be done using the Zoom Window (ZOOWIN) command or by using the Home and Page Down keys to center and zoom in to the area.

NOTE 1: Closed seam lines represent areas of the image that will be used in the final mosaic output. Multiple areas of a single image may be cut out and force them to be used in the final output. This may be needed if a feature that would normally not be used from an image because it is discarded by the normal open seam line, but it is required to force the feature to display.

NOTE 2: If using ZOOWIN, it will be required to end the ZOOWIN command before continuing to the next step.

5. Select the “Place Seam” button on the VrMosaic Main Steps dialog or select “4 Place Seam” from the MenuKeys dialog. This will display a new MenuKeys dialog that provides options for collecting the seam line.

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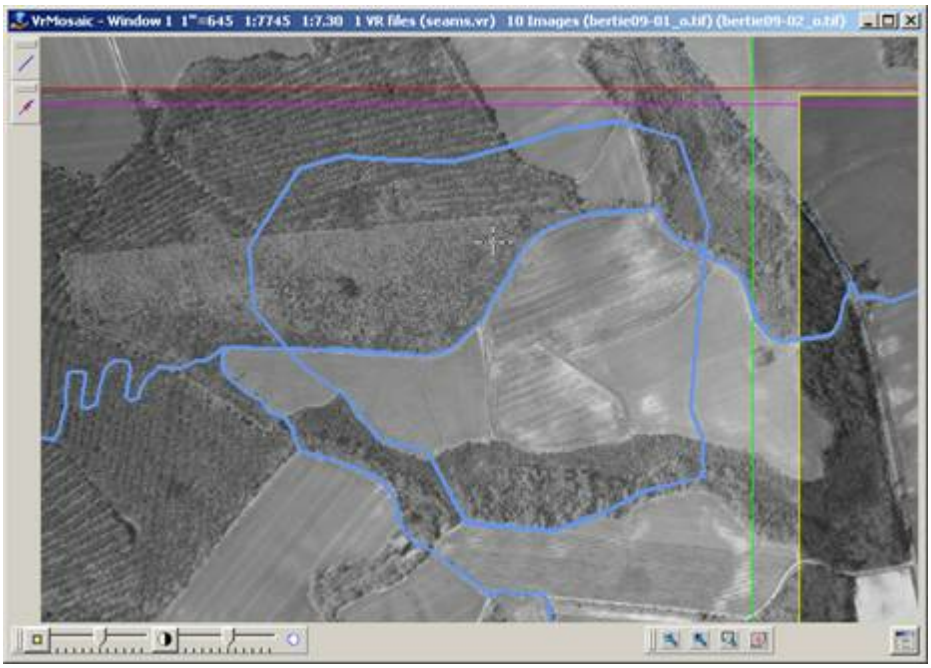
6. In graphics Window 1, position the cursor where the seam line should begin and press button 1 to digitize a point. A rubber-band line should be displayed from the point selected to the current cursor location.

7. Continue to use button 1 to digitize points along the seam line. Use the Zoom commands to zoom in and out as needed. Because this is a closed seam line, once 3 points have been digitized, the display automatically shows a closing line going back to the first point. Use option "3 Backup" if a point is placed in the wrong location.

8. After all points have been digitized (there is no need to snap back to the first point), select "4 End" from the MenuKeys dialog to end and save the seam line. The previous MenuKeys dialog will be displayed, and the next image will be highlighted.

9. Repeat this process as many times as needed starting with step 3.



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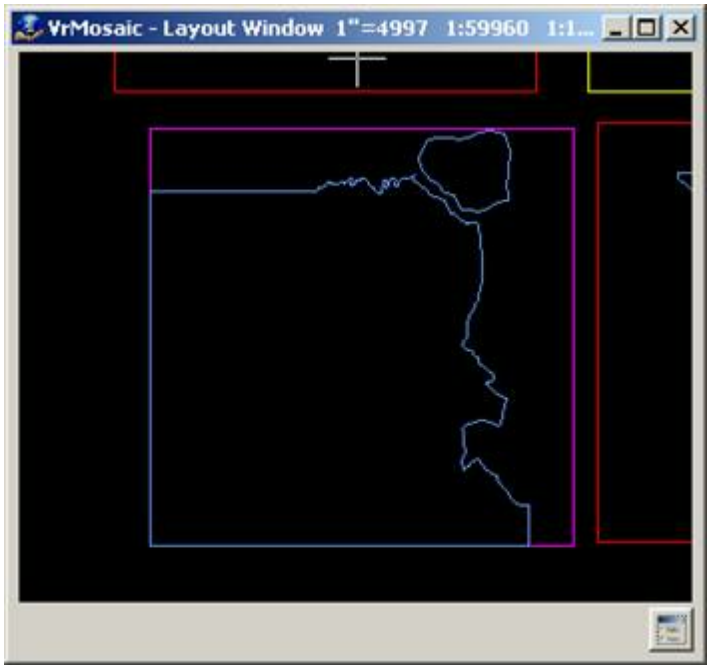

A single closed polygon has been added to upper left corner of an image. The layout shows that the image data will be taken from this image.

Editing Seam Lines

In this section of the tutorial, the seam line editing tools will be used to make changes to existing seam lines.

Editing Using Standard Mode

The standard mode for editing seam lines is very similar to using the VrOne Edit Line (EDILIN) command. In fact, the Edit Line Command (EDILIN) can be used to edit seam lines in VrOne or in VrMosaic without having the Mosaic application running. Using the standard mode editing tool built into the Mosaic application provide the added benefit of a real time image preview, along with the ability to move common points that are shared by multiple seam lines.

1. Select "2 Edit Seams" from the Main MenuKeys dialog (this is the first dialog displayed when staring the Mosaic application).

2. Point to an existing seam line graphics Window 1, and press button 1 (Id Seam). The cursor should snap to the nearest seam line point, and the Edit Seams MenuKeys dialog will be displayed.

3. Use the options displayed in the MenuKeys dialog to edit the line. Try moving points, deleting points, and inserting points. As the points are changed, the display will be refreshed to show how the images are affected by the new seam line location.

4. When finished, select "# End" (F12), to save the edited line and return to the previous

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MenuKeys dialog.

5. Repeat Steps 2-4 for other seam lines.

Editing Using Dynamic Mode

In dynamic mode, it is not required to identify a single seam line to edit as it is in standard mode. Instead, handles are displayed on all lines and point may be moved deleted or inserted at any time in a very intuitive manner. When the cursor is over a point handle, it will become solid. At this point press button 1 to move the point or button 2 to delete the point. If the cursor is not over a point handle, the nearest line segment will be highlighted. While a line segment is highlighted, any press of button one will insert a new point onto that line segment at the current cursor location.



1. Select “2 Edit Seams” from the Main MenuKeys dialog (this is the first dialog displayed when staring the Mosaic application).

2. Select “2 Dynamic Edit” from the Edit Seam MenuKeys dialog. All point handles will be calculated and displayed (there may be a delay if a large project is open).

3. Zoom in near a seam line so detailed image data is visible.

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4. Place the cursor over a point that is shared by multiple seam lines. The 1st MenuKeys item should change to read “1 Move Pt”, and the second MenuKeys item (2 Del Pt) should be available.

5. Press button 1 to begin moving the point. The Move Point MenuKeys dialog will be displayed. This dialog has options for adding multiple points to the move group. For this tutorial, just a single point will be moved.

6. Move the cursor to a new location and press button 1. All seam lines that shared the common point are now changed to reflect the new point location. The image data is also changed to reflect the new seam line location. The Edit Seam MenuKeys dialog should now be displayed.

7. Place the cursor near the middle of a seam line segment, making sure it is not over an existing point handle. The closest seam line to the cursor should now be highlighted.

8. Press button 1 to insert a point at the cursor location. Notice that the seam line segment is changed to include new point. The image data is also changed to reflect the latest seam line data.

9. Place the cursor over the newly added point. The first MenuKeys item should change to read “1 Move Pt” and the second MenuKeys item (2 Del Pt) should be available.

10. Press button 2 to delete the point. Notice that the seam line segment is changed to remove the deleted point. The image data is also changed to reflect the latest seam line data.

Creating Final Mosaics

In this section of the tutorial, the final output mosaic images will be created.

Output Using Manual Mode

In this section of the tutorial, a single output image using manual mode will be created. Manual mode allows a manual selection of the bounds of a single output window. A new image will be written for the area selected.

1. Select the “Create Mosaics” button on the VrMosaic Main Steps dialog or select “5 Create Mosaics” from the MenuKeys dialog. This will display the Output MenuKeys dialog.

2. Select “1 Manual” from the MenuKeys dialog.

3. In graphics Window 1, digitize the lower left corner of the output window.

4. In graphics Window 2, digitize the upper right corner of the output window. Drag the cursor to select the upper right window corner, the VrMosaic main window status area will display the

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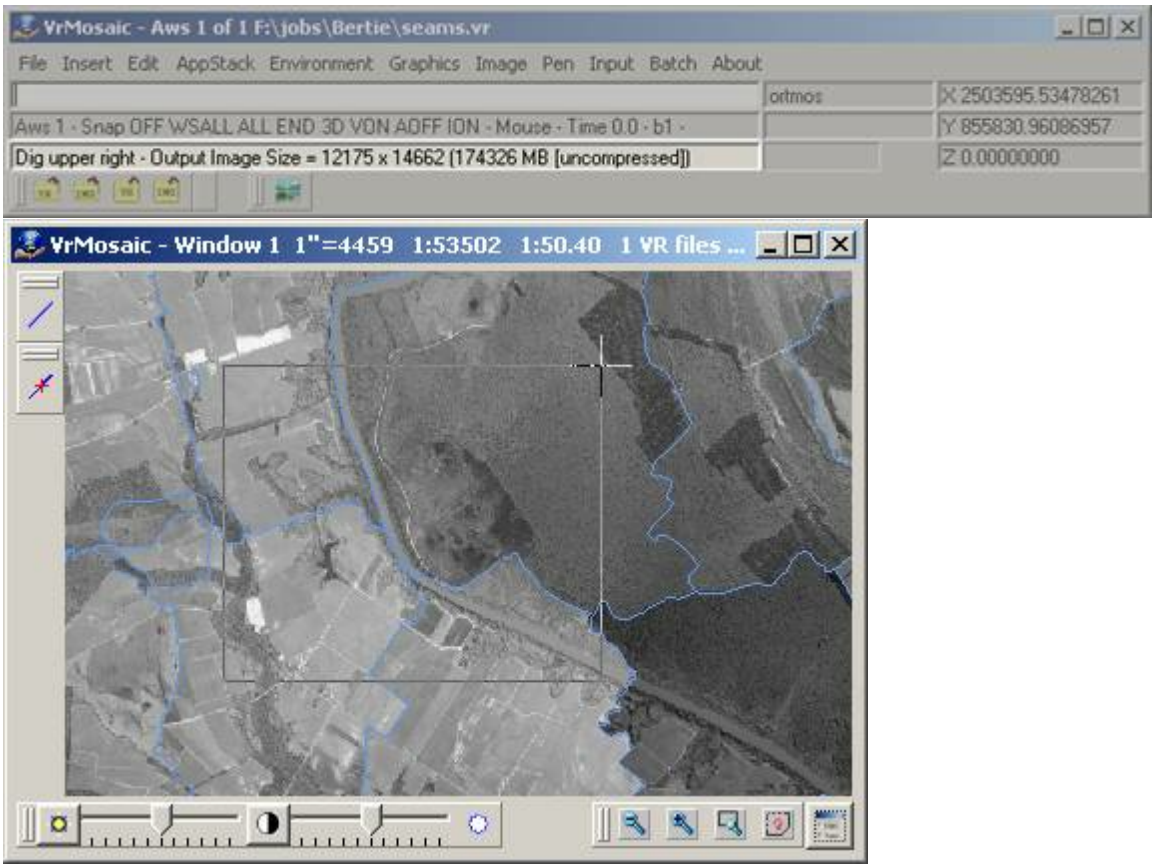
output image pixel dimensions and file size. The file size is only approximate, and reflects the raw size before compression. A confirmation MenuKeys dialog will be displayed. The VrMosaic main window status area will display the name of the Output File that will be created.

5. Select "1 Accept" to begin creating the output image. If the project settings are set for Image Balancing, then the images will be balanced first. The graphics window will display a moving scanline from the top to the bottom of the output area as a status indicator. When the output image is complete the VrMosaic main window status area will display the time it took to create the image. The Output MenuKeys dialog will display again, ready for a new output area to be selected (the same file will be overwritten unless the output file name is changed).

NOTE: Having feather mode on can significantly add to the processing time.



Output Using Batch Mode

In this section of the tutorial, multiple output images will be created using batch mode. Batch mode requires that a sheet layout exist in the current VrOne seam file. The sheet layout procedure will be covered before continuing to the output steps.

Creating a Sheet Layout

In this section of the tutorial, a sheet layout to be used by the Batch Output mosaic process will be created. Sheet borders will be placed in Layer 2, and Sheet names will be placed in Layer 3

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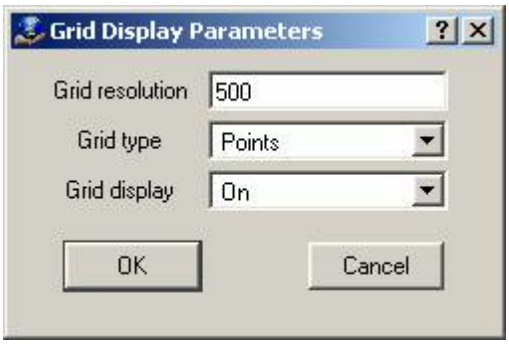
(the default layers in a new project). The grid command will be used to make the placement of the sheets easier.

1. Select Graphics->Set Grid Resolution from the pull down menu or enter SETGRI in the command prompt. This will display the Grid Parameters dialog box.
2. Type in 500.0 for a grid resolution.
3. Set grid type to points.
4. Set the grid display to "On".
5. Press "OK" to close the grid display dialog.



6. The Graphics window should show display grid points every 500.0 ground units.

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7. Select Insert->Line from the pull down menu or type in or enter the Insert Line command (InsLin) in the command prompt. This will start the Insert Line command.

8. Enter SETLAY 2 in the command prompt. This sets the target layer to 2, the default layer for sheet borders.

9. Using the grid points as a guide (the cursor will automatically snap to the grid), use Insert Line to digitize a square sheet in graphics window 1. Make the sheet the size that would be used in a typical project.

10. Select "# End" to end the Insert Line command.

11. Select Edit->Edit Line from the pull down menu or type in EDILIN in the command prompt. This will start the Edit Line command.

12. Select the upper left hand corner of the sheet line that was just placed.

13. Select "6 Line Functions" from the MenuKeys dialog.

14. Select "4 Copy Line" from the MenuKeys dialog.

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15. Place copies of the sheet line next to each other. Place as many copies as needed to cover the output area with sheets. Having the grid points on will ensure that the sheets line up perfectly.

16. End the "Edit Line" command.

17. Select Insert->Text from the pull down menu or enter the Insert Text command (InsTex) in the command prompt. This will be used to place sheet name labels for each sheet that was defined in the previous steps.

18. Select “7 Enter Params” from the MenuKeys dialog. The Text Parameters dialog will be displayed.

19. Set the Layer to 3, the default layer for sheet names.

20. Set the width and height to large values such as 40.0 (the exact size will depend on the sheet sizes that were defined, but it should be large enough to be seen while viewing the sheet from an overview level).

21. Set the Justification X and Y to center. This is not necessary, but it makes it easier to position the text in the center of the sheets.

22. Set the Text value to SHEET1.TIF.

23. Press the “Ok” button to close the Text Parameters dialog.

24. Digitize a location in the center of one of the existing sheets. This will place the text label “SHEET1.TIF” in the center of the sheet.

25. Use “7 Enter Params” to change the sheet name to the next number (SHEET2.TIF), or type in txt=SHEET2.TIF.

26. Digitize a location in the center of the next sheet.

27. Repeat steps 25 and 26 until all sheets have a unique sheet name label inside them.

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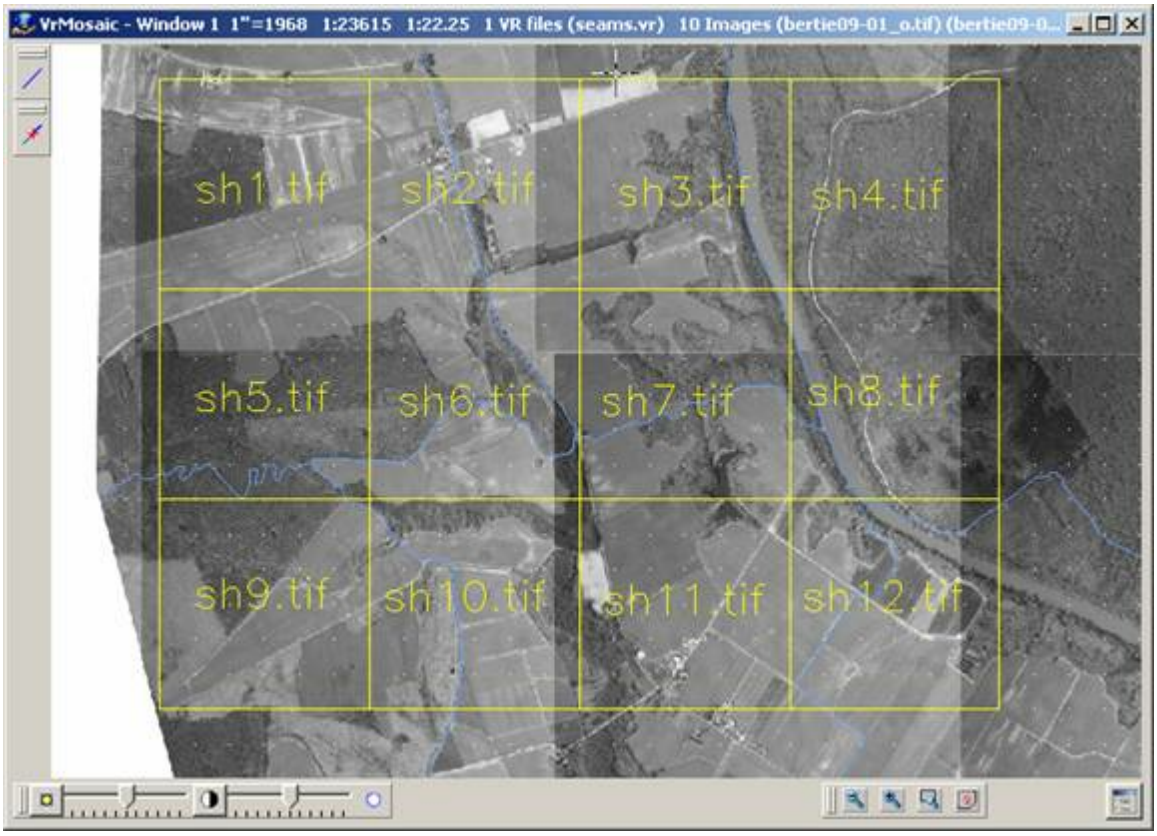

Selecting Sheets to Output

In this section of the tutorial, the sheets to output based on the defined sheet layout will be selected.

1. Select “Create Mosaics” on the VrMosaic Main Steps dialog or select “5 Create Mosaics” from the MenuKeys dialog. This will display the Output MenuKeys dialog.
2. Select “2 Batch” from the MenuKeys dialog. A dialog will be displayed providing information about the layers to search for sheet borders and sheet names.
3. Press the “Yes” button to continue. A new dialog will be displayed showing all of the sheets borders that were found along with the sheet names associated with each one.
4. Place a check mark beside each sheet to create.

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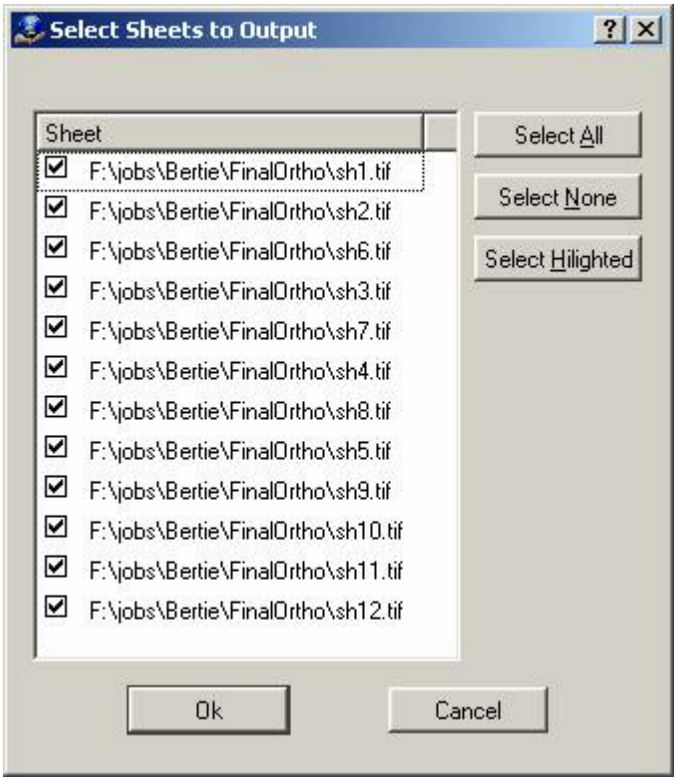

5. Press "Ok" to begin creating the output images. If the project settings call for for Image Balancing, then the images will be balanced first. The graphics window will display a moving scanline from the top to the bottom of the sheet output area as each sheet is created. After the sheets have been created, the Main MenuKeys dialog will be displayed.
NOTE: Having feather mode on can add significantly to the processing time.

4 Hardware

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Vr Mapping

Hardware Configurations

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Computers and Monitors

- NVIDIA 3D Vision Package
- Monitors
- Multiple Monitors
- Drivers
- Suggested Computer Configurations

Digitizers

- Digitizer/Stereo Plotter Configurations

Touch Pads

- VrController
- Vr Touchscreen
- Keyport 252
- CEDEQ Enterpad P120
- Kinesis Savant 58-key Programmable Keypad

Graphics Cards

- NVIDIA Quadro 4000/K4200/M4000/P4000
- NVIDIA Quadro FX 1300/1400/3400/4400 Stereo Graphics Card for PCI-Express (PCI-X)
- NVIDIA Quadro4 980 XGL Stereo Graphics Card for AGP
- 3Dlabs Wildcat 5110 / 6110 Stereo Graphics Card
- 3Dlabs Oxygen GVX210 Stereo Graphics Card

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3Dlabs Oxygen GVX1 Pro Stereo Graphics Card

3D Input Devices

Stealth 3D Mouse / Stealth 3D J-Mouse
Leica TopoMouse
Stealth Z-Mouse / Stealth Hand Wheels
Immersion / Stealth E-Mouse / Stealth V-Mouse
Z/I Mouse
Joysticks, Joypads, Game Controllers, Gamepads

Miscellaneous

CEC-488 Interface Card
USB to Serial Converter
Turning Off the Cursor Shadow
Setting Up a Network Printer

CEDEQ ENTERPAD P120 120 Button Key Pad (Keyboard Connection)

The CEDEQ Enterpad P120 is a 120-button keypad that connects to the computer between the computer and the system keyboard. The Enterpad connects directly to the computer keyboard port; the system keyboard connects to the Enterpad. Each connector is the small MINI-DIN 6 pin connector. This keypad may be purchased from Cardinal Systems, LLC.

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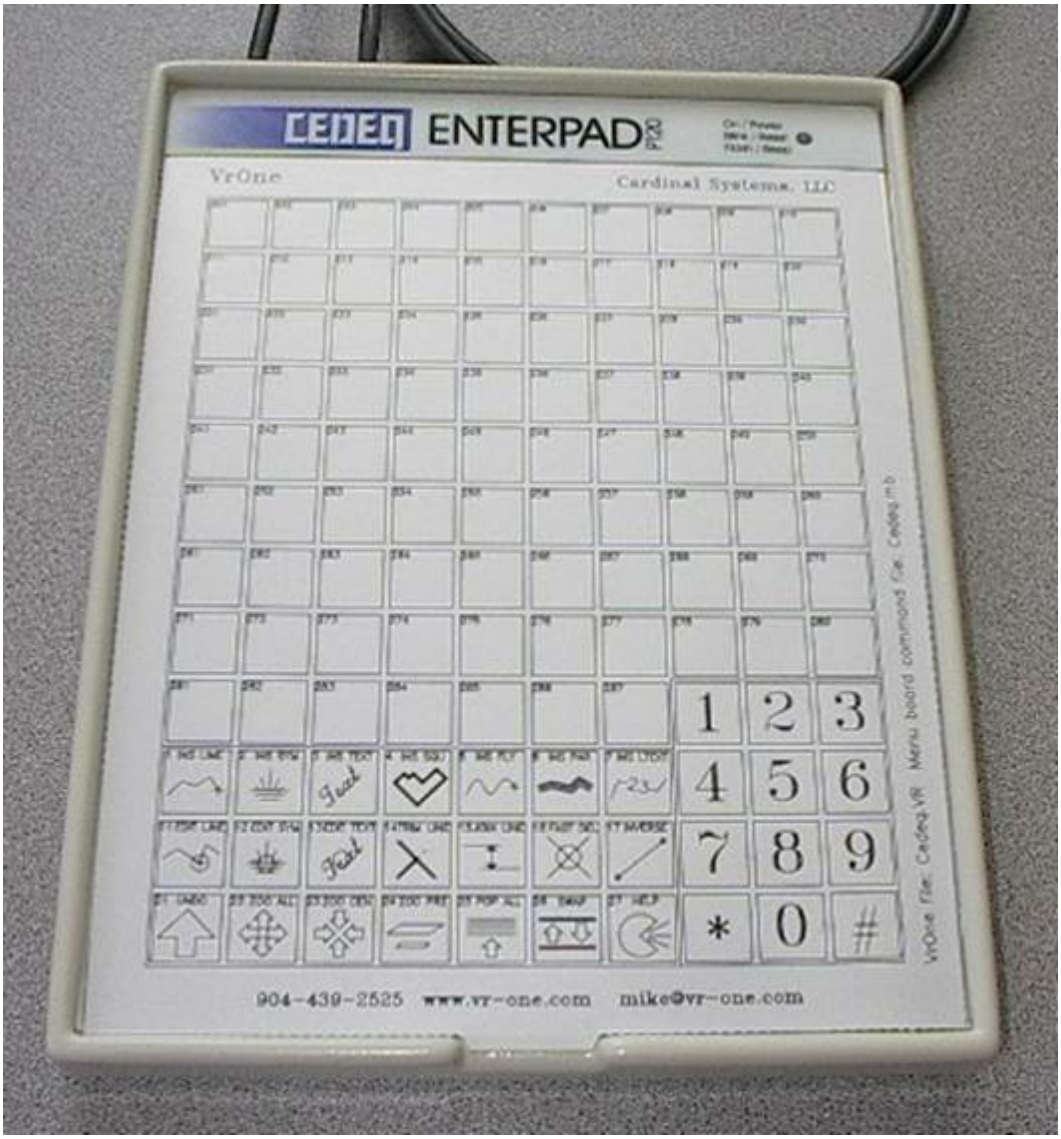

Connecting The Keypad

1. Turn off computer and disconnect the keyboard.
2. Plug the keypad into the keyboard port on the back of the computer
3.Plug the keyboard into the keypad at the end of the cable.

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Downloading The Keypad

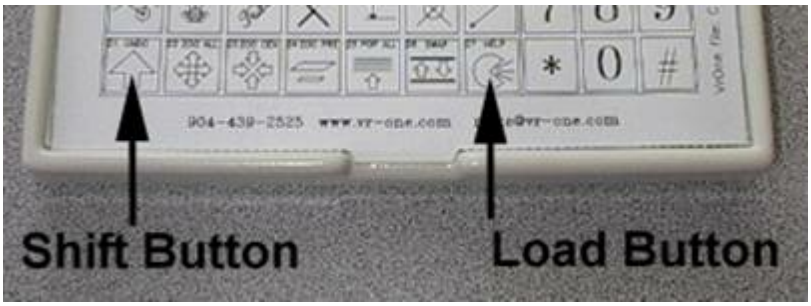
If purchased from Cardinal Systems, LLC, the keypad comes preloaded with key assignments, making it usable with VrOne. Once the keypad assignments have been downloaded, they should not need to be downloaded again. Key assignments may be made in VrOne. If this is a new keypad or you wish to customize the keypad key assignments (not recommended) follow the instructions below.

The following operations must be done from a command prompt (DOS prompt).

1.Copy the download program from the Cedeq disk (pos42.exe) and the key assignments file (\vr\data\vrone.pos) into the same directory. These two files may be downloaded from the VrOne web page from the Cedeq directory.

2. Type: pos42 vrone 1

3. When prompted, press and hold the Shift key on the keypad then press the Load key on the keypad.



NOTE: Download cannot be performed from Windows NT/2000. The following steps may be done to download the keypad from Windows NT/2000:

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1. Create a Dos bootable floppy disk. A floppy may be formatted and made bootable with the command format /S a: from DOS or Windows 95/98/ME.

2. Copy the download program from the Cedeq disk (pos42.exe) and the key assignments file (\vr\data\vrone.pos) into the floppy. These two files may be downloaded from the VrOne web page from the Cedeq directory.

3. Insert the floppy and reboot the computer.

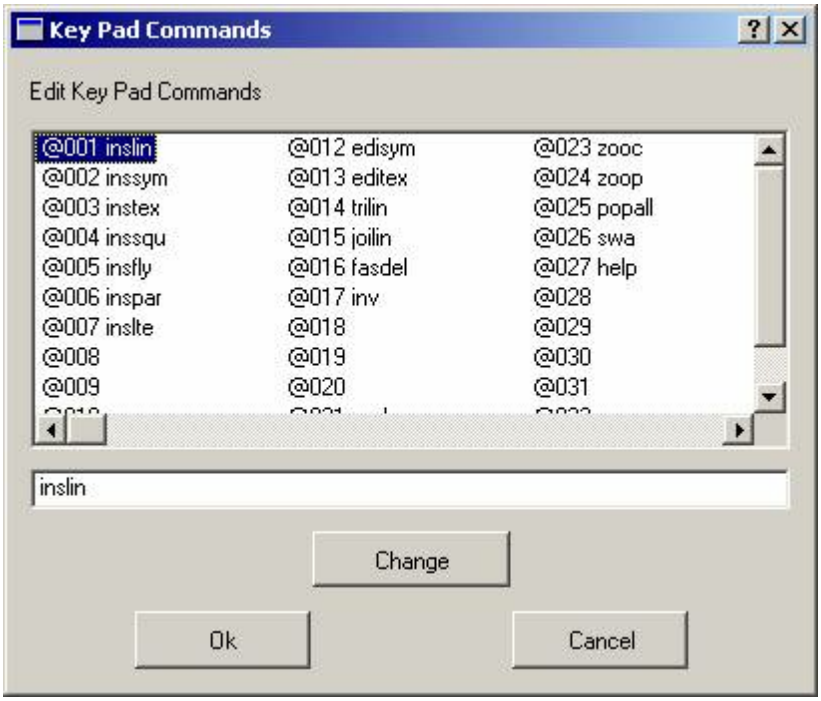
4. Type: pos42 vrone 1

5. When prompted press and hold the Shift key on the keypad then press the Load key on the keypad.

6. When the download is complete, remove the floppy and reboot the computer.

Editing The Key Assignments

The keypad key assignments may be changed in VrOne from Input->Edit Key Pad Commands (EdiKey). The numbers to the left of the @ symbol correspond to the numbers on the keypad overlay. The default VrOne assignments allow 87 Function Key buttons and 21 VrOne command buttons.



Support Files

The following files are delivered with VrOne for the Cedeq keypad:

- **`\vr\data\default.kp`** – VrOne key assignments. This file determines the VrOne Function Key or key-in or macro to run when a button is pressed. This file should be renamed or re-created with a new name to avoid being overwritten by the new VrOne release. This file name for the key assignments may be defined in the VrOne configuration

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program (vrcfig).

- **\vr\data\vrone.pos** – Initial button assignments that are downloaded to the keypad once. If a keypad is purchased from Cardinal Systems, this operation is not needed.
- \vr\data\cedeq.VR – VrOne file containing the Cedeq keypad key overlay. This file may be customized and plotted.

Kinesis Savant 58-key Programmable Keypad

The Kinesis Savanttm Professional is a 58-key programmable keypad that may be used with VrOne. Any available VrOne key-in including 12 button input may be assigned to this keypad. Two layer functionality offers two functions for every key. The PS/2 version has no software to load (driver provided for USB version). Just program directly from your PC-compatible keyboard. PS/2 version has built-in pass through connection for your PS/2 keyboard. This item plugs into the PC (or USB) keyboard port, so think of it as a programmable, 58-key keyboard on the side. A regular PS/2 (or USB) keyboard is required to reprogram the keypad but otherwise it can be used all by itself. See www.kinesis-ergo.com/savant_58key.htm for more information.



3Dlabs Oxygen GVX1 Pro Graphics Card

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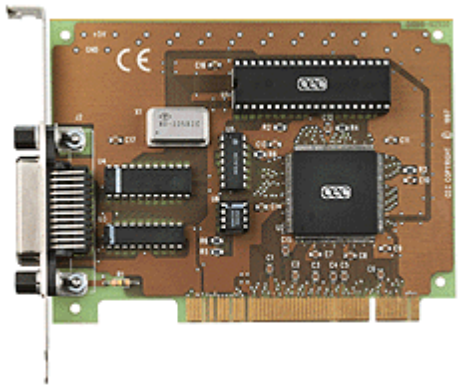
The 3Dlabs Oxygen GVX1 Pro graphics card is used to view stereo images and vectors with VrTwo. This card is supported on Pentium II and Pentium III based computers but not on Pentium 4/i850 motherboard based computers. The i850 chipset used on Pentium 4 motherboards supports 1.5 volt AGP PRO50 boards and the AGP PRO slot on these motherboards is configured so that the 3.3 volt AGP boards can't be inserted. 3Dlabs has reported that a Pentium 4 compatible board will be available by the third quarter of 2001.

CEC-488 Interface Card



The CEC-488 Interface Card may be used to connect VrOne to the Zeiss P1/P1/P3 stereo plotters and is manufactured by Capitol Equipment Corporation (www.cec488.com). VrOne has been tested using the PCI version of this card running Windows 2000. Although there are installations running VrOne and Windows ME with this card, we recommend the use of Windows 2000.
While most of the Zeiss instruments offer a serial interface, the CEC-488 is much faster when reading and writing coordinate data to the instrument. The CEC-488 is based on the IEEE-488 interface standard that was used by Hewlett Packard as HP-IB and by other manufacturers as GPIB (General Purpose Interface Bus).

USB To Serial Converter

If your computer has a single serial port and you require two serial devices (stereo plotter and digitizer) to be connected, a USB (Universal Serial Bus) converter may be used. This converter adds another COM port by converting an existing USB port.
The Belkin USB Serial Adapter shown below has been tested on Windows 2000 and runs well. Note: Check compatibility with your operating system.

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www.belkin.com - Belkin part number: F5U103

The converter shown below is the D-Link DSB-S25 USB to Serial Port Converter Cable. This converter has not yet been tested.



www.dlink.com/products/usb/dsbs25/

The KEYSPAN USB PDA ADAPTER shown below was a lower cost converter. This converter was tested under Windows 2000 to connect to a Calcomp Drawing Board II digitizing tablet. The model tested was advertised to work only under Windows 98 but Windows 2000 drivers are available on their web site.

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www.keyspan.com

Turning Off the Cursor Shadow

On some computers when the mouse is active, the cursor or dragged lines, symbols and text leave white dots on the screen. The mouse pointer shadow in Windows can cause this problem. To turn off the mouse pointer shadow:
Windows NT 4.0 / Windows 2000: My Computer -> Control Panel -> Mouse -> Pointers tab -> Uncheck “Enable pointer shadow”

4.1 Computers And Monitors

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Vr Mapping

Computers and Monitors

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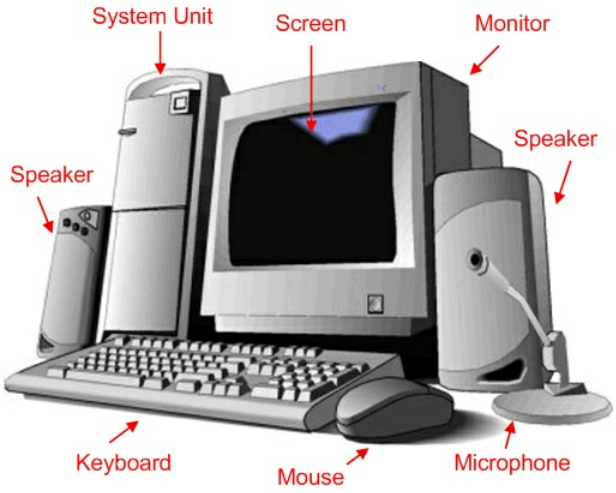

Suggested Computer Configurations
NVIDIA 3D Vision Package
Monitors CRT
Multiple Monitors

4.1.1 Suggested Computer Configurations

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

Suggested Computer Configurations

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Description

The Vr Mapping Software is a Microsoft Windows application and will run on many computers with this operating system. Computer hardware configurations depend on the Vr Mapping application that is used. The informatin below are suggestions; your requirements and preferences may be different.

More help with hardware for Vr Mapping Software can be found on the Vr Hardware Configurations Help Page.

All Configurations

- **Computer -** Dell and HP computers may be used as high quality, reliable computers. Custom built computers have proven to work well also.
- **Computer Processor** - Any processor supporting Microsoft Windows. This includes Intel and AMD. Recommended processor speed is 3.0 GHZ or greater. This includes the single Intel Dual Core or the single Intel Core 2 Duo or the Intel Core 2 Quad, or the Intel Core i7 or the dual or quad core Intel Xeon processors. The Intel quad core or higher processor is recommended.
- **Memory** - 16 GB or greater is recommended. 32 GB is recommended for applications such as orthophoto, aerial triangulation, and point cloud (LiDAR, DSM) applications.
- **Disk Drives** - Disk drives should have a rotational speed equal to or greater than 7,200 RPM. Serial ATA (SATA), ULTRA ATA, and solid state disk drives work well with Vr Mapping.
- **Graphics Cards** - For 3D stereo applications, a NVIDIA graphics card is required. Recommended graphics cards include the Quadro 4000, K4000, K4200, K5000, K5200, K6000, M4000 or P4000 graphics cards. The NVIDIA Quadro P4000 is the recommended choice due to it's price/performance point. A comparison chart of the newest cards can be found at http://www.nvidia.com/object/compare-quadro-gpus.html. The 3D stereo graphics card must support quad-buffered stereo and typically have a 3-pin stereo

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connector. The NVIDIA specification sheet will typically mention "3D Stereo Support" for a supported card.

- **Monitors -** 17- inch or greater. Flat screen LCD screens are recommended and multiple monitors are supported. When using graphics cards with DisplayPort interfaces only, care must be taken when choosing a 3D monitor. See the NVIDIA Quadro 4000/K4200/ M4000/P4000 page for more information.
- **Stereo Hardware** - The NVIDIA 3D Vision package is required for stereo applications such as VrTwo and VrThree (VrLiDAR). The components that make up the 3D Vision system include a graphics card, 120Hz monitor, 3D emitter, and stereo glasses.
- **Operating System -** Microsoft Windows 7 or Windows 10 64-bit is required for Vr Mapping Version 5 and above. If using the Windows 10 Creators Update (version 1703), the NVIDIA Quadro driver must be upgraded to version 385.08 or greater. **NOTE**: Windows XP is no longer recommended.
- **3D Mouse** - If a 3D mouse is used, we have recommended the Stealth 1 Z-Mouse (S1), the Stealth 2 Z-Mouse (S2), the smaller Stealth 3 Z-Mouse (S3) or the brand new Stealth 4 (S4) Z-Mouse. For years, the Stealth Z-Mouse has been successful and reliable. These 3D mice may be purchased from Cardinal Systems or Stealth International.
- Optional Hardware - The VrController iPad App allows the control of the Vr Mapping software using an Apple iPad as the touchscreen input device. NOTE: Currently not supported for iOS 11.

4.1.2 NVIDIA 3D Vision Package

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Vr Mapping

NVIDIA 3D Vision Bundle

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Description
Operating Systems
Graphics Cards
Drivers
Video Cable
Multiple Monitors
Card Configuration
Emitter

Document revised: October 3rd, 2011

Description

The NVIDIA 3D Vision Bundle consists of a 120Hz LCD monitor, a pair of stereo glasses, and an emitter. This package, coupled with a supported quad-buffered graphics card such as the NVIDIA Quadro K4000 offers great performance with 3D stereo roaming for VrTwo and and VrThree (VrLiDAR) 3D VrThree. It is also possible to configure dual monitors using this configuration.

The monitors supported offered with the bundle include hardware from various monitor manufacturers. A list of supported 3D monitors can be found at 3D Glasses and Displays on the NVIDIA web site. A list of supported hardware for the 3D Vision Bundle including graphics cards can be found at 3D Vision Pro System Requirements on the NVIDIA web site.

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3D stereo viewing with Vr Mapping requires an NVIDIA quad-buffered OpenGL graphics card. A list of quad-buffered graphics cards from NVIDIA can be found at NVIDIA 3D Vision for Quadro on the NVIDIA web site. Currently, the recommended graphics card for Vr Mapping's 3D stereo applications is the NVIDIA Quadro K4000.

The 64-bit version of Windows 7 is recommended.

Operating Systems

The following operating systems have been tested with the NVIDIA 3D Bundle and Vr Mapping:

- Windows 7 64-bit (recommended)
- Windows 7 32-bit
- Windows XP 32-bit

Graphics Cards

Graphics cards currently tested for use with the NVIDIA 3D Bundle and Vr Mapping:

- NVIDIA Quadro P4000 (recommended)
- NVIDIA Quadro M4000 (recommended)
- NVIDIA Quadro 4000
- NVIDIA Quadro K5000
- NVIDIA Quadro 5000
- NVIDIA Quadro FX 3800
- NVIDIA Quadro FX 3700
- NVIDIA Quadro FX 4600
- NVIDIA Quadro FX 4800

Drivers

Windows 7

The latest drivers for the NVIDIA Quadro graphics cards can be downloaded from the NVIDIA web site. See Graphics Card Drivers for more information on driver versions.

Windows XP

The latest drivers for the NVIDIA Quadro graphics cards can be downloaded from the NVIDIA web site. If there are problems with the latest drivers then known working drivers can be downloaded from the Cardinal Systems web page. See Graphics Card Drivers for more information on driver versions.

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The Graphics Driver

The graphics driver may be downloaded from the NVIDIA web site. The following example shows entries in the fields provided that will display the latest graphic driver for download for the 64-bit version of Windows 7 for the Quadro FX 3800 graphics card.



The Emitter Driver

If running Windows 7 and the NVIDIA Graphics Driver is release 275 or later, this step is not required. See Performing a Clean Install below.

An additional driver must be initially installed for the USB emitter. This driver is referred to as the 3D Vision Driver and this driver is installed after graphics driver is installed. The emitter driver can be found on the NVIDIA web site by selecting "Beta and Archived Drivers". The following example shows entries in the fields provided that will display the emitter drivers for download for the 64-bit version of Windows 7 for the Quadro FX 3800 graphics card.

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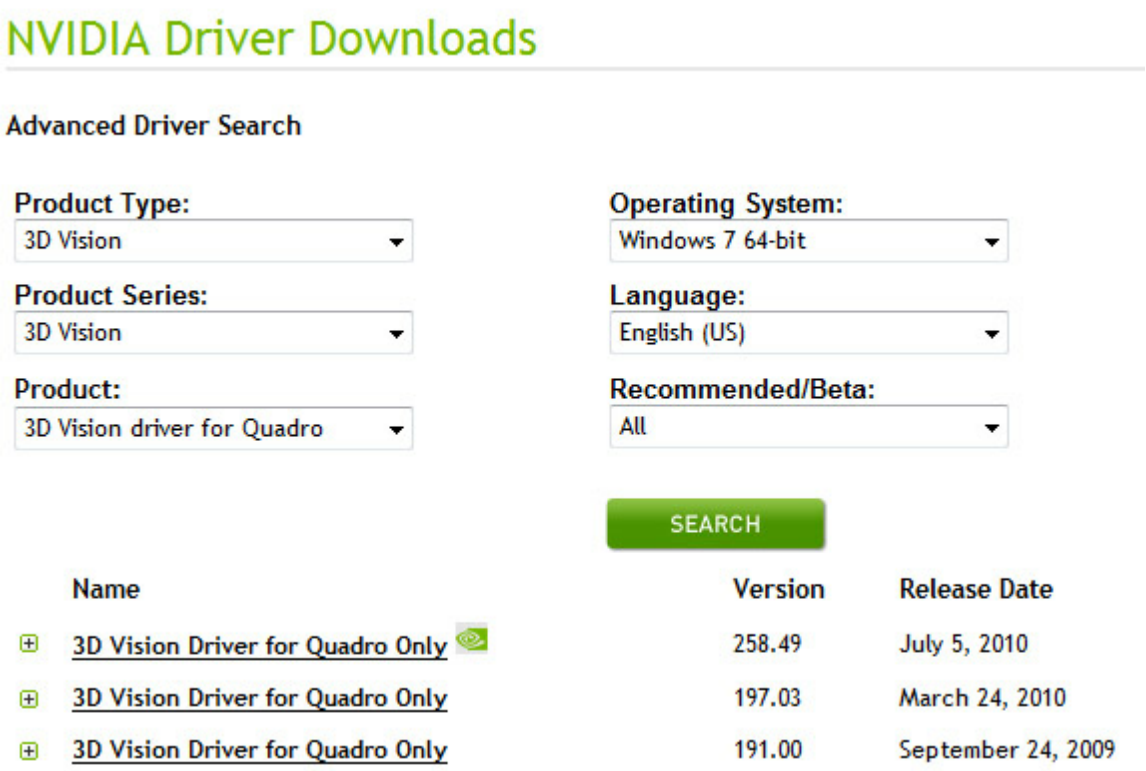

Performing a Clean Install

Beginning with NVIDIA Graphics Driver release 275 and above, the 3D Vision Driver (Emitter Driver) is included with the graphics driver and the step of downloading and installing this driver is not needed if running Windows 7. If the driver installation is an upgrade then a clean install should be performed as shown below. A clean install requires the resetting the graphics driver settings after installation. See Card Configuration below.

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Video Cable



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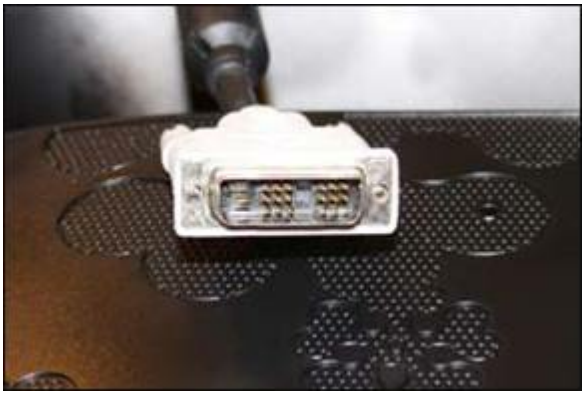

The correct digital cable is on the left

The digital cable for the stereo monitor should contain all available pins. In the above images the cable on the left must be used.

Multiple Monitors

The supported NVIDIA graphics cards support dual monitors and it is possible to configure the system with two LCD monitors. The second monitor should have the ability to cycle at 120Hz or 60Hz. Typically, the left LCD monitor is used to view stereo.

Card Configuration

Start the Display Properties dialog by pressing the right mouse button anywhere on the desktop and selecting Properties then the Settings tab.

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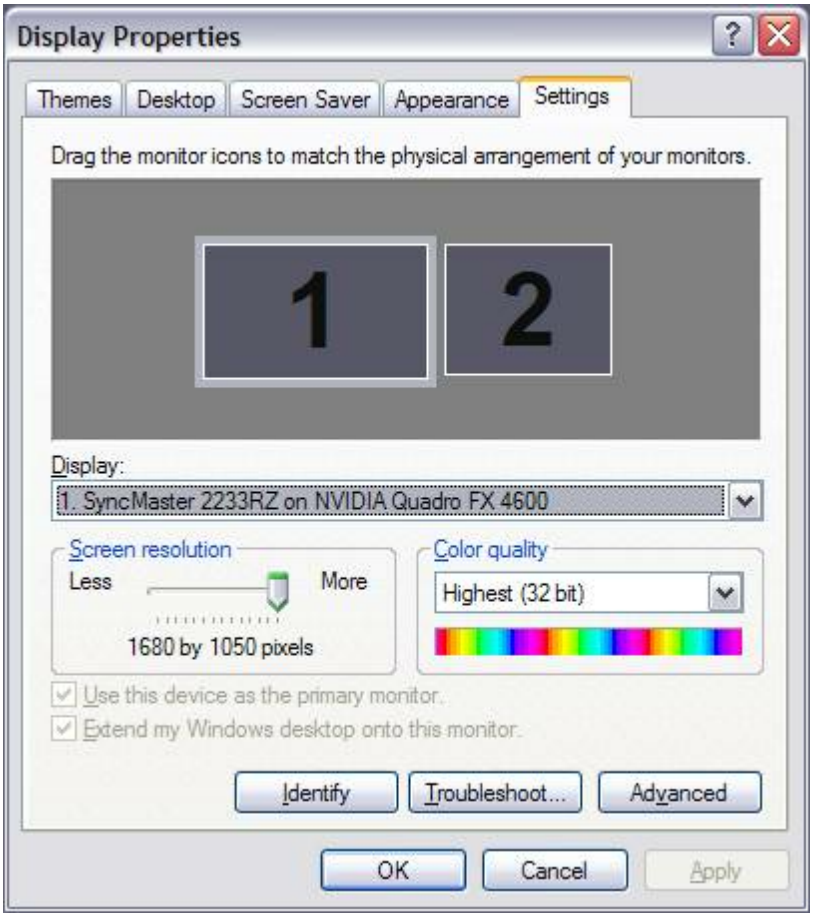

Press the Advanced button then select the Quadro FX tab and press “Start the NVIDIA Control Panel”.

Select “System Information” at the bottom of the left window and check the driver version.

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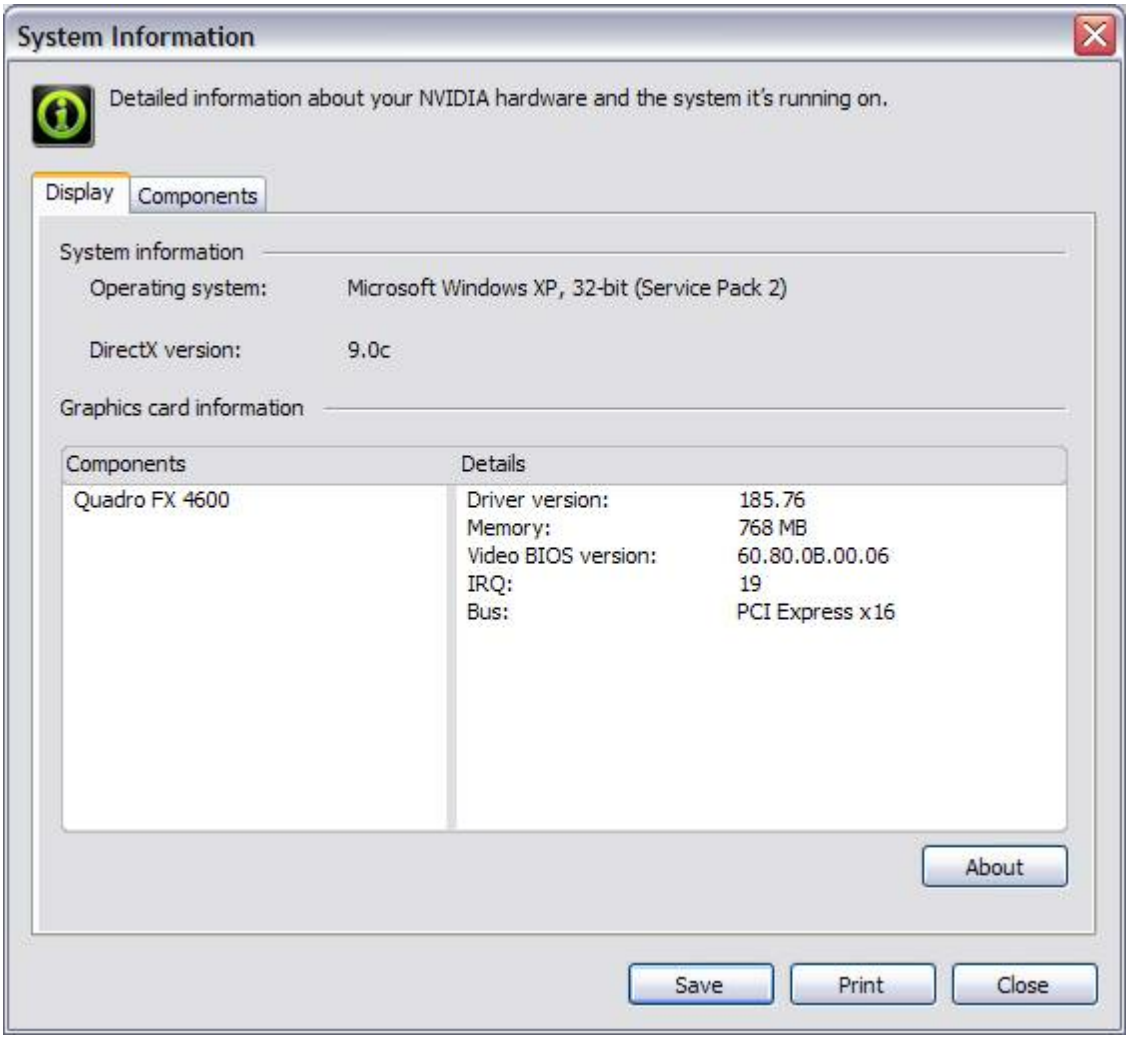

Select "Manage 3D settings" under "3D Settings" in the left window pane and configure the following settings. The remainder of the settings may remain set to their default settings.

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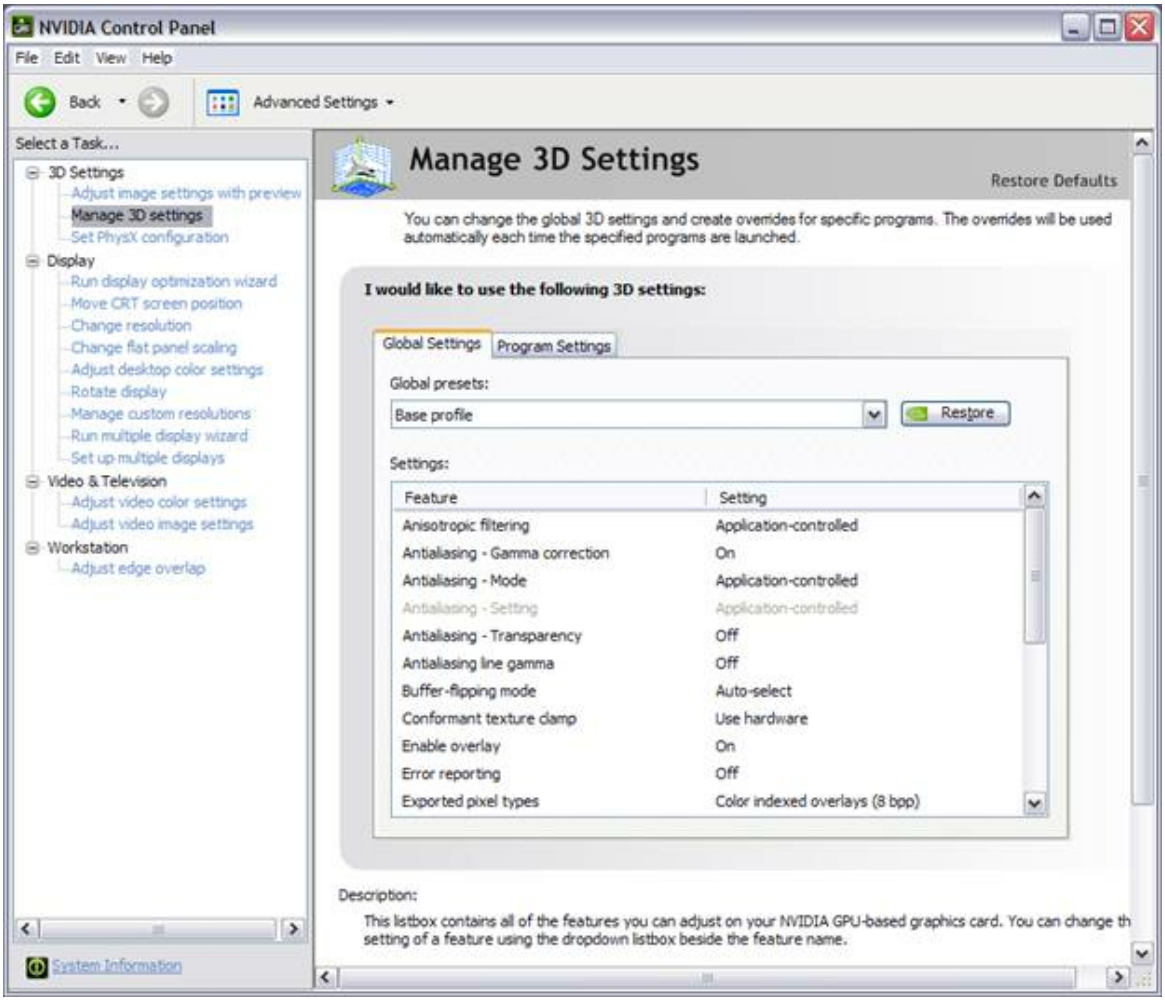

Setting	Value
Enable overlay	On
Multi-display/mixed-GPU acceleration	Multiple display performance mode
Stereo – Display mode	On-board DIN connector (with NVIDIA IR Emitter)
Stereo – Enable	On

Select “Change resolution” under “3D Settings” in the left window pane. Under “1. Select the display you would like to change.” select the Samsung SynchMaster icon and select the Refresh rate of 120 Hertz.

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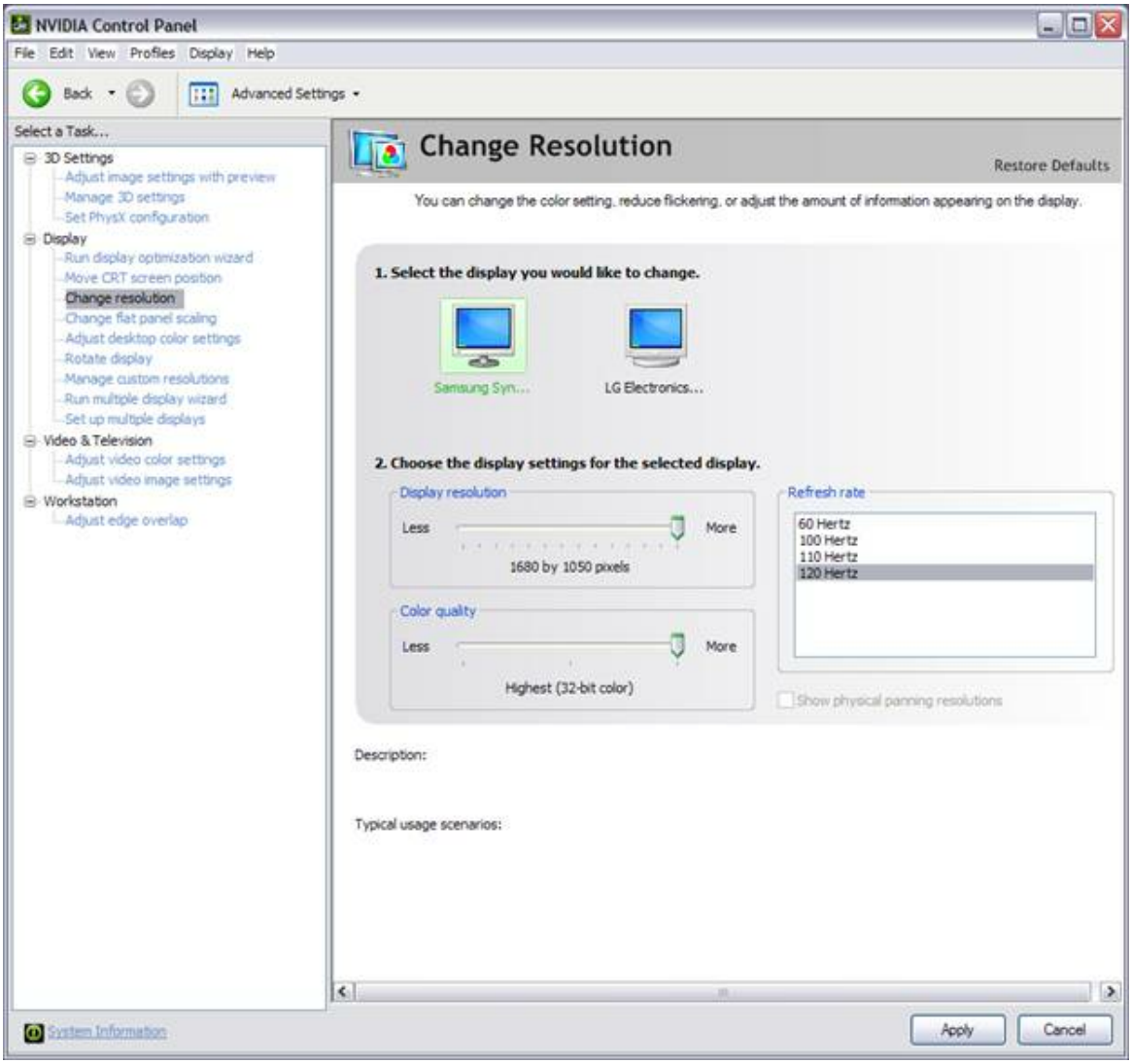

Emitter

Following are the color codes for the NVIDIA 3D emitter

Color	Description
Standard green	Configured
Bright green	Emitter on
Red	Driver not configured

See the Drivers section in the document for information about the emitter driver.

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4.1.3 Monitors

Vr Mapping

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Monitors



Description
Display Interface
DisplayPort Notes

Description

A wide range of monitors are supported by the recommended graphics cards for Vr Mapping. Workstations may consist of multiple monitors which include 3D stereo capable monitors and non-stereo monitors and may be driven from a single graphics card. See NVIDIA 3D Vision Package for information on stereo compatible monitors.

The trend in display technologies is toward non-CRT display screens such as LCD monitors. The use of CRT type monitors in virtually non existent today.

Vr Mapping's 3D stereo applications such as VrTwo and VrThree (VrLiDAR) require a 3D monitor. These monitors are designed to display 3D and use a recommended refresh rate of 120Hz. Typically, higher and lower refresh rates are available but Vr Mapping recommends 120Hz. Secondary, non-stereo monitors may be configured and may display 2D windows and program dialog boxes and menus. The display of 3D stereo on a monitor at less than 120Hz may produce noticeable image flicker

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If any of the Vr Mapping products except for VrTwo and VrAirTrig is being used then an LCD monitor will work well. This includes VrOne, VrConfiguration, VrOrtho, VrMosaic, ImageUtility, VrVolumes and VrBalance. Any application that displays 3D stereo will show flicker on an LCD monitor. NOTE: A feature of VrOne is the 3D viewer that is designed to display vectors in 3D. There are two modes to this viewer; 3D in which the display in which the vectors are in a perspective 3D view and 3DS (3D Stereo) in which the display is in a 3D view which requires a stereo card and stereo glasses.

Display Interface

There are two popular display interfaces available on today's graphics cards and monitors. The DVI (Digital Visual Interface) interface was introduced in 1999 and is available on many current and older 3D monitors. While still popular, it is being replaced by the newer DisplayPort interface which was introduced in 2008. The Dual-Link DVI interface and the DisplayPort interface are both capable of 3D stereo display. It should be noted however, that an NVIDIA 3D Vision supported monitor must be used for both of these interfaces. There are monitors available that support the DVI and DisplayPort interface but are unable to properly display 3D stereo. It should also be noted that the HDMI (High-Definition Multimedia Interface) display interface does not have the ability to display 3D stereo and is not discussed here.



Dual-Link DVI (left) and DisplayPort (right) connectors.

Shown above are the Dual-Link DVI and the DisplayPort cable connectors. Notice that the DVI connector contains all available pins. Cables for non-stereo monitors may not contain all available pins and will not produce 3D stereo.

A NVIDIA 3D Vision supported monitor must be used for 3D stereo viewing with Vr Mapping. Information about supported monitors along with other information can be found at NVIDIA System Requirements. Also see DisplayPort Notes below for a list of supported NVIDIA 3D Vision DisplayPort monitors.



NVIDIA Quadro 4000 and K4200

The NVIDIA Quadro 4000 and K4200 has one DVI port and two DisplayPort interfaces. The

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DVI port is used to drive the 3D stereo monitor. The DisplayPorts may be used to drive secondary, non-stereo monitors.



NVIDIA Quadro M4000 and P4000

The Quadro M4000 and P4000 contain four DisplayPort interfaces. Any of these ports may be used to drive the 3D stereo monitor and secondary, non-stereo monitors. The M4000 and P4000 do not have a DVI port. Please see DisplayPort Notes below.

DisplayPort Notes

In the past, the 3D LCD monitors used the Dual-Link DVI port for stereo and the older graphics cards contained at least one DVI connection. Later graphics cards such as the NVIDIA Quadro M4000 and Quadro P4000 do not have a DVI connection but have multiple DisplayPorts. The 3D monitor should have a DisplayPort connection or should support NVIDIA's G-Sync connection, which is a DisplayPort with additional display hardware. Only DisplayPort monitors recommended by NVIDIA should be considered and are listed below.

Workstations may be configured with two or more LCD monitors. Multiple monitors can be 3D compatible monitors but also may be non-stereo LCD monitors. In the configuration, the stereo monitor is typically on the left and the non-stereo monitor(s) on the right.

It's possible to use an older non-DisplayPort, DVI based 3D monitors with the Quadro M4000 or Quadro P4000 with the use of a DisplayPort to Dual-link DVI adapter. Following are 3D monitors recommended by NVIDIA that support the DisplayPort interface for non-DVI graphics cards such as the NVIDIA Quadro M4000 or Quadro P4000 (10-Feb-2017).

```
Acer      XB240H_A
Acer      XB241
Acer      XB241YU
Acer      XB252
Acer      XB270H_A
Acer      XB270HU
Acer      XB270HU A
Acer      XB280HK
Acer      XB321HK
Acer      Z271
Acer      Z301C
Acer      Z321Q
AOC       AC352UCG
AOC       AG271QG
AOC       G2460PG
Asus      PG248
Asus      PG258Q
Asus      PG278Q/QR
```

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```
Asus       PG348Q
BenQ       XL2420G
Dell       S2417DG
HP Omen    X35
Lenovo     Y27
Philips    272G5DYEB
ViewSonic XG2703
```

A Dual-Link DVI stereo monitor with a DisplayPort to Dual-Link DVI adapter may be configured. The StarTech DP2DVID2 adapter is recommended in this configuration. The DisplayPort to DVI adapters are 3rd party products and may require a reboot from time to time by un-plugging and re-plugging the USB cable.



StarTech DisplayPort to DVI Dual-Link Adapter

Document revised: December 2017

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4.1.4 Monitors CRT

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Vr Mapping

Monitors CRT

Description

NOTE: December 2017 - With the advances in graphics card and monitor technologies, much of the data in this document is deprecated.

When viewing 3D stereo in VrTwo the display monitor should be capable of a refresh rate of at least 100Hz at a resolution of 1280x1024. Refresh rates slower than 100Hz can result in noticeable flicker to the operator. See NVIDIA 3D Vision Package for information on stereo compatible LCD monitors.

The trend in display technologies is toward non-CRT display screens such as LCD screens and finding CRTs with 100-120Hz capability is more difficult. Manufacturers of CRT monitors have either switched production to CRT technologies or gone out of business. High quality CRTs are still being made but searching for them is necessary.

If any of the Vr Mapping products except for VrTwo and VrAirTrig is being used then an LCD monitor will work well. This includes VrOne, VrConfiguration, VrOrtho, VrMosaic, ImageUtility, VrVolumes and VrBalance. Any application that displays 3D stereo will show flicker on an LCD monitor. NOTE: A feature of VrOne is the 3D viewer that is designed to display vectors in 3D. There are two modes to this viewer; 3D in which the display in which the vectors are in a perspective 3D view and 3DS (3D Stereo) in which the display is in a 3D view which requires a stereo card and stereo glasses.

An LCD screen is capable of displaying stereo but at 85Hz there will be noticeable image flicker.

Where to Look

Call Michael Hooper at Sharper Technology (650-964-4600) www.sharpertechnology.com. Michael is up on the latest stereo compatible CRT's and has a wide variety of stereo products.

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Google makes a good commercial search engine called Froogle (www.froogle.com). Using a search key of `Monitor CRT 22″` or a variation of will show a list of 22-inch CRT monitors. If you don't mind a used monitor then a search of eBay (www.ebay.com) should yield some good finds.

Newegg (www.newegg.com) has a selection of CRT monitors available but check the specifications carefully.

Listed below are several monitors that should work well with the graphics cards supported by VrTwo. NOTE: Please check the specifications carefully. Cardinal Systems has not tested all the products listed below.

	Monitor
	ViewSonic P220f 22" CRT Monitor ViewSonic G220f 21" CRT Monitor ViewSonic G220fb 21" CRT Monitor ViewSonic G225fB 21" CRT Monitor (www.sharpertechnology.com)
	Mitsubishi Diamond Pro 2060U (DP2060U)
	NEC MultiSync FP2141SB CRT monitor

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	NEC MultiSync FE-2111SB-BK

4.1.5 Multiple Monitors

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Vr Mapping

Multiple Monitors

Description

NOTE: December 2017 - With the advances in graphics card technologies, the latest graphics cards used by Vr Mapping contain up to four monitor ports and can drive both 3D stereo and non-stereo monitors. Much of the data in this document is deprecated. Please see Monitors for more information.

It may be desirable to run multiple monitors on the computer for Vr Mapping. Many graphics cards support two monitors and the need to use two graphics cards in not needed. When running VrTwo however, some graphics cards will support only one monitor for stereo even though they have two ports. Cards such as the PNY NVIDIA Quadro FX 1300 will disable the overlay plane when two monitors are connected. This is not suitable when running VrTwo as this program makes use of the overlay plane for interactive graphics in stereo. In this case two

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graphics cards must be used. When running a stereo monitor, a second monitor and the Vr Touchscreen a second graphics card is needed to run the second monitor or the touchscreen.

NOTE: When running multiple graphics cards it may be necessary to run cards from different manufacturers or to run cards from the same manufacturer. Running the same graphics chip set from two different manufacturers can cause confusion with the graphics driver. For example, running a PNY NVIDIA Quadro FX 1400 as the stereo card in a PCI-Express slot and an eVGA GeForce MX 4000 in the PCI slot may cause problems because both cards use the NVIDIA chip set but are from two different manufacturers. Using the PNY NVIDIA Quadro FX 1400 in the PCI-Express slot and the ATI Radeon 7500 in the PCI slot works well because each card uses the driver supplied by the manufacturer.

The testing of multiple graphics cards has been done in Window XP only. Windows XP should support up to nine monitors.

When the Vr Touchscreen is used it is considered another monitor in windows and when used with VrTwo requires another graphics card.



Shown below a configuration using a stereo monitor, a second monitor and a third monitor that is running the Vr Touchscreen.

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As shown below, this configuration is running a PNY NVIDIA Quadro 4 980 XGL as the stereo card. This card is driving monitor 1 and is using only one of the two ports available. The second monitor and the Vr Touchscreen are being driven from an ATI Radeon 7500 graphics card.

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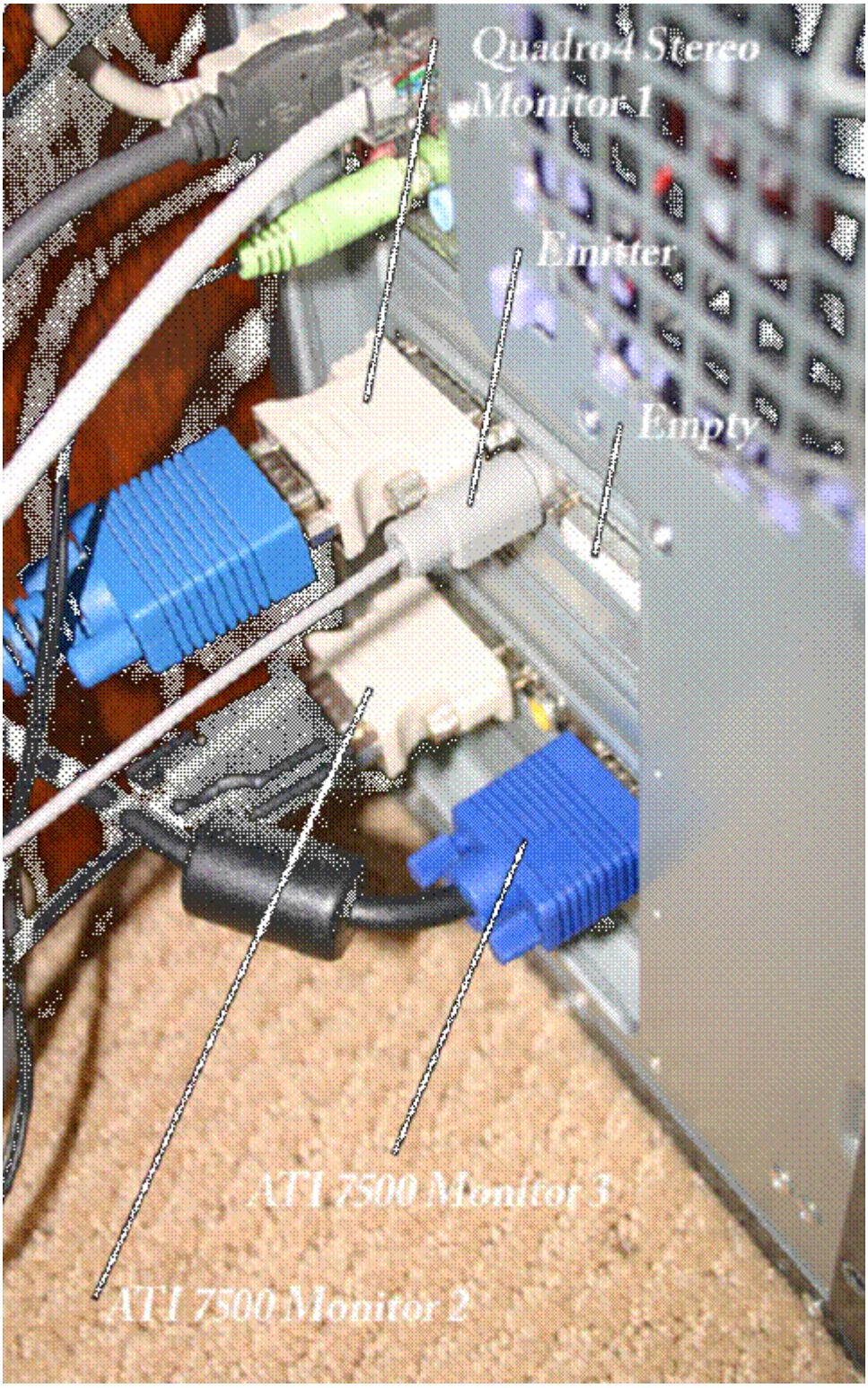

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4.2 Graphics Cards

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Vr Mapping

Graphics Cards



NVIDIA Quadro FX 3700

Drivers
NVIDIA Quado 4000/K4200/M4000/P4000
NVIDIA Quadro FX 1300/1400/3400/4400
NVIDIA Quadro4 980 XGL Stereo Graphics Card for AGP (deprecated)
3Dlabs Wildcat 5110 / 6110 Stereo Graphics Card (deprecated)
3Dlabs Oxygen GVX210 Stereo Graphics Card (deprecated)

See also: NVIDIA 3D Vision Package

4.2.1 Graphics Card Drivers

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Vr Mapping

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Graphics Card Drivers

Description
Drivers
Version 4 - Windows XP - CRT / Planar
Version 5 - Windows XP 32-bit
Version 5 - Windows 7 64-bit
Version 5 - Windows 10 64-bit
Version 6, Version 7 - Windows 10 64-bit
Version 6, Version 7 - 3D PluraView Stereo Monitor
Downloading Current Drivers From the NVIDIA Web Site
Downloading Archived Drivers From the NVIDIA Web Site
Driver Installation

Description

Following are some graphics card drivers used by Vr Mapping. Unless noted, the following versions have been tested by Cardinal Systems or are currently in use by Vr Mapping customers. The Windows XP and Windows 7 operating systems are no longer recommended.

Drivers

Most of the latest driver versions listed below can be downloaded from the NVIDIA web page.

See Monitors for information on LCD based monitor systems.

NOTE: Stereo display on the NVIDIA Quadro FX 1400 is not supported by the NVIDIA drivers for Windows 7.

Version 4 - Windows XP - CRT / Planar (Obsolete)

Graphics Card	Driver Version	Comment
NVIDIA Quadro 4 980 XGL	6.7.2.2	
NVIDIA Quadro FX 1300	6.7.2.2	
NVIDIA Quadro FX 1400	7.1.8.4 8.1.6.7	

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	9.1.3.6	
NVIDIA Quadro FX 3400	6.7.2.2 9.1.8.5	
NVIDIA Quadro FX 3450	9.1.3.6	
NVIDIA Quadro FX 3500	9.1.3.6	
NVIDIA Quadro FX 4400	7.1.8.4	
NVIDIA Quadro FX 4500	8.4.2.6	
NVIDIA Quadro FX 4600	9.7.7.8	
NVIDIA Quadro FX 4600	6.14.11.6002	HP Web Site

Version 5 - Windows XP 32-bit (Obsolete)

Graphics Card	Driver Version	Comment
NVIDIA Quadro FX 1400	191.87	Dual monitors
NVIDIA Quadro FX 1400	191.87 - 197.90	Single monitor
NVIDIA Quadro FX 3700	258.49	3D Vision Bundle (LCD monitor)
NVIDIA Quadro FX Emitter	258.49	3D Vision Bundle (LCD monitor)

Version 5 - Windows 7 64-bit

Graphics Card	Driver Version	Comment
NVIDIA Quadro FX 1400	-	Stereo not supported
NVIDIA Quadro FX 3700	259.12	The latest NVIDIA drivers typically work
NVIDIA Quadro FX 3800	259.12	The latest NVIDIA drivers typically work
NVIDIA Quadro FX 4600	258.96	The latest NVIDIA drivers typically work
NVIDIA Quadro 4000	259.57	The latest NVIDIA drivers typically work

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NVIDIA Quadro FX Emitter	258.49	3D Vision Bundle (LCD monitor)

Version 5 - Windows 10 64-bit

Graphics Card	Driver Version	Comment
NVIDIA Quadro 4000	386.01	The latest NVIDIA drivers typically work
NVIDIA Quadro K4200	386.01	The latest NVIDIA drivers typically work
NVIDIA Quadro M4000	386.01	The latest NVIDIA drivers typically work
NVIDIA Quadro P4000	386.01	The latest NVIDIA drivers typically work

Version 6, Version 7 - Windows 10 64-bit

Graphics Card	Driver Version	Comment
NVIDIA Quadro 4000	426.00	See note below
NVIDIA Quadro K4200	426.00	See note below
NVIDIA Quadro M4000	426.00	See note below
NVIDIA Quadro P4000	426.00	See note below
NVIDIA Quadro RTX 4000	426.00	442.50 also tested

Note: On April 11, 2019 NVIDIA announced future drivers will no longer support NVIDIA 3D Vision.
The NVIDIA driver R418 (426.00) should be used when using 3D Vision.

Version 6, Version 7 - 3D PluraView Stereo Monitor

Various graphics cards from NVIDIA and AMD with various graphics drivers should work with this stereo display system.
Please consult the manufacturer's documentation for more details.

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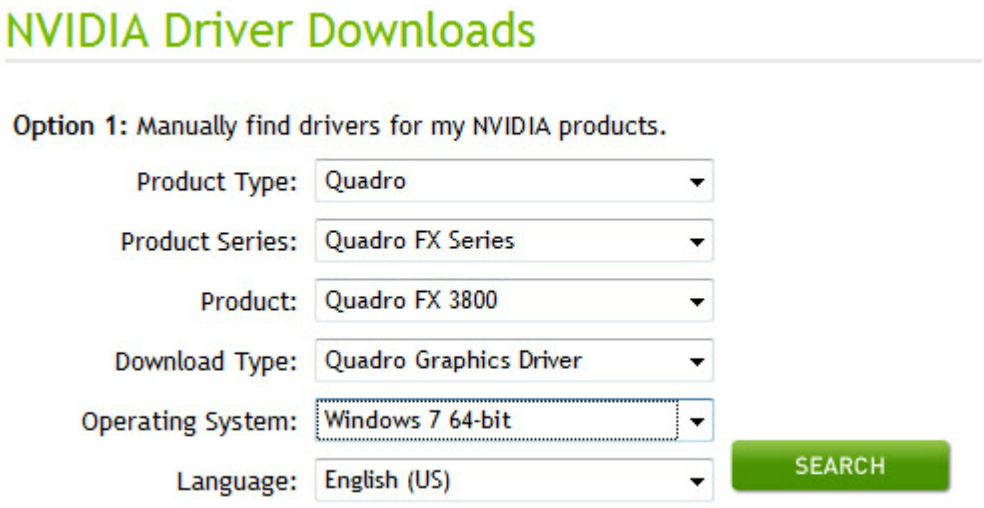
Downloading Current Drivers From the NVIDIA Web Site

The graphics driver may be downloaded from the NVIDIA web site. The following example shows entries in the fields provided that will display the latest graphic driver for download for the 64-bit version of Windows 7 for the Quadro FX 3800 graphics card.



Downloading Archived Drivers From the NVIDIA Web Site

Archived and older drivers may be downloaded from the NVIDIA web site by selecting "Beta and Archived Drivers". The following example shows entries in the fields provided archived drivers for the Windows XP version for the Quadro FX 1400 graphics card.

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NVIDIA Driver Downloads

Advanced Driver Search

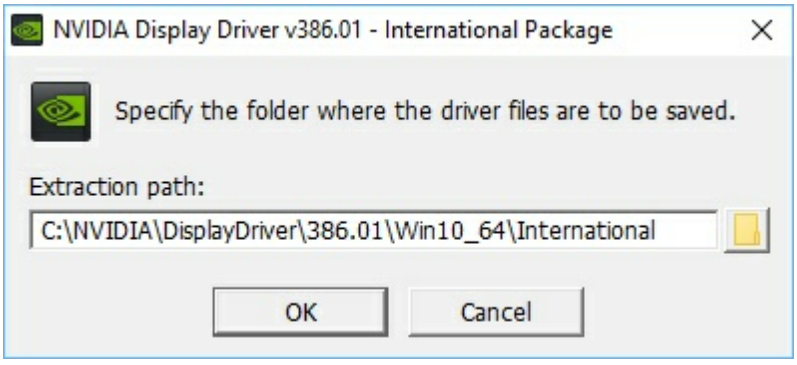
Product Type: Quadro
Operating System: Windows XP
Product Series: Quadro FX Series
Language: English (US)
Product: Quadro FX 1400
Recommended/Beta: All

SEARCH

Name	Version	Release Date
Quadro Release 197 WHQL	197.90	May 28, 2010
Quadro Release 197 WHQL	197.85	May 21, 2010
Quadro Release 197 WHQL	197.59	April 29, 2010
Quadro Release 197 WHQL	197.54	April 21, 2010
Quadro Release 197 WHQL	197.28	April 7, 2010
Quadro Release 197 WHQL	197.03	March 19, 2010
Quadro Release 191 WHQL	191.87	February 9, 2010

Driver Installation

The driver file is typically downloaded into the Windows Download folder. It can be run from that folder by double clicking on the filename.



Extraction path definition

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When the driver file is run, the user will be prompted for a path to extract the contents of the driver to for installation. The default path is typically used.



Installation options

Once the driver is extracted, the installation process begins and the user is prompted for the Installation options. The Custom (Advanced) installation option is recommended.

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Custom installation options

The Custom installation options include an option to "Perform a clean installation". Checking this option is recommended. A clean installation removes the existing driver before installation of the new driver. Once installation is complete the Video Card Configuration may need to be set again is it was previously set. If there are problems such as non-stereo after the installation of a new driver and the video card configuration then a cold start of the computer may be required. A cold start consists of shutting down the computer and removing power (pulling the power cord) then re-powering and re-booting the computer.

Document revised: February 2021

4.2.2 NVIDIA Quadro 4000/K4200/M4000/P4000/RTX 4000

Vr
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NVIDIA Quadro 4000/K4200/ M4000/P4000/RTX 4000 Video Card Configuration



Description
Configuration for LED Monitors
Configuration for the 3D PluraView Stereo Monitor
Turning Off Shadows Under Windows

Description

The NVIDIA Quadro 4000/K4200/M4000/P4000/RTX 4000 graphics cards offer PCI-Express (PCI-X) interface performance. At the present time these cards offer very good performance for 3D stereo VrTwo and VrThree (VrLiDAR) and other Vr Mapping programs that support 3D stereo viewing. The Quadro 4000/K4200/M4000/P4000/RTX 4000 is

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compatible with the NVIDIA 3D Vision Package which consists of a graphics card, 3D supported LED monitor, stereo glasses, and 3D emitter. These cards are also compatible with the 3D PluraView stereo monitor.

The NVIDIA Quadro 4000/K4200/M4000/P4000/RTX 4000 graphics cards have been tested for Windows 7 and Windows 10. The use of Windows XP (2016) and Windows 7 (2020) is no longer recommended. Before configuring the graphics card, a recommended driver should be downloaded from the NVIDIA web page at http://www.nvidia.com.

Graphics Card	Memory (GB)	Microarchitecture	Release
NVIDIA Quadro 4000	2	Fermi	2010
NVIDIA Quadro K4200	4	Kepler	2013
NVIDIA Quadro M4000	8	Maxwell	2015
NVIDIA Quadro P4000	8	Pascal	2017
NVIDIA Quadro RTX 4000	8	Turning	2018

Monitors

Please see Monitors for more information on 3D stereo monitors for Vr Mapping.

Configuration for LED Monitors

In Windows 7 or Windows 10, right mouse click on the desktop and select "NVIDIA control panel"

If the 3D PluraView stereo monitor is being used please use the Configuration for the 3D PluraView Monitor

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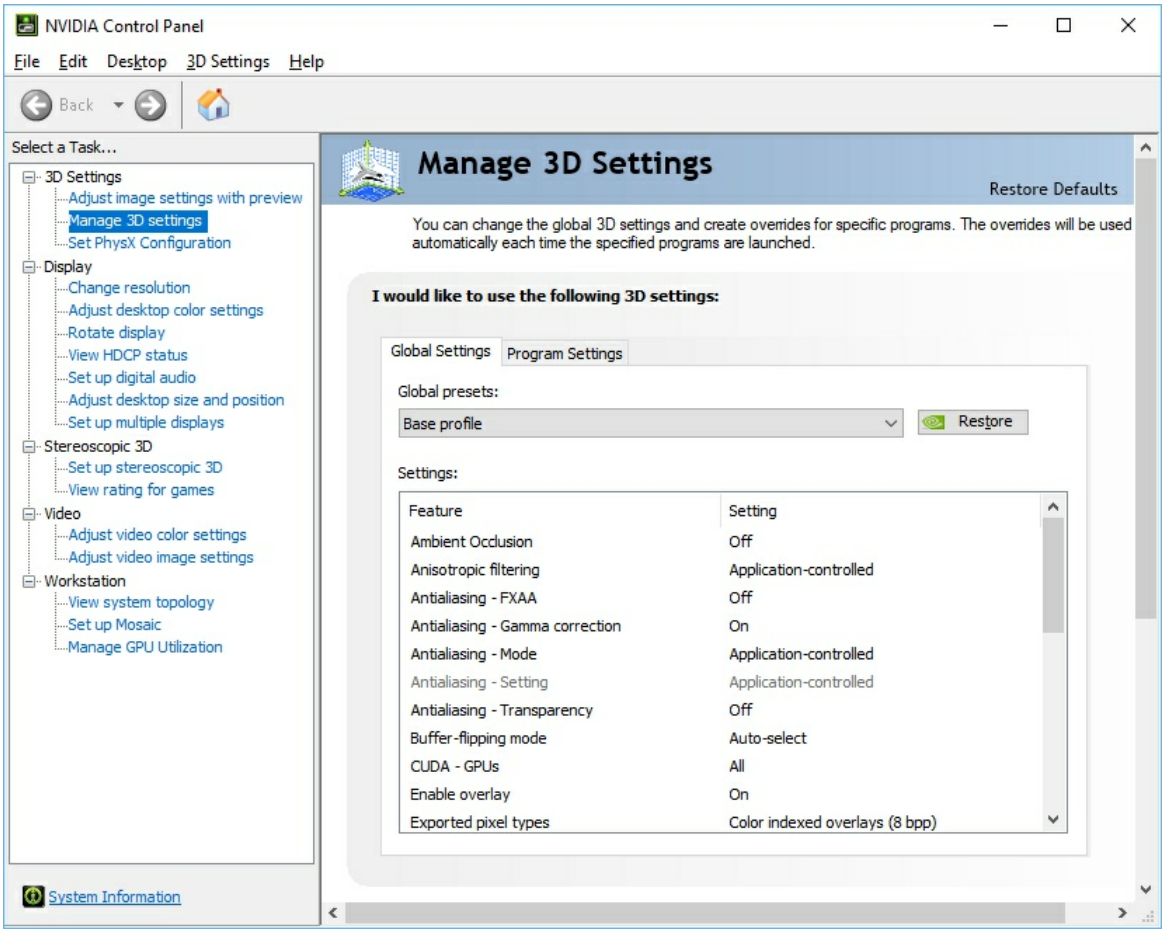

The NVIDIA Control Panel

Select "Manage 3D settings" from the "Select a Task" panel on the left. Duplicate the following settings. If a setting is not listed below it may remain at its default setting.

Setting	Value
Enable overlay	On
Stereo - Display mode	On-board DIN connector (with NVIDIA 3D Vision)
Stereo - Enable	On
Vertical sync	Off (optional)

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The NVIDIA 3D Vision stereo emitter

If "Use on-board DIN connector (with NVIDIA 3D Vision)" is not available as an option to “Stereo - Display mode” make sure the NVIDIA emitter's USB cable is plugged in and the light on the front of the emitter is dim green. On newer computers, the use of the synchronization cable from the 3-pin connector from the graphics card to the emitter is not needed. Only the USB cable is needed.

Screen Resolution and Refresh Rate

Select "Change resolution" from the "Select a Task" panel on the left.

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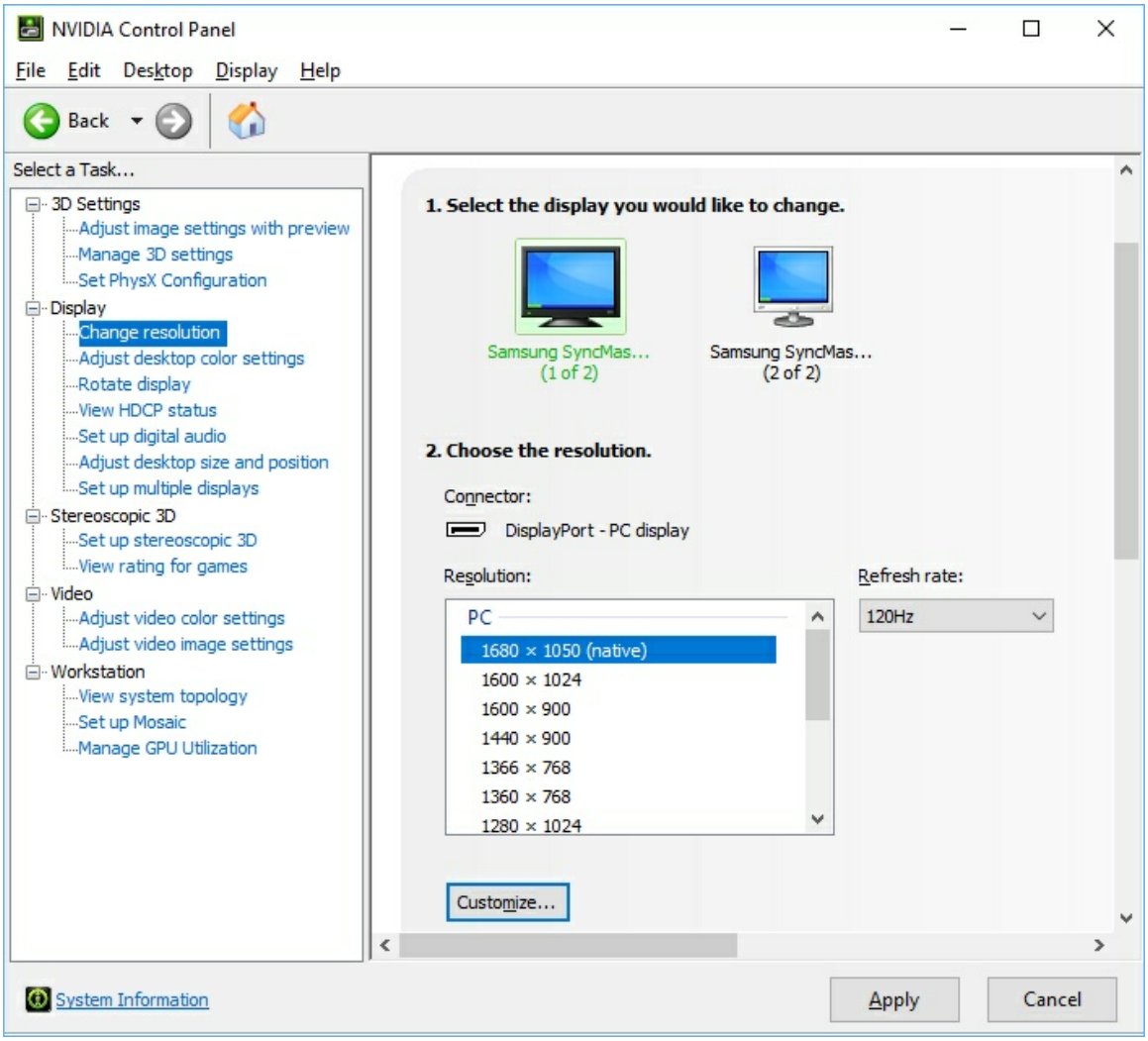

The NVIDIA Control Panel

Select a screen resolution under the PC section under "Resolution:" then select 120Hz for the "Refresh rate:". Some monitors will display a list of resolutions under "Resolution:" entitled "Ultra HD, HD, SD". If this is displayed, scroll down to the "PC" section, as shown above, and select a resolution from the list.

Configuration for the 3D PluraView Stereo Monitor

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Following are the settings for the 3D PluraView stereo system for Windows 10. Testing was performed using a NVIDIA Quadro M4000 with the NVIDIA R418 (426.00) driver.

NOTE: If documentation is available from the manufacturer about configuring the graphics card, please consult it as it should cover the different 3D PluraView systems available. This configuration is based on the 27" model.

Connections to the Computer

There are two DisplayPort connectors from the 3D PluraView. These two connectors should be labeled "Bottom" and "Top". Plug the Bottom cable into port1 and the Top cable into port 2 on the graphics card

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DisplayPort connections to the NVIDIA graphics card.

Display Mode and 3D Display Mode

Right mouse click on the desktop and choose Display settings

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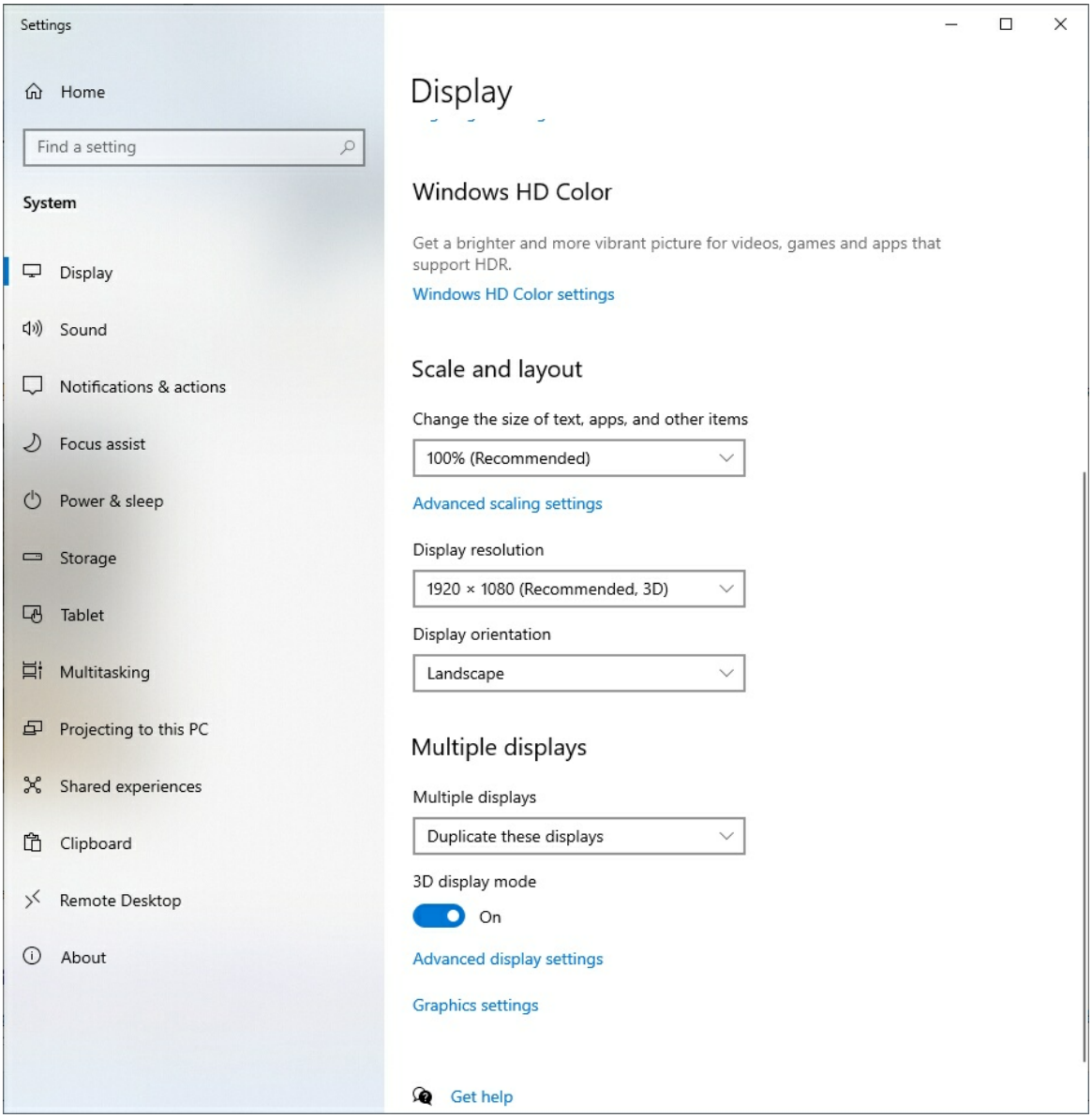

Display settings - Setting Multiple displays and 3D display mode

Under Multiple displays, select Duplicate these displays
Under 3D display mode, select On

Card Configuration

Right click on the desktop and choose "NVIDIA control panel".

Select "Manage 3D settings" from the "Select a Task" panel

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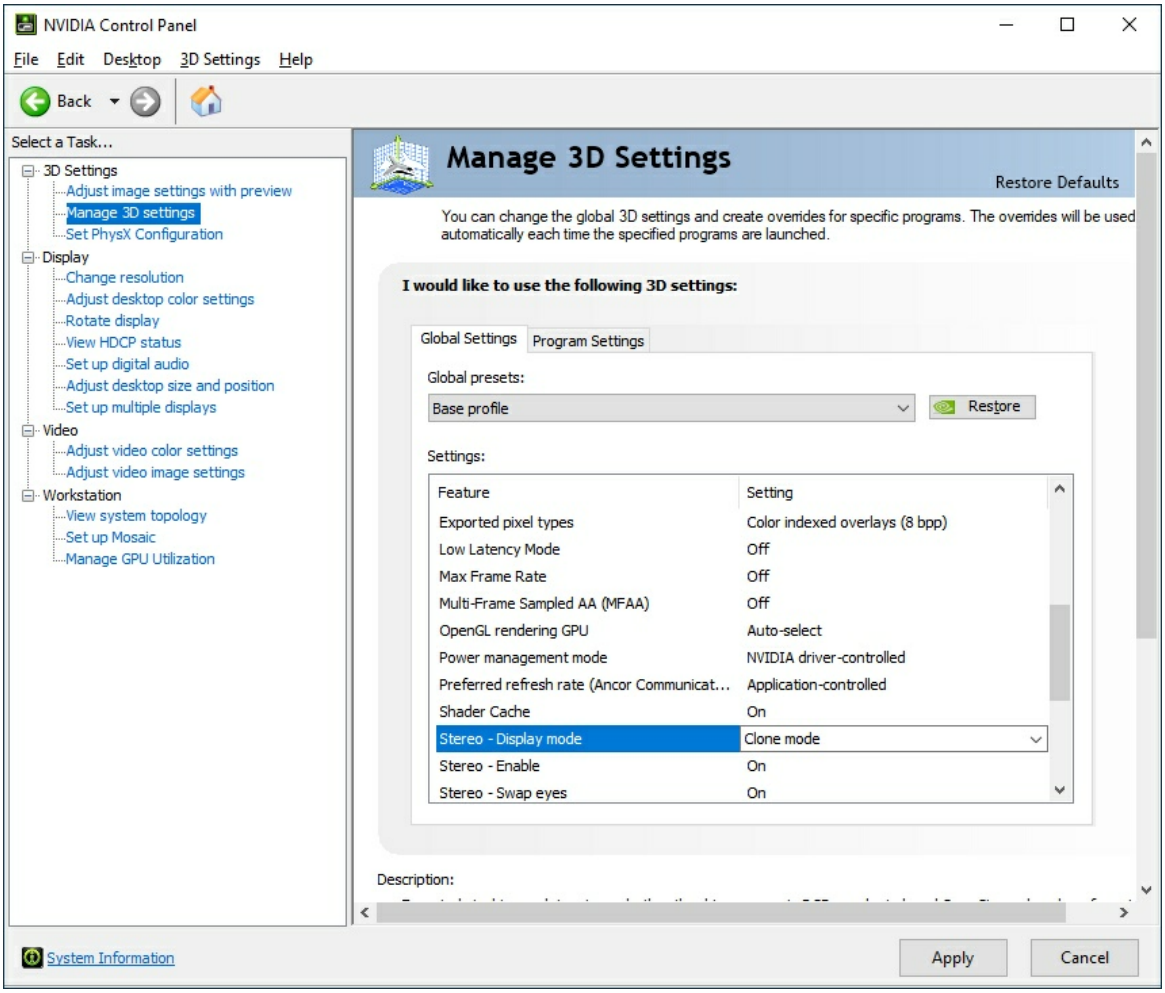

NVIDIA 3D settings dialog

Select "Base profile" under "Global presets" and choose the following settings

Setting	Value
Enable overlay	On
Stereo - Display mode	Clone mode
Stereo - Enable	On
Stereo - Swap eyes	On (this might need to be Off on your system)
Vertical sync	Off (optional)

Card configuration settings

Screen Resolution and Refresh Rate

Select "Change resolution" from the "Select a Task" panel on the left.

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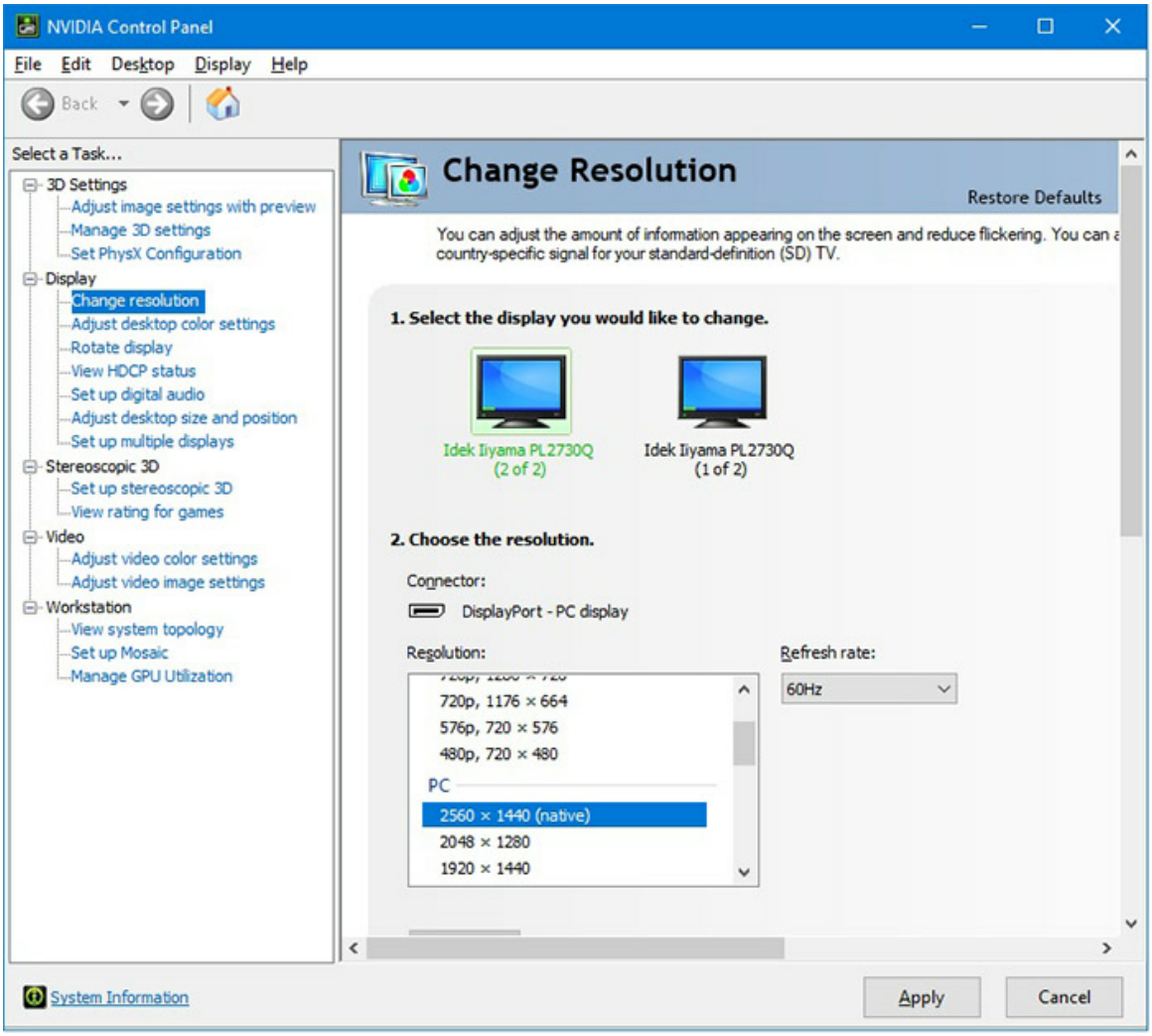

Resolution and Refresh rate settings

Select a screen resolution under the PC section under "Resolution:" then select 60Hz for the "Refresh rate:". Some monitors will display a list of resolutions under "Resolution:" entitled "Ultra HD, HD, SD". If this is displayed, scroll down to the "PC" section, as shown above, and select a resolution from the list.

3D PluraView documentation revised: February 2021

Turning Off “Show Shadows Under Menus” and “Show Window Contents While Dragging”

The display of shadows under menus may cause display problems in the stereo window with some Windows configurations. To turn this feature off, type "Appearance" in the "Type here to search" area in the lower left portion of the screen and select "Adjust the appearance and performance of Windows - Control Panel". Uncheck "Show shadows under windows" and

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uncheck "Show window contents while dragging".

The display of window contents will cause the stereo display software to repaint graphics multiple times when a window is being dragged over a graphics window and it is advisable to turn this feature off by un-checking it.

Document revised: February 2021

4.2.3 NVIDIA Quadro FX 1300/1400/3400/4400 Stereo Graphics Card for PCI-Express (PCI-X)

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

NVIDIA Quadro FX 1400 - FX 5600 Video Card Configuration



NVIDIA Quadeo FX 1400

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Description
Multiple Monitors
Card Configuration
Card Configuration – Interface 1
Card Configuration – Interface 2
Screen Refresh Rate
Turning off “Show shadows under menus” and “Show window contents while dragging”
Configuration for the Planar SD Stereo/3D Monitors
Configuration of VrTwo for the Planar SD Stereo/3D Monitors
Configuration for the True3Di Stereo Monitor
Configuration of VrTwo for the True3Di Stereo Monitor

Description

The NVIDIA Quadro FX 1400 – FX 5600 graphics cards offer PCI-Express (PCI-X) interface performance. At the present time these cards offer very good performance for 3D stereo roaming for VrTwo.

Before configuring the graphics card, a recommended driver should be downloaded from the NVIDIA web page at http://pny.com or http://www.nvidia.com. Drivers may also be downloaded from the Vr Mapping software download area on the web page from the Drivers folder. A list of recommended drivers may be found at www.cardinalsystems.net/help/Drivers.html.

NOTE: The NVIDIA Quadro FX 1400 graphics card does not support stereo display in Windows 7.

NOTE: It is strongly recommended to use the PNY manufactured NVIDIA Quadro FX cards. There are several manufacturers that make the NVIDIA graphics cards and PNY has shown virtually no problems over the past several years. The PNY cards may be purchased from www.zipzoomfly.com or www.newegg.com.

NOTE: The monitor used for stereo viewing should be capable of refresh rates of 100 Hertz or better. This is not applicable when using the Planar stereo viewing systems..

Multiple Monitors

Without the correct NVIDIA driver the Quadro FX may not be able to use two monitors from a single Quadro card. The overlay plane may not available when two monitors are configured and VrTwo needs this plane for interactive graphics. Please make sure that a recommended NVIDIA driver is configured.

When running multiple monitors the nView Display Mode must be set to Dualview.

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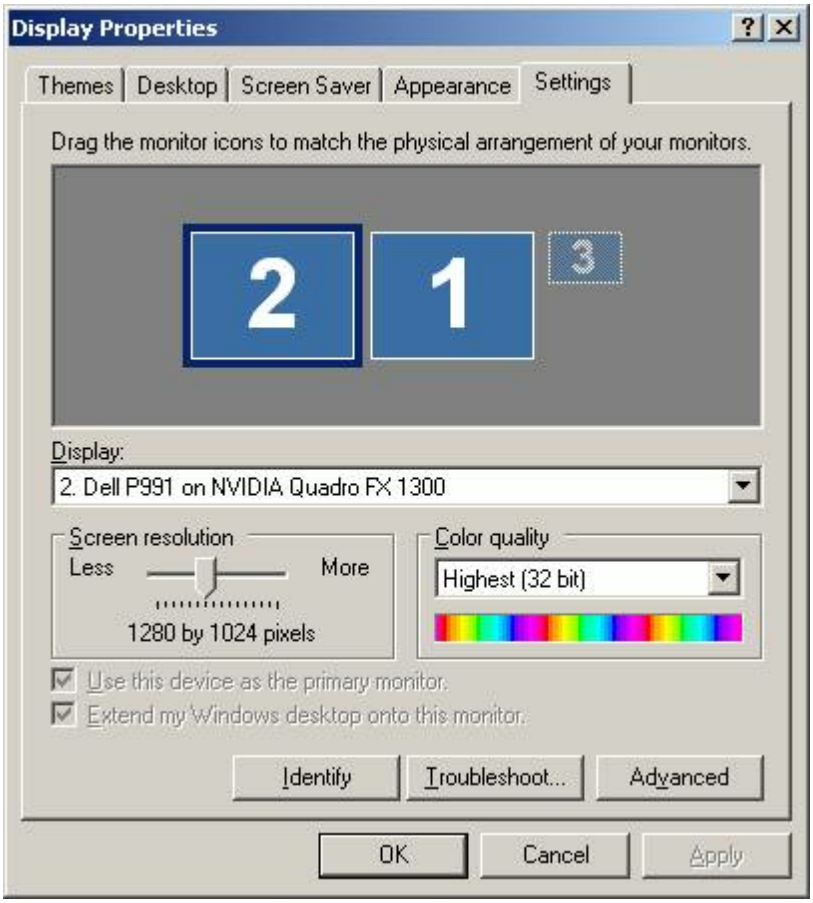
It is possible to use a second graphics card to drive the second monitor or the VrTouchscreen. Since the Quadro uses the PCI-X slot, the second graphics card may be a standard PCI graphics card. As of September 2004 the ATI Radeon 7000, or equivalent, was a good graphics card for the second monitor. Windows XP handles dual monitors from two graphics cards well and is suggested as the operating system to run VrTwo. More information can be found at Multiple Monitor Configurations.

Card Configuration

NOTE: There are two user interfaces from PNY that will different depending on the driver version being used. Interface 1 is used for the older versions and Interface 2 is used on the newer versions.

Start the Display Properties dialog by pressing the right mouse button anywhere on the desktop and selecting Properties then the Settings tab.

The screen resolution of 1280 x 1024 offers adequate screen space for stereo display and menus on a single screen. The Color quality of 32bit is suggested.



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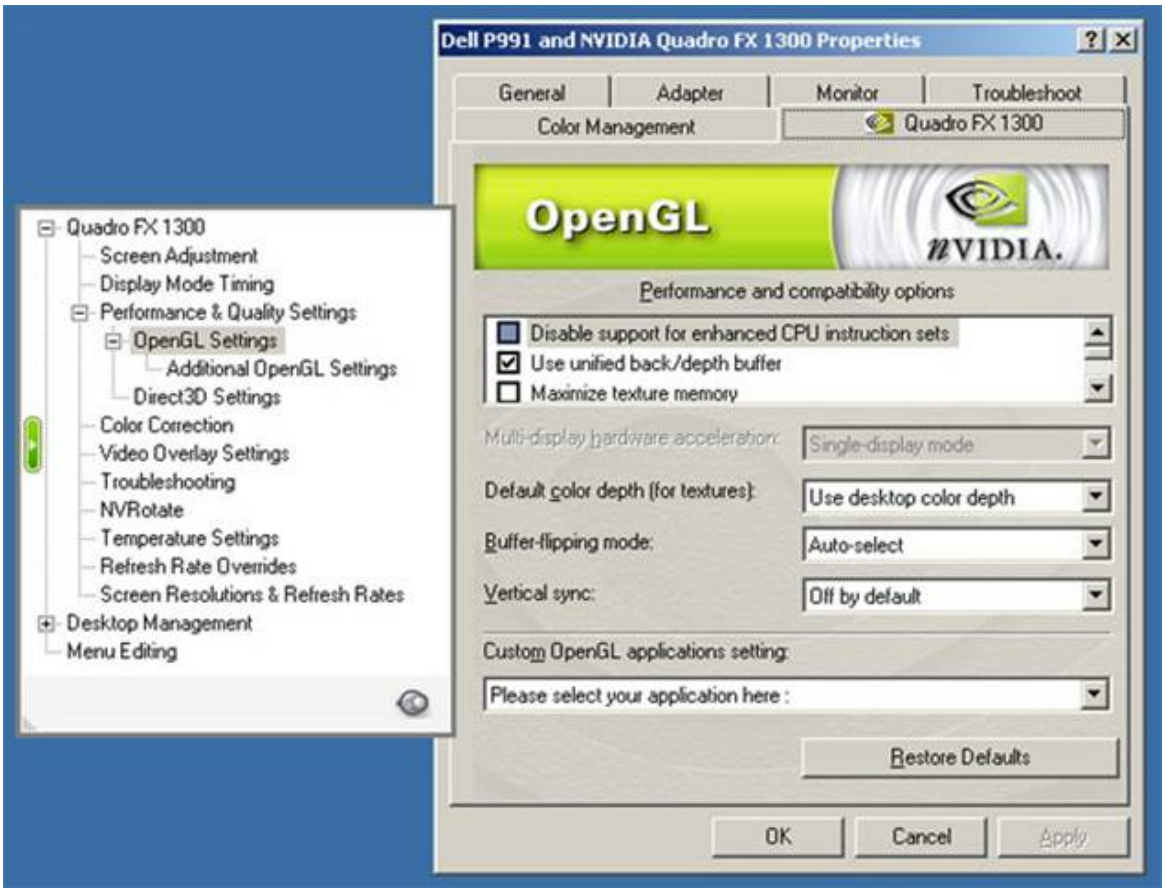
Card Configuration - Interface 1

Pressing the Advanced then the Quadro FX button will display further properties in which OpenGL and monitor settings may be made.

The OpenGL Settings may be left at their default values. All the check boxes in "Performance and compatibility" are un-checked except for "Use unified back/depth buffer". The Vertical sync setting should be set to "Off by default".



The "Enable stereo in OpenGL" setting turns on stereo and "Enable overlay in OpenGL" allows the interactive display of lines in VrTwo. The Exported pixel types may be set to "Color indexed overlays (8 bpp).

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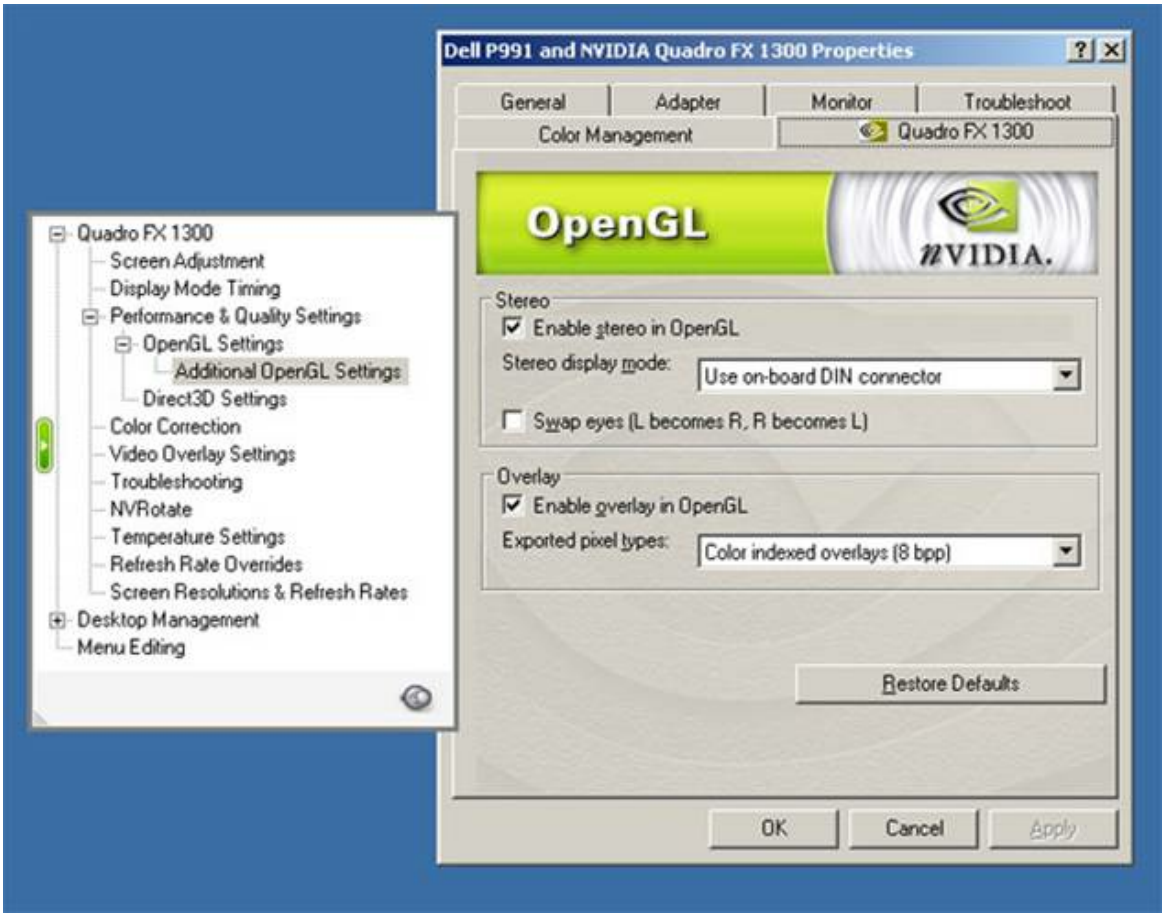

Card Configuration - Interface 2

Pressing the Advanced then the Quadro FX button will display further properties.

On the side menu select “Performance and Quality Settings”.

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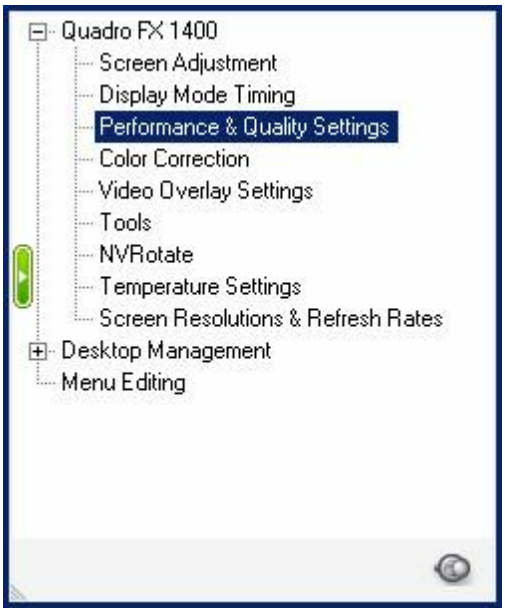

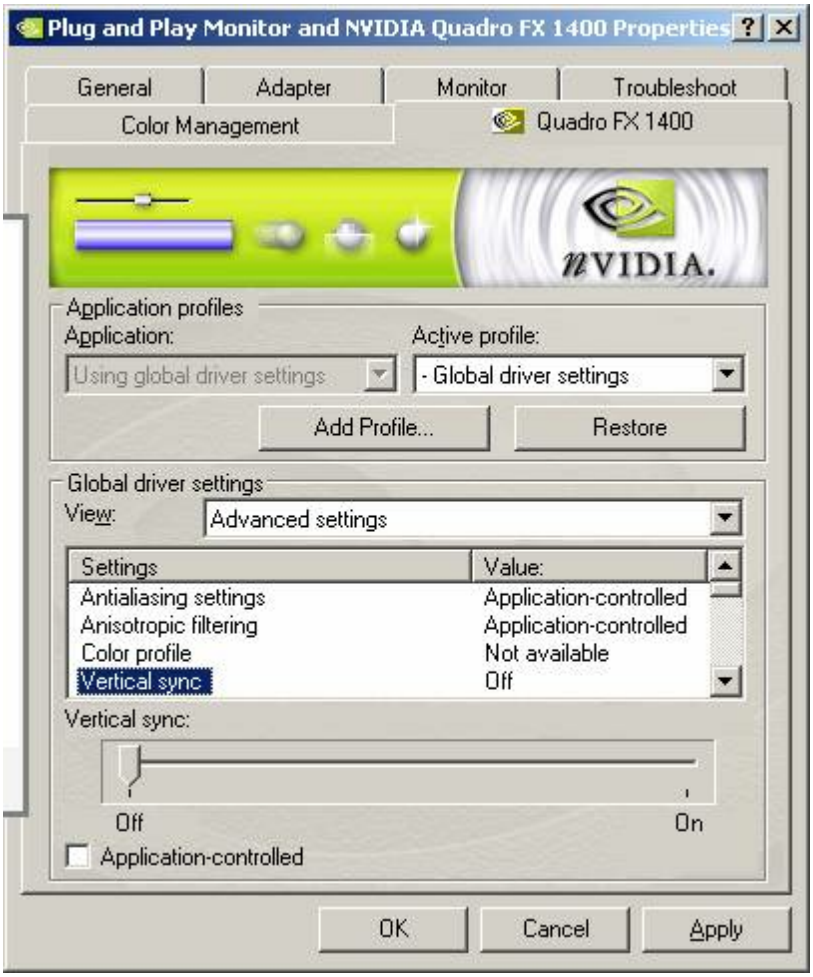

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NOTE: Make sure the View option is set to “Advanced settings” or all options will not be displayed.

Select Vertical sync then un-check Application-controlled and choose Off on the slider. Duplicate the following settings. If a setting is not listed below it may remain at its default setting.

Setting	Value
Vertical sync	Off
Hardware acceleration	Single-display mode
Maximize texture memory	Off
Enable stereo	On
Stereo display mode	Use on-board DIN connector
Force stereo shuttering	Off
Enable overlay	On

If Use on-board DIN connector is not available as an option to “Stereo display mode” then check your driver version. Refer to Drivers on the Hardware Help page for a list of working drivers.

Screen Refresh Rate

The Monitor tab allows the configuration of the Screen Refresh Rate. The Quadro maximum screen refresh rate is 100 Hertz.

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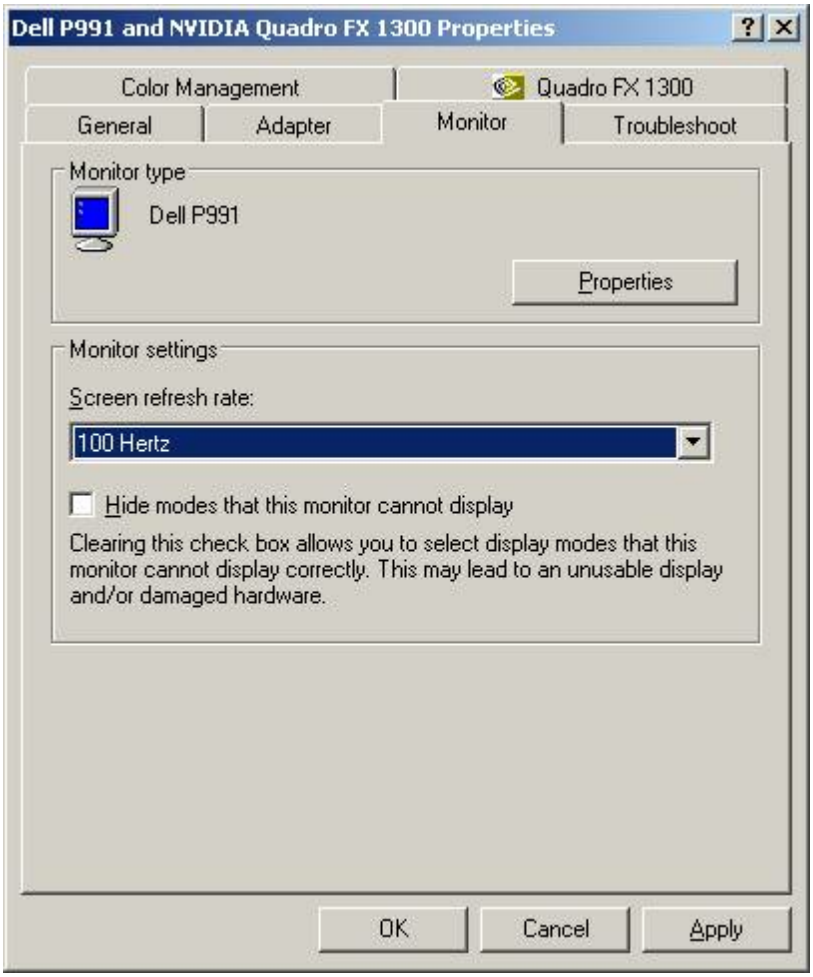

Turning Off “Show Shadows Under Menus” and “Show Window Contents While Dragging”

The display of shadows under menus may cause display problems in the stereo window with some Windows XP configurations. To turn this feature off right mouse click on the desktop -> Appearance -> Effects -> uncheck Show shadows under menus.

The display of window contents will cause the stereo display software to repaint graphics multiple times when a window is being dragged over a graphics window and it is advisable to turn this feature off by un-checking it.

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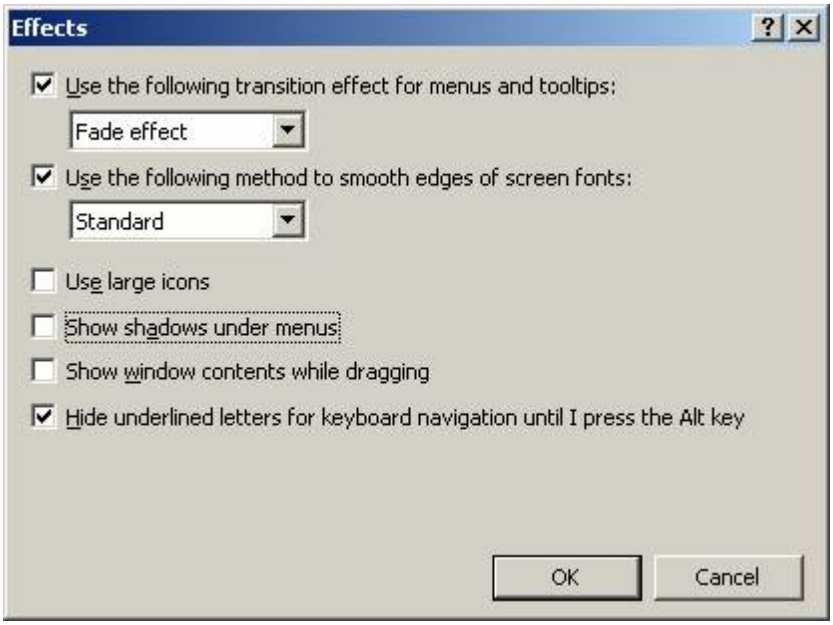

Configuration for the Planar SD Stereo/3D Monitors



Following are the settings for the Quadro FX when using the Planar's SD Stereo/3D Monitors.

On the side menu select "nView Display Settings" then select Clone for the "nView Display Mode"

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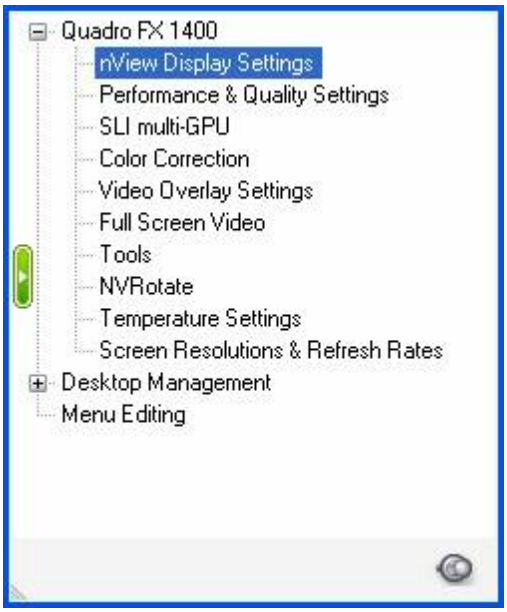

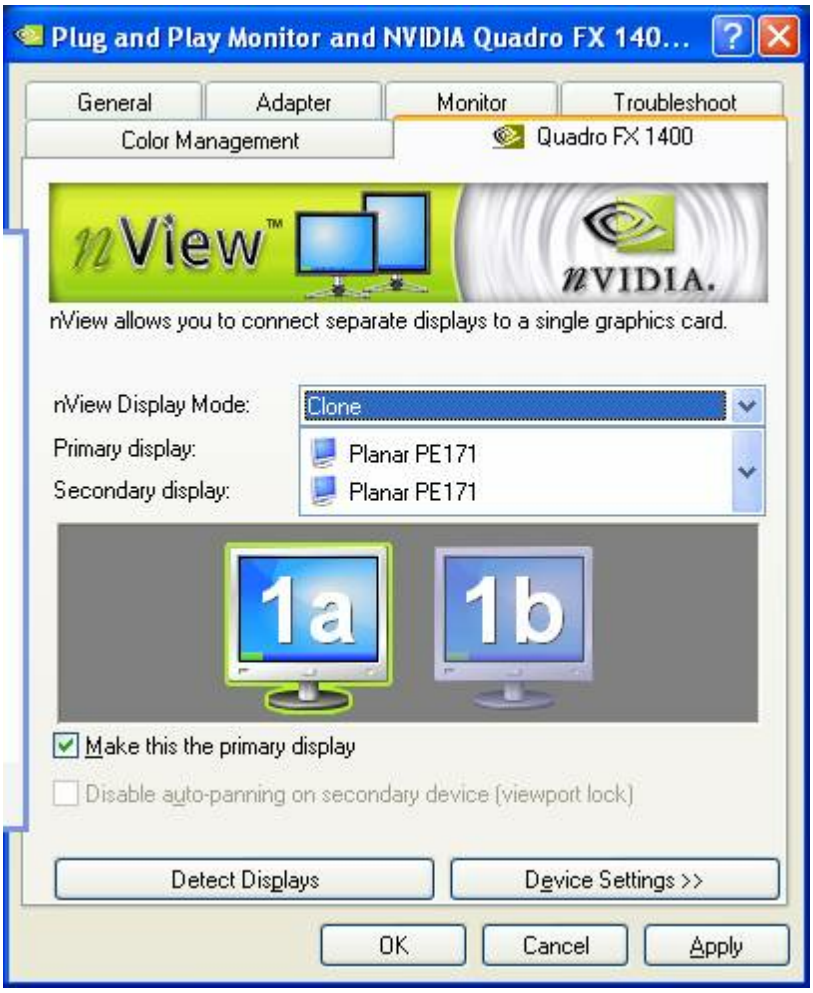

On the side menu select “Performance and Quality Settings” then select “Use nView Clone

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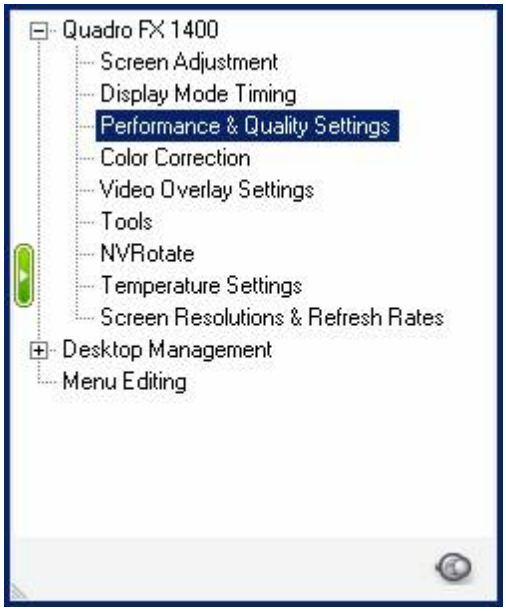
mode" for the "Stereo display mode".





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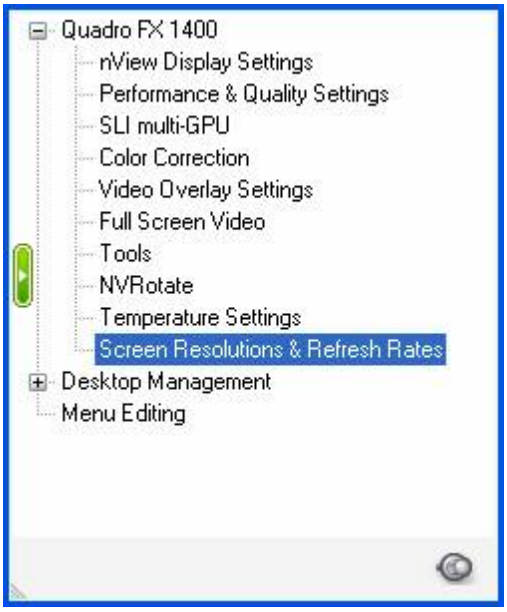
To set the screen refresh rate to 75 Hertz select “Screen Resolutions & Refresh Rates” on the side menu. A new refresh rate may need to be created under “Custom resolutions and refresh rates” which can be done using the Add button.



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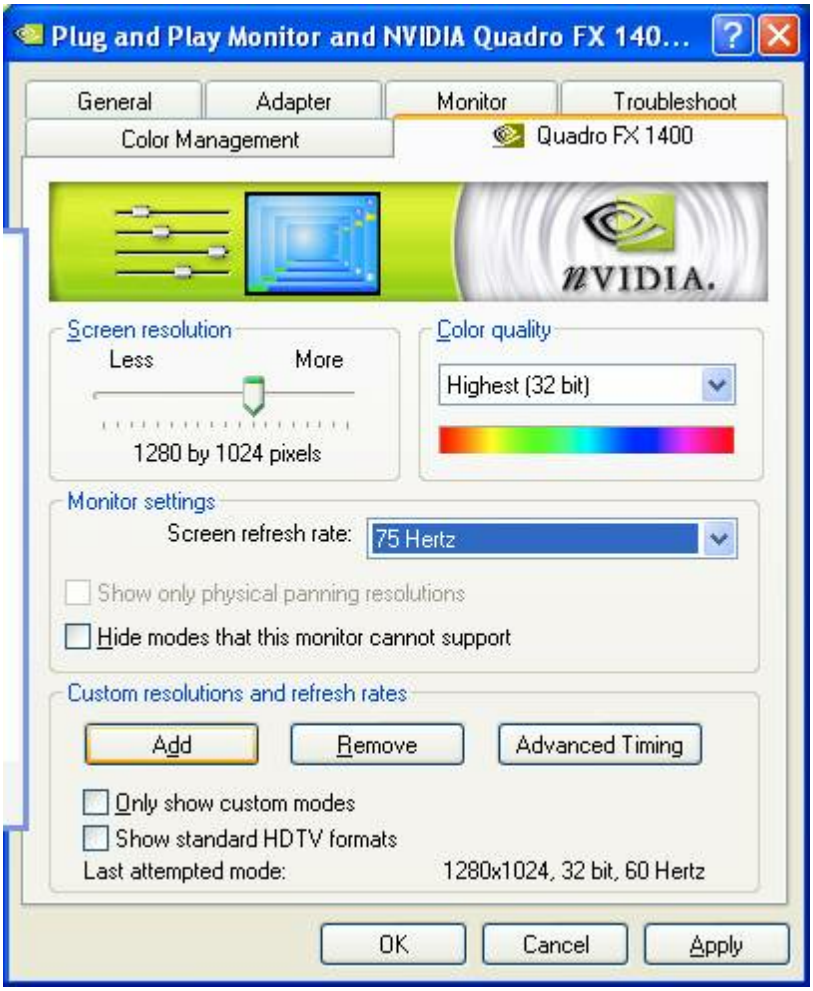

Configuration for VrTwo for the SD Stereo/3D Monitors

The configuration of VrTwo for the Planar screens can be done from the Vr Configuration program under Configuration->XYZ Digitizer.
Set “VrTwo use overlay plane” to No. This setting has been tested with the NVIDIA Quadro FX 1400. When using NVIDIA graphics cards containing more memory the setting of Yes may work. Please test both settings for best results.

Configuration for the True3Di Stereo Monitor

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Model tested: True3Di SDM-190M
Graphics card tested: PNY Quadro FX 1400
Graphics driver version: 9.1.3.6

Following are the settings for the Quadro FX when using True3Di Stereo/3D Monitors. **NOTE**: After configuring the graphics card, make sure the True3Di is in stereo mode by pressing and holding the rightmost button on the front panel. The configuration may be done in stereo mode if the stereo viewing glasses are worn.

Hardware connection

The graphics cable connection from the graphics card port nearest to the emitter socket is connected to the cable connection on the right side (view looking at the back of the monitor). The other graphics cable is connected from the graphics point farthest from the emitter socket to the cable connection of the left side of the True3Di Monitor.

Graphics card configuration

On the side menu select “nView Display Settings” then select Clone for the “nView Display Mode”

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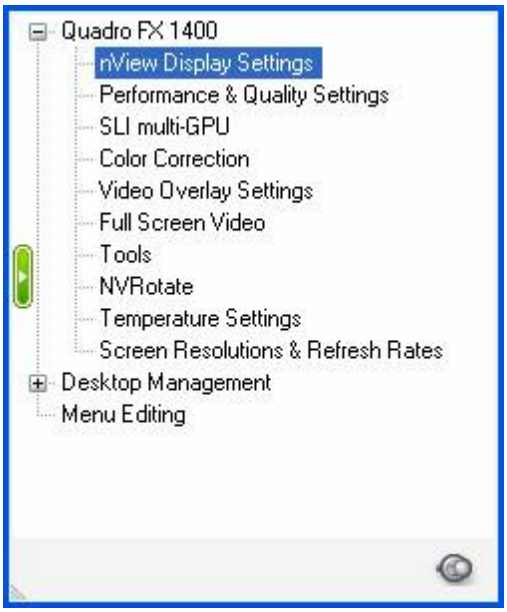

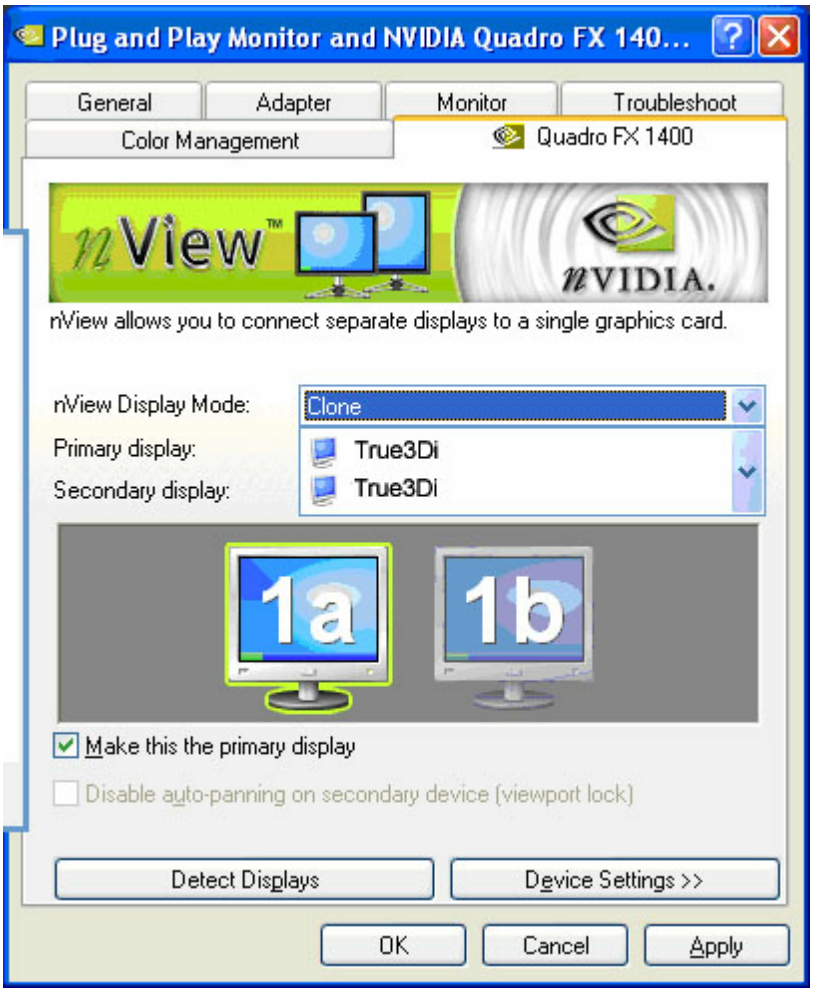

On the side menu select “Performance and Quality Settings” then select “Use nView Clone

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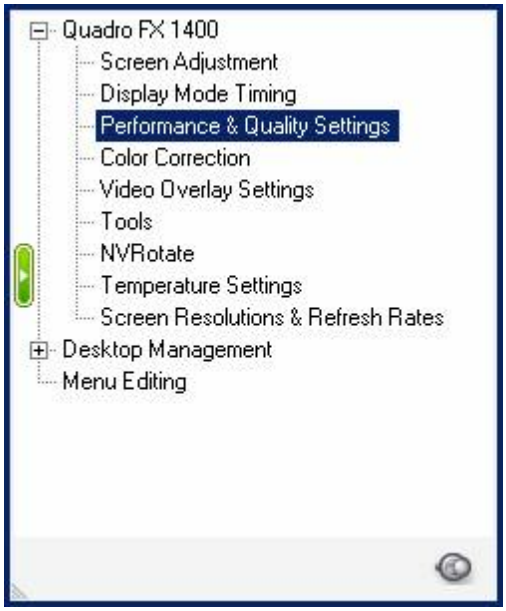
mode" for the "Stereo display mode".





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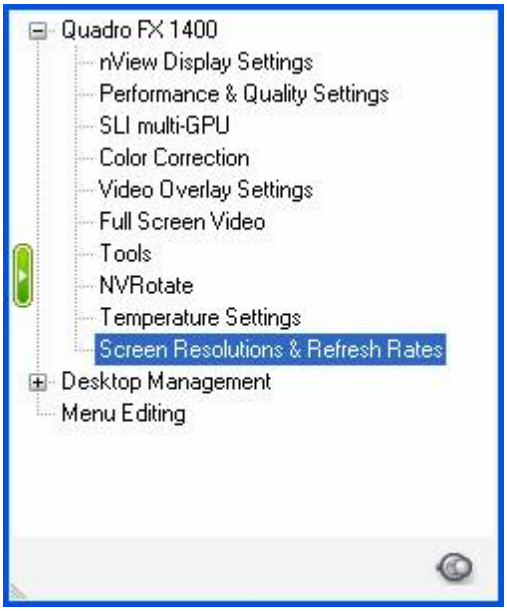
NOTE: Make sure the View option is set to “Advanced settings” or all options will not be displayed.

Select Vertical sync then un-check Application-controlled and choose Off on the slider. Duplicate the following settings. If a setting is not listed below it may remain at its default setting.

Setting	Value
Vertical sync	Off
Hardware acceleration	Use nView Clone mode
Maximize texture memory	Off
Enable stereo	On
Force stereo shuttering	Off
Stereo display mode	Use nView Clone mode
Swap eyes	On
Enable overlay	On

To set the screen refresh rate to 75 Hertz select “Screen Resolutions & Refresh Rates” on the side menu. A new refresh rate may need to be created under “Custom resolutions and refresh rates” which can be done using the Add button.



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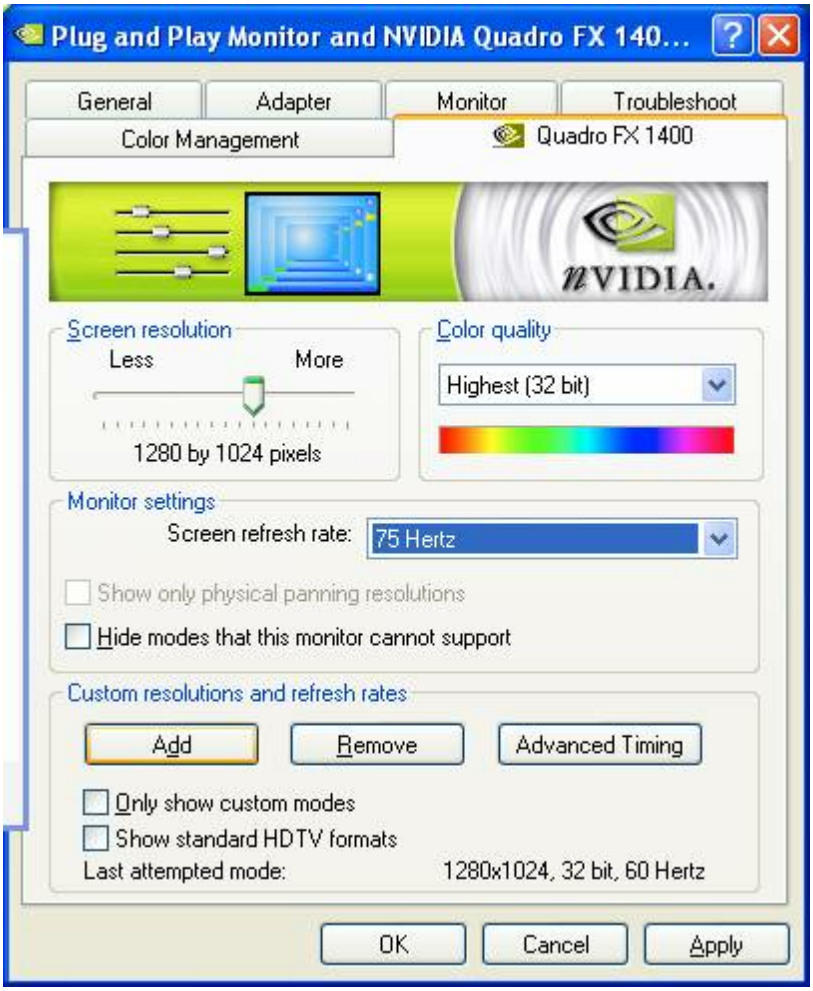

Configuration for VrTwo for the True3Di Stereo Monitor

The configuration of VrTwo for the True3Di screens can be done from the Vr Configuration program under Configuration->XYZ Digitizer.
Set "VrTwo use overlay plane" to No. This setting has been tested with the NVIDIA Quadro FX 1400. When using NVIDIA graphics cards containing more memory the setting of Yes is more desirable and may work. Please test both settings for best results.

Document revised: August 2010

4.2.4 NVIDIA Quadro4 980 XGL Stereo Graphics Card for AGP

Vr

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Mapping

NVIDIA Quadro 980 XGL Video Card Configuration

Note: With the advances in graphics display technology, the information in this document is deprecated. (December 2017)

Description

The NVIDIA Quadro4 XGL offers professional graphics by delivering breakthrough application performance and graphics programmability. At the present time these cards offer very good performance for 3D stereo roaming for VrTwo. If roaming is not needed and static stereo mode is used the 3Dlabs GVX1 Pro and GVX210 graphics cards may be used with VrTwo.

As of September 2004 the NVIDIA Quadro4 XGL graphics card could be purchased from ZipZoomFly (www.zipzoomfly.com).

Before configuring the graphics card, the latest drivers should be downloaded from the NVIDIA web page at http://www.nvidia.com/page/quadro4.html.

NOTE: The monitor used for stereo viewing should be capable of refresh rates of 100 Hertz or better.

Dual Monitors

Even though the Quadro4 XGL offers dual monitor capability, it is not possible to use two monitors from a single Quadro4 card. The overlay plane is not available when two monitors are configured and VrTwo needs this plane for interactive graphics. To set up dual monitors a second graphics card must be used to drive the second monitor. Since the Quadro4 uses the AGP slot, the second graphics card must be a PCI graphics card. As of September 2004 the ATI Radeon 7000, or equivalent, was a good graphics card for the second monitor. Windows XP handles dual monitors from two graphics cards well and is suggested as the operating system to run VrTwo.

Card Configuration

Start the Display Properties dialog by pressing the right mouse button anywhere on the desktop and selecting Properties then the Settings tab.

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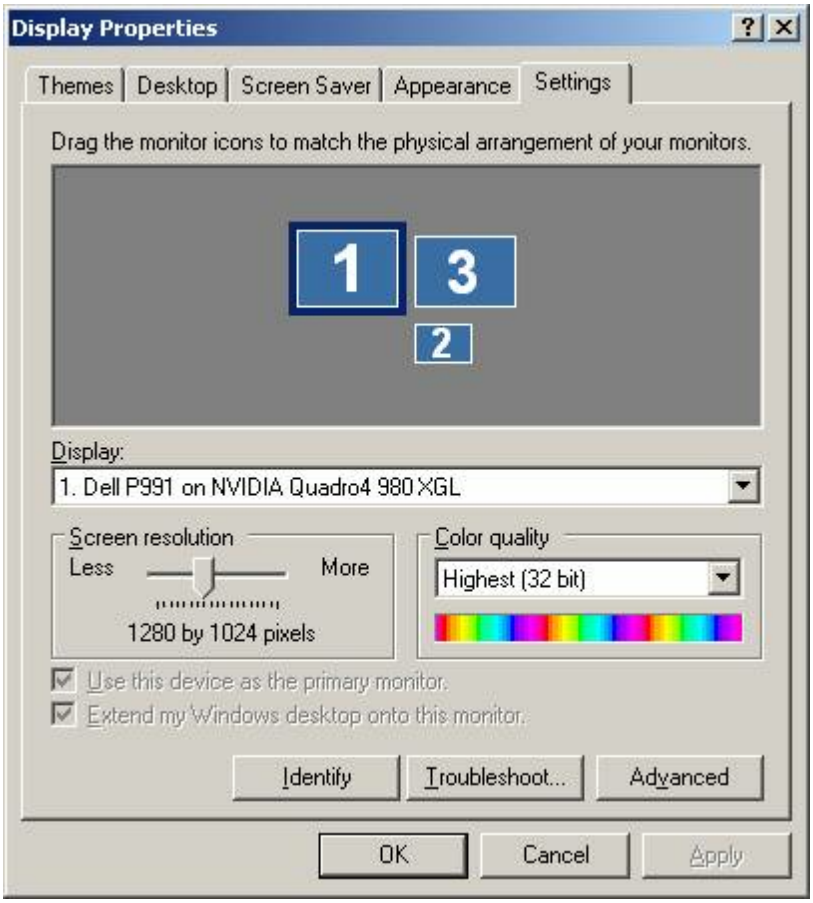
The screen resolution of 1280 x 1024 offers adequate screen space for stereo display and menus on a single screen. The Color quality of 32bit is suggested.



Pressing the Advanced button will display further properties in which OpenGL and monitor settings may be made.

The OpenGL Settings may be left at their default values. All the check boxes in “Performance and compatibility” are un-checked except for “Use unified back/depth buffer”. The Vertical sync setting may be set to “Off by default” which will result in faster roaming speed but may cause some slight halation of the floating mark. Halation occurs when the floating mark appears to rise and fall slightly when moving it left and right rapidly. This is similar to the effect on a stereo plotter when the photograph illumination lights were not balanced.

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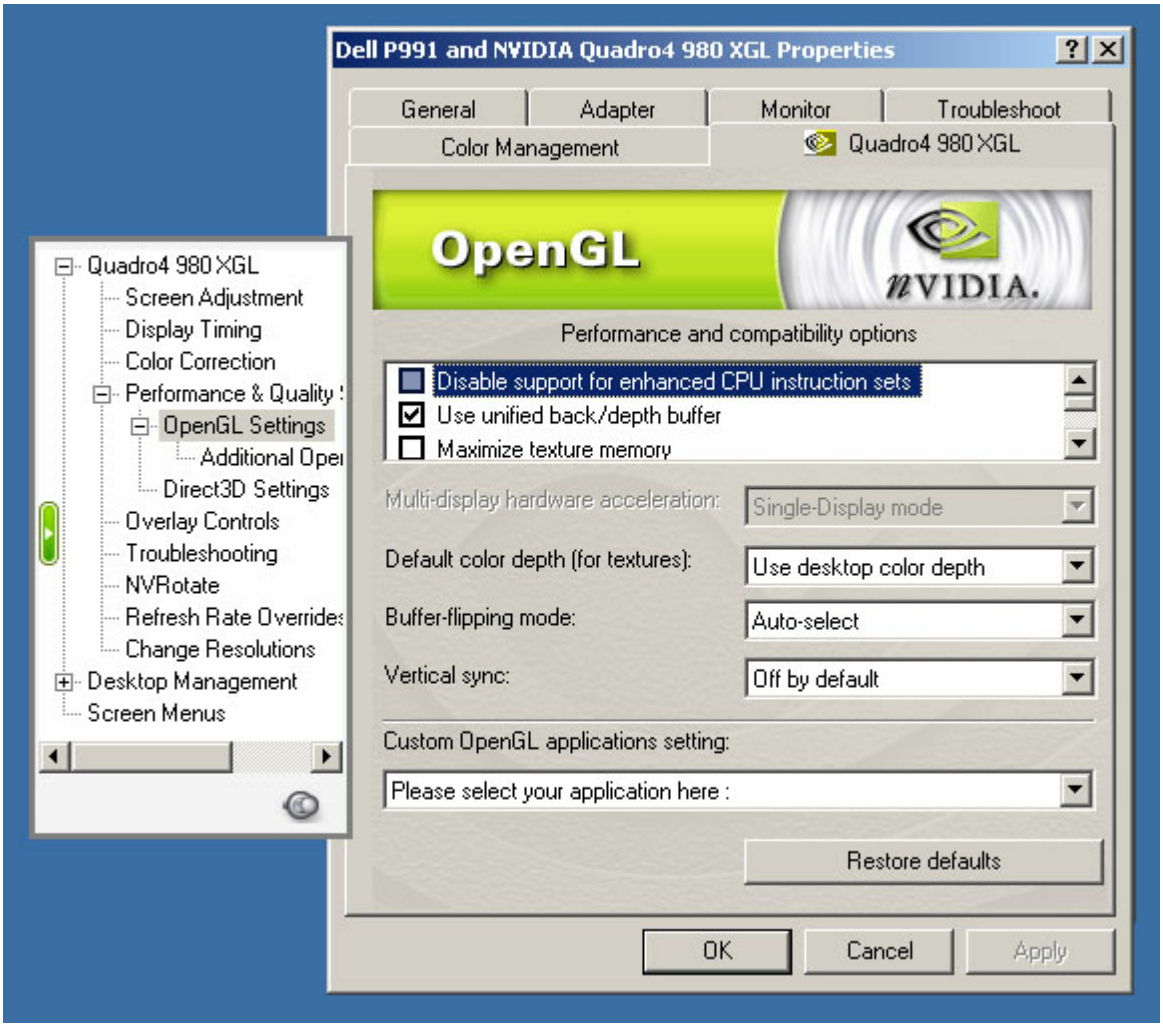

The “Enable stereo in OpenGL” setting turns on stereo and “Enable overlay in OpenGL” allows the interactive display of lines in VrTwo.

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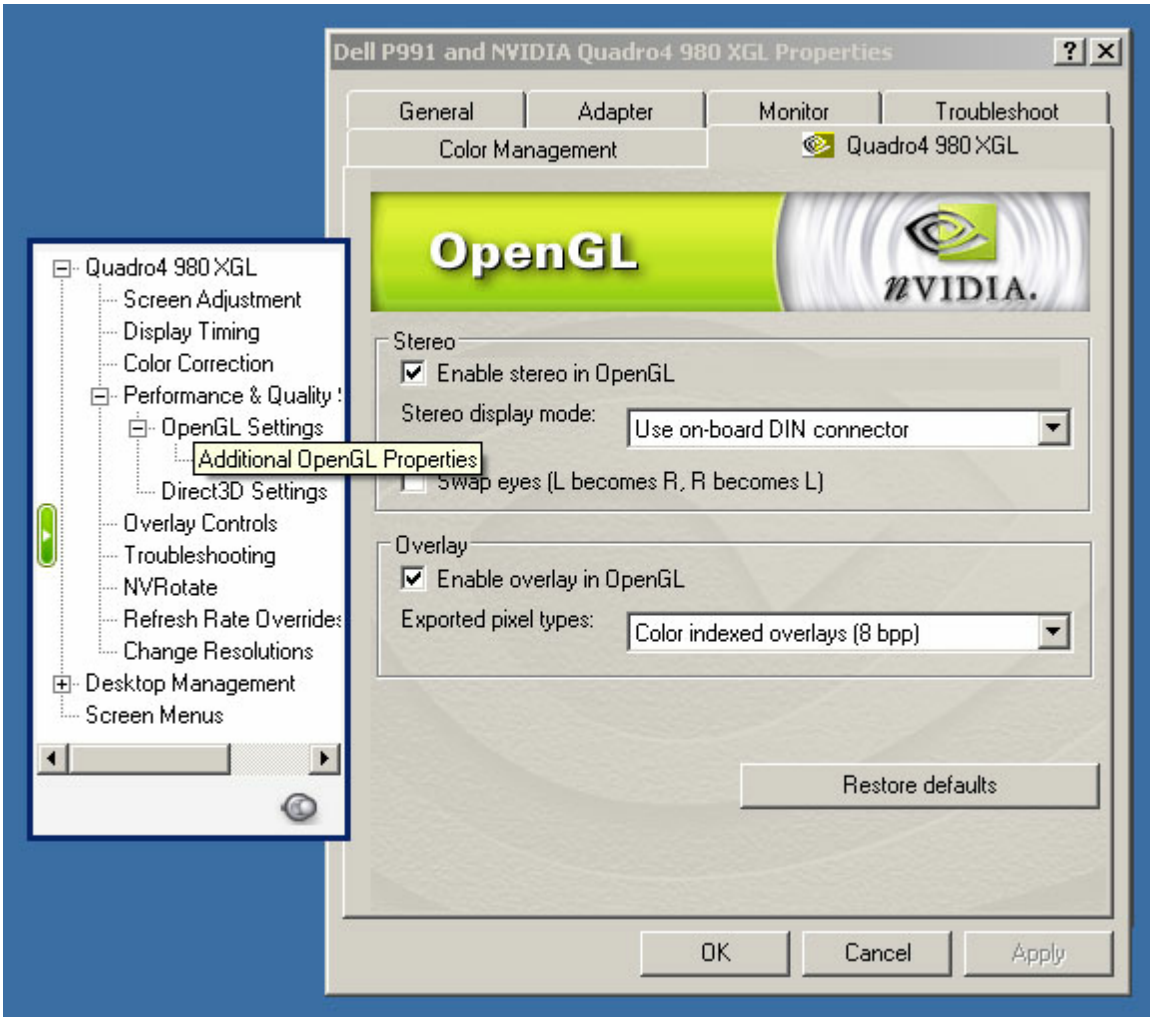

The Monitor tab allows the configuration of the Screen Refresh Rate. The Quadro4 XGL's maximum screen refresh rate is 100 Hertz.

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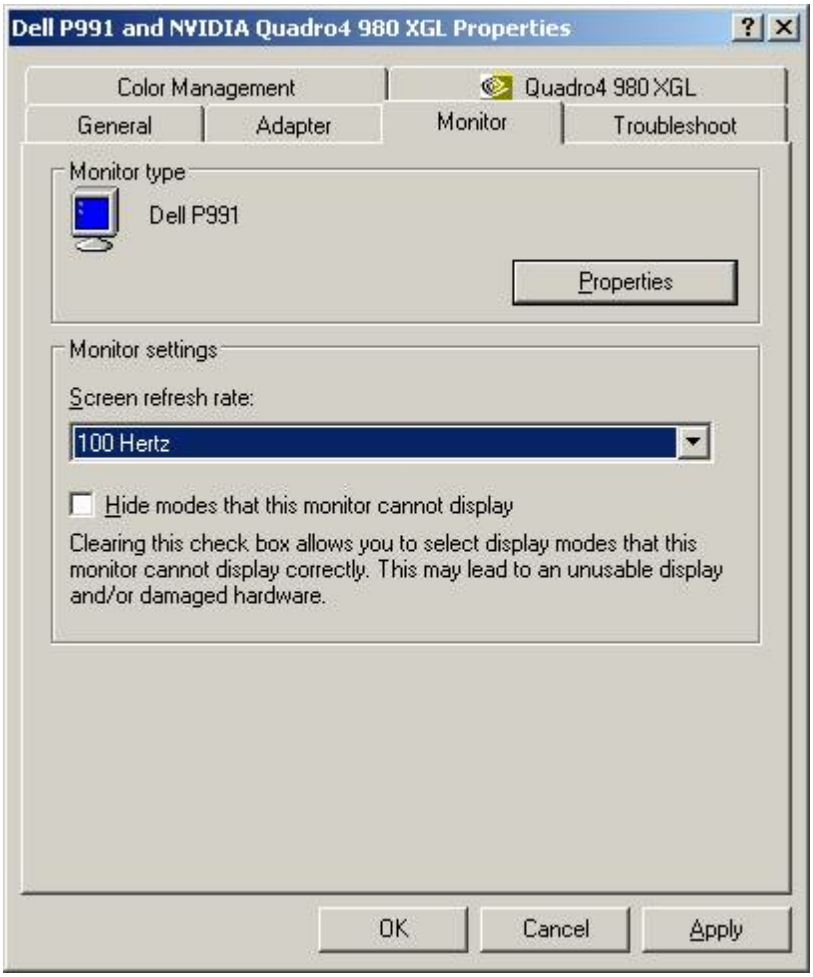

Document revised: 2005

4.2.5 3Dlabs Wildcat 5110 / 6110 Stereo Graphics Card

Vr Mapping

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Wildcat II 5120 / Wildcat III 6110 Configuration

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Note: With the advances in graphics display technology, the information in this document is deprecated. (December 2017)

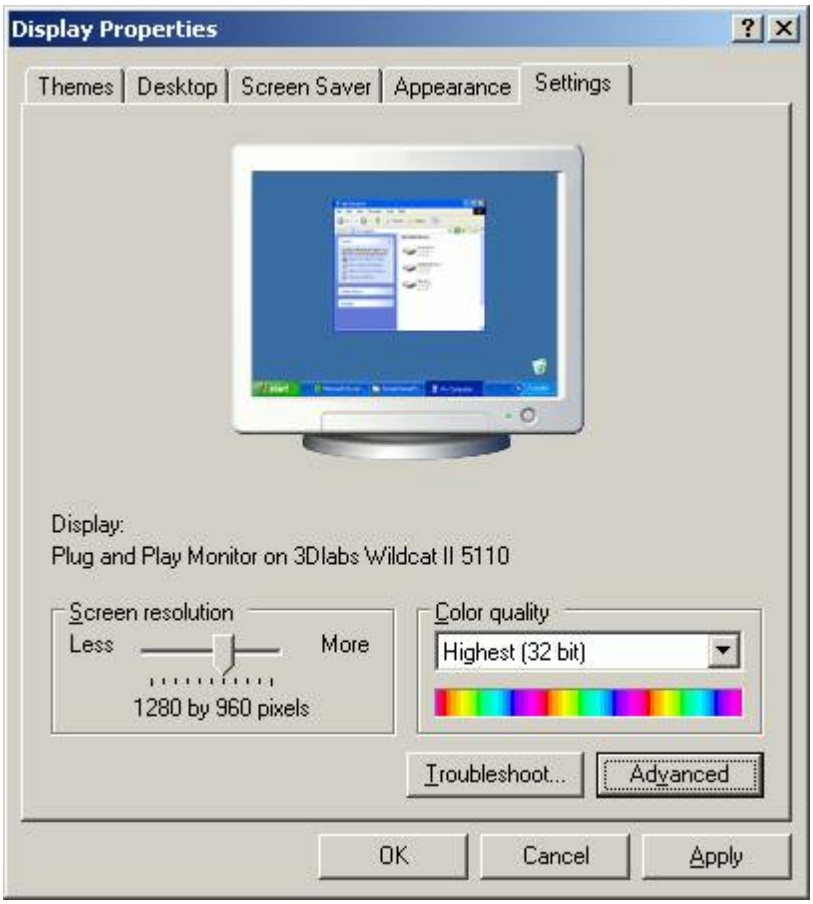
"On February 24th 2006, 3DLABS refocused its business and stopped developing its workstation graphics cards for the PC and announced it would focus on its new DMS™ low-power media-rich application processors." - http://www.3dlabs.com/content/Legacy/

The Wildcat™ 3D graphics cards offer stereo graphics with dual-pipeline-architecture. These cards offer the excellent performance for 3D stereo roaming for VrTwo. If roaming is not needed and static stereo mode is used the 3Dlabs GVX1 Pro and GVX210 graphics cards may be used with VrTwo.

Before configuring the Wildcat graphics card, the latest drivers should be downloaded from the 3Dlabs web page at www.3dlabs.com.

NOTE: The monitor used for stereo viewing should be capable of refresh rates of 100 Hertz or better.

Start the Display Properties dialog by pressing the right mouse button anywhere on the desktop and selecting Properties then the Settings tab.



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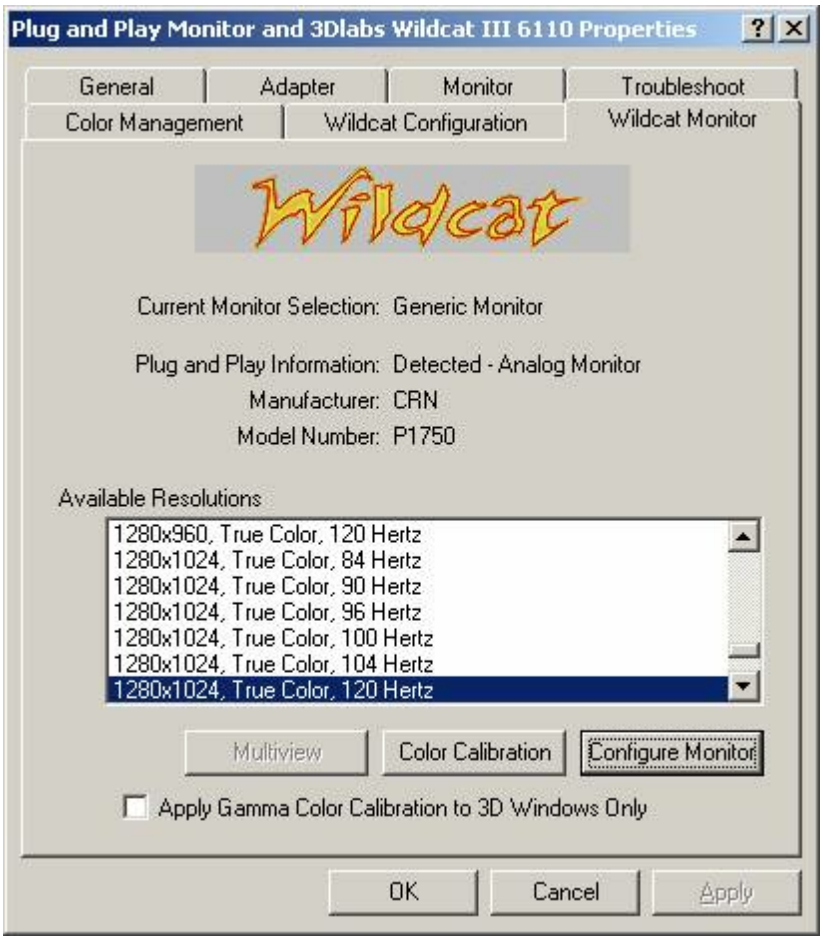
Notice the 3Dlabs Wildcat card is listed in the Display area. Press the Advanced button and then the Wildcat Monitor button. If there is no Wildcat Configuration or Wildcat Monitor tab, then the proper drivers have not been loaded. Visit the 3Dlabs web page at www.3dlabs to download the drivers.



Press the Configure Monitor button to configure the Wildcat card

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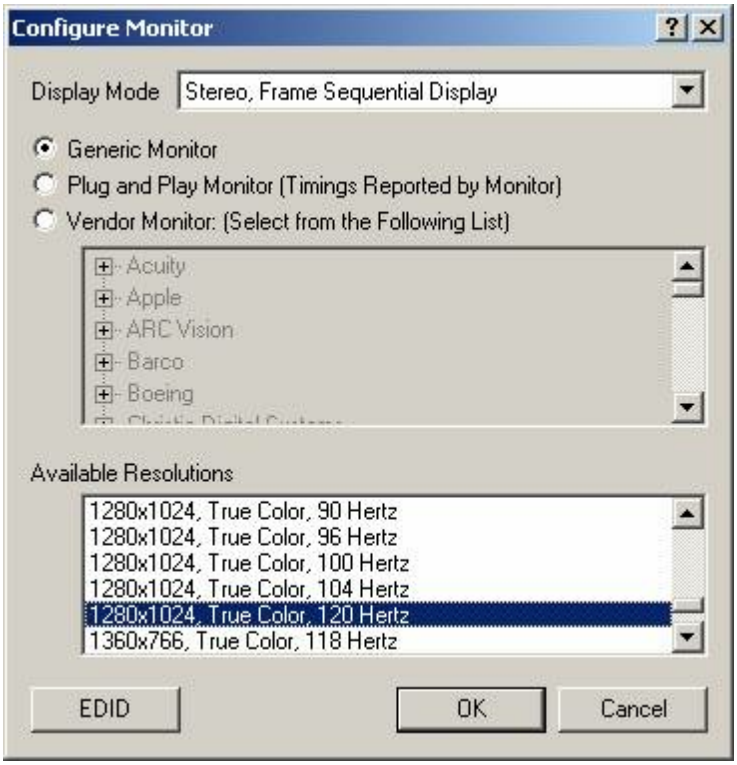

Notice the Display mode is set to "Stereo, Frame Sequential Display". If this option is not available then the proper drivers are not loaded. Visit the 3Dlabs web page at www.3dlabs to download the drivers. A screen refresh rate of 100 Hertz or greater is need to avoid flicker when in stereo mode. At the 1280x1024 resolution, 100, 104 and 120 Hertz are available. NOTE: The monitor used MUST be capable of the refresh rate set in Available Resolutions.

Document revised: 2005

4.2.6 3Dlabs Oxygen GVX210 Stereo Graphics Card

ON-LINE REFERENCE DOCUMENTATION
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www.cardinalsystems.net

Vr Mapping

3Dlabs GVX210 Configuration

Note: With the advances in graphics display technology, the information in this document is deprecated. (December 2017)

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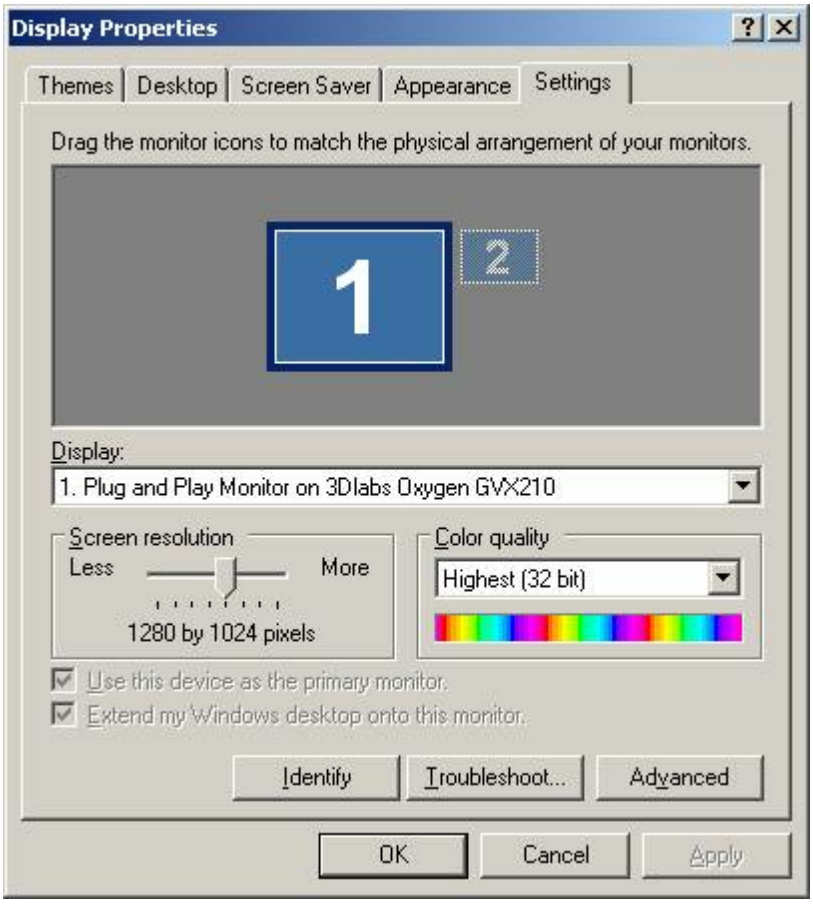
The 3Dlabs GVX210 graphics cards may be used with VrTwo for viewing stereo in static and roaming modes. This card performs well but other graphics cards such as the 3Dlabs 5110, 3Dlabs 6110 and the PNY Quadro 980 XGL perform better when roaming.

Before configuring the GVX210 graphics card, the latest drivers should be downloaded from the 3Dlabs web page at www.3dlabs.com.

NOTE: The monitor used for stereo viewing should be capable of refresh rates of 85 Hertz or better.

Configuring the GVX210

Start the Display Properties dialog by pressing the right mouse button anywhere on the desktop and selecting Properties then the Settings tab.



Notice the GVX210 Wildcat card is listed in the Display area. A resolution of 1280 by 1024 and other resolutions work. Note that not all available resolutions offer an Overlay Plane that VrTwo requires for cursor and tentative line display.

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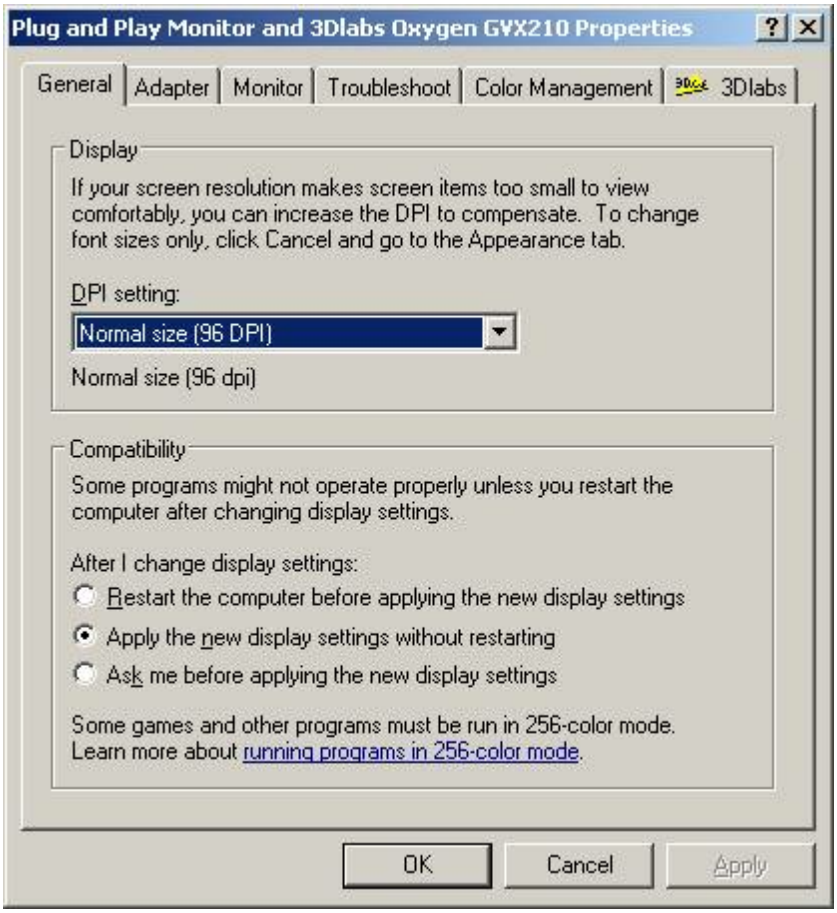
Press the Advanced button for the following dialog. From this dialog the 3Dlabs settings monitor refresh rate may be set.



Press the 3Dlabs tab then the Advanced button then the Open GL Support tab then the Advanced tab for the following dialog.

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Check the Stereo View support option. You may need to reboot when completing this option. Press OK to return to the previous dialog.

Press the Monitor tab.

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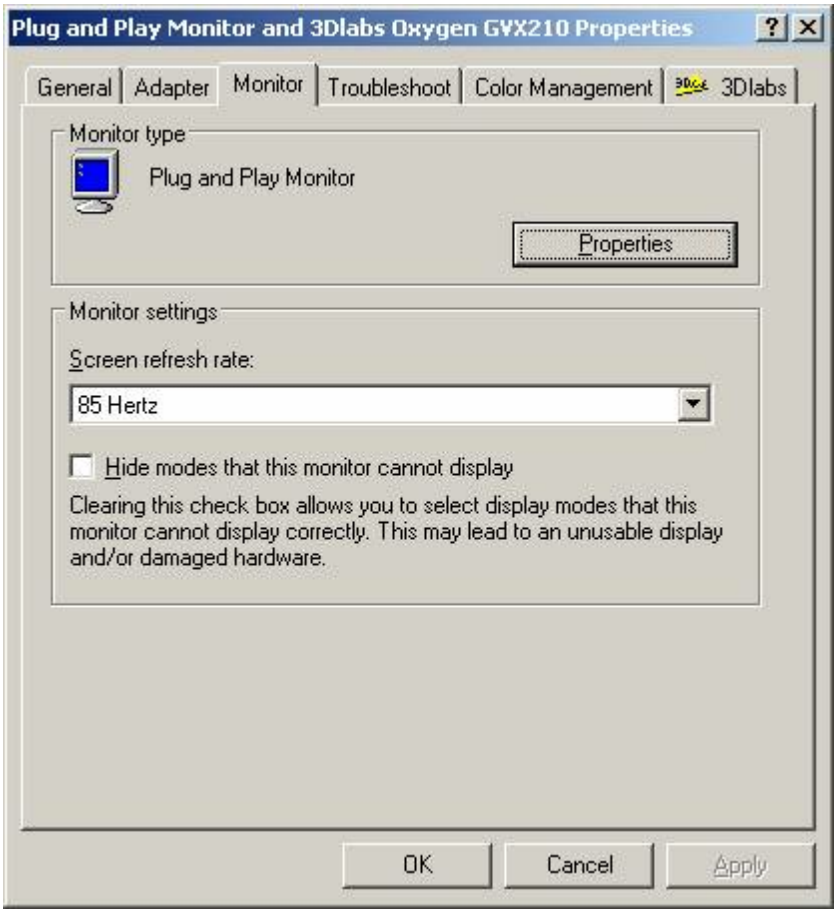

It is desirable to use a Screen refresh rate of 100 Hertz or better but the GVX210 does not allocate the Overlay Plane at this rate. A refresh rate of 85 Hertz works but may display a small amount of flicker when viewing stereo. Try to keep your workstation in an area of subdued light and away from florescent lighting to minimize the effects of flicker.

Press OK to return to the previous dialog and OK again to exit the Display Properties. After exiting Display Properties if your computer prompts for a reboot press OK.

Checking the Parameters

Start VrTwo

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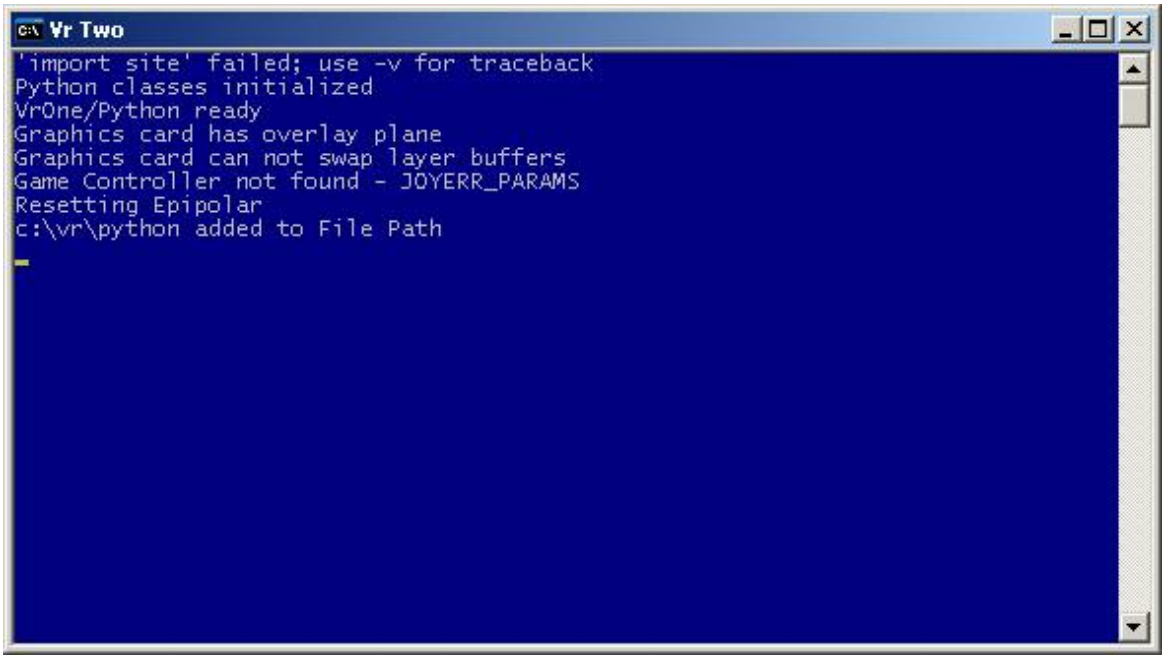

When VrOne and VrTwo start they display messages in the Command Prompt window indicating various parameters and conditions. If the GVX210 card is working correctly for VrTwo you should see the message "Graphics card has overlay plane". If you receive the "Graphics card does not have overlay plane" then check your settings or try a different screen resolution.

Document revised: 2004

4.3 Touchscreens and Touch Pads

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Vr Mapping

Touchscreens and Touch Pads

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The Apple iPad

Touchscreens and touch pads are optional and are designed for use with VrOne and VrTwo. Their purpose it to make menu selections easy and fast when collecting data. The keys on these devices can be programmed to start VrOne and VrTwo Function Keys, Macros and key-ins.

VrController for the iPad
Vr Touchscreen
Keyport 252
CEDEQ Enterpad 120
Kinesis Savant 58-key Programmable Keypad

4.3.1 Vr Controller for the iPad

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Vr Mapping

VrController for the iPad

NOTE: The VrController for the iPad is no longer available. Please see the Vr Touchscreen as an alternate touch input device.

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The Apple iPad

- VrController Overview
- VrController Interface
- Connecting VrOne/VrTwo to VrController
- VrController Programming
- VrController MenuKeys

VrController Overview

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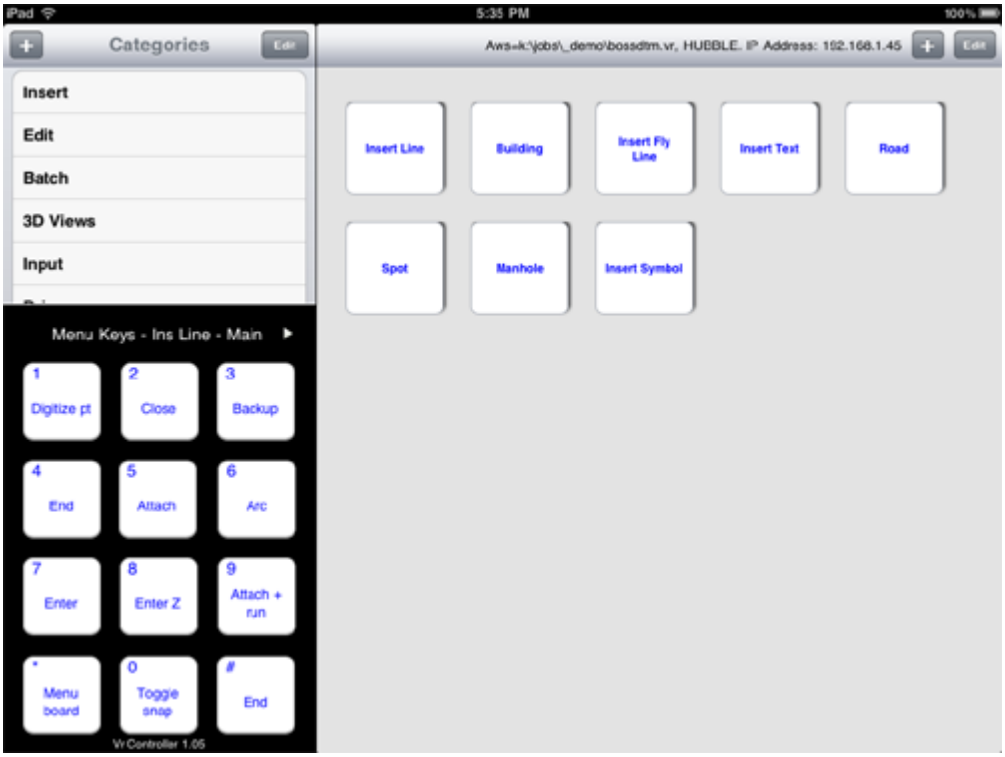

The VrController for the iPad

The VrController iPad App allows the control of the Vr Mapping software using an Apple iPad as the touchscreen input device. The VrController is available from the Apple App Store and may be downloaded to an iPad for free. The Apple iPad provides a powerful and seamless method for launching key-ins, Function Keys and Macros from an iPad to control functions in VrOne and VrTwo. Unlike other touchscreen input devices, there are no requirements for extra graphics cards or wired connections. The iPad connects wirelessly (Wi-Fi) to VrOne and VrTwo, and requires no configuration.

A large number of Categories and Menu buttons (commands or applications) are available with the VrController. The interface is as intuitive and as easy to use as the iPad itself.

VrController Interface

The VrController App connects over a wireless Wi-Fi network to VrOne or VrTwo running on Windows XP or Windows 7. The Vr Mapping computer can be on a wireless (Wi-Fi) or wired network connection, but it must be on the same internal network as the VrController App. When you first start the VrController app it will display the current IP address of the iPad device.

Connecting VrOne/Two to the VrController

The connection between the VrController App and VrOne/VrTwo is initiated by VrOne/VrTwo. There are two commands in VrOne/VrTwo that may be used to connect to the VrController. The recommended method for connecting is with the "Find Controller" (FinCon)

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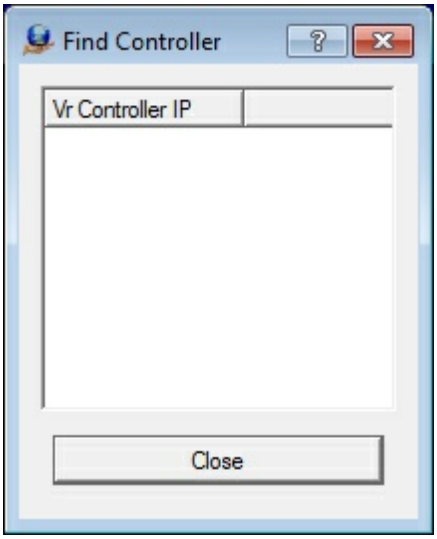
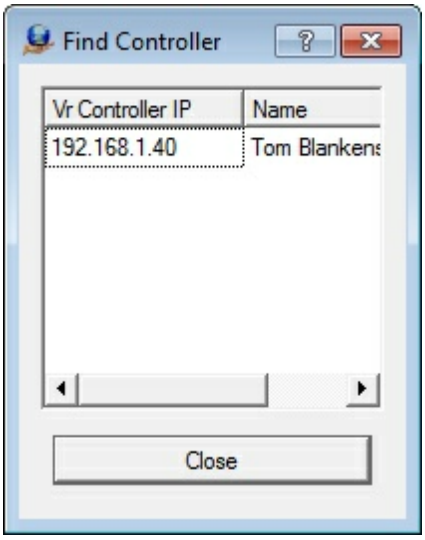
command. Selecting Input->Find Controller or typing FinCon which will display the following dialog box.



The Find Controller dialog box displayed by VrOne or VrTwo

If the iPad is connected to the local network via Wi-Fi with the VrController App running it should display in the dialog as shown below.



The Find Controller dialog box showing a connection to the iPad VrController app.

If the Find Controller (FinCon) command does not find the iPad, you may use the alternative "Connect Controller" (ConCon) command to try a direct connection to the iPad. The Connect Controller key-in must be entered in the VrOne/VrTwo command window and should be followed by the IP address displayed on the iPad. For example, if the iPad displays an IP address of 192.168.1.5, then the following command will attempt to connect to the iPad on this address.

ConCon 192.168.1.5

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Select the Input -> Disconnect Controller or key-in DisCon to disconnect from an iPad that is currently connected to VrOne or VrTwo.

VrController Programming

The VrController provides an almost unlimited number of commands to be programmed on the iPad. Any number of Categories may be defined, and each Category may have multiple pages of Command (application) buttons associated with it.

Creating a New Category

To create a new Category, press the plus (+) button on the upper left corner of the categories section. If using landscape mode, categories are always displayed. If using portrait mode, categories may be displayed by pressing the "Categories" button on the upper left of the screen. A dialog box will be displayed allowing a new category name to be entered.

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Creating a new Category

Editing Categories

To re-arrange or delete categories, press the Edit button on the upper right corner of the Categories section. The categories list will enter edit (wiggle) mode, allowing the categories to be moved into different positions, or to be deleted. To rename a category, press and hold a finger on the Category name. Press the Done button on the upper right corner of the Categories section to exit editing mode.

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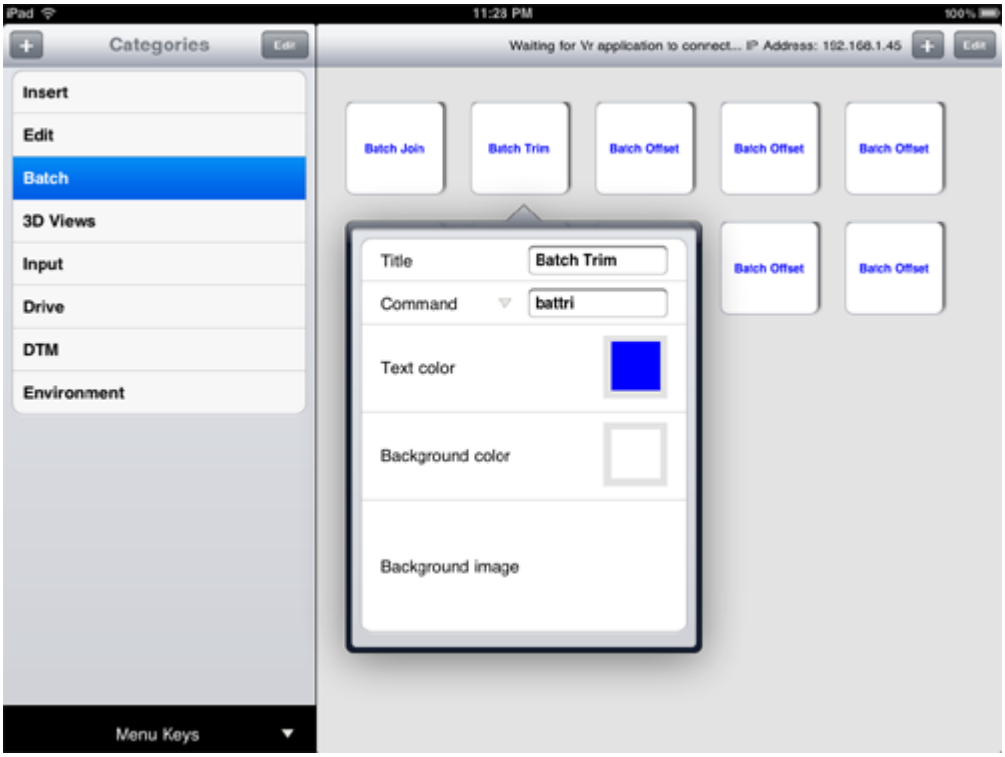
Creating a New Command Button

To create a new Command button, press the plus (+) button on the upper right hand section of the Command area. A dialog box will display allowing the entry of the Button title, command text, button background color, and optional button image.



Creating a new Command button

The VrController allows the selection of commands from a predefined list of VrOne/VrTwo commands (Applications). The selection dialog displays the full VrOne/VrTwo appllication names, making it easy to enter application text without having to look up the key-in for the application.

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Defining a VrOne or VrTwo application

Editing Buttons

To re-arrange, edit, or delete buttons, press the Edit button to the upper right of the button area. Edit mode may also be entered by pressing and holding any button. Once edit (wiggle) mode is on, the buttons will start shaking and a Delete button (X) will be displayed on each button. Press the Done button in the upper right of the button area to exit Edit mode.

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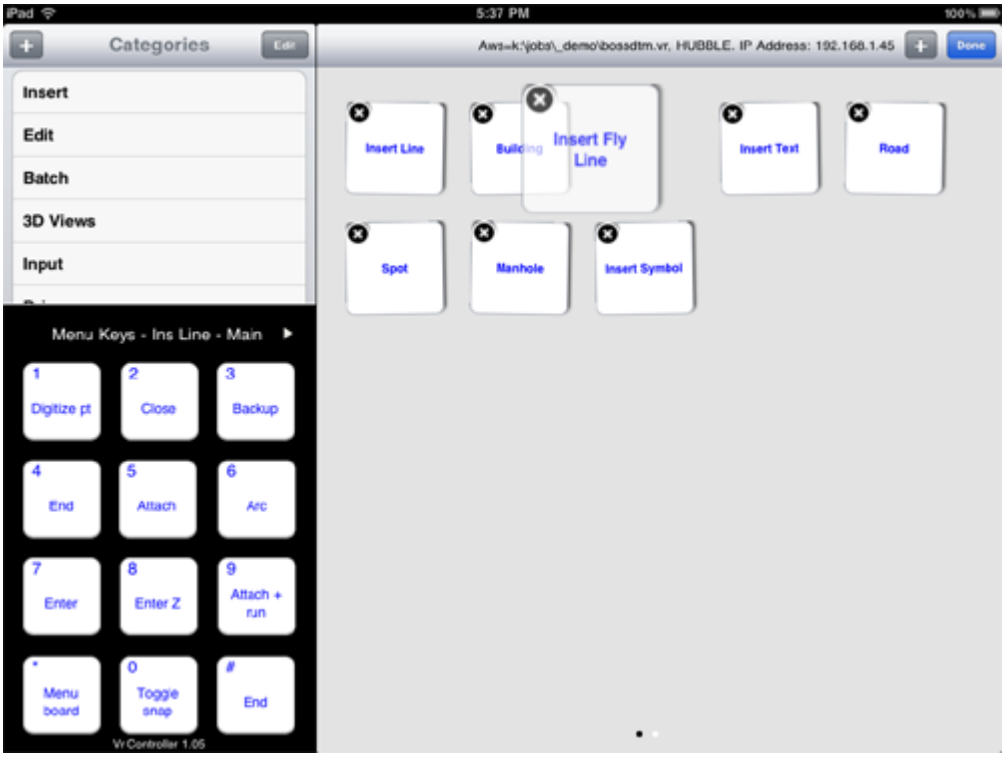

The edit (wiggle) mode

Holding down a button and dragging it while in edit (wiggle) mode may be used to rearrange buttons. Holding down a button longer will display the button edit dialog box. Pressing the delete button will remove a button after user confirmation.

VrController MenuKeys

The VrController automatically displays the current MenuKey labels for the active command running in VrOne/VrTwo. The MenuKeys are always available under the Categories section, but may be hidden by touching the right arrow (>) to the right of the MenuKeys title.

4.3.2 Vr Touchscreen

Vr Mapping

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Vr Touchscreen



Vr Touchscreen Overview
Vr Touchscreen Interface
Vr Touchscreen Programming
Configuring VrOne/VrTwo for the Vr Touchscreen

Vr Touchscreen Overview



The Vr Touchscreen (original configuration)

The Vr Touchscreen software is designed to be used with VrOne, VrTwo, and VrThree (VrLiDAR) and offers 567 user definable buttons on a touch screen device. Each button has the ability to output a Vr button number, Vr macro name and (or) start a Vr Function key. Any

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valid Vr key-in string may be placed on a Vr Touchscreen button. Programming the screen is as easy as touching the program button then the button to program. Each button may have its own text, color, text font and text. The 567 buttons are on 9 overlays of 63 buttons each.

The top row of the touch screen is the overlay row and is used to select one of nine menu overlays.



The Vr Touchscreen programmable push button interface

Vr Touchscreen Interface

The Vr Toucscreen software is included with VrOne, VrTwo, and VrThree. This button dialog can be displayed on any Windows monitor. However it is designed to be used with a touch capable monitor. Following are several touchscreen monitors that can be used to display and work with the Vr Touchscreen dialog.

Xenarc 700TSV

Originally, the Vr Touchscreen button dialog used the Xenarc 700TSV as the additional touchscreen monitor. This small monitor normally required a second graphics card and is typically used today.

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The Xenarc 700TSV

ViewSonic TD1655

These newer touchscreen monitors are easier to implement and configure and run as an additional monitor in Windows.



The ViewSonic TD1655

Apple iPad and Android Tablets

These tablets can be used as an additional touchscreen monitor using connection drivers such as Spacedesk (www.spacedesk.net).

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VrTouchscreen displayed on the Apple iPad



Vr Touchscreen on the Samsung Android based tablet

Vr Touchscreen Programming



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The Touchscreen Parameter File

The parameter file name that contains the Vr Touchscreen button assignments and parameters is defined in the Vr Configuration program from the Configuration -> General pull-down. By default this file name is assigned \vr\hostdir\default.ts. If you program any buttons on the Vr Touchscreen you should not use this name as it will be overwritten on the next Vr software install.

Entering Program Mode

The lower left button on the Vr Touchscreen shows the Vr logo and is the program button. A single press of this button and it will change to green and display "Select Button to Edit".



The Program Button

Programming a Button

At this time you may press any button to be programmed. First select the overlay to be edited by pressing one of the nine overlay buttons along the top row. A button to be programmed may be one of the 63 buttons on a single overlay or one of the nine overlay buttons along the top row. Pressing a non-overlay button will display the following dialog. Pressing an overlay button will display a similar dialog but without the "Command key-in" and "Apply to all menus?" fields.



The Edit Button

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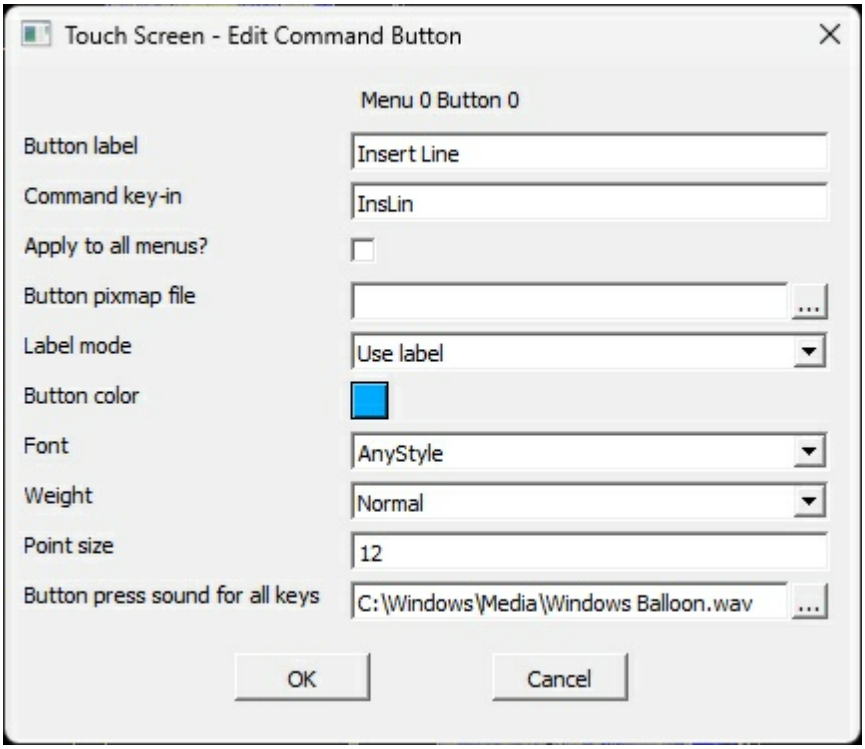

The Edit Command Dialog

Button label

The text label that will be displayed on the button face may be entered here. If the Label Model is set to Use label this text will be shown. Up to three rows of text may be entered depending on the size of the text. A blank in the text will indicate the next word will be displayed on the next line.

Command key-in

When this button is pressed this command string will be passed to VrOne. This line may contain any valid key-in, macro and (or) Function Key name. Multiple key-ins may be separated with a comma. VrOne 12-key button presses may be entered as b0-b11 where b0 is the snap on/off key and b10 is the * key and b11 is the # key.

Apply to all menus?

If this is checked then the button will be placed on all nine menu overlays.

Button pixmap file

An icon of picture may be placed on the button face instead of a text label. The Label mode must be set to Use pixmap to display a pixmap on the button face.

Label mode

Options are Use label, Use pixmap, or Use both. This parameter sets the display mode for the button face.

Button color

Shows the current button color and allows editing of the color by pressing the color picker

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button.

Font
This combo box allows the choosing of a text font for the text display on a button face. Options include Helvetica, Times, Courier and System.

Weight
This combo box allows the choosing of a text weight for the text display on a button face. Options include Light, Normal and Bold.

Point size
The size of the text label may be set here and is expressed as point size.

Button press sound for all keys
A wave (.wav) sound file may be played when a key is pressed. For a silent key press, leave this parameter blank.

Copying a Button

Pressing the program button again will change its color to yellow and display "Select Button to Copy". A source button may now be pressed and the display will change to "Select Target Button" at which time a target button may be pressed.



The Copy Button

Exiting Program Mode

Pressing the program button once again when "Select Button to Copy" is displayed will exit program mode and display the Vr logo on the button. Any buttons that were programmed are now ready for use.



The Program Button

Configuring VrOne/Two for the Vr Touchscreen

VrOne/VrTwo can be configured to start the Vr Touchscreen menu in the Vr Configuration program (VrCfig). Under the Configuration -> Keyport pulldown the Keyport Type may be set

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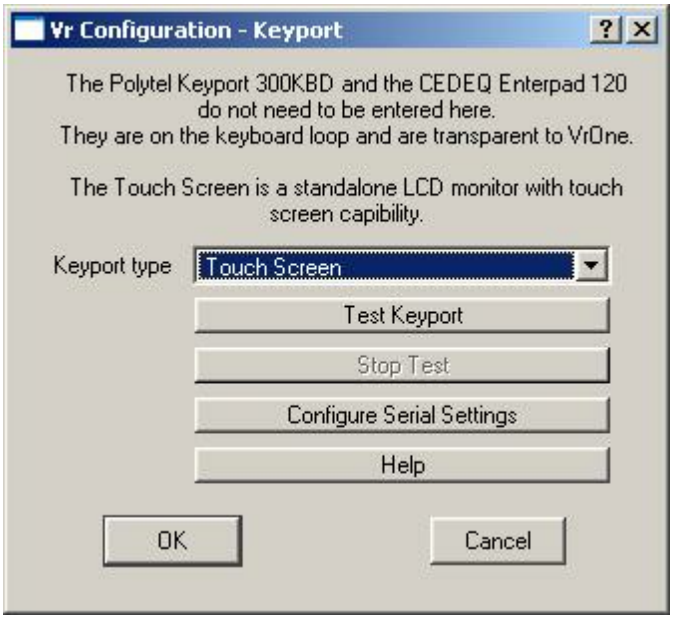
to Touch Screen.



No other settings are required. When VrOne/VrTwo starts it will display the Vr Touchscreen menu on one of the screens. This is a Windows dialog box and may be dragged to a touchscreen monitor. Once there, it may be maximized and it will fill the entire touchscreen display. A restart of VrOne/VrTwo/VrThree will place the menu at its last position.

Original document: July 2007
Document revised: July 2024

4.3.3 Keyport 252

ON-LINE REFERENCE DOCUMENTATION
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Vr Mapping

Keyport 252

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The Keyport 252

The Keyport 252 is a touch-sensitive programmable keypad for use with VrOne. These keypads come with a serial (RS-232) interface and a USB (Universal Serial Bus) interface. VrOne supports both the USB and serial configurations. The Keyport 252 is available from Cardinal Systems, LLC or DAT/EM Systems International under the name DAT/EM Keypad™ .

Following are the subjects covered by this documentation:

- Feet Configuration
- Hardware Connections
- USB Connection
- Serial Connection
- Driver Installation
- VrOne Configuration
- VrOne Menu Board
- Editing Button Assignments

Feet Configuration

VrOne uses the Keyport 252 in a portrait orientation with the connections to the left of the keyport. The default feet locations are normally in portrait orientation and may need to be relocated.

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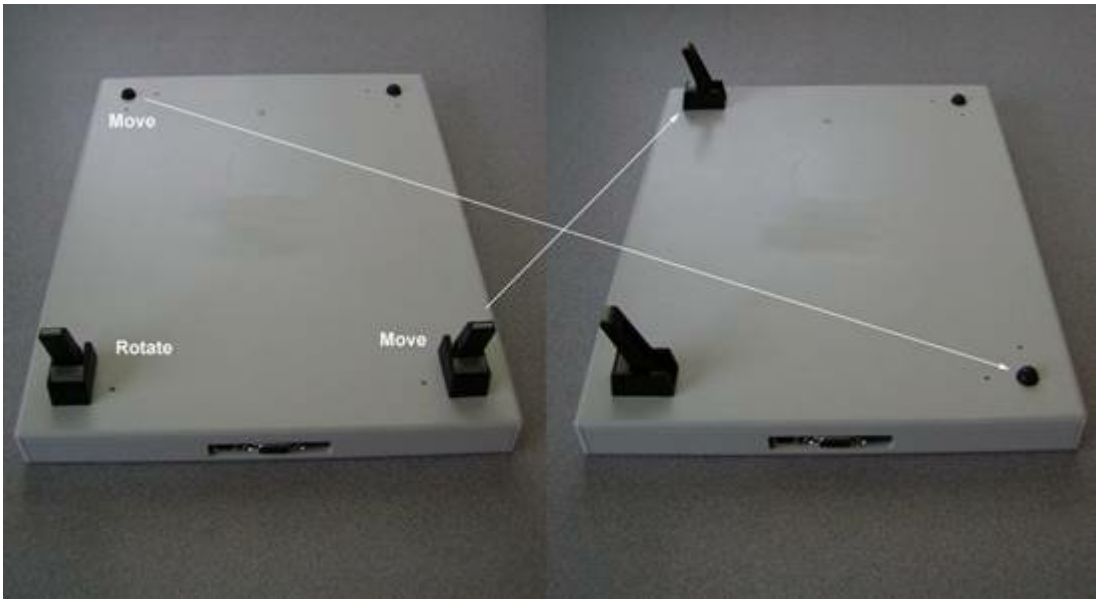
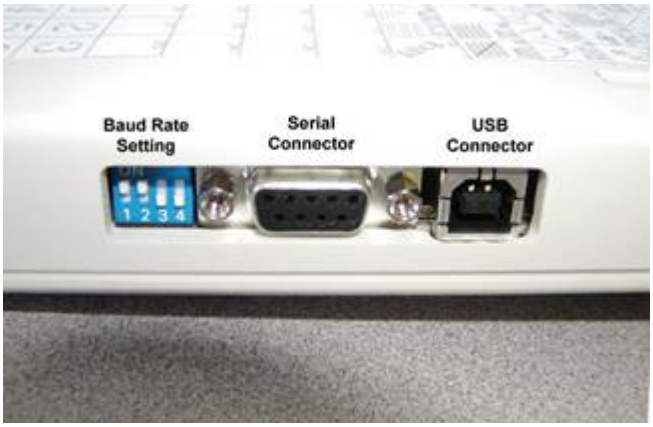


Hardware Connections



The Keyport 252 interfaces

The Keyport 252 supports both serial and USB interfaces. Choose one of the two interfaces that best connection to suit your needs.

The Baud Rate Setting must match the Baud Rate selected in the Vr Configuration program VrCfig. Even if the USB interface is used, the correct Baud Rate must be selected. Following are possible Baud Rate settings:

Baud	Switch 1	Switch 2	Switch 3	Switch 4
4800	On	Off	Off	Off
9600	**On**	**On**	**Off**	**Off**
19200	On	Off	On	Off

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38400	On	On	On	Off

The switch settings in the photo are 9600 Baud which is the default for connection to VrOne.

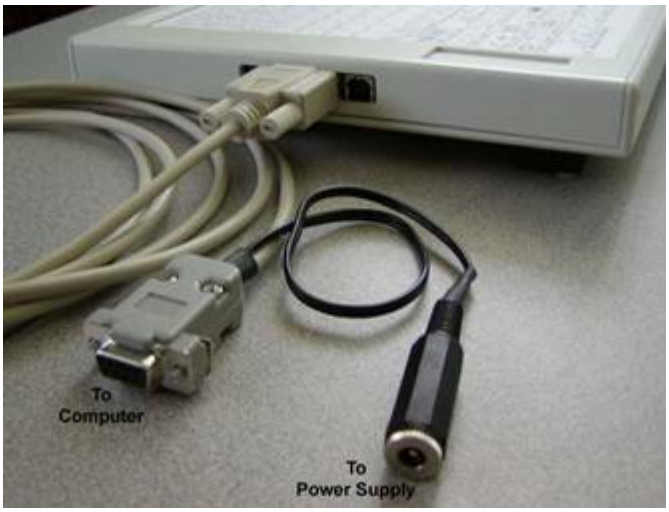
USB (Universal Serial Bus) Connection



The USB cable

A single cable is used for USB. This cable supplies data and power for the Keyport 252. An external power supply is not needed when using the USB connection.

Serial Connection



The serial (RS-232) cable

The serial connection consists of a single 9-pin connection to the Keyport 252 and a single 9-pin connection to the computer and a connection to the external power supply.

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Driver Installation

If the serial connection is being used the following step may be skipped.

At this time the Keyport 252 USB cable should not be connected to your computer. **NOTE**: The dialog boxes displayed below are from Windows XP. Windows 2000 dialog boxes may be slightly different

When the Keyport 252 is connected to VrOne using the USB interface, USB Virtual Serial Drivers are needed. These drivers may be downloaded from the Cardinal Systems FTP site and are in the UsbComPort directory. Download all files in this directory into a temporary directory on your computer.

With the computer on, connect the USB cable first to the keypad then to the computer.



After connecting the USB cable the dialog box shown above should appear. Select “Install from a list or specific location” and press “Next>”

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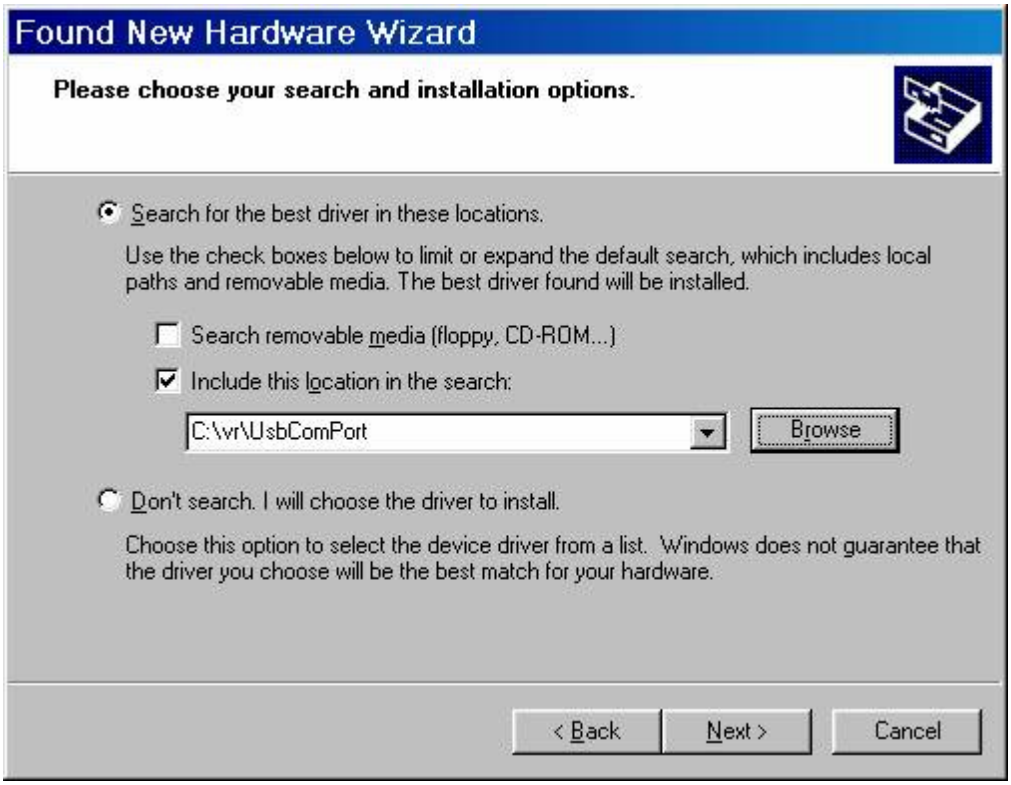

Uncheck “Search removable media”, check “Include this location in the search” and enter the directory where the UsbComPort files are located and press “Next>”.

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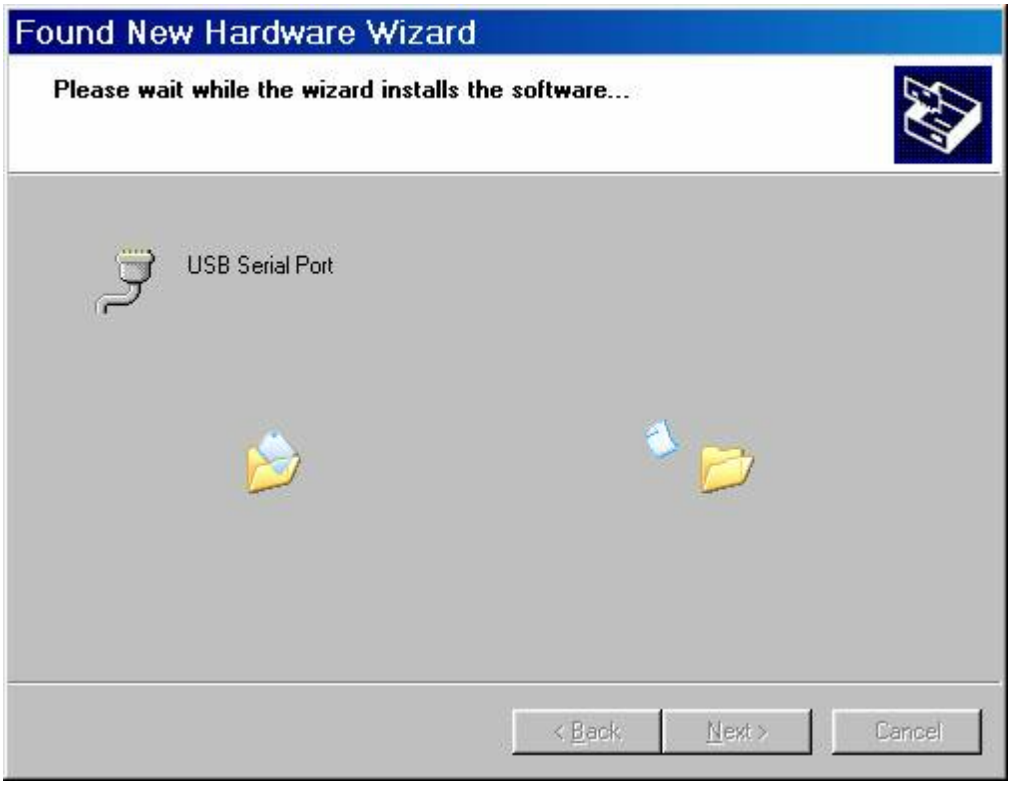

The dialog shown above is displayed showing driver installation.



If the dialog shown above appears press “Continue Anyway”

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When installation of the USB COM port drivers is complete the dialog box shown above will appear and “Finish” may be pressed.

It is necessary to know the COM port that is being used for proper configuration with VrOne. The port chosen is normally should be in the range of COM1 thru COM4. If the above installation process did not display the COM port chosen you may use the Windows Device Manager to find the COM port used by the keypad.

To get to the Device Manager, press the right mouse button while on the “My Computer” icon and a pop-up menu will be displayed. Choose Properties then Device Manager.

In the Device Manger dialog, choose “Ports” to display the serial ports currently used. Look for “USB Serial Port” which should display the COM port used. In the dialog box displayed below, COM3 is used for the USB Serial Port.

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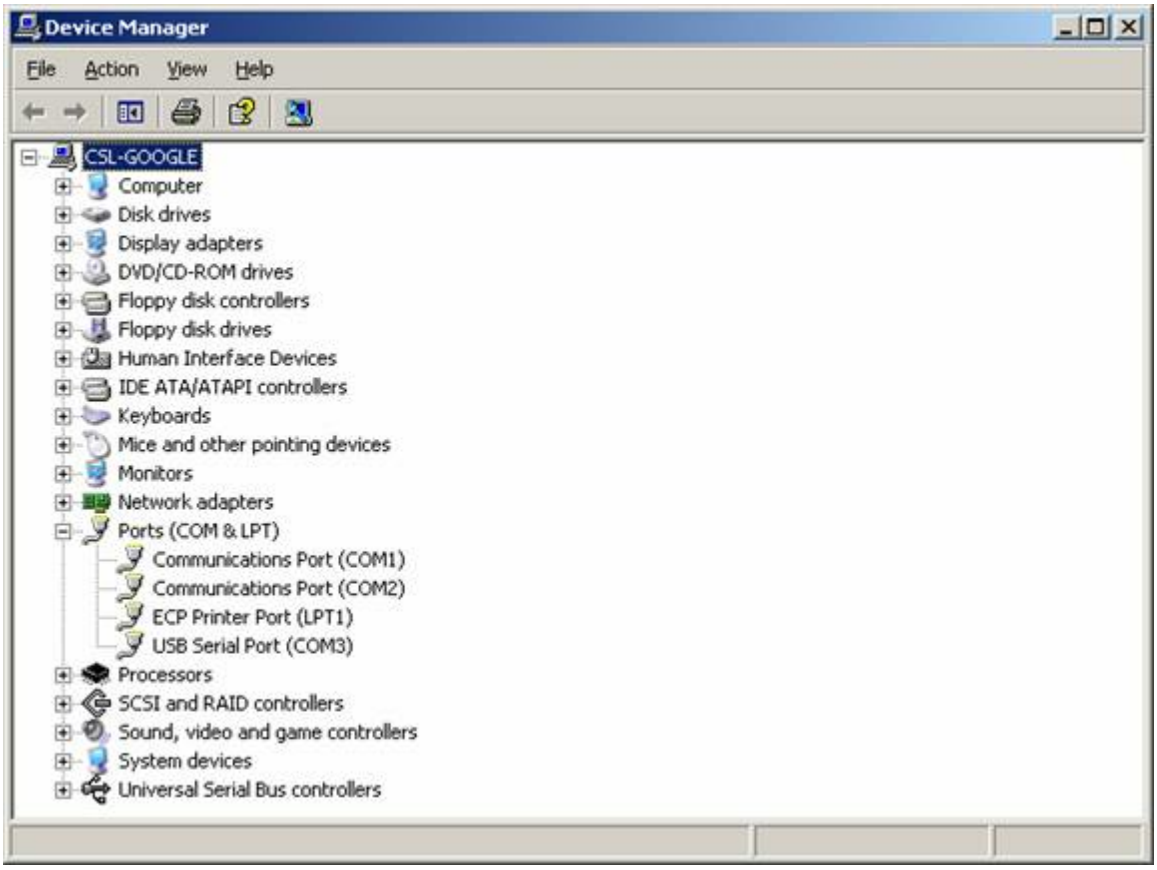
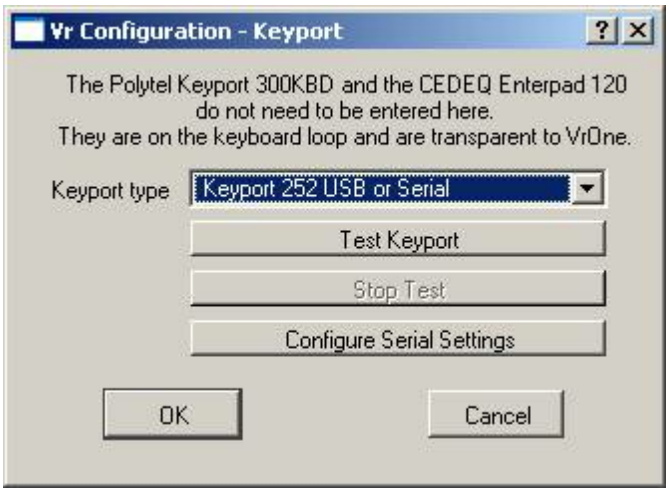


VrOne Configuration

The Vr Configuration program VrCfig is used to configure and test the connection to the Keyport 252. Choose Configuration->Keyport to configure the Keyport 252.



The COM port and Baud Rate may be selected by pressing the Configure Serial Settings. Only the Serial device and Baud rate should be changed and the remaining default settings should

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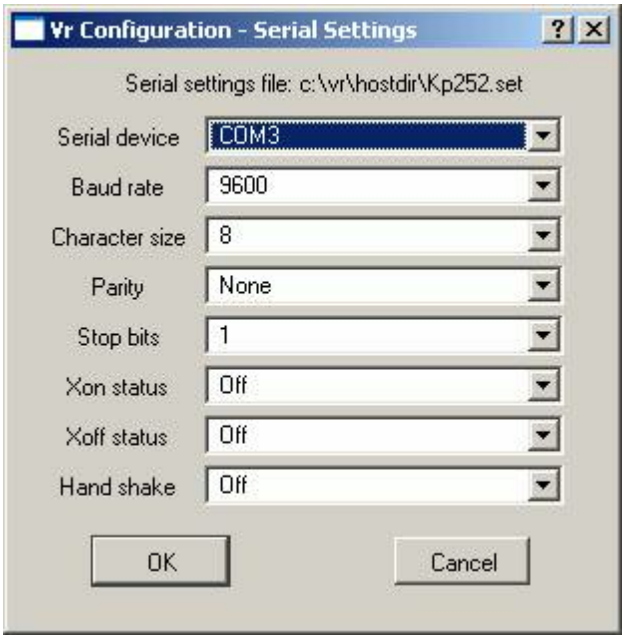
remain the same. NOTE: The baud rate when using Serial should be 19200.



VrOne Menu Board and the VrOne Key Pad Commands



The Keyport 252 Menu Board overlay

A sample VrOne Menu Board overlay is delivered with VrOne and is in \vr\data\Kp252.VR. This file may be opened in VrOne and modified as needed. NOTE: The \vr\data\Kp252.VR file is overwritten during installation and if modified, should be renamed or moved from the \vr\data folder.

The button assignments for VrOne keys 1-108 and 201-341 are set in the Key Pad Commands

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from the Input menu in VrOne.

Editing Button Assignments

VrOne Key Pad commands are used to define the button assignments on the Kp252. By default, these button assignments are delivered in the \vr\data\default.kp file. The location of this file may be changed in the Vr Configuration program (VrCfig) under Configuration->General-> Keypad Command File. NOTE: The default file \vr\data\default.kp is overwritten during installation and if modified, should be renamed for moved from the \vr\data folder.

To edit the VrOne Key Pad button assignments use Input->Edit Keypad Commands (EdiKey) in VrOne.

4.3.4 CEDEQ Enterpad P120

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CARDINAL SYSTEMS, LLC
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Vr Mapping

CEDEQ ENTERPAD P120 120 Button Key Pad (Keyboard Connection)

Connecting the Keypad
Downloading the Keypad
Editing the Key Assignments
Support Files

The CEDEQ Enterpad P120 is a 120-button keypad that connects to the computer between the computer and the system keyboard. The Enterpad connects directly to the computer keyboard port and the computer keyboard connects to the Enterpad. Each connector is the small MINI-DIN 6 pin connector. This keypad may be purchased from Cardinal Systems, LLC.

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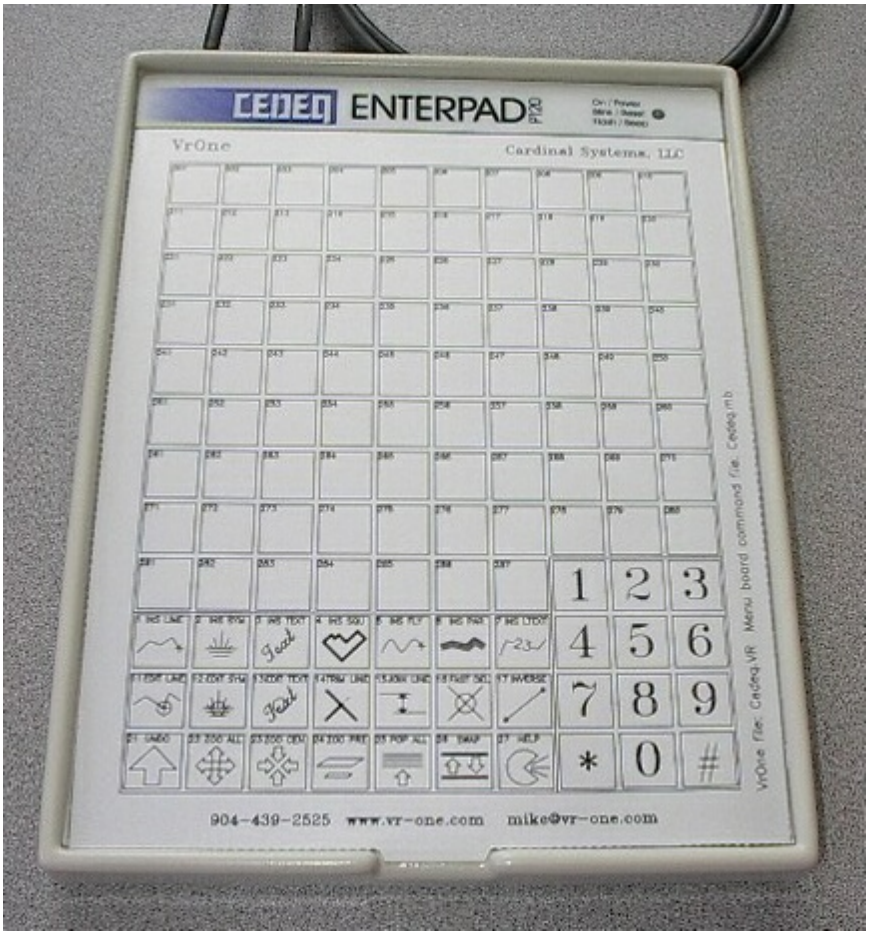

The CEDEQ Enterpad P120

Connecting the Keypad

Turn off computer and disconnect the keyboard.
Plug the keypad into the keyboard port on the back of the computer
Plug the keyboard into the keypad at the end of the cable.

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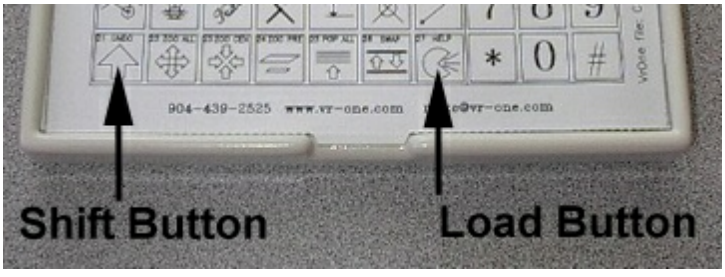
The CEDEQ Enterpad connection cables

Downloading the Keypad

If purchased from Cardinal Systems, LLC, the keypad comes downloaded with key assignments making it usable with VrOne. Once the keypad is downloaded it should not need to be downloaded again. Key assignments may be made in VrOne. If this is a new keypad or you wish to customize the keypad key assignments (not recommended) the following instructions may be followed.

The following operations must be done from a command prompt (DOS prompt).

- Copy the download program from the Cedeq disk (pos42.exe) and the key assignments file (\vr\data\vrone.pos) into the same directory. These two files may be downloaded from the VrOne web page from the Cedeq directory.
- Type: `pos42 vrone 1`
- When prompted press and hold the Shift key on the keypad then press the Load key on the keypad.



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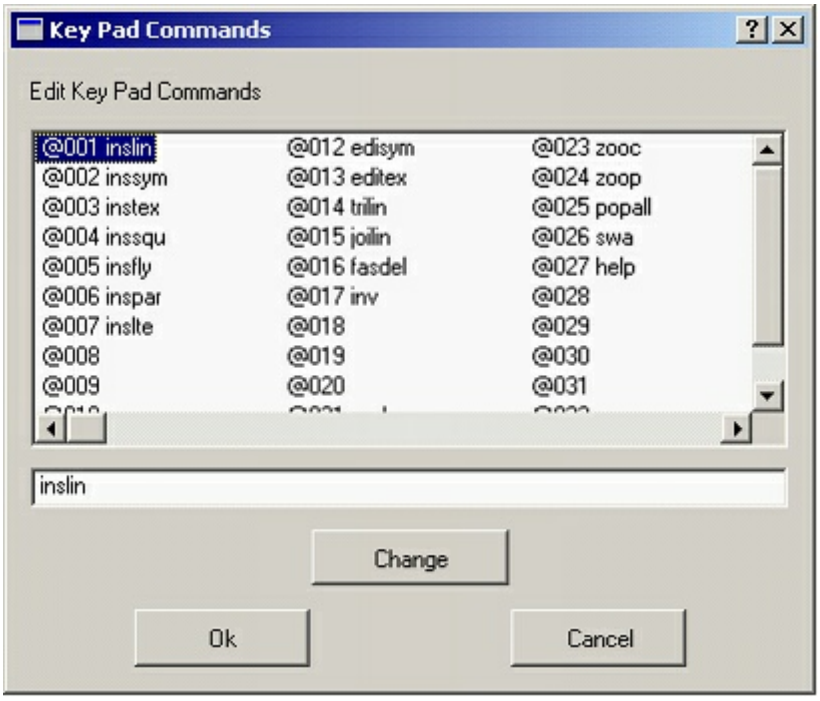
NOTE: Download cannot be done from Windows NT/2000. The following steps may be done to download the keypad from Windows NT/2000:

- Create a Dos bootable floppy disk. A floppy may be formatted and made bootable with the command **`format /S a:`** from DOS or Windows 95/98/ME.
- Copy the download program from the Cedeq disk (pos42.exe) and the key assignments file (\vr\data\vrone.pos) into the floppy. These two files may be downloaded from the VrOne web page from the Cedeq directory.
- Insert the floppy and reboot the computer.
- Type: **`pos42 vrone 1`**
- When prompted press and hold the Shift key on the keypad then press the Load key on the keypad.
- When the download is complete, remove the floppy and reboot the computer.

Editing the Key Assignments

The keypad key assignments may be changed in VrOne from Input->Edit Key Pad Commands (EdiKey). The numbers to the left of the @ symbol correspond to the numbers on the keypad overlay. The default VrOne assignments allow 87 Function Key buttons and 21 VrOne command buttons.



Editing Key Pad Commands

Support Files

The following files are delivered with VrOne for the Cedeq keypad:

- **\vr\data\default.kp** – VrOne key assignments. This file determines the VrOne Function

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Key or key-in or macro to run when a button is pressed. This file should be renamed or re-created with a new name to avoid being overwritten by the new VrOne release. This file name for the key assignments may be defined in the VrOne configuration program (vrcfig).

- **\vr\data\vrone.pos** – Initial button assignments that are downloaded to the keypad once. If a keypad is purchased from Cardinal Systems, this operation is not needed.
- **\vr\data\cedeq.VR** – VrOne file containing the Cedeq keypad key overlay. This file may be customized and plotted.

4.3.5 Kinesis Savant 58-key Programmable Keypad

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Kinesis Savant 58-key Programmable Keypad

The Kinesis Savant[tm] Professional is a 58-key programmable keypad that may be used with VrOne. Any available VrOne key-in including 12 button input may be assigned to this keypad. Two layer functionality offers two functions for every key. The PS/2 version has no software to load (driver provided for USB version). Just program directly from your PC-compatible keyboard. PS/2 version has built-in pass through connection for your PS/2 keyboard. This item plugs into the PC (or USB) keyboard port, so think of it as a programmable, 58-key keyboard on the side. A regular PS/2 (or USB) keyboard is required to reprogram the keypad but otherwise it can be used all by itself. See www.kinesis-ergo.com/savant_58key.htm for more information.

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4.4 3D Input Devices

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

3D Input Devices

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The Stealth Z-mouse

The 3D input devices provides an ergonomic, two-handed 3D input for VrTwo. These input devices have a XY motion sensor, a high-resolution Z wheel and up to 10 buttons. Hand wheels are also supported as a 3D input device. These devices normally connect to the computer using a serial (RS-232) or USB connection.

Stealth 3D Mouse
Stealth Z-Mouse / Stealth Hand Wheels
TopoMouse
Immersion / Stealth E-Mouse
Z/I Mouse
Softmouse 3D
Joy Sticks

4.4.1 Stealth 3D Mouse

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Vr Mapping

Stealth 3D Mouse

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Description

The Stealth 3D Mouse provides an ergonomic, two-handed 3D input for VrTwo. The mouse has an optical XY motion sensor, a high-resolution Z wheel and 10 buttons. The standard Stealth 3D Mouse has two thumb buttons above the Z-wheel. The connection of the Stealth 3D Mouse requires a single USB port.

Installation

This is the original Stealth 3D mouse and is recognized by the Windows as a system mouse and requires no additional drivers. Simply plug the USB connector into any available USB port and Windows 2000/XP should automatically configure the mouse. NOTE: Never install the Kensington drivers that are available for the Stealth 3D Mouse. These drivers cause problems with the feel of the Z motion.

Since the Stealth Mouse is recognized as a system mouse, once it is connected there will be two mice available. Both are active and may be used at any time. The buttons on both the Stealth Mouse and the original system mouse may be configured to emit VrOne button codes.

The Stealth Z-Mouse is a newer 3D input device and differs from the original Stealth 3D Mouse in that it does not configure as a Windows mouse so when in operation the Windows mouse may be used for normal operations such as pulling down menus etc.

For more information about the Stealth 3D Mouse line of products including the Stealth 3D Mouse please the Stealth International web page. Stealth International provides a wide range of 3D input devices and offers sales and support of these products.

Configuration

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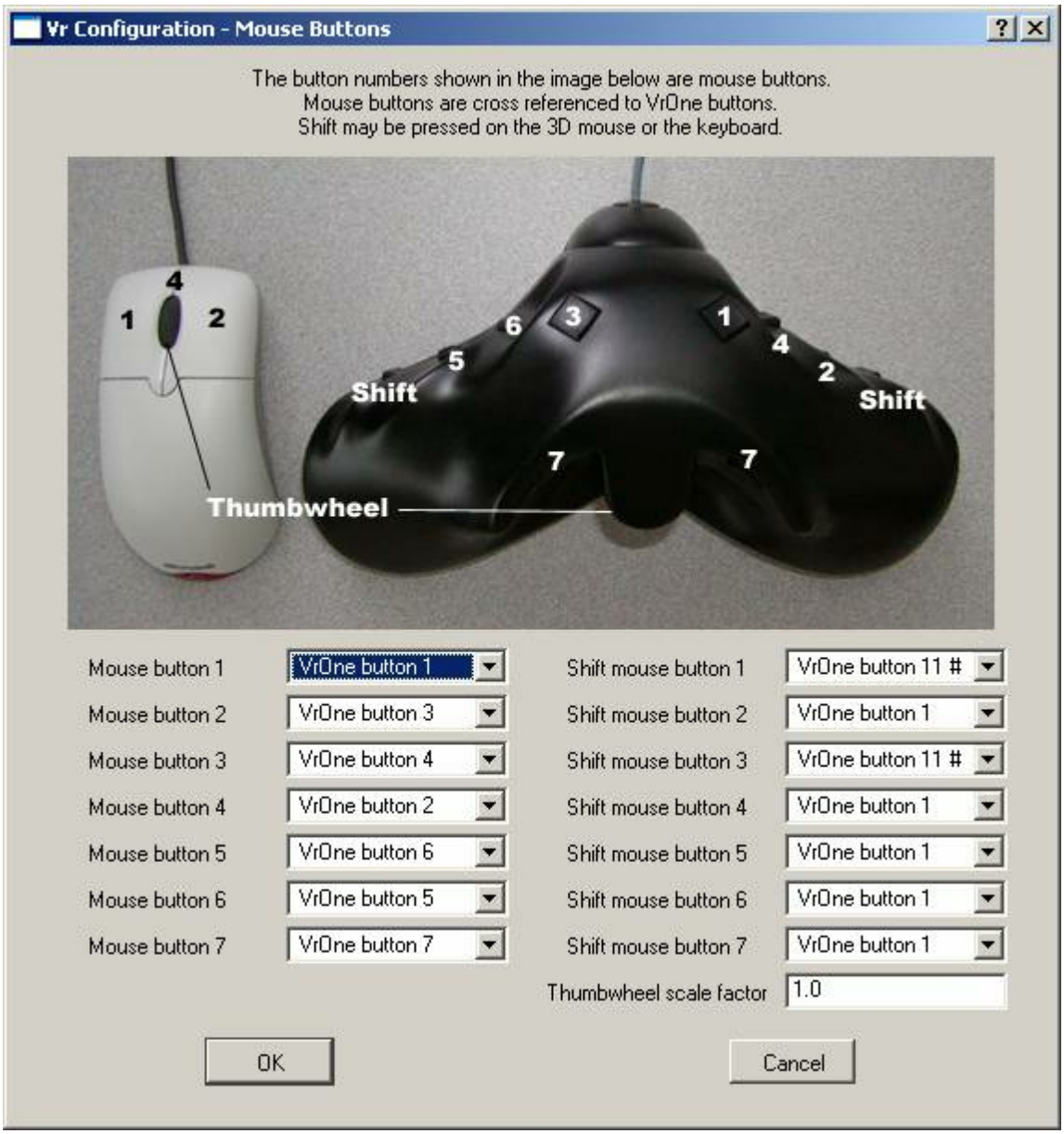

The Stealth Mouse and system mouse button assignments and thumbwheel scale factor may be configured with the Device Control (DevCon) command. This command may be executed anytime VrTwo is running. With the Shift keys, it is possible to cross-reference up to 14 VrOne buttons. The shift key is used to access 7 more buttons and it is also used as a clutch button which disengages the floating mark while the button is pressed.

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4.4.2 Stealth Z-Mouse / Stealth Hand Wheels

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
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Stealth Z-Mouse / Stealth Hand Wheels


Stealth S1-Z


Stealth S2-Z


Stealth S3-Z


Stealth S4-Z

- Description
- Hardware
- Driver Installation
- Driver Installation for Windows 7
- Driver Installation for Windows 10

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- Vr Configuration
- Stealth Z-Mouse / Vr Button Assignments
- Stealth Hand Wheel Foot Switch / Vr Button Assignments
- b0-b11 Button Assignments

Description

The Stealth Z-Mouse is a free-hand device for moving the cursor in the XYZ directions in VrTwo. Several sizes are available; the S1-Z, S2-Z, S3-Z and the S4-Z (Stealth 4). Features include a mouse-style optical movement sensor for the XY movements and a Z-wheel for Z movements. 18 user definable buttons are available. The VrOne Stealth Z-Mouse driver allows any button to be programmed to emit a predefined VrOne key press from 0 to 11 or any VrOne key-in which may include key-ins, macros and (or) function keys.

Note: The newer Stealth 4 Mouse (S4-Z) is a Z-Mouse and uses the Stealth Z-Mouse drivers.

The Stealth Handwheels include two high-precision XY handwheels along with a Z foot disk. Also include are three-pedal footswitches. The Stealth Z-Mouse and the Stealth Handwheels share the same driver in interface.

The Z-Mouse differs from the original Stealth 3D Mouse in that it does not configure as a Windows mouse so when in operation the Windows mouse may be used for normal operations such as pulling down menus etc.

For more information about the Stealth 3D Mouse line of products including the Stealth Z-Mouse please the Stealth International web page. Stealth International provides a wide range of 3D input devices and offers sales and support of these products.

Hardware

The Stealth Z-Mouse and Hand Wheels are connected to the computer via a standard USB (Universal Serial Bus). Power is supplied from the USB interface and an AC adapter is not needed.

Driver Installation

If the Stealth Z-Mouse has been upgraded to support Windows 8 then the driver installation is automatic when the USB cable is plugged into the computer. Please see "Driver Installation for Windows 10" below for more information.

If running Windows XP or Windows 7, plug your mouse or hand wheels into the USB Port. Windows Plug and Play will normally pop up to ask for a disk. Insert the CD provided into your CD reader, and tell Windows that you have a disk. Installation should be automatic. If it does not install automatically, run Control Panel/Add new hardware, and manually install the

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driver, indicating the CD drive and directory. The drivers for the Stealth Z-Mouse may be loaded from the Stealth 3D Mouse web page at http://stealth3dmouse.com/ under Drivers. If the drivers are downloaded from the web site then a CD is not needed for installation.

Driver Installation for Windows 7

1. Download version 2.0x from www.stealth3dmouse.com.
2. Un-compress the Stealth driver files and placed the contents into the C:\Stealth folder. If this folder does not exist then create it before un-compressing the driver file.
3. Plug in Stealth USB cable. NOTE: If Windows begins to install the "Device Driver Software", open the Driver Software Installation dialog and press "Skip obtaining driver software from Windows update".
4. "Stealth Z-Mouse V01" should appear in the main Device Manager dialog window.
5. Start Device Manager (Click Start button -> Type "Device Manager" in search box -> Click Device Manager). Right mouse click "Stealth Z-Mouse V01" -> Select "Update Driver Software"
6. Select "Browse my computer for driver software"
7. Entered c:\Stealth in search box, press Next
8. Repeat steps 4-6 to install drivers from the USB Serial Port. Substitute "USB serial port" for "Sealth Z-Mouse V01". (This step may not be needed with later drivers)

NOTE: If Windows installs the wrong driver, restart the Device Manager -> select "Universal Serial Bus controllers" -> Right mouse click "USB Serial Converter" -> Uninstall and check "Delete the driver software for this device". Unplug the Stealth USB cable and return to step 3 above.

Driver Installation for Windows 10

If the current Stealth Z-Mouse was used on Windows 7 then the mouse must be upgraded to run on Windows 8 which will allow it to run on Windows 10. This upgrade can be done by following the instructions on the Stealth 3D Mouse web page under Drivers. Select "Download and follow instructions to modify Stealth Z-Mouse for Win 8" to upgrade the mouse. Once the mouse has been upgraded, it can be plugged into a Windows 10 computer and configuration will be automatic. NOTE: The upgrade must be performed from Windows 7.

Vr Configuration

Vr may be configured to use the Z-Mouse or Handwheels from the Vr Configuration program (VrCfig). From the Configuration pull-down, the “VrTwo 3D input” item may be selected which will bring up to following dialog box.

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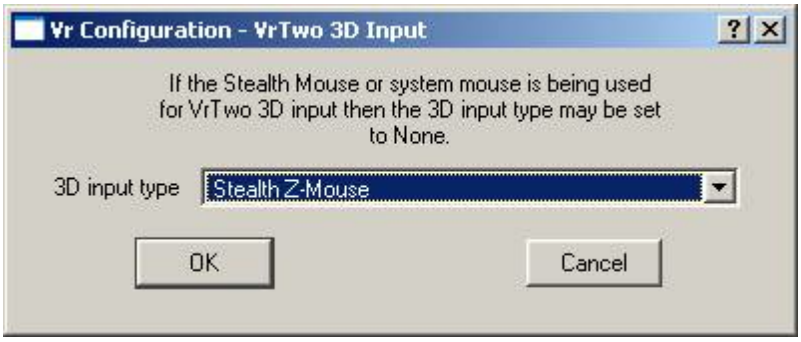

Stealth Z-Mouse / Vr Button Assignments

Any button on the Z-Mouse may be programmed to emit one of the following:

- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key up to 64 characters.
- A Clutch / Shift function.

To configure button assignments the Input->Device Controls->Stealth Z-Mouse may be selected or type DevSzm (Device Stealth Zmouse) while in VrOne or VrTwo.

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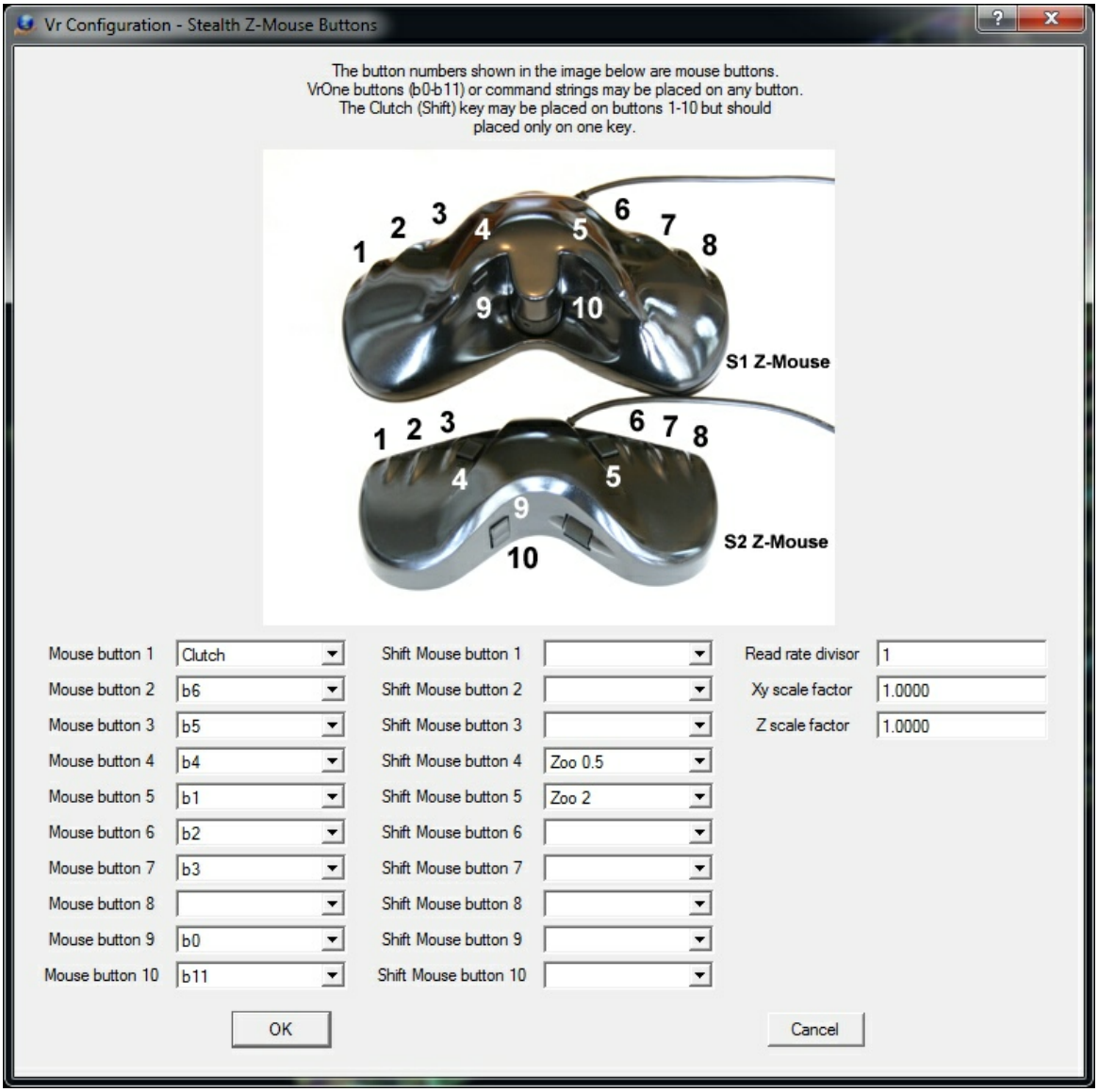

The Stealth Z-Mouse Button assignment dialog box

Mouse button / Shift Mouse button

There are ten user definable mouse buttons available on the Stealth Z-Mouse. If one of the Mouse Buttons are assigned as a Clutch/Shift button then the Shift Mouse Buttons are available for assignment. In the dialog box displayed above, the right columns contain the user-defined key definitions that will be executed when the button is pressed. All button assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again.

Possible button assignments are:

- **B0-b11** - VrOne button presses 1-12.
- **Key-in** - Any valid VrOne key-in
- **Clutch (Shift)** – When pressed, the XY motion of the Z-Mouse are disconnected. The

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Clutch / Shift button can be placed on any Mouse Button 1 through 10. It is not recommended to use more than one Clutch button. If more than one is used then one Clutch button cannot act as a Shift button to the other. The button that the Clutch/Shift function is assigned cannot be shifted. For example; If the Mouse Button 1 is assigned as a Clutch/Shift key then the Shift Mouse Button 1 assignment will be ignored.

Assigning VrOne Key-ins - VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example;

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the user.

Read rate divisor

The Read divisor may be set to slow down the input from the mouse with 1 being the fastest setting.

XY Scale Factor

This parameter sets the scale factor of XY input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

Z Scale Factor

This parameter sets the scale factor of Z input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

Stealth Hand Wheel Foot Switch / Vr Button Assignments

Any foot switch on the Hand Wheel Foot Switch may be programmed to emit one of the following:

- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key up to 64 characters.

To configure button assignments the Input->Device Controls->Stealth Handwheels may be selected or type DevSha (Device Stealth Handwheels) while in VrOne or VrTwo.

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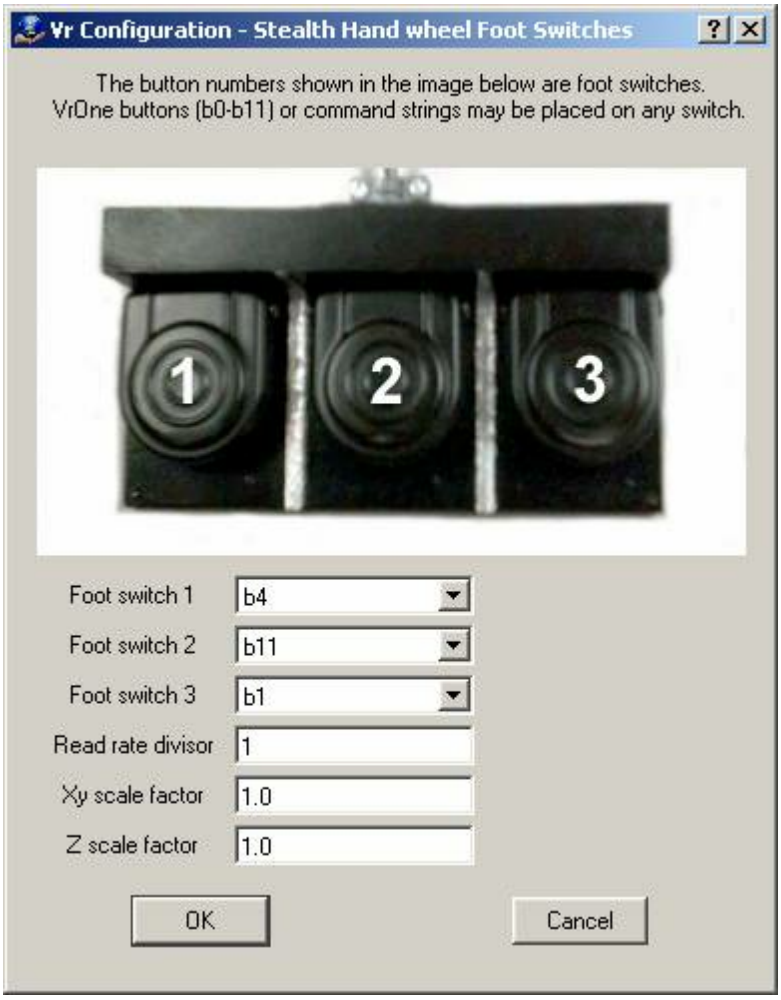

The Stealth Hand Wheel Foot Switches assignment dialog box

Foot switch

The Foot switch button numbers are displayed in the left column and reference the Z-Mouse buttons as shown in the image above. The right columns contain the user-defined key definitions that will be executed when the button is pressed.
All foot switch assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again.

Possible button assignments are:

- **B0-b11** - VrOne button presses 1-12.
- **Key-in** - Any valid VrOne key-in

Assigning VrOne Key-ins - VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example;

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the

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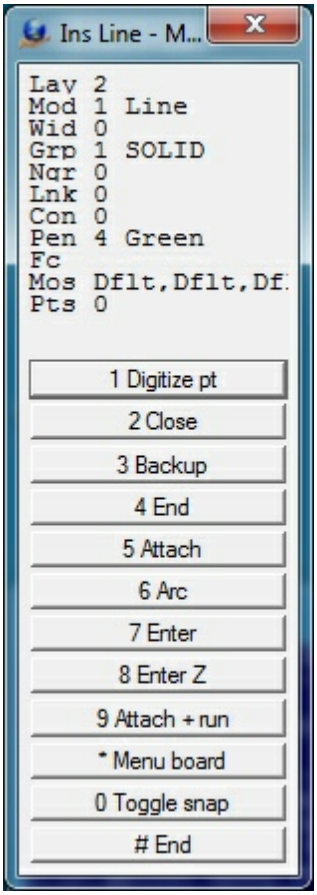
user.

Read rate divisor
The Read divisor may be set to slow down the input from the mouse with 1 being the fastest setting.

XY Scale Factor
This parameter sets the scale factor of XY input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

Z Scale Factor
This parameter sets the scale factor of Z input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

b0-b11 Button Assignments



VrOne/VrTwo Menu Keys Dialog

VrOne/VrTwo allows interactive input from 12 buttons. These Vr Buttons are assigned to the system keyboard F1 - F12 keys and may be assigned to buttons on input devices such as the Stealth Z-Mouse. The b0-b11 button assignments correspond to VrOne button presses 1-12 as shown in the Insert Line example above. Following are the b0-b11 assignments.

```
b1  - Vr button press 1
```

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```
b2  - Vr button press 2
b3  - Vr button press 3
b4  - Vr button press 4
b5  - Vr button press 5
b6  - Vr button press 6
b7  - Vr button press 7
b8  - Vr button press 8
b9  - Vr button press 9
b10 - Vr button press *
b0  - Vr button press 0 (toggle snap on/off)
b11 - Vr button press # (normally used to terminate a VrOne/VrTwo application)
```

4.4.3 TopoMouse

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Leica (LH) TopoMouse™



Description

The Leica TopoMouse™ is a free-hand device for moving the cursor in the XYZ directions in VrTwo and is used for carrying our frequent photogrammetric operations. Features include a

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mouse-style trackball for the XY movements and a Z-wheel for Z movements. 16 user definable buttons are available. The VrOne TopoMouse driver allows any button to be programmed to emit a predefined VrOne key press from 0 to 11 or any VrOne key-in which may include key-ins, macros and (or) function keys. Several TopoMouse specific functions may also be programmed on any button such as Clutch and fast XY movements.

Hardware

There are two versions of the TopoMouse which include the RS-232 (Serial) version and the USB version.

Serial Interface

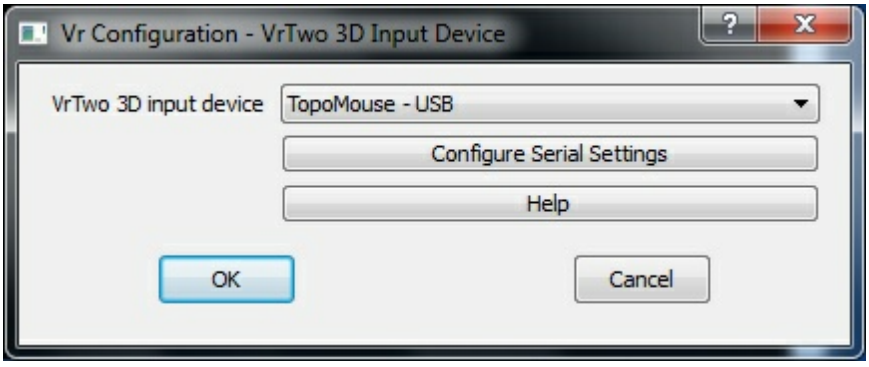
The TopoMouse Serial is connected to the computer via the 9-pin RS-232 (Serial) interface. Power is supplied from the AC power adaptor which is plugged into the wire near the serial connector. The default RS-232 protocol for the mouse is 9600 baud, 8 data bits, no parity and 1 stop bit. By default VrOne uses these settings.

USB Interface

The TopoMouse USB is connected to the computer via a standard USB connector. A USB driver is required which can be obtained from The Silicon Labs driver may be downloaded from the Cardinal Systems website at the same location for the Vr Mapping software download. 32-bit and 64-bit versions of the driver are available and the corresponding one for your operating system should be downloaded and installed. The Silicon Labs version 6.7.2.0 of the drivers were used for testing. The later versions of the drivers use the generic Windows WinUSB driver.

Vr Configuration

Vr may be configured to use the TopoMouse from the Vr Configuration program (VrCfig). From the Configuration pull-down, the “VrTwo 3D input” item may be selected which will bring up to following dialog box.



TopoMouse/Vr Button Assignments

Any button on the TopoMouse may be programmed to emit one of the following:

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- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key up to 64 characters.
- A TopoMouse function. These functions are the Clutch and fast X and Y motion commands.

To configure button assignments the Input->Device Controls->TopoMouse may be selected or type DevTop (Device TopoMouse) while in VrOne or VrTwo.

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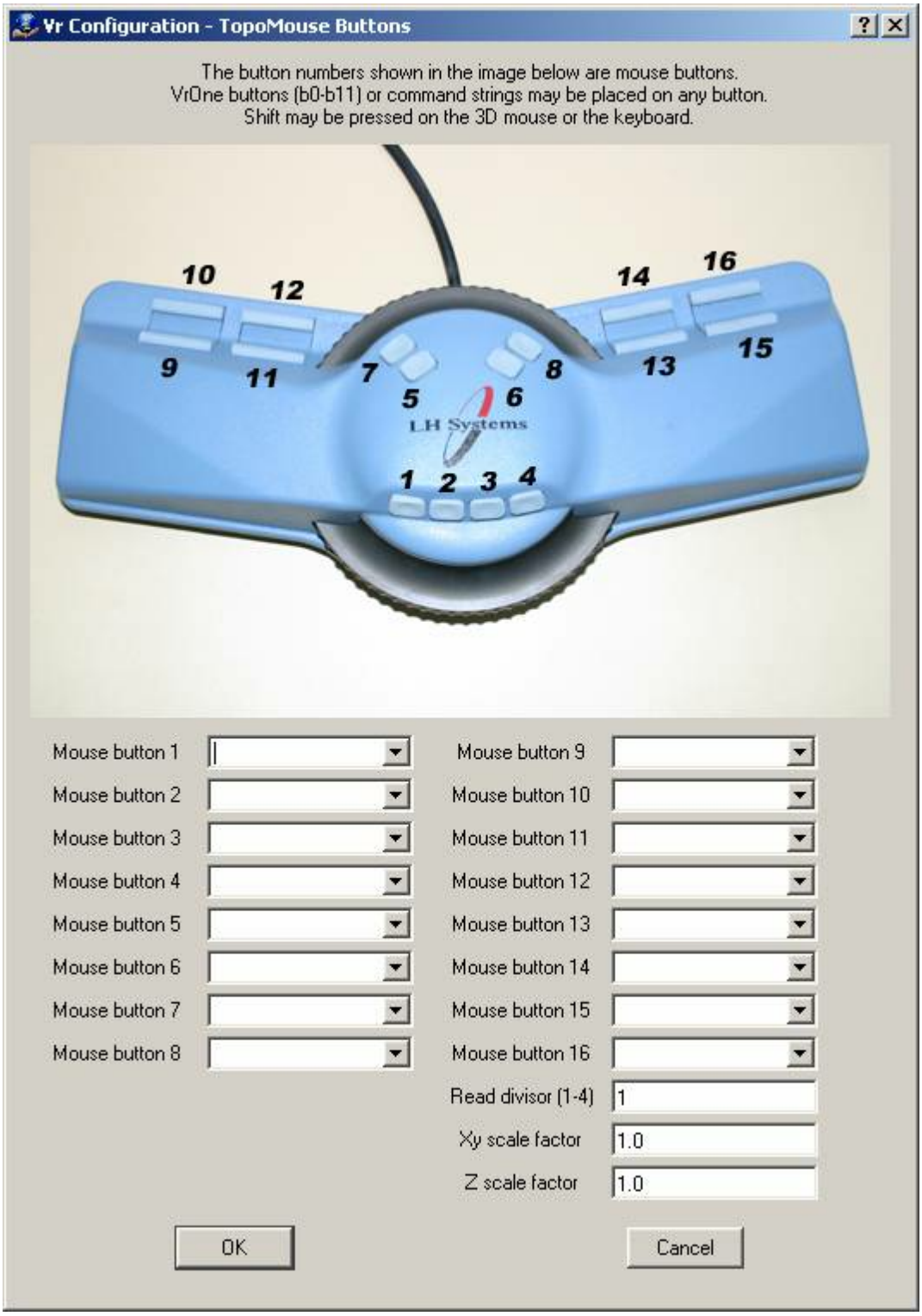

The TopoMouse button numbers are displayed in the left column and reference the unassigned TopoMouse buttons as shown in the image above. The right columns contain the user-defined key definitions that will be executed when the button is pressed.

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Only the Clutch, +X, -X, +Y, -Y buttons will auto-repeat when held down. All other button assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again.

Predefined assignments are:

- **B0-b11** - VrOne button presses 1-12.
- **Clutch** – When pressed, the XY motion of the TopoMouse are disconnected.
- **+X, -X, +Y, -Y** – Pressing and holding one of these keys will move the stereo plotter in this frame motion. The speed of the instrument will increase as the button is held down (ramping).

VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example;

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the user.

The Xy and Z scale factors may be set for to regulate the resolution from the mouse. The Read divisor may be set to slow down the input from the mouse with 1 being the fastest setting.

TopoMouse is a trademark of LH Systems, LLC, which is a wholly-owned subsidiary of Leica Geosystems.

Updated May 8th, 2016

4.4.4 Immersion / Stealth E-Mouse

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CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Immersion / Stealth E-Mouse / Stealth V-Mouse

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The Stealth E-Mouse and Immersion Mouse (The V-Mouse is not shown)

Description

The Immersion and Stealth E-Mouse are free-hand devices for moving the cursor in the XYZ directions in VrTwo. One of two models may be used which include the original Immersion Mouse with the Immersion Interface Box (IBox) or the Stealth E-Mouse which emulates the Immersion format. 20 user definable buttons are available. The Vr Mapping Immersion driver allows any button to be programmed to emit a predefined VrOne key press from 0 to 11 or any VrOne key-in which may include key-ins, macros and (or) function keys. Fast motion buttons may also be assigned.

For more information about the Stealth 3D Mouse line of products including the Stealth E-Mouse please the Stealth International web page. Stealth International provides a wide range of 3D input devices and offers sales and support of these products.

NOTE: The Immersion / Stealth E-Mouse / Stealth Z-Mouse is supported in Windows 7/10 64-bit starting at Vr Mapping version 05.02.00.

Hardware

The Immersion/Stealth E-Mouse are connected to the computer via a standard serial (RS-232) interface. Power is supplied to the Immersion Interface Box or the Stealth E-Mouse via a power adapter that is connected to a power plug near the 9-pin serial connector. The Stealth V-Mouse is connected to the computer via a USB cable. The V-Mouse emulates the serial interface.

Driver Installation

There is no driver installation required for either the Immersion or Stealth E-Mouse or Stealth V-Mouse. The drivers are included in VrTwo.

Vr Configuration

Vr may be configured to use the Immersion/Stealth E-Mouse/Stealth V-Mouse from the Vr

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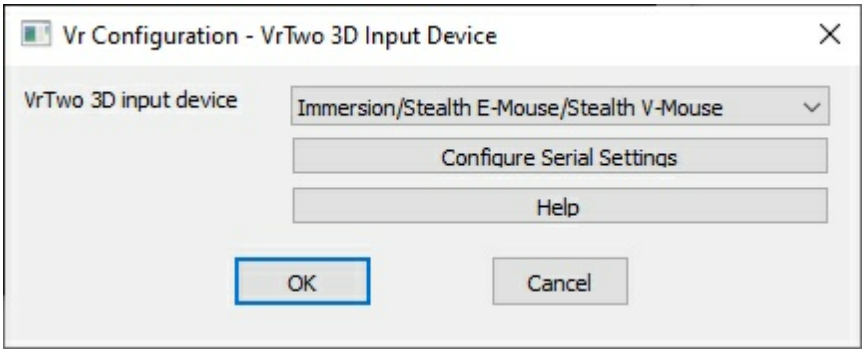
Configuration program (VrCfig). From the Configuration pull-down, the “VrTwo 3D input” item may be selected which will bring up to following dialog box.



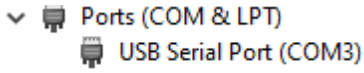
Vr Configuration. VrTwo 3D Input Device dialog

VrTwo 3D input device

Select "Immersion/Stealth E-Mouse/Stealth V-Mouse"

Configure Serial Settings

The Computer Serial Settings allows the setting of the serial communication parameters. Only "Serial device" and "Baud rate" are used from these parameters. The default Baud rate is 19200. The remainder of the settings are automatically set by the Immersion driver.
The Immersion/Stealth E-Mouse/Stealth V-Mouse will have a Serial Device or a COM port assigned to the device. The Serial Device will be a number from 1 to 9. This is also know as a COM port. To find the Serial Device number, start the Windows Device Manager. A list of devices will be displayed which should include a Ports entry.



In the above example the Serial Port is COM3 so the Serial Device is 3.

Immersion/Stealth E-Mouse/Stealth V-Mouse - Vr Button Assignments

Any button on the Immersion/Stealth E-Mouse/Stealth V-Mouse may be programmed to emit one of the following:

- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key up to 64 characters.
- A pre-defined function which include the Clutch and fast X and Y motion commands.

To configure button assignments the Input->Device Controls->Immersion/Stealth E-Mouse may

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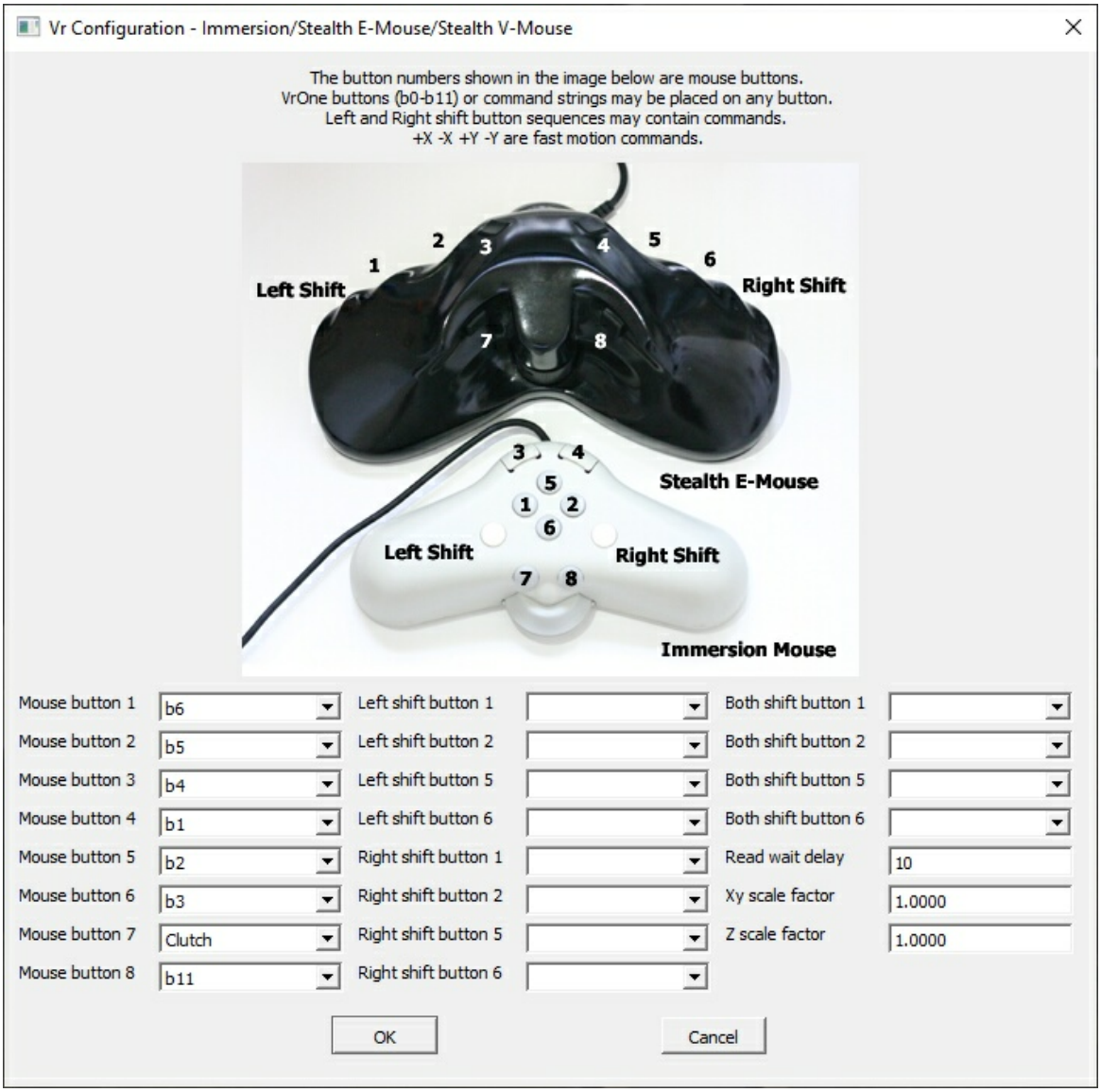
be selected or type DevImm (Device Immersion) while in VrOne or VrTwo.



The Vr Button Assignments dialog (The Stealth V-Mouse is not shown but has button placements similar to the Stealth E-Mouse)

The Immersion/Stealth E-Mouse/Stealth V-Mouse button numbers are displayed in the left column and reference the Z-Mouse buttons as shown in the image above. The right columns contain the user-defined key definitions that will be executed when the button is pressed.
All button assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again.

Mouse and Shift Buttons

Possible button assignments are:

- **B0-b11** - VrOne button presses 1-12.

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- **Key-in** - Any valid VrOne key-in
- **Clutch** – When pressed, the XY motion of the Z-Mouse are disconnected. The Clutch / Shift button is predefined and cannot be assigned to another key.
- **+X, -X, +Y, -Y Fast Motion** – Pressing and holding one of these fast motion keys will move the stereo plotter in this frame motion. The speed of the instrument will increase as the button is held down (ramping).

VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example;

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the user.

Read wait delay
The "Read Wait Delay" sets the time to wait between reads of the mouse. This parameter must be greater than zero and should be set to a value that balances the number of reads with the smoothness of motion of the floating mark. A value too small will use more CPU time while a value too large will result in jerky floating mark movement. This parameter is entered as milliseconds where 1000 is one second. The default value should be 5 to 50 and should not be zero.

Xy scale factor
Sets the scale factor for the XY movement of the mouse. A scale factor of 1 is no scale factor. Reversing the sign of a scale factor reverses the motion direction.

Z scale factor
Sets the scale factor for the Z movement of the thumb wheel. A scale factor of 1 is no scale factor. Reversing the sign of a scale factor reverses the motion direction.

Updated March 26th, 2022

4.4.5 ZI Mouse

Vr Mapping

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Z/I Mouse



The Z/I Mouse

- Description
- Hardware
- Drivers
- Driver Installation for the USB Driver Type
- Vr Configuration - Selecting the Z/I Mouse
- Z/I Mouse / Vr Configuration
- b0-b11 Button Assignments

Description

The Z/I Mouse is a high-precision, 3D mouse used for input of 3D data from photogrammetric and stereo sources. Features include 3D input from mouse motion and Z-wheel inputs, 3D input from force sticks (with the USB interface) and 15 programmable buttons

Hardware

The Z/I Mouse is connected to the computer via a standard USB (Universal Serial Bus) connector. Power is supplied to the Z/I Mouse via a power adapter that is connected to a power plug near the USB connector. The Z/I Mouse is supported in Windows XP 32-bit and Windows 7 64-bit. Both the 32-bit and 64-bit versions of VrTwo support the Z/I Mouse.

Drivers

One of two driver types are available for the Z/I Mouse.

- **Joystick Driver Type** - This driver is included in Windows and does not require the loading of another driver. The force sticks are not supported when using this driver. In the Device Control for the Z/I Mouse (DevZim) this is driver type "Joystick".

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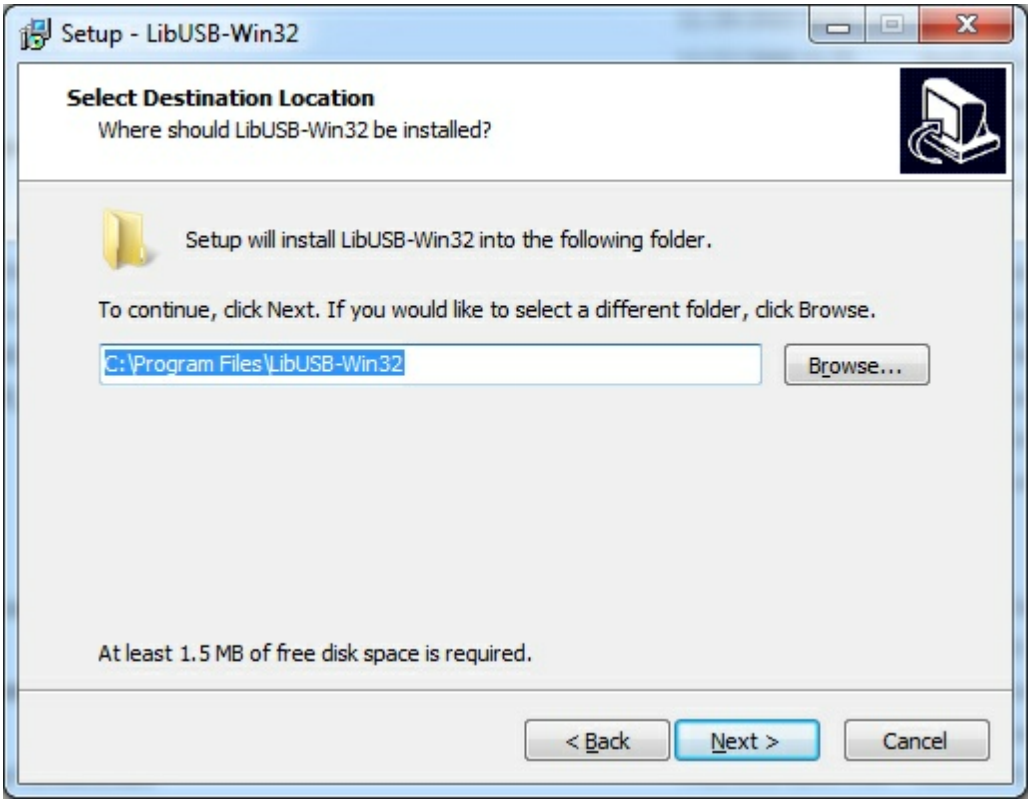
- **USB Driver Type** - All inputs are supported with the use of this driver. The loading and configuration of a driver is necessary to use this driver type (See Driver Installation for the USB Driver Type). In the Device Control for the Z/I Mouse (DevZim) this is driver type "USB". The current executable file containing the driver and the filter is "libusb-win32-devel-filter-1.2.4.0.exe" and can be found in the drivers folder in the "Download Vr Mapping Software" area of the web page. The file is also delivered with the Vr Mapping installation and if the default install folder is used, can be found in c:\vr\bin.

NOTE: Any existing non-Vr mouse driver must be removed in order for this driver to work correctly. This includes drivers that allow the Z/I mouse to work similar to the system mouse. The Vr Mapping driver considers the Z/I mouse a separate device from the system mouse.

NOTE: If the mouse begins to miss button presses, the USB driver can be restarted by unplugging the USB connector from the computer, unplugging and reinserting the power supply and reinserting the USB connector.

Driver Installation for the USB Driver Type

There are two steps involved when installing the USB driver. The first is driver installation and the second is the installation of a driver filter for the Z/I Mouse. Before installing the driver and filter, plug in the USB connector for the mouse and make sure the device is powered. Tuning the mouse upside down should show the red mouse sensor light when the device is powered.



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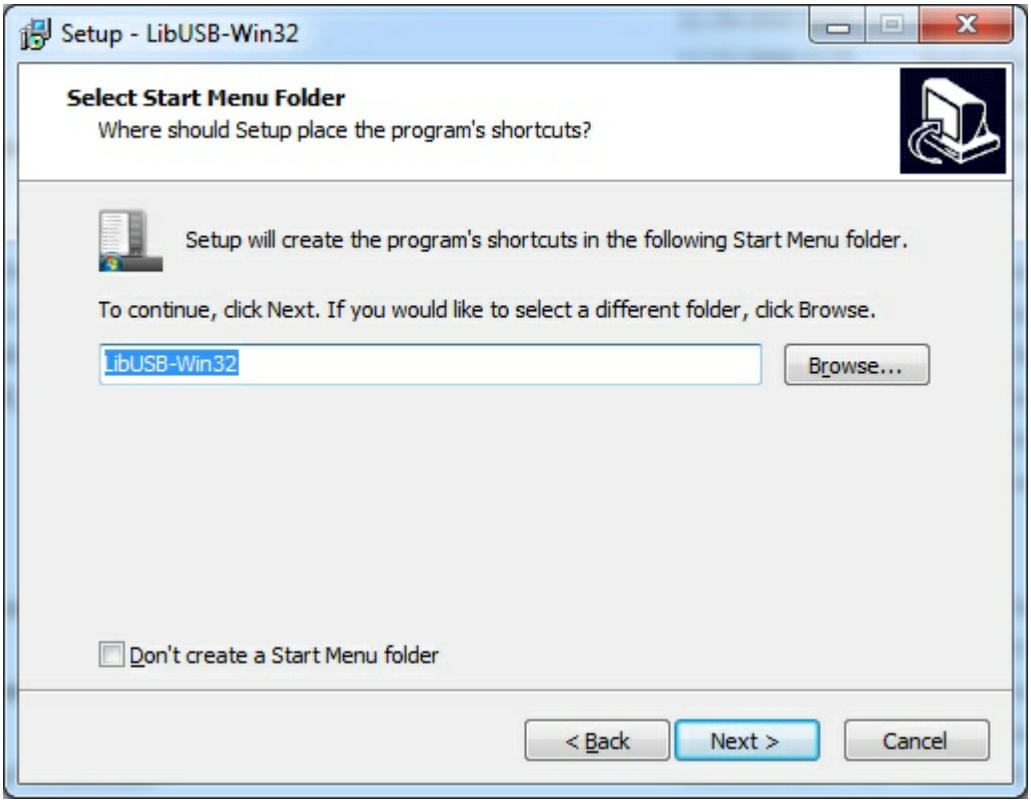
Select a destination folder for the installation of the driver. The default folder is recommended.



Select a optional shortcut in the Start Menu folder. The default shortcut is recommended.

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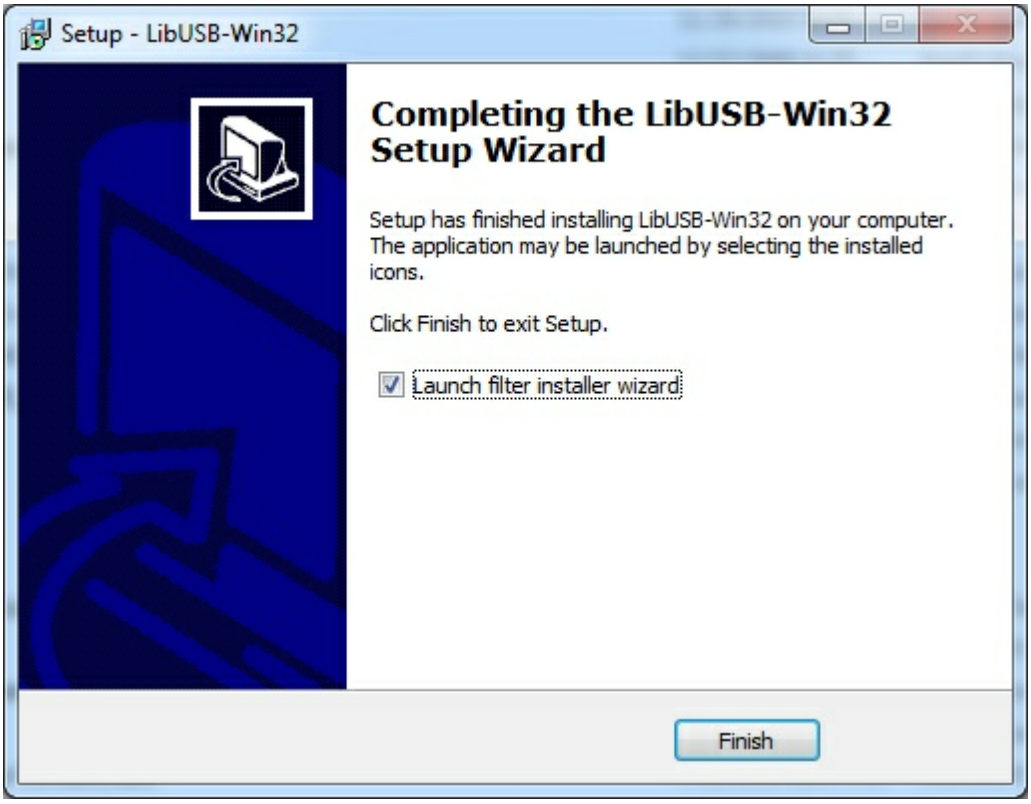

Once the USB driver is installed, the next step is to install the driver filter for the mouse. This is accomplished with the Filter Installer Wizard which is started after the USB driver is installed. Check Launch filter installer wizard and press Finish to start the next step.

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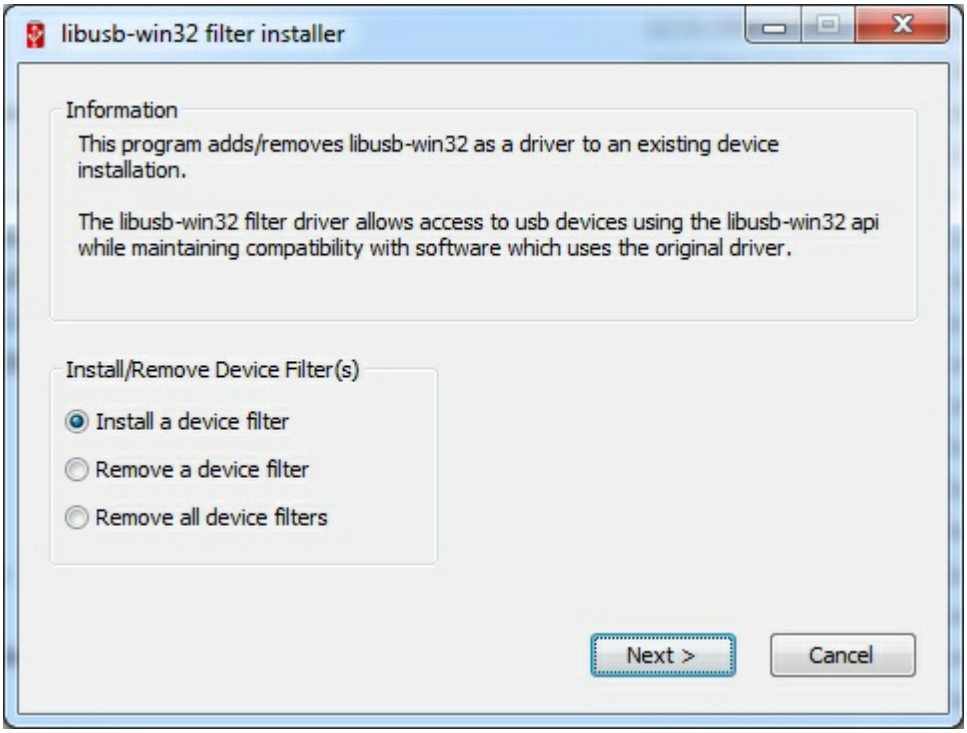
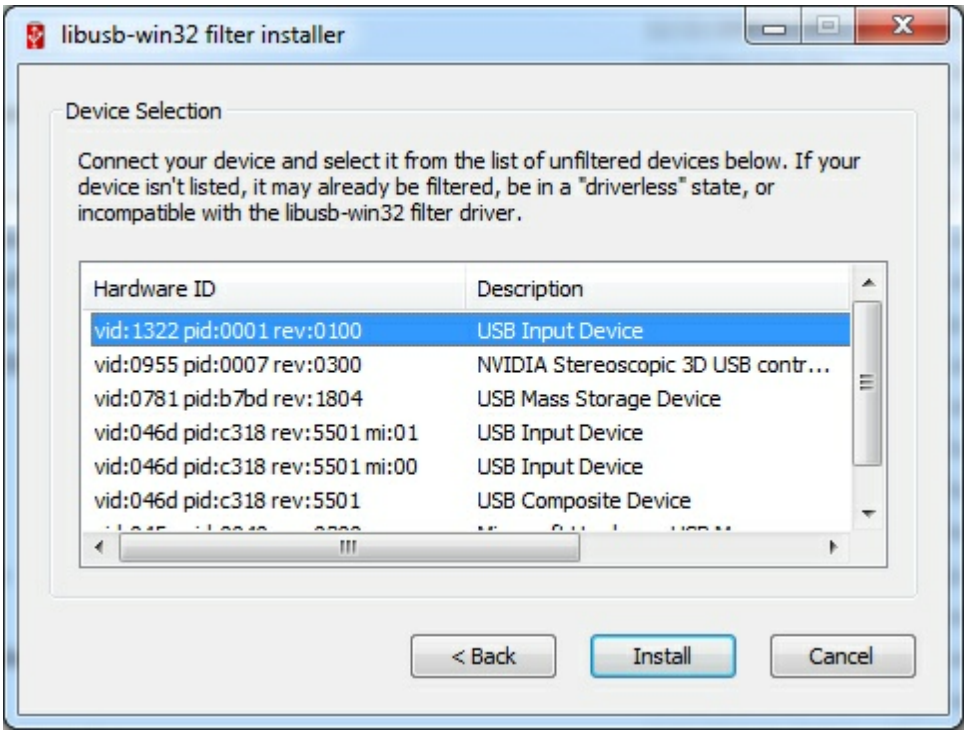


Check "Install a device filter" and press Next. If the existing device filter or filters need to be removed one of the Remove options may be selected. A device filter can be removed and re-installed multiple times.



Highlight the vid:1322, USB Input Device line as shown above. The Z/I Mouse uses the Vendor

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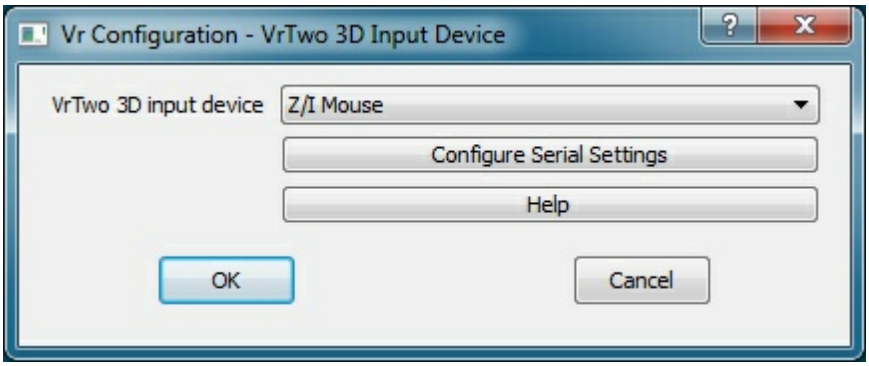
Id (vid) of 1322 and the Product Id (pid) of 0001.
If the device is not shown then the driver might be already installed or the Z/I Mouse is not plugged in or it might not be powered. Once the correct device is highlighted the Install button may be pressed to install the driver for the Z/I Mouse. Once the mouse is installed the above dialog is redisplayed and Cancel may be pressed to end the installation process.

Vr Configuration - Selecting the Z/I Mouse

Vr may be configured to use the Z/I Mouse from the Vr Configuration program (VrCfig). From the Configuration pull-down, the "VrTwo 3D input" item may be selected which will bring up to following dialog box.



Serial settings are not needed for the use of the Z/I Mouse so the Configure Serial Setting option displays a message indicating such.

Z/I Mouse / Vr Configuration

Any button on the Z-Mouse may be programmed to emit one of the following:

- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key up to 64 characters.
- A Clutch function.

To configure button assignments the Input->Device Controls->ZI Mouse may be selected or type DevZim (Device ZI Mouse) while in VrOne or VrTwo. Some of the changes made to the button assignments and configuration settings do not take effect until the driver is started again. The driver may be restarted by restarting the program or switching between static and roaming stereo display modes.

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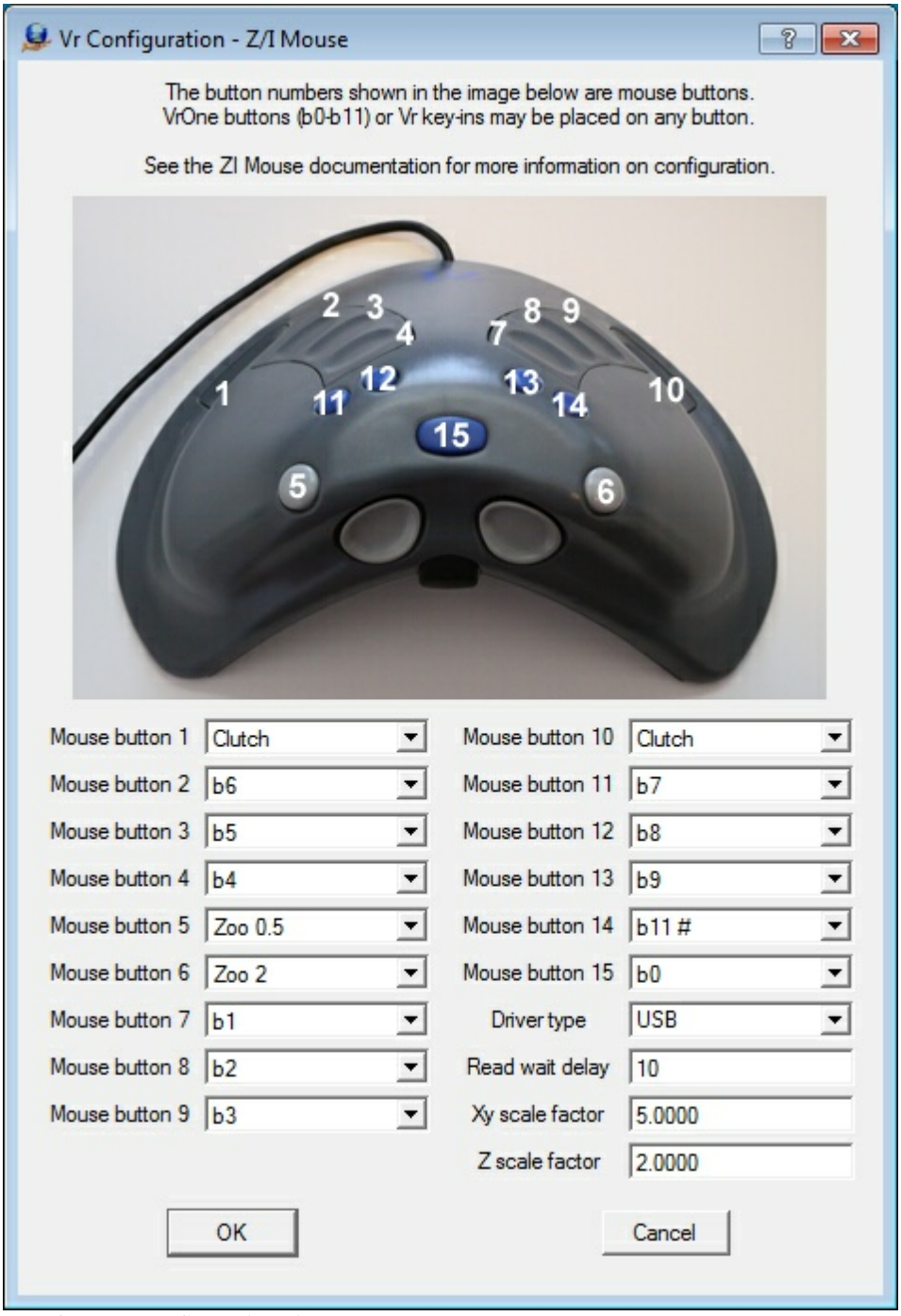

The Z/I Mouse configuration dialog box

Mouse button / Shift Mouse button

There are ten user definable mouse buttons available on the Z/I Mouse. If one of the Mouse Buttons are assigned as a Clutch button then motion inputs are ignored while this button is being held down. In the dialog box displayed above, the right columns contain the user-defined key definitions that will be executed when the button is pressed. All button assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again.

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Possible button assignments are:

- **B0-b11** - VrOne button presses 1-12.
- **Key-in** - Any valid VrOne key-in
- **Clutch** – When pressed, the XY motion of the Z-Mouse are disconnected. The Clutch button can be placed on any Mouse Button 1 through 15 and more than one button may be assigned as a Clutch button.

Assigning VrOne Key-ins - VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example;

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the user.

Driver Type

One of two driver types are available for the Z/I Mouse.

- **Joystick Driver Type** - This driver is included in Windows and does not require the loading of another driver. The force sticks are not supported when using this driver. This is driver type "Joystick".
- **USB Driver Type** - All inputs are supported with the use of this driver. The loading and configuration of a driver is necessary to use this driver type. This is driver type "USB". See Driver Installation for the USB Driver Type.

If this parameters is changed then the driver must be restarted by restarting the program or switching between static and roaming stereo display modes.

Read Wait Delay

The Read Wait Delay determines the amount of time to wait between reads. This value is expressed in milliseconds where 1000 is 1 second.

XY Scale Factor

This parameter sets the scale factor of XY input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

Z Scale Factor

This parameter sets the scale factor of Z input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

b0-b11 Vr Button Assignments

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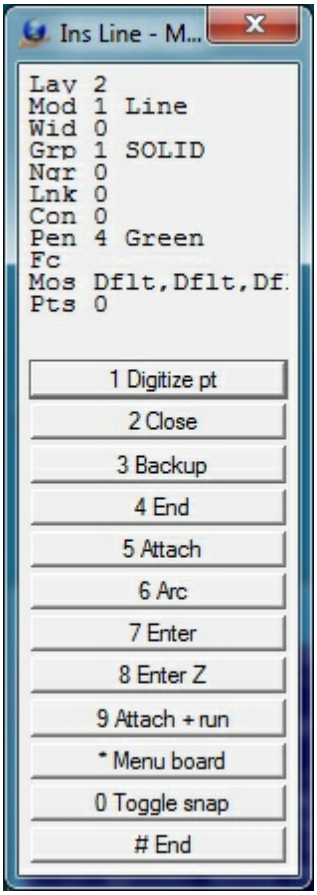

VrOne/VrTwo Menu Keys Dialog

VrOne/VrTwo allows interactive input from 12 buttons. These Vr Buttons are assigned to the system keyboard F1 - F12 keys and may be assigned to buttons on input devices such as the Z/I Mouse. The b0-b11 button assignments correspond to VrOne button presses 1-12 as shown in the Insert Line example above. Following are the b0-b11 assignments.

```
b1  - Vr button press 1
b2  - Vr button press 2
b3  - Vr button press 3
b4  - Vr button press 4
b5  - Vr button press 5
b6  - Vr button press 6
b7  - Vr button press 7
b8  - Vr button press 8
b9  - Vr button press 9
b10 - Vr button press *
b0  - Vr button press 0 (toggle snap on/off)
b11 - Vr button press # (normally used to terminate a VrOne/VrTwo application)
```

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4.4.6 Softmouse 3D

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Vr Mapping

Softmouse 3D



The Softmouse 3D

- Description
- Hardware
- Driver Installation
- Vr Configuration
- Softmouse 3D / Vr Button Assignments
- b0-b11 Button Assignments

Description

The Softmouse 3D is a 10 button, free-hand device for moving the cursor in the XYZ directions

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in VrTwo. The Vr Mapping driver configuration allows up to 20 buttons to be user defined as Vr key-presses, fast-motions, clutch, Vr commands, function keys or macros. For more information about the Softmouse 3D, please visit the Softmouse 3D website.

Hardware

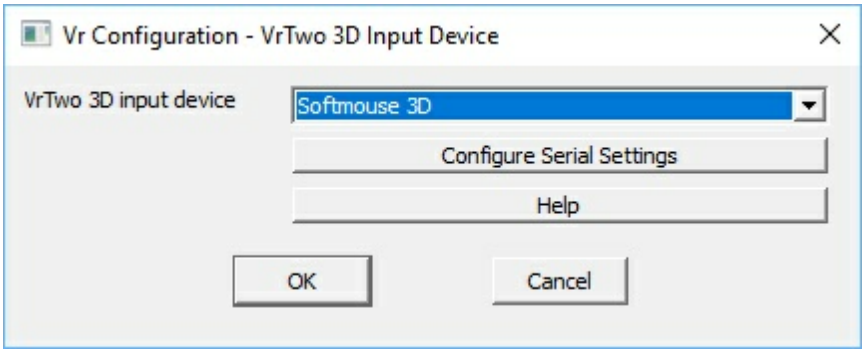
The Softmouse 3D is connected to the computer via a standard USB (Universal Serial Bus) interface. Power is supplied from the USB interface and an AC adapter is not needed.

Driver Installation

The supported Vr Mapping operating systems, Windows 7 and Windows 10 do not require the user to install a driver to use the Softmouse 3D. The required drivers will be automatically installed the first time the USB cable from the mouse is plugged in.

Vr Configuration

Vr may be configured to use the Softmouse from the Vr Configuration program (VrCfig). From the Configuration pull-down, the “VrTwo 3D Input Device” item may be selected which will bring up to following dialog box.



The Vr Configuration - VrTwo 3D Input Device dialog

The mouse does not use any serial settings and pressing the "Configure Serial Setting" will display a dialog indicating this.

Softmouse 3D / Vr Button Assignments

Any button on the Softmouse may be programmed to emit one of the following:

- A VrOne button press with a value from 0 to 11 (b0-b11). Button press 10 is the Vr * key, button press 11 is the 0 key (used to condition snap) and button press 11 is the # key which is normally used to terminate a VrOne application.
- Any valid VrOne key-in. These key-ins may include a VrOne key-in, Macro or Function Key. Multiple key-ins may be placed on a single key (separated with a comma) up to 64 characters.

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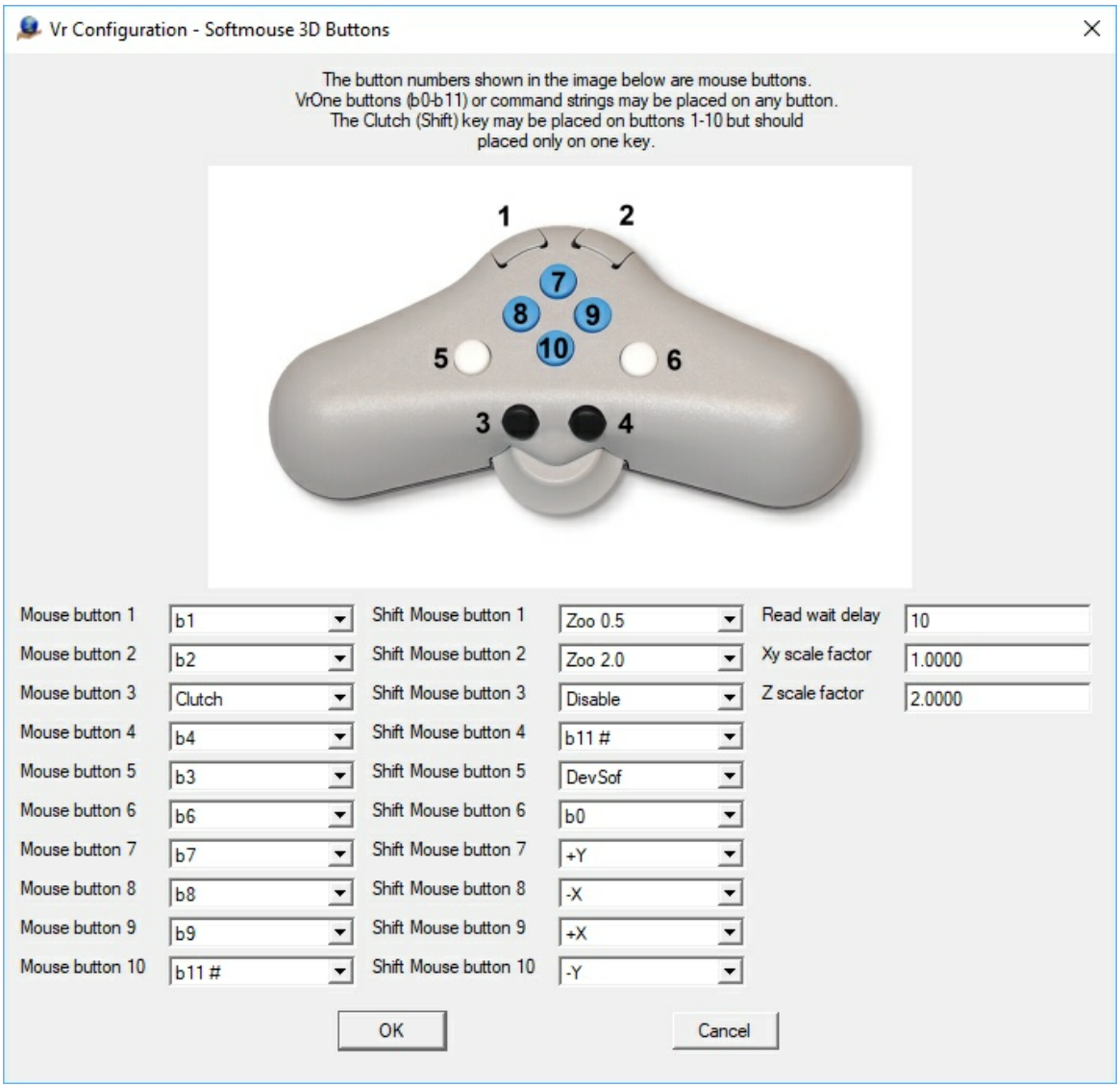
- A Clutch / Shift function.

To configure button assignments the pull-down menu Input -> Device Controls -> Softmouse 3d may used. The dialog may also be display with the key-in of DevSof (Device Softmouse) while in VrOne or VrTwo.



The Softmouse 3D Button assignment dialog box

Mouse button / Shift Mouse button

There are ten user definable mouse buttons available on the Softmouse. If one of the Mouse Buttons are assigned as a Clutch/Shift button then the Shift Mouse Buttons are available for assignment. In the dialog box displayed above, the right columns contain the user-defined key definitions that will be executed when the button is pressed. All button assignments will emit a command when the button is pressed and will not emit another until the button is raised and pressed again unless the button pressed is a +X, -X, +Y, or -Y button (fast motion buttons).

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The fast motion buttons will auto-repeat for as long as they are held down.

Possible button assignments are:

- **B0-b11** - VrOne button presses 1-12. See B0-B11 Button Assignments below.
- **Key-in** - Any valid VrOne key-in
- **Clutch (Shift)** – When pressed, the XY motion of the Z-Mouse are disconnected. The Clutch/Shift button can be placed on any Mouse Button 1 through 10. It is not recommended to use more than one Clutch button. If more than one is used then one Clutch button cannot act as a Shift button to the other.
- **+X, -X, +Y, -Y** - A fast-motion may be assigned to any button. Typically, fast-motions are defined on buttons 7-10 (the blue buttons). A fast-motion button will auto-repeat as long as it is held down. Speed ramping is performed when a fast-motion button is first pressed. This starts the motion slow and increases to a maximum movement speed as the button is held down.
- **Assigning VrOne Key-ins -** VrOne key-ins (commands) may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example; Zoo 0.5 or Zoo 2.0 could be assigned to two buttons which would zoom in 2X (Zoo 0.5) or zoom out 2x (Zoo 2.0). Vr Mapping Function Key names or Macro names may be assigned to any button.

Read wait delay

A read delay may be specified which slows the frequence of mouse reads. A read delay of 0 may be unnecessarily fast and might waste computer resources. This value for this parameter should be set as high as possible but low enough as to avoid jitter when moving the mouse in roaming mode. The wait delay is expressed in milliseconds (1000 = one second) and the default value is 10. The wait delay will vary between computers depending on the speed of each computer.

XY Scale Factor

This parameter sets the scale factor of XY input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

Z Scale Factor

This parameter sets the scale factor of Z input from the mouse. A value of 1 is no scale factor. A negative number reverses the direction of the motion.

b0-b11 Button Assignments

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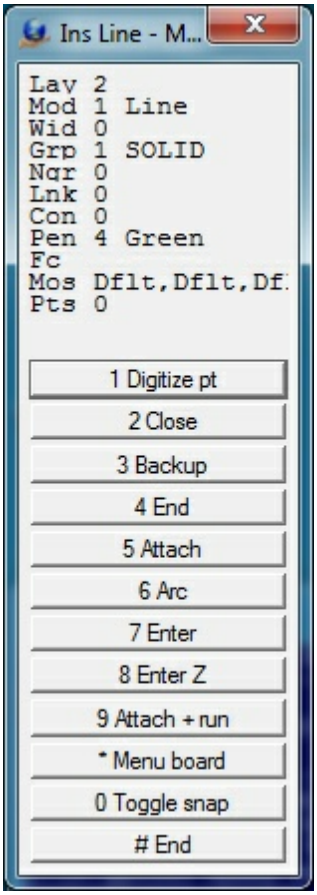

VrOne/VrTwo Menu Keys Dialog

VrOne/VrTwo allows interactive input from 12 buttons. These Vr Buttons are assigned to the system keyboard F1 - F12 keys and may be assigned to buttons on input devices such as the Stealth Z-Mouse. The b0-b11 button assignments correspond to VrOne button presses 1-12 as shown in the Insert Line example above. Following are the b0-b11 assignments.

```
b1  - Vr button press 1
b2  - Vr button press 2
b3  - Vr button press 3
b4  - Vr button press 4
b5  - Vr button press 5
b6  - Vr button press 6
b7  - Vr button press 7
b8  - Vr button press 8
b9  - Vr button press 9
b10 - Vr button press *
b0  - Vr button press 0 (toggle snap on/off)
b11 - Vr button press # (normally used to terminate a VrOne/VrTwo application)
```

Updated June 14th, 2019

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4.4.7 Joysticks

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Vr Mapping

Joysticks / Joypads / Game Controllers / Gamepads



Description

Generic joysticks, joypads, game controllers and gamepads are supported by VrTwo as input devices or as additional input devices. These devices are typically characterized as having a USB interface, up to two XY motion sticks, a Z motion and up to 32 buttons. Since there are many different manufacturers and many different configurations the information shown here is only one example.

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Hardware

Most joysticks consist of one or more of the following components.

- One or two XY motion (D-pad) inputs.
- One or two Z motion inputs.
- Up to 32 buttons
- USB interface

Joysticks and VrTwo

In VrTwo the input required is XYZ and a button press. Since typical joysticks offer two XY inputs the configuration of these devices allow the cross referencing of a joystick input axis to VrTwo axis. Joysticks for VrTwo are considered as an “add on” device and do not need to be turned on the in Vr Configuration program. If a joystick or joysticks are connected they will be recognized during the VrTwo startup. Joysticks may also be used in addition to other 3D input devices such as the Stealth mouse or Handwheels. The input motions from the joystick will override existing 3D input device motions when active but will not disable them.

Vr Configuration

Joysticks may be configured in VrOne or VrTwo from the Input -> Device Controls -> Joysticks pull-down menu or from the DevJoy key-in. Following are the dialog boxes that are available when configuring joysticks.

Main Menu

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Joystick to edit
Up to two joysticks are supported by VrTwo. This field defines the joystick to configure when cross-referencing buttons, axis or setting scale factors.

Read delay
Defines the time to wait between reads of the joystick in milliseconds. For reference, 1000 milliseconds is one second. The default value is 10.

Joystick 1 mode
Allows the enabling or disabling of joystick 1 input.

Joystick 2 mode
Allows the enabling or disabling of joystick 2 input.

Button Cross-Reference

Joysticks may have up to 32 buttons which may be cross-referenced to VrOne/VrTwo buttons

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or key-ins. VrOne key-ins may be placed on any key simply by typing the desired VrOne command or commands up to 64 characters. Multiple commands are separated by a comma. For example:

```
ZooA, SetLayMacro, RoadFuncKey
```

Could be entered which would perform a Zoom All then run the SetLayMacro macro then start the RoadFuncKey function key. Of course, SetLayMacro and RoadFuncKey are defined by the user.

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Axis Cross-Reference

Most joysticks have up to two XY axis inputs which are called “sticks” and up to two Z axis

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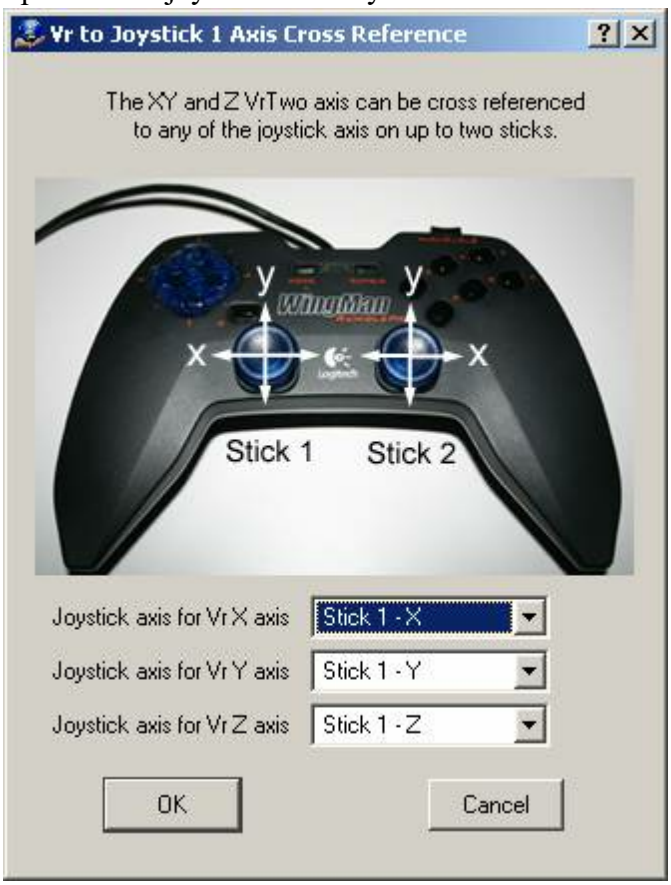
inputs. These joystick axes may be cross-referenced to the VrTwo XY or Z input axis.



Joystick Scale Factors

The six possible input axes from the joystick may be scaled as needed by the user. The default scale factor for each of these axes is 1.0.

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Joystick Test

Since there are many types of joysticks available it is possible to test a currently connected joystick to determine the location of the two sticks and the location of the buttons. When the test is started an information box will be displayed showing the following fields.

```
x1   y1   z1    x2   y2   z2   JoystickButton   VrCommandString
```

Where:

x1, y1	XY coordinate from stick 1
z1	Z coordinate 1
x2, y2	XY coordinate from stick 2
z2	Z coordinate 2, if available
JoystickButton	Raw joystick button (1-32)
VrCommandString	Vr command string assignment for the current button press. The Vr Command Strings are defined in Button Cross-Reference.

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When joystick testing is complete the Stop Joystick Test button may be pressed on the main menu.

4.5 Digitizer Configurations

Vr Mapping

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Digitizer Configurations

Altek AC22	Altek AC32	Calcomp 9100
Calcomp Drawingboard	Hitachi Puma Plus	Numonics 2200
Numonics AccuGrid	Numonics GridMaster	Summagraphics SummaSketch III
Analog Stereo Instruments	Galileo DigiCart	AP32 Analytical Instrument Conversion
ABC Analytical Instrument Conversion	Leica SD2000	Wild AC1/BC1/BC2
Zeiss Planicomp P1/P2/P3/P33	Leica SOCET SET DPW	VrTwo Stereo Plotter



Altek AC22

The ALTEK/KURTA AC22 DataTab DT12/18 is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\ac22.set

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Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```



Altek AC32

The ALTEK/KURTA AC32 is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\ac32.set

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\c9100.key contains cursor button cross-references. This file may be edited to suit you needs.

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Calcomp 9100

The CALCOMP 9100 is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\c9100.set

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\c9100.key contains cursor button cross-references. This file may be edited to suit you needs.



Calcomp Drawingboard

The CALCOMP DrawingBoard is a Xy digitizer and is connected to the computer via a serial interface. The following documentation has been tested for the Drawingboard III and the Drawingboard VI.

The serial settings are in the file: \vr\hostdir\db3.set

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The USB interface on the Drawingboard VI is not supported.

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

Tablet Settings

Following are the default settings for the tablet that match the settings in the Default Serial Settings file. There are two banks of settings with 18 settings each.

BANK	SETTINGS																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
A	1	1	0	0	1	1	1	1	1	1	0	1	0	1	1	1	0	1	
B	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
C	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(Drawingboard VI)

See the Tablet Works CD from GTCO Calcomp for more information.
NOTE: It is not necessary to install the drivers from the Tablet Works CD. These drivers are not required for operation with VrOne.

Changing The Tablet Configuration

- Place cursor over the [CONFIG EXIT] box. Press any cursor button. The CONFIGURATION light should be on.
- Press the desired BANK button [A 1-18] or [B 1-18] or [C 1-18]. The power light will come on to indicate that box being set. NOTE: Bank C is available on the Drawingboard VI
- Move the cursor over the CONFIGURATION buttons and make changes to match the configuration above.
- Place cursor over the SAVE [DEFAULT] (or [2] or [3]) box. Press any key to save the current configuration.
- Place cursor over the [CONFIG EXIT] box. Press any cursor button. The CONFIGURATION light should now be off.

Hitachi Puma Plus

The Hitachi Puma Plus is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\puma.set

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Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\puma.key contains cursor button cross-references. This file may be edited to suit you needs.

Tablet Settings

Following are the default settings for the tablet that match the settings in the Default Serial Settings file.

Configuring the Tablet

You will need the PUMA PLUS/SETUP MENU and the PUMA PLUS/CUSTOM MODE MENU.

To Enter setup: Place cursor over Puma+ area on the upper right corner of the tablet frame. Hold any button 1 for 3 seconds. Press:

[CUSTOM] on top menu [HITACHI] on bottom menu
[MAX] [REMOTE] [1000] [8 bit] [None] [1 Stop] [BAUD]
[Binary] green box [No] 5 Byte Binary
[SAVE] on top menu

See the Puma Plus documentation for more information.



Numonics 2200

The Numonics 2000 series is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\numo.set

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Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=7
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

Tablet Settings

Following are the default settings for the tablet that match the settings in the Default Serial Settings file.

Configuring the Tablet

```
   SWITCH A           SWITCH B           MODE      SWITCH
8 7 6 5 4 3 2 1    8 7 6 5 4 3 2 1     1 2 3 4     OFF OPEN
*     *                  *       * *     *
  * *   * * * *    * *   * * *             * * *    ON  CLOSED
```

See the Numonics 2000 documentation for more information about the above switch settings.



Numonics AccuGrid

The Numonics AccuGrid series is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\agrid.set

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

Tablet Settings

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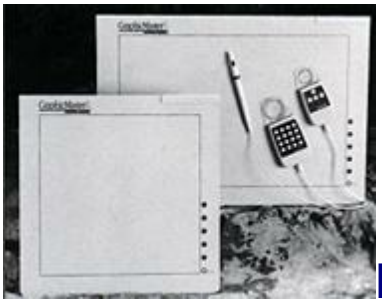
Following are the default settings for the tablet that match the settings in the Default Serial Settings file.

```
OUTPUT FORMAT         : Numonics Binary
BAUD RATE             : 9600
DATA BITS             : 8
PARITY                : None
STOP BITS             : 1
MODES                 : Polled
INCREMENT SIZE        : 0
STREAM RATE           : MAX
LINES PER INCH        : 1000
TRANSMIT OUT OF PROX : Enable
```

To save, press button while cursor is in CONFIRM CHANGES box

Configuring the Tablet

- Align AccuGrid Setup Menu with bottom edge of active area.
- Place cursor on MENU box on the right side of the tablet.
- Press and hold any key until continuous tone stops.
- Place cursor on Menu origin on Setup Menu and press any key.



Numonics GridMaster

The Numonics GridMaster is a Xy digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\nugm.set

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\nugm.key contains cursor button cross-references. This file may be edited to

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suit you needs.



Summagraphics SummaSketch III with 16 button cursor

The Summagraphics SummaSketch III is a Xy digitizer normally 12”x12” inches in size and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\ss16.set. The serial settings are not configurable on this tablet and the default values must be used.

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=7
Parity=2
StopBits=2
XonStus=0
XoffStus=0
```



Analog Stereo Instruments

All analog instruments share similar characteristics in that they output three-dimensional square coordinates and do have the ability to be driven to a known location. Once the orientation is complete the instrument coordinates may be read and transformed to ground using the values generated by orientation. The orientation program needs to differentiate between the different

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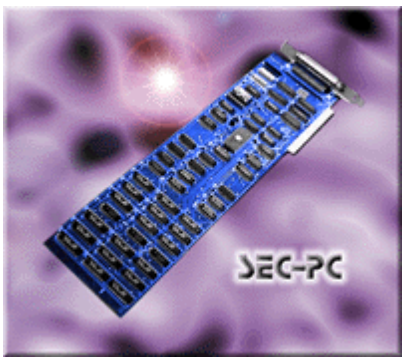
types of analog instruments for accurate results but VrOne does not.

There are three interfaces that support all analog instruments. The first is the Fischer Computer Systems SEC-PC card, which is inserted into an ISA slot inside the computer. The second is the Fischer Computer Systems SEC-PCI card, which in inserted into a PCI slot inside the computer. The third is the Fischer Computer Systems SEC-232 interface that connects to one of the computers serial ports. The SEC-232 was commonly used on UNIX computers in the past. Because all analog instruments may be connected to one of these two interfaces there are only two drivers for these instruments.

The supported analog instruments are the Wild AG1, Wild B8, Wild A10, Wild A8, Kern PG2, Zeiss E3, Zeiss TopoCart, Galileo 2C and the Galileo G6/G7/G8.



Fischer Computer Systems SEC-PC for Analog Stereo Instruments

The Fisher Computer Systems SEC-PC card is inserted into an ISA slot inside the computer.

SEC-PC Configuration

If this is the first time this program is being run then the SEC-PC drivers must be installed. Following are instructions for installing these drivers.

The drivers may be downloaded from the Fischer Computer Systems web page at www.secpc.com

Installing SEC-PC drivers on Windows NT 4.0 and Windows 2000

- Install driver files in c:\secnt\
- Type: cd \secnt\install
- Type: dcopy
- Type: register
- Reboot computer

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NOTE: register requires regini.exe, which is part of NTRESKIT in Registry Tools

After reboot is complete:

- Start REGEDIT
- Search for SECIO (use Find on Edit pulldown) There may be several SECIO entries. Search until the one with EmulateHardware in the Parameters Folder is found.
- Open Parameters folder
- EmulateHardware should be set to 0
- IoPortAddress should be set to the address set on SEC-PC card as follows: (816 or 820) (See below)
- Exit REGEDIT and reboot computer.

The IoPort Address Switch Settings:

```
    OPEN                          OPEN
* *     * *                   *     * *
    * *     * *             *   * *     * *
1 2 3 4 5 6 7 8             1 2 3 4 5 6 7 8
816 (330 hex)               820 (334 hex)
```

This operation should only be done once.

The SEC-PC IO address and the Footswitch Bounce Count may be set using the VrOne configuration program.
The SEC-PC IO Address from the VrOne configuration is not used from Windows NT.
The Bounce Count parameter is used for footswitch de-bouncing in which the footswitch must stay down this many iterations to be considered a valid press. A good starting parameter is 10 to 20.

The file \vr\hostdir\secpc.key contains footswitch and keypad cross-references. If this file does not exist, the SEC-PC driver will create it.



Fischer Computer Systems SEC-PCI for Analog Stereo Instruments

The Fisher Computer Systems SEC-PCI card is inserted into a PCI slot inside the computer.

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This card has been tested with VrOne in Windows 2000/XP only.

SEC-PCI Configuration

After inserting the SEC-PCI card, reboot the computer. A New Hardware Wizard dialog box should appear as follows. Insert the FCS SEC-PCI Driver Install Disk, press Next and follow instructions



The file \vr\hostdir\secpci.key contains footswitch and keypad cross-references. If this file does not exist, the SEC-PCI driver will create it.

The Vr configuration program, VrCfig, is used to configure VrOne to use this card.
The SEC-PC IO Address from the VrCfig is not used by this card.
The Bounce Count parameter in VrCfig is used for footswitch de-bouncing in which the footswitch must stay down this many iterations to be considered a valid press. A good starting parameter is 500 to 1000.

Fischer Computer Systems SEC-232 for Analog Stereo Instruments

The Fischer Computer Systems SEC-232 is an external interface that connects to one of the computers serial ports. The SEC-232 was commonly used on UNIX computers in the past.

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Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The only value used from the Serial Settings file by the SEC-232 driver is the Baud rate.

SEC-232 Configuration

The following switch settings are on the SEC-232 motherboard. (This is the largest and bottom most board in the SEC-232.) These switch settings set the Baud rate to 9600, Idle mode to OFF and Beep mode to ON.

```
1 2 3 4 5 6 7 8      ON
* * * *   *   *
        *   *        OFF
```

The following switch settings are on the SEC interface board. (This is the board that the cable from the stereo plotter is connected to). These switch settings set the SEC-PC board inside the SEC-232 to 816 (330 hexadecimal). This is an internal setting and should not need to be changed for VrOne.

```
1 2 3 4 5 6 7 8
* *     * *
    * *     * *
```

The SEC-232 transmits data on RS-232 pin 2 and receives data on pin 3.



Galileo DigiCart

The Galileo Digicart-40 and StereoCart are analytical Xyz stereo digitizers and are connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\dcart.set

Default Serial Settings File

```
Device=COM1
```

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```
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\dcart.key contains cursor button cross-references. This file may be edited to suit you needs.



AP32 Analytical Instrument Conversion

AP32 supports the most popular analytical plotters such as the Planicomp P-Series from Zeiss, the SD2000/SD3000 (and the upgraded DSR14) family from Leica, and the Aviolyt (AC1, BC1, BC2 and BC3), Kern DSRx and C1xx instruments, provided the AC2000/BC2000, DSR2000 and P100 Upgrade Kits from SoftMap, Inc upgrade them.

When AP32 is connected to VrOne it outputs different formats based on the type of instrument. When AP32 is interface the the SD2000/SD3000, DSRxx, Wild Aviolyt AC1/BC1/BC2 or BC3 it outputs the Leica SD2000 format. When AP32 is interfaced to the Zeiss C100/C120 or Planicomp P-Series P1/P2 or P3 it outputs Zeiss Planicomp format. VrOne may be configured for the SD2000 or Zeiss P1/P2/P3/P33 when using AP32. See Leica SD2000 or Zeiss P1/P2/P3/P33 for more information.



ABC Analytical Instrument Conversion

ABC software and hardware is a package for the conversion to PC of Analytical Stereo plotters, including: Zeiss Planicomp C-100 Series, the Wild Aviolyt BC-x Series, the Kern

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DSRxx series, Intergraph Intermap Analytic (IMA), Traster T-x Series and Wild OR-1. The ABC conversion is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\abc.set

Default Serial Settings File

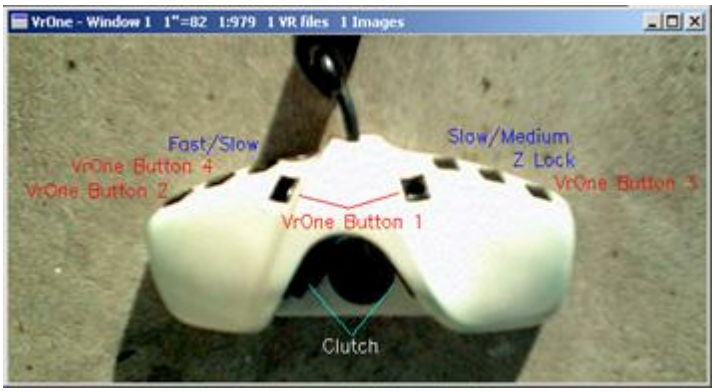
```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
```

The file \vr\hostdir\abc.key contains cursor button cross-references. This file may be edited to suit you needs.

NOTE: It may be necessary to jump the CTS (Clear to Send) and DTR (Data Terminal Ready) pins of the serial cable connector on the controlling computer side. CTS is pin number 5 and DTR is pin number 20 on a 25 pin serial connector. CTS is pin number 8 and CTS is pin number 4 on a nine pin connector.

ABC IMA Conversion

Following are the button and footswitch cross-reference information for the ABC IMA Intergraph Intermap conversion. The default VrOne and system key assignments for the puck and for the footswitch are shown below with the VrOne button assignments shown in red. Abc Conversion button assignments are shown in blue. Consult the ABC documentation for information about customizing these buttons. The button assignments for VrOne may be changed in the key file: \vr\hostdir\abc.key.



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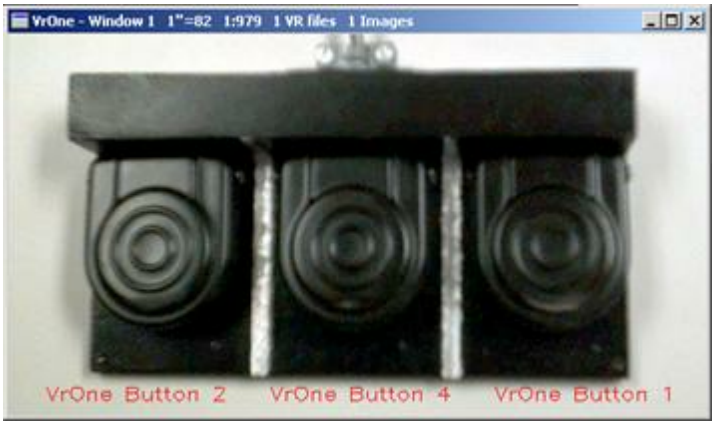



Leica SD2000

The Leica SD2000 is an analytical Xyz stereo digitizer and is connected to the computer via a serial interface. The serial settings are in the file: \vr\hostdir\sd2000.set

The SD2000 format is widely used by several manufacturers:

- **Leica** – Leica Mapping Terminal
- **SoftMap Inc**. – AP32 Analytical conversion and model orientation
- **ABC Software Developers** – ABC32 Analytical conversion and model orientation
- **Luis Cogan** – MACS Multimodel

The SD2000 format is also output when the AP32 Analytical conversion is on a Wild BC2, Wild BC3 and KERN DSR. The settings in the Serial Settings file will depend on the configuration as noted below.

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=0
Stopbits=1
XonStus=0
```

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```
XoffStus=0
HandShake=1
UseGround=0
```

The HandShake keyword specifies if handshaking is to be done when driving the instrument. HandShake should be set to 1 when AP32 is connected to a Wild BC3 and set to 0 for all other configurations.

UseGround should be set to 0 when using SD2000 format and should be set to 1 when using MACS Multimodel

The file \vr\hostdir\sd2000.key contains cursor button cross-references. This file may be edited to suit you needs.

Using The Kern DSR 16 Button Keypad With AP32

The file \\DSR\\INPUTKEY.DEF must be modified so that buttons 7 and 8 are different than the left and right footswitches. This file is on the DSR controlling computer and it must have a keyboard and monitor connected to it. The DOS program EDIT may be used to edit this file.

In the file INPUTKEY.DEF

```
Change: KEY7 24212221
To:     KEY7 20212221

Change: KEY8 24212321
To:     KEY8 20212321
```

Key Cross-Reference

The file \vr\hostdir\sd2000.key contains cursor button cross-references. This file may be edited to suit you needs. The Raw Key is the cross-referenced key from the instrument and can be determined by running Test Digitizer in the VrOne configuration program in Configuration->Xyz Digitizers.

The following cross-reference should be used as defaults when the AP32 is connected to the Wild BC1 or Wild BC2

```
# SD2000 KEY CROSS-REFERENCE
#
# Filename: c:\vr\hostdir\sd2000.key
#
# Up to 16 keys can be cross-referenced to 12
# VrOne keys
# Valid VrOne keys are: 0 1 2 3 4 5 6 7 8 9 10 11
# Where 10 is the * key
# Where 11 is the # key
#
#       Raw Key        VrOne Key (0-11)
```

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```
#       |               |
#       v               v
KEY      0              0
KEY      1              1
KEY      2              2
KEY      3              3
KEY      4              4
KEY      5              5
KEY      6              6
KEY      7              7
KEY      8              8
KEY      9              9
KEY     10             10
KEY     11             11
KEY     12             12
KEY     21              1
KEY     23              2
KEY      0             -1
```

The following cross-reference should be used as defaults when the AP32 is connected to the Wild BC3

```
# SD2000 KEY CROSS-REFERENCE
#
# Filename: c:\vr\hostdir\sd2000.key
#
# Up to 16 keys can be cross-referenced to 12
# VrOne keys
# Valid VrOne keys are: 0 1 2 3 4 5 6 7 8 9 10 11
# Where 10 is the * key
# Where 11 is the # key
#
#       Raw Key         VrOne Key (0-11)
#       |               |
#       v               v
KEY      0              0
KEY      1              1
KEY      2              2
KEY      3              3
KEY      4              4
KEY      5              5
KEY      6              6
KEY      7              7
KEY      8              8
KEY      9              2
KEY     10             10
KEY     11             11
KEY     12             12
KEY     21              1
KEY     23              4
KEY      9             11
```

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Wild AC1/BC1/BC2

It is possible to connect VrOne to a Wild BC1/BC2 that is still running on the Data General Nova 4X or the Data General DG 30. In this configuration the Data General is used for model orientation and controls the instrument real-time loop. VrOne runs on a stand-alone PC and connects to the Data General via a serial cable. An interface program called PM6V is run on the Data General, which communicates with VrOne.

NOTE: Most customers upgrade the AC1/BC1/BC2 to one of the conversion packages such as AP32 or ABC. Due to the age of the Data General computers, the connection of VrOne to these computers is becoming rare. It is suggested the instrument be upgraded.

The configuration of the VrOne serial settings in the file: \vr\hostdir\pm6.set

Default Serial Settings File

```
Device=COM1
Baud=9600
CharSize=8
Parity=2
Stopbits=1
XonStus=0
XoffStus=0
```



Zeiss Planicomp P1/P2/P3/P33

The Zeiss P1/P2/P3/P33 is an analytical Xyz stereo digitizer and is connected to the computer via a serial interface or a GPIB (General Purpose Interface Bus) interface.

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Serial Interface

Most Planicomp models have both GPIB and serial interface connections on the instrument motherboards. It is important to check the availability of the serial interface before configuration. The serial settings are in the file: \vr\hostdir\p3.set. There is a nine pin connector on the mother board of the P-processor in the Zeiss instrument. Using the serial interface allows the instrument to be connected to almost any computer. The transfer rate of the serial connection is slower than the GPIB interface.

Serial Cable

The pin-out on the Zeiss instrument is non-standard is a special cable is needed. On a standard nine pin connector, pin 5 is normally the ground but the Zeiss instrument uses pin 7 for this purpose. The cable configuration is as follows:

Description	Pin - Zeiss	Pin - Computer
Transmit	2	2
Receive	3	3
Ground	7	5

The connector for the Zeiss instrument is a 9-pin Female connector
The connector for the application is a 9-pin Male connector. If the RS-232 port on the application computer is a 25-pin connector then a 9 to 25 pin adapter will be needed.

Configuration Of The Zeiss Instrument

The RS-232 protocol settings are set on the 517521-9110 board and are as follows:

Switch	Switch OFF	Switch On
1	IEEE-488	RS-232
2	Parity Enable	Parity Disable
3	Parity Even	Parity Odd
4	2 Stopbits	1 Stopbit
5	8 Databits	7 Databits

Switches 6-8 set the RS-232 baud rate:

Switch	150	300	600	1200	2400	4800	9600	19200
6	ON	OFF	ON	OFF	ON	OFF	ON	OFF
7	ON	ON	OFF	OFF	ON	ON	OFF	OFF
8	ON	ON	ON	ON	OFF	OFF	OFF	OFF

The default VrOne switch settings are:

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19200 Baud – 8 Data Bits – No Parity – 1 Stop Bit

Switch->	1	2	3	4	5	6	7	8
ON	*	*		*				
OFF			*		*	*	*	*

Configuration of VrOne

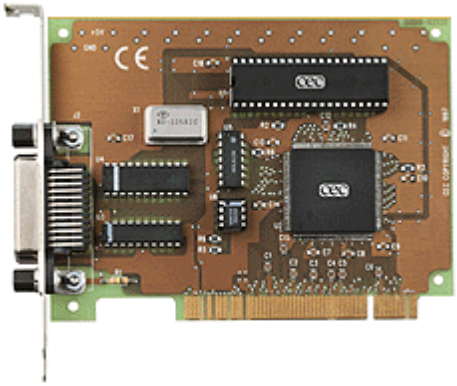
The above Zeiss instrument values must be match the settings in the VrOne Serial Settings file: \vr\hostdir\p3.set.

Default Serial Settings File

```
Device=COM1
Baud=19200
CharSize=8
Parity=0
Stopbits=1
XonStus=0
XoffStus=0
HandShake=1
UseGround=0
```

GPIB Interface

All Planicomp models have a GPIB connector on the motherboard that is used to connect the Zeiss instrument to the computer. This requires an additional interface card to be placed in the application computer. VrOne currently uses the Capitol Equipment Corporation CEC-488 card.



The CEC-488 Interface Card may be used to connect VrOne to the Zeiss P1/P1/P3 stereo plotters and is manufactured by Capitol Equipment Corporation (www.cec488.com). VrOne has been tested using the PCI version of this card running Windows 2000. Although there are installations running VrOne and Windows ME with this card, we recommend the use of Windows 2000 or Windows NT.

While most of the Zeiss instruments offer a serial interface, the CEC-488 is much faster when reading and writing coordinate data to the instrument. The CEC-488 is based on the IEEE-488

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interface standard that was used by Hewlett Packard as HP-IB and by other manufacturers as GPIB (General Purpose Interface Bus).

GPIB Interface Cable

The cable shown below is required to connect the Zeiss Planicomp to the application computer. This cable may be referred to as a GPIB Cable, HPIB Cable or IEEE-488 Cable.





Leica SOCET SET DPW

The standard release of VrOne has the ability to interface to the Leica SOCET SET DPW (Digital Photogrammetric Workstation). This gives the ability to collect data with VrOne with capabilities that include the display of stereo vectors in SOCET SET. Use the VrOne configuration program VrCfig to set SOCET SET as the current Xyz digitizer.

Assigning 3D Mouse Buttons

Copy the SOCET button assignment file \vr\data\vrone.acc to \ usr\geoset\internal_dbs\events\VRONE (Note: The filename VRONE must be upper case) This file contains the cross-references from the 3D mouse buttons to VrOne buttons 1-12. Some of these button assignments may conflict with existing assignments delivered from LH Systems. You can remove assignments to unused applications in \usr\geoset\internal_dbs\events to make more 3D mouse buttons available.

The 3D mouse button assignments may be edited in SOCET SET by using: Preferences-> Keyboard/Trackball Accelerator Mapping

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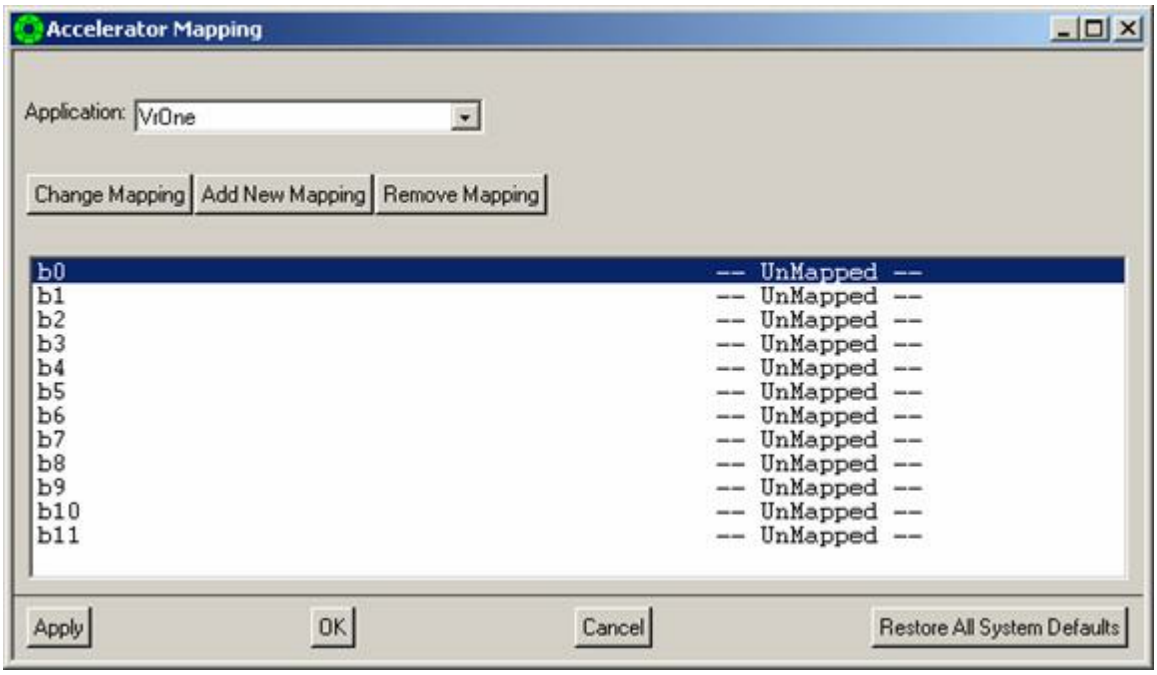

The b0-b11 listed on the left side of the Accelerator Mapping dialog box are the 12 VrOne buttons with b0 normally set to toggle snap, b10 for the * key and b11 for the # (End) key. By default the VrOne button assignments are UnMapped.



VrTwo Stereo Plotter

VrTwo adds stereo viewing to the VrOne editing and data capture package. VrTwo is designed to work together with VrOne and all the functionality of VrOne is available while running VrTwo. Use the VrOne configuration program VrCfig to set VrTwo as the current Xyz digitizer.

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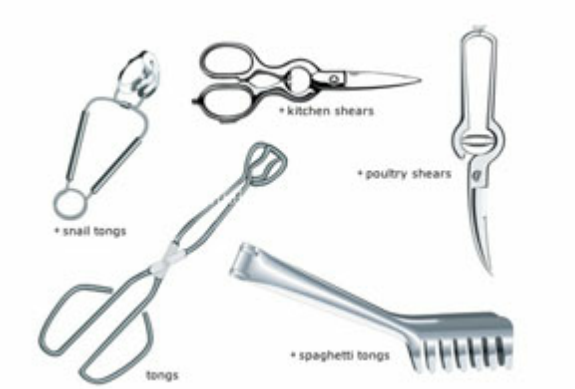
4.6 Miscellaneous

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Miscellaneous



Miscellaneous hardware and hardware related documentation.

Changing the COM Port

4.6.1 Changing the COM Port

ON-LINE REFERENCE
DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Changing the COM Port

It is possible to change the communications port number for a device in Window 7. This may be

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required if two serial (RS-232) devices are using the same port number. It is also useful if a device that is using a Serial to USB converter requires its COM number be in the range of COM1 or COM2 and there is no on-board serial interfaces in that range.

The following instruction are for Windows 7 however the instructions are similar for setting the COM port in Windows XP.

NOTE: Incorrect settings to the COM point may result in the disabling the input from a device. Before making any changes the current settings should be documented in case the settings need to be reset.

Start the Device Manger
Start Button -> Control Panel -> Hardware and Sound -> Device Manager (under Devices and Printers)

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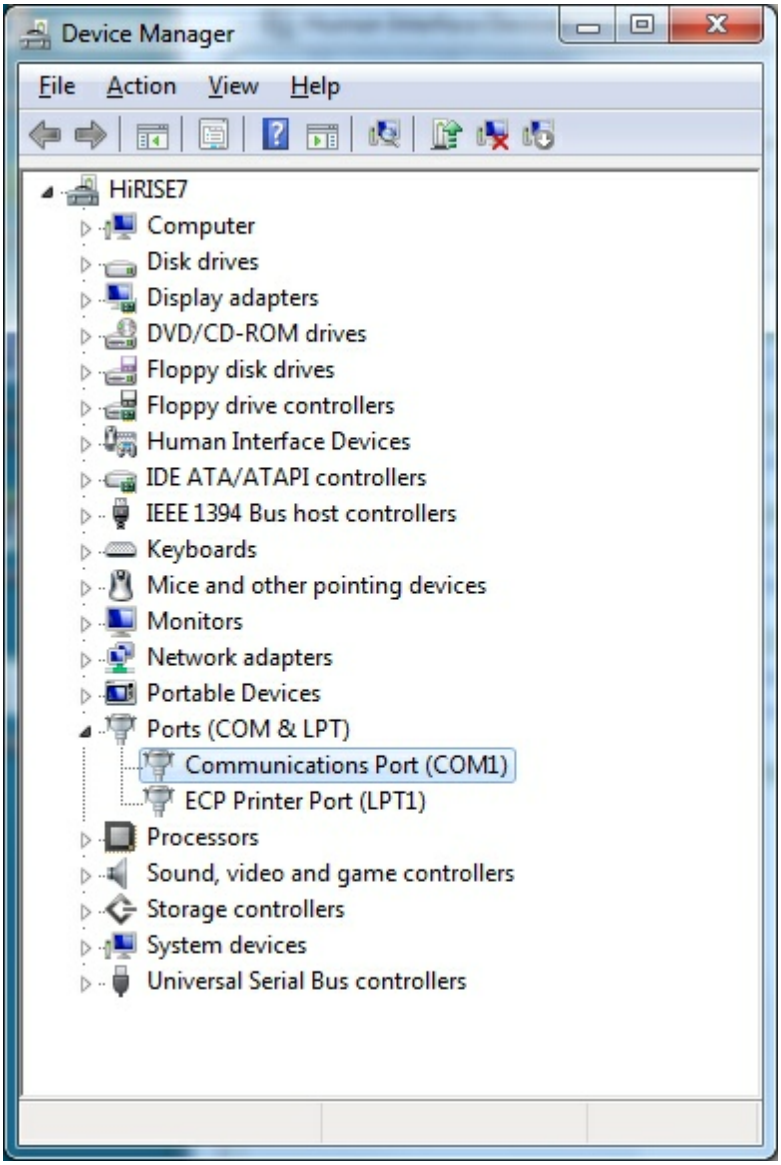

The Device Manager dialog box

Expand the Ports (COM & LPT) item and select the Communications Port (COMn) and select the Port Settings tab

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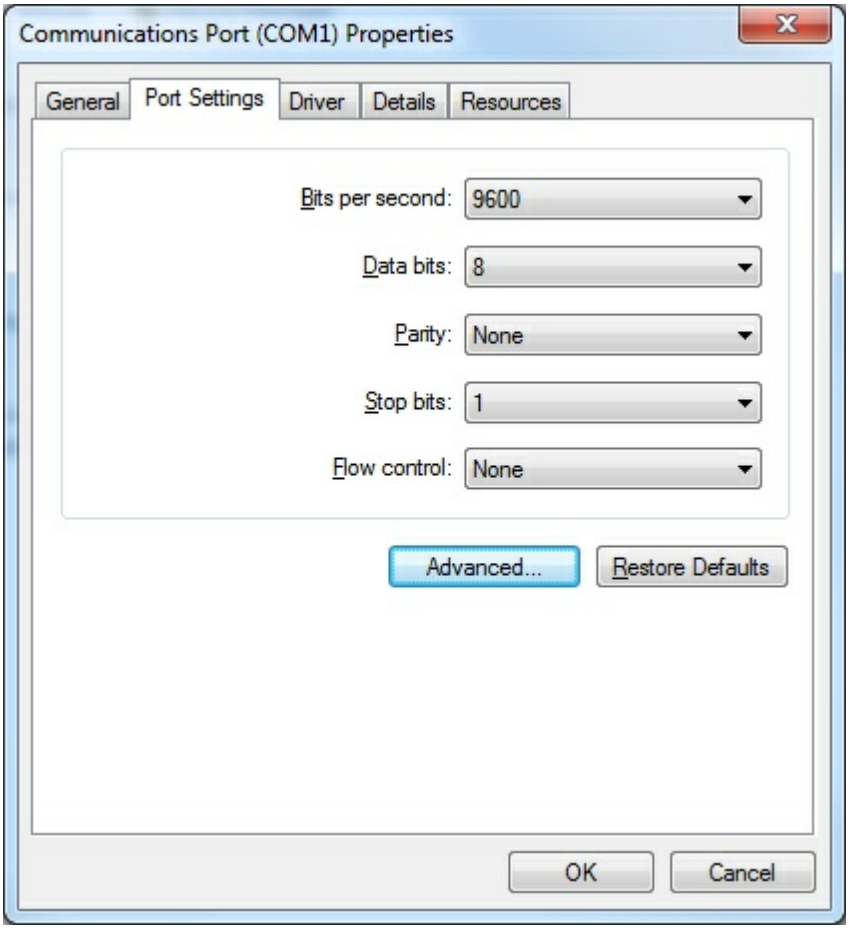

The Communications Port (COMn) Properties

Press the Advanced button which will display the Advanced Settings dialog box.

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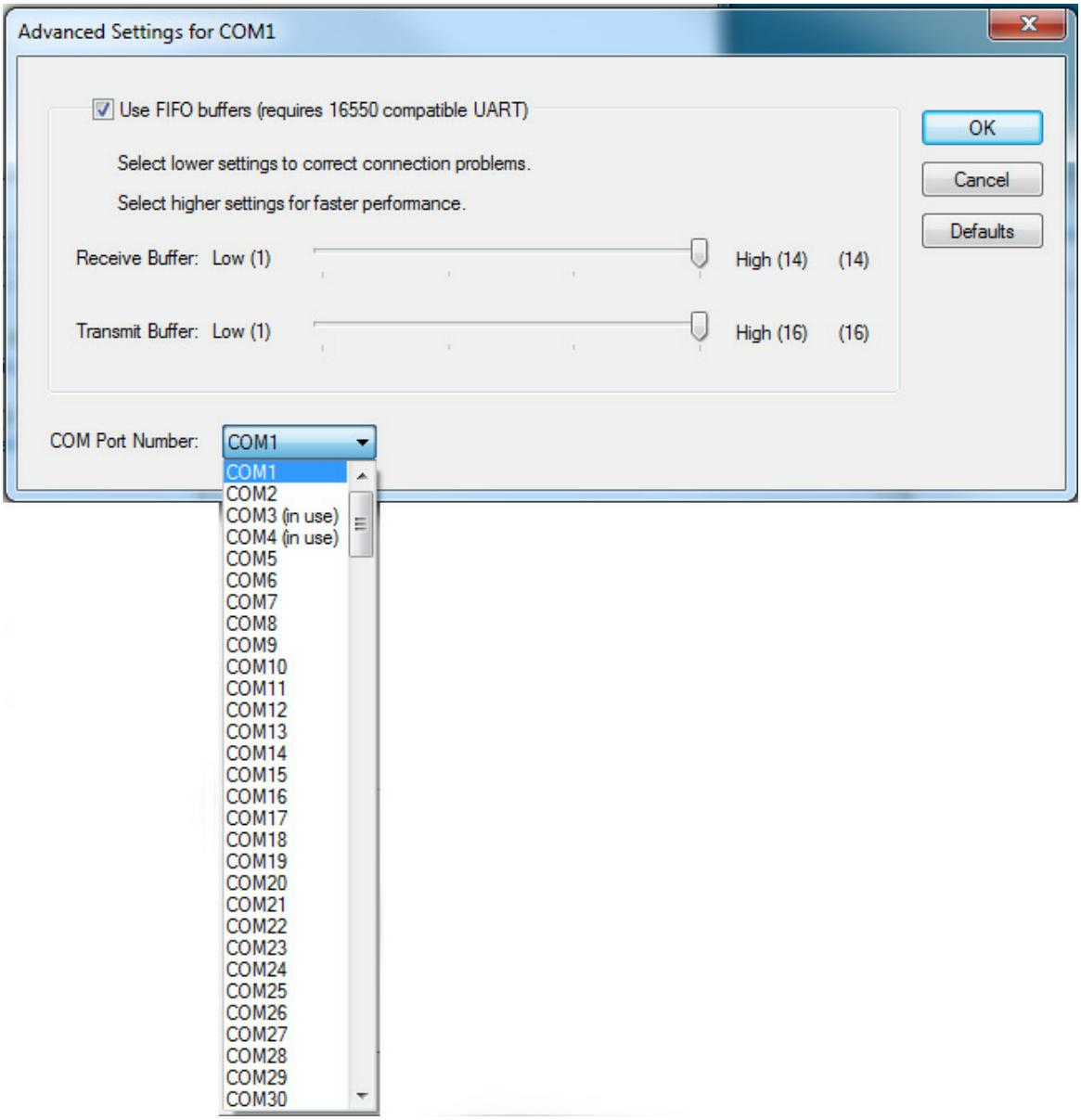

The Communications Port Advanced Settings dialog box

The COM Port Number combo box will display the available COM port number and the COM port numbers that are currently in use. This will allow the selection of another COM port number.

5 Reference

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

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Mapping

Reference



Some useful information.

Coordinate Projections
Miscellaneous Reference
Vr Mapping Definitions
Z Rules

5.1 Coordinate Projections

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Coordinate Projections

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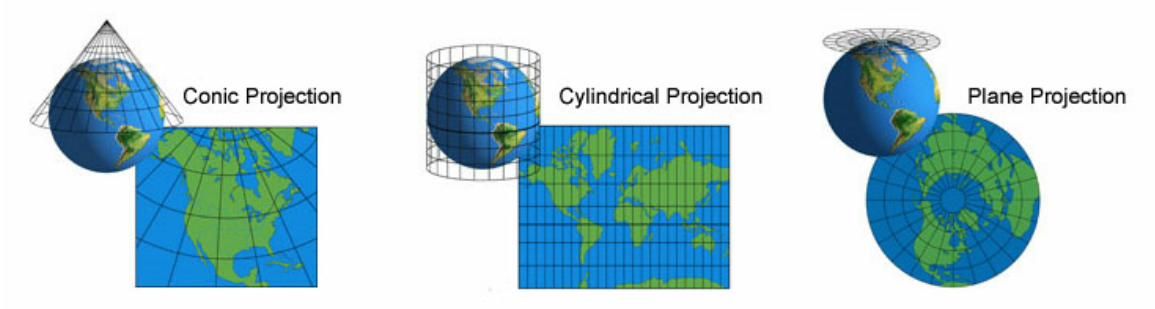


Three basic projections

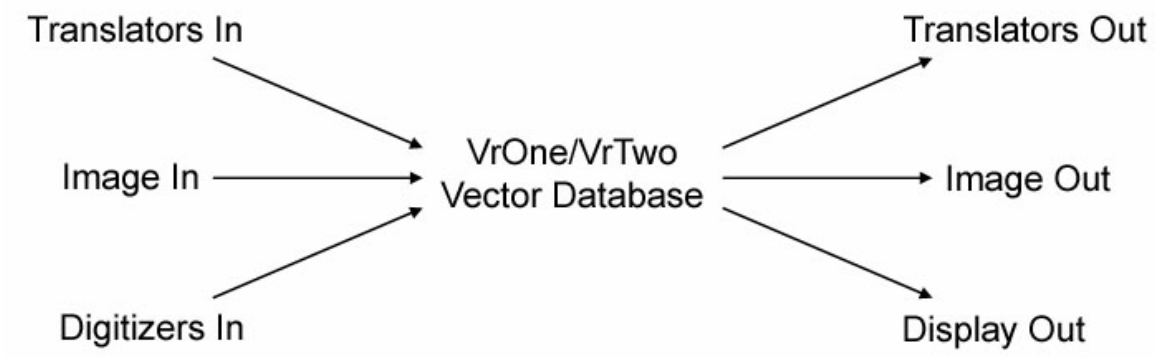
Overview
Setting the Coordinate Projections
Defining a Coordinate Projection
Supported Coordinate Projection Parameters
Using Coordinate Projections

Overview

VrOne and VrTwo support coordinate projection transformations during input from translators, images, and digitizers. Coordinate projection transformations are also supported during output to translators, images and the coordinate display in the Main Window and the coordinate display dialog box. In normal usage, it is sufficient to leave coordinate projections turned off and allow VrOne/VrTwo to work in the input coordinate system.

In the above diagram each item may be in a different coordinate projection with transformations performed between each item.

For example, it would be possible to establish the VrOne/VrTwo database coordinate system as state plane in feet but display the current cursor location in one of the coordinate displays as WGS84 in latitude and longitude. Or, for example, it may be necessary to translate State Plane coordinate points from an ASCII file that are in meters into a VrOne file that is using a State Plane coordinate system in feet. By setting the correct projection parameters, the points could automatically be translated from meters to feet during the ASCII In (AscIn) process.



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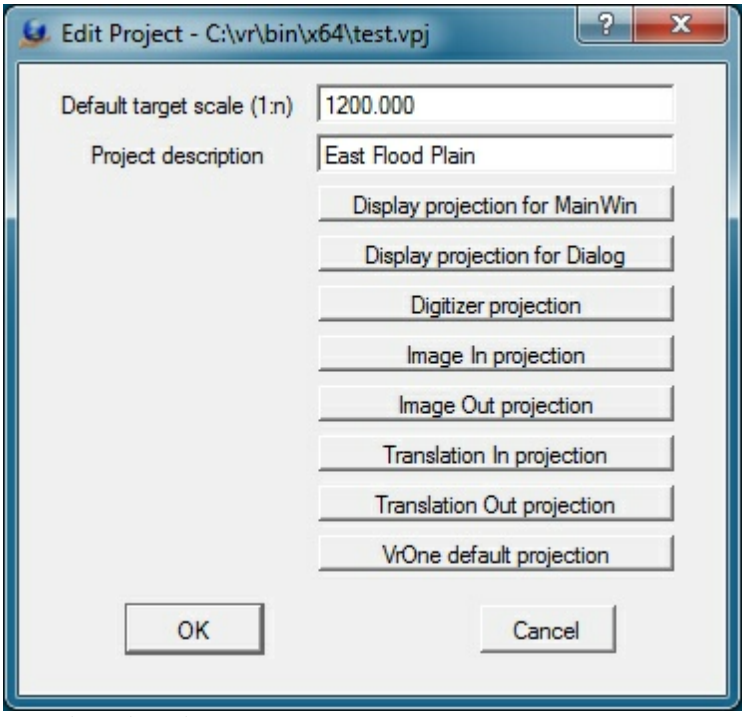
Each coordinate transformation can be turned off or on. If a transformation is turned off then the coordinates will be transferred with no change. If all the coordinate transformations are turned off then the VrOne/VrTwo database coordinate system is undefined and assumes the coordinate system of the inputs. For example, if a model was set using state plane coordinates then the Digitizer In coordinate system would be in state plane also.

For a background and detailed explanation of Map Projections, please visit Carlos A. Furuti's Map Projections site. For a detailed look at map projections, please see the "Map Projections - A Working Manual" from the USGS. For explanations of many grid & datums around the world, please see the "Grid & Datums" column at ASPRS Online.

Setting the Coordinate Projections

The coordinate projections may be set using the Edit Project (EdiPro) command or the Project -> Edit Project pull-down menu.

The input coordinate projections will be transformed to the VrOne/VrTwo coordinate projections. The output coordinate projections will define the transformation from the VrOne/VrTwo coordinate projection to the output coordinate projection.



The Edit Project dialog box

Default target scale

Defines the default target scale to assign new VrOne/VrTwo vector files. This value is expressed as a ratio. For example, 1:1200 would be equal to 1"=100'.

Project description

A project description for informational purposes may be entered in this field.

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Display projection for MainWin
The right side of the VrOne/VrTwo Main Window displays the current cursor location. This defines the coordinate projection for this coordinate display. If this projection is turned off then coordinates will be displayed in the same coordinate projection as the VrOne/VrTwo file.

Display projection for Dialog
An additional coordinate display may be shown by using the Coordinate Dialog Box (CooDia) command. This defines the coordinate projection for this display. If this projection is turned off, coordinates will be displayed in the same projection as the VrOne/VrTwo file.

Digitizer projection
Defines the coordinate projection for input systems such as the VrTwo model orientation, analog and analytical stereo plotters, Xy digitizers, ADS40, and SOCET SET. If this projection is turned off, the coordinates will be sent without transformation to VrOne/VrTwo in the projection of the input device.

Image in projection
Defines the coordinate projection for images that are used as input. VrOne has the ability to display images such as orthophotos and images such as these are geo-referenced and have a defined coordinate projection. If this projection is turned off the coordinates will be sent to VrOne/VrTwo in the coordinate projection of the image, without transformation.

Image out projection
Defines the coordinate projection for images that are created by Vr Mapping. For example, VrOrtho can set the coordinate projection for the geo-referencing of the output image. If this projection is turned off the coordinates of the image will be in the same coordinate projection of the system that created them. For example, when generating orthophotos, if the coordinate projection is turned off then the coordinate projection will be in the same as the single photo resection coordinate projection.

Translation In projection
The coordinate projection of the input files for such translators such as Dxf and Microstation may be defined with this coordinate projection. If this projection is turned off the coordinates will be sent to VrOne/VrTwo in the projection of the input file, without transformation.

Translation Out projection
The coordinate projection of the output files for such translators such as Dxf and Microstation may be defined with this coordinate projection. If this projection is turned off the coordinates of the output file will be the same coordinate projection as the VrOne/VrTwo file.

VrOne default projection
Each VrOne/VrTwo files coordinate system may be defined in any of the supported coordinate projections. If this projection is turned on then any new VrOne/VrTwo vector files will be set to this coordinate projection. If this coordinate projection is turned off then the VrOne/VrTwo coordinate projection will be undefined. The coordinate projection for a VrOne/VrTwo file may be set at any time after file creation with the Edit Vr Header (EdiVr) command.

Defining a Coordinate Projection

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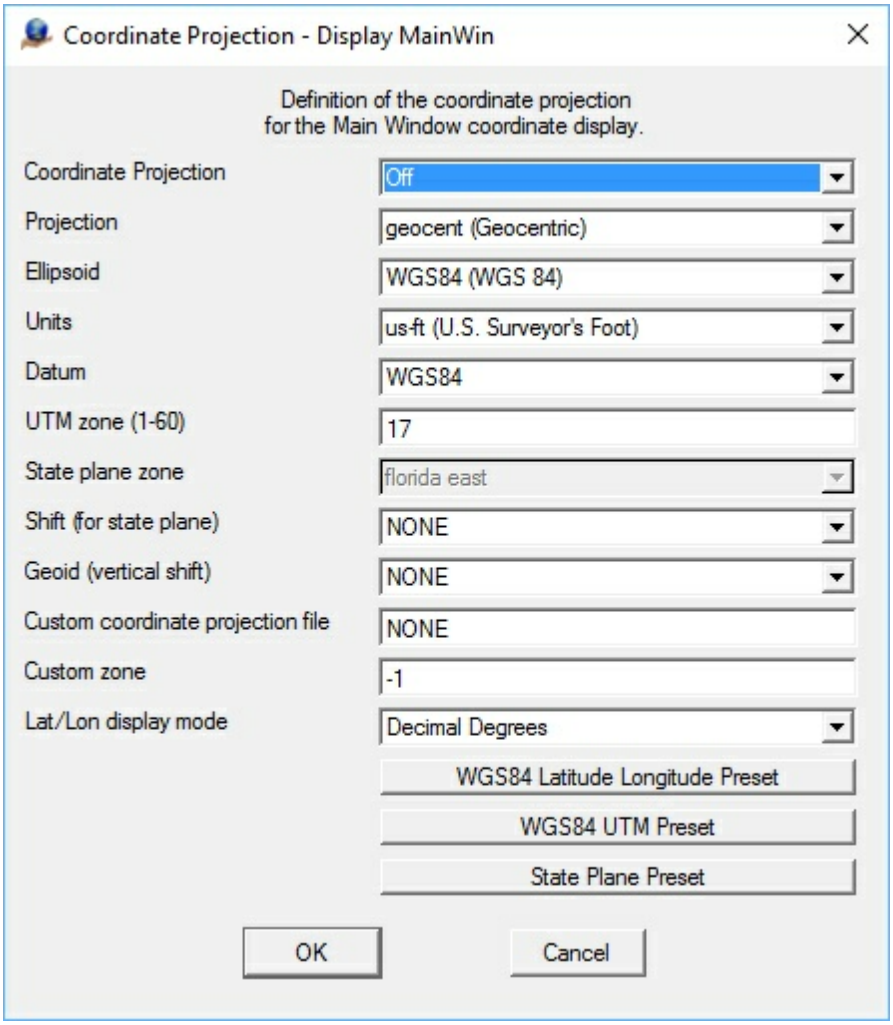
Some or all of the eight possible coordinate projections may be defined.



A Coordinate Projection definition dialog box

Coordinate Projection

The status of the coordinate projection can be defined as on or off. If the coordinate projection is turned off then coordinates will be passed with no translation.

Projection

Defines the projection used by this coordinate system. Some common projections are Universal Transverse Mercator (UTM), Polyconic (American). Although it is not a projection, LatLon (Geodesic) is an option and should be chosen when working directly in Geographic coordinates (Latitude and Longitude). It can be useful to set the VrOne database to LatLon when working with ADS40 stereo models to speed up graphics display. Because the ADS40 models are defined using an WGS84 geodetic system, this turns off any time consuming projection computations during ADS40 data collection.

Ellipsoid

The Earth is not exactly spherical, but is closer in shape to an oblate ellipsoid, a shape which bulges around the equator. The Ellipsoid parameter defines the shape of the earth used for the

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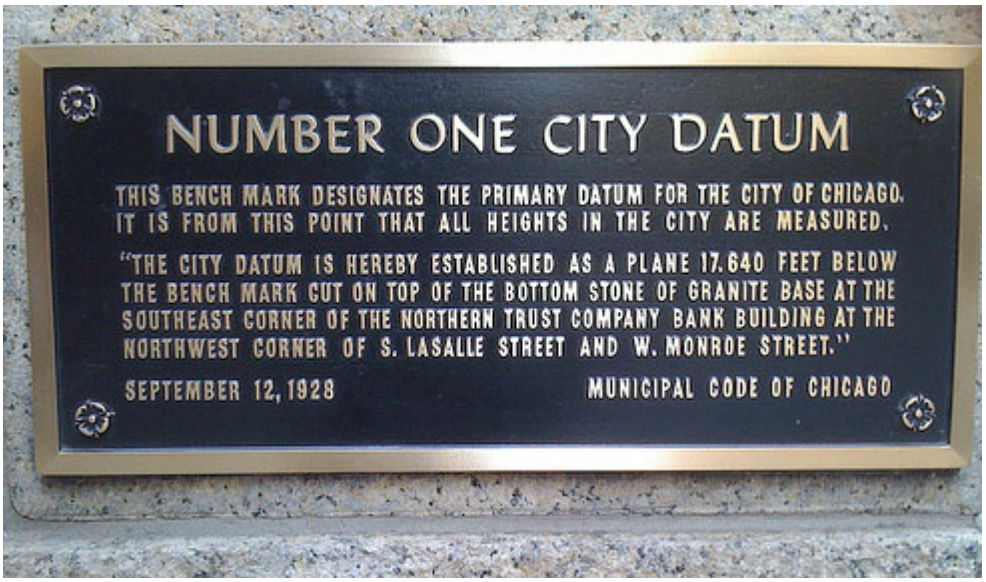
current projection. Common ellipsoids are WGS 84 and GRS 80. WGS84 is used most often and is the ellipsoid used by GPS systems.

Units

Defines the units for this coordinate projection. Choices include us-ft (U.S. Surveyor's Foot), ft (International Foot), and m (Meter).

Datum

Defines the horizontal datum for this coordinate projection. Setting the datum determines how the other projection parameters are used. If the NAD27 or NAD83 datums are chosen, then a State Plane coordinate system is used, and the Sate plane zone number must be specified correctly. Projection and ellipsoid are ignored when State Plane is used. If the UTM datum is chosen, then a UTM zone must be specified correctly.



N 41° 52.842 W 087° 37.938 - Marker for the primary datum for the City of Chicago, the point from which all the heights in the City of Chicago are measured.

UTM zone (1-60)

The Universal Transverse Mercator (UTM) coordinate system is a grid-based method of specifying locations on the surface of the Earth that is a practical application of a 2-dimensional Cartesian coordinate system. It is a horizontal position representation, i.e. it is used to identify locations on the earth independently of vertical position, but differs from the traditional method of latitude and longitude in several respects. The UTM system is not a single map projection. The system instead employs a series of 60 zones, each of which is based on a specifically defined secant transverse Mercator projection.

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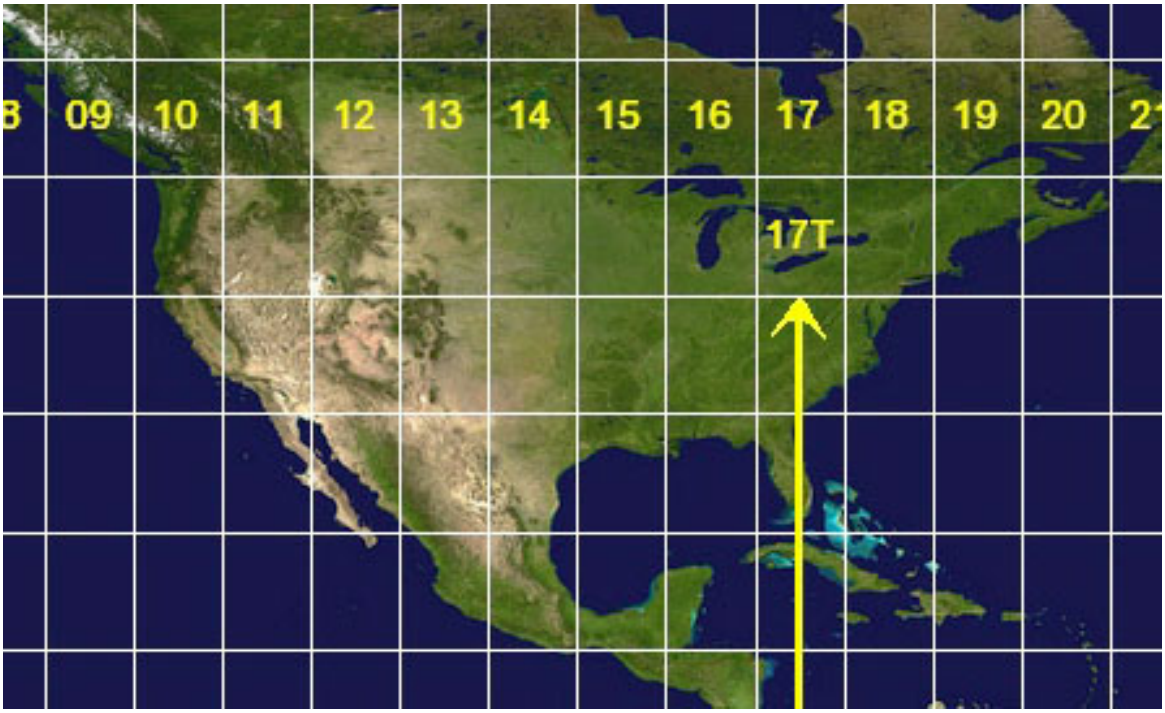

The UTM zones for North America

State plane zone number

The State Plane Coordinate System (SPS or SPCS) is a set of 124 geographic zones or coordinate systems designed for specific regions of the United States. Each state contains one or more state plane zones, the boundaries of which usually follow county lines. There are 110 zones in the continental US, with 10 more in Alaska, 5 in Hawaii, and one for Puerto Rico and US Virgin Islands.

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The State Plane Coordinate System

Shift (for state plane)

Defines the North American Datum Conversion (NADCON) grid data file to obtain latitude and longitude shift information for converting between coordinate systems within the United States.

Geoid (vertical shift)

The Earth's shape is neither spherical nor ellipstical; it is a geoidic. The geoid is the equipotential (level) surface that represents best, in a least square sense, the global mean sea level. The Geoid for vertical shift defines the geoid model used by this coordinate system. This is only used when working in the NAD83 State Plane datum. If a Geoid model is specified, elevations will be adjusted real-time to account for the Geoid offsets. If a Geoid model is selected, then the Geoid shift files must be installed to your Vr Mapping installation folder. See Installing the Geoid Files section of the ADS40 tutorial for detailed installation instructions.

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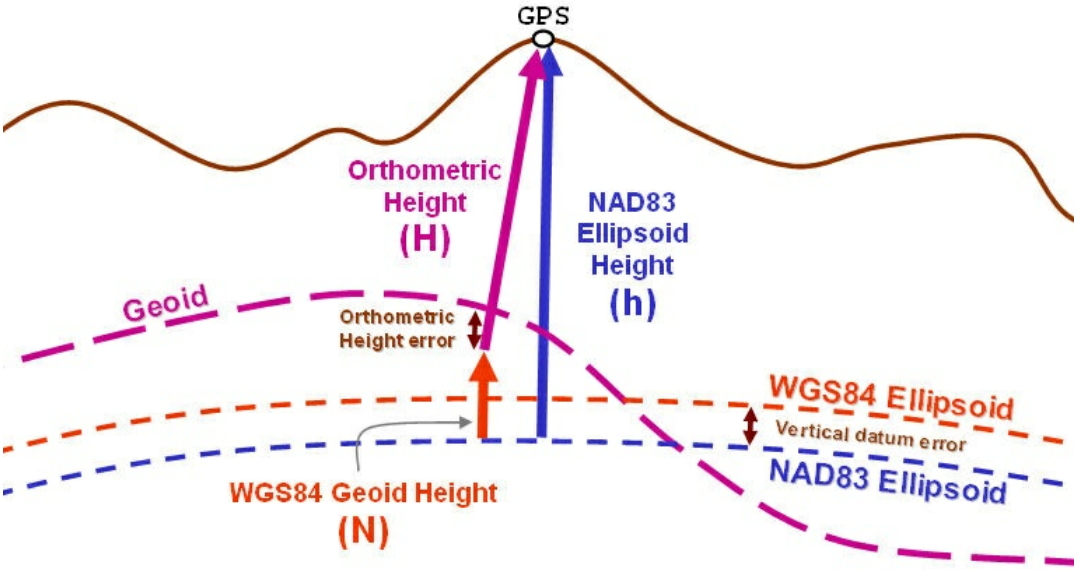

Geoid example

Custom coordinate projection file

A custom projection file may be specified along with a custom zone. The custom projection file should be placed in the \vr\bin\geo folder. It may have any valid filename up to 16 characters. The custom zone is any number up to 5 digits. The settings found in the custom projection file override any settings specified in the projection dialog box.

The custom projection file contains a list of projections defined based on the Proj.4 (http://trac.osgeo.org/proj) parameter syntax. A list of parameters using Proj.4 syntax may be found here (http://trac.osgeo.org/proj/wiki/GenParms) . A good example that shows how custom projections are defined is the nad83 file in the \vr\bin\geo folder. You can use this file as a reference for creating your own custom projections, but be careful not to change anything in the nad83 file.

A sample entry in a custom projection file may look like this:

```
<500> +proj=utm +ellps=WGS84 +units=m +datum=WGS84 +zone=32 +nc +nocut +nodefs <>
```

Each entry begins with a number inside left and right arrows (<500>), and usually ends with empty left and right arrows (<>). A single definition may be split across several lines like this:

```
# 201: arizona east: nad83
<201> proj=tmerc  a=6378137 es=.0066943800229
lon_0=-110d10 lat_0=31 k=.9999
x_0=213360 y_0=0
no_defs <>
```

Any lines beginning with a # symbol are ignored.

To experiment with setting a coordinate projection and rotating a visual map based on the

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projection, please see http://www.jhlabs.com/java/maps/proj/.

Custom zone
When a custom coordinate projection file or files have been created, this parameter specifies the custom projection to use. In the above example of a custom coordinate projection, a custom zone "201" was created and is referenced for use by setting the "Custom zone" to 201.

Coordinate display decimal places
Defines the number of decimal places, digits to the right of the decimal point, of the coordinates in the VrOne/VrTwo Main Window and the Coordinate Dialog Box (CooDia). This parameter is available for the "Display projection for MainWin" and "Display projection for Dialog".

Lat/Lon display mode
If the coordinate projection of output to the VrOne/VrTwo Main Window or the Coordinate Dialog Box (CooDia) is in latitude/longitude, this parameter defies the display format. Options are "Decimal Degrees", "Degrees, Minutes, Seconds" and "Degrees, Decimal Minutes". This parameter is available for the "Display projection for MainWin" and "Display projection for Dialog".

WGS84 Latitude Longitude Preset
Sets the current parameters to WGS84 latitude longitude. Your projection parameters may be different than this preset.

WGS84 UTM Preset
Sets the current parameters to WGS84 UTM. Your projection parameters may be different than this preset and the setting of the UTM zone is required.

State Plane Preset
Sets the current parameters to State plane. Your projection parameters may be different than this preset and the setting of the State plane zone is required.

Supported Coordinate Projection Parameters

Following are the supported coordinate projection parameters.

Projections

```
aea       (Albers Equal Area)
aeqd      (Azimuthal Equidistant)
airy      (Airy)
aitoff    (Aitoff)
alsk      (Mod. Stererographics of Alaska)
apian     (Apian Globular I)
august    (August Epicycloidal)
bacon     (Bacon Globular)
bipc      (Bipolar conic of western hemisphere)
boggs     (Boggs Eumorphic)
bonne     (Bonne (Werner lat_1=90))
cass      (Cassini)
```

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```
cc          (Central Cylindrical)
cea         (Equal Area Cylindrical)
chamb       (Chamberlin Trimetric)
collg       (Collignon)
crast       (Craster Parabolic (Putnins P4))
denoy       (Denoyer Semi-Elliptical)
eck1        (Eckert I)
eck2        (Eckert II)
eck3        (Eckert III)
eck4        (Eckert IV)
eck5        (Eckert V)
eck6        (Eckert VI)
eqc         (Equidistant Cylindrical (Plate Caree))
eqdc        (Equidistant Conic)
euler       (Euler)
fahey       (Fahey)
fouc        (Foucaut)
fouc_s      (Foucaut Sinusoidal)
gall        (Gall (Gall Stereographic))
geocent     (Geocentric)
geos        (Geostationary Satellite View)
gins8       (Ginsburg VIII (TsNIIGAiK))
gn_sinu     (General Sinusoidal Series)
gnom        (Gnomonic)
goode       (Goode Homolosine)
gs48        (Mod. Stererographics of 48 U.S.)
gs50        (Mod. Stererographics of 50 U.S.)
hammer      (Hammer & Eckert-Greifendorff)
hatano      (Hatano Asymmetrical Equal Area)
imw_p       (International Map of the World Polyconic)
kav5        (Kavraisky V)
kav7        (Kavraisky VII)
krovak      (Krovak)
labrd       (Laborde)
laea        (Lambert Azimuthal Equal Area)
lagrng      (Lagrange)
larr        (Larrivee)
lask        (Laskowski)
lonlat      (Lat/long (Geodetic))
latlon      (Lat/long (Geodetic alias))
latlong     (Lat/long (Geodetic alias))
longlat     (Lat/long (Geodetic alias))
lcc         (Lambert Conformal Conic)
lcca        (Lambert Conformal Conic Alternative)
leac        (Lambert Equal Area Conic)
lee_os      (Lee Oblated Stereographic)
loxim       (Loximuthal)
lsat        (Space oblique for LANDSAT)
mbt_s       (McBryde-Thomas Flat-Polar Sine (No. 1))
mbt_fps     (McBryde-Thomas Flat-Pole Sine (No. 2))
mbtfpp      (McBride-Thomas Flat-Polar Parabolic)
mbtfpq      (McBryde-Thomas Flat-Polar Quartic)
mbtfps      (McBryde-Thomas Flat-Polar Sinusoidal)
```

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```
merc      (Mercator)
mil_os    (Miller Oblated Stereographic)
mill      (Miller Cylindrical)
moll      (Mollweide)
murd1     (Murdoch I)
murd2     (Murdoch II)
murd3     (Murdoch III)
nell      (Nell)
nell_h    (Nell-Hammer)
nicol     (Nicolosi Globular)
nsper     (Near-sided perspective)
nzmg      (New Zealand Map Grid)
ob_tran   (General Oblique Transformation)
ocea      (Oblique Cylindrical Equal Area)
oea       (Oblated Equal Area)
omerc     (Oblique Mercator)
ortel     (Ortelius Oval)
ortho     (Orthographic)
pconic    (Perspective Conic)
poly      (Polyconic (American))
putp1     (Putnins P1)
putp2     (Putnins P2)
putp3     (Putnins P3)
putp3p    (Putnins P3')
putp4p    (Putnins P4')
putp5     (Putnins P5)
putp5p    (Putnins P5')
putp6     (Putnins P6)
putp6p    (Putnins P6')
qua_aut   (Quartic Authalic)
robin     (Robinson)
rouss     (Roussilhe Stereographic)
rpoly     (Rectangular Polyconic)
sinu      (Sinusoidal (Sanson-Flamsteed))
somerc    (Swiss. Obl. Mercator)
stere     (Stereographic)
sterea    (Oblique Stereographic Alternative)
tcc       (Transverse Central Cylindrical)
tcea      (Transverse Cylindrical Equal Area)
tissot    (Tissot)
tmerc     (Transverse Mercator)
tpeqd     (Two Point Equidistant)
tpers     (Tilted perspective)
ups       (Universal Polar Stereographic)
urm5      (Urmaev V)
urmfps    (Urmaev Flat-Polar Sinusoidal)
utm       (Universal Transverse Mercator (UTM))
vandg     (van der Grinten (I))
vandg2    (van der Grinten II)
vandg3    (van der Grinten III)
vandg4    (van der Grinten IV)
vitk1     (Vitkovsky I)
wag1      (Wagner I (Kavraisky VI))
```

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```
wag2       (Wagner II)
wag3       (Wagner III)
wag4       (Wagner IV)
wag5       (Wagner V)
wag6       (Wagner VI)
wag7       (Wagner VII)
weren      (Werenskiold I)
wink1      (Winkel I)
wink2      (Winkel II)
wintri     (Winkel Tripel)
```

Ellipsoids

```
MERIT      (MERIT 1983)
SGS85      (Soviet Geodetic System 85)
GRS80      (GRS 1980(IUGG, 1980))
IAU76      (IAU 1976)
airy       (Airy 1830)
APL4.9     (Appl. Physics. 1965)
NWL9D      (Naval Weapons Lab., 1965)
mod_airy   (Modified Airy)
andrae     (Andrae 1876 (Den., Iclnd.))
aust_SA    (Australian Natl & S. Amer. 1969)
GRS67      (GRS 67(IUGG 1967))
bessel     (Bessel 1841)
bess_nam   (Bessel 1841 (Namibia))
clrk66     (Clarke 1866)
clrk80     (Clarke 1880 mod.)
CPM        (Comm. des Poids et Mesures 1799)
delmbr     (Delambre 1810 (Belgium))
engelis    (Engelis 1985)
evrst30    (Everest 1830)
evrst48    (Everest 1948)
evrst56    (Everest 1956)
evrst69    (Everest 1969)
evrstSS    (Everest (Sabah & Sarawak))
fschr60    (Fischer (Mercury Datum) 1960)
fschr60m   (Modified Fischer 1960)
fschr68    (Fischer 1968)
helmert    (Helmert 1906)
hough      (Hough)
intl       (International 1909 (Hayford))
krass      (Krassovsky, 1942)
kaula      (Kaula 1961)
lerch      (Lerch 1979)
mprts      (Maupertius 1738)
new_intl   (New International 1967)
plessis    (Plessis 1817 (France))
SEasia     (Southeast Asia)
walbeck    (Walbeck)
WGS60      (WGS 60)
WGS66      (WGS 66)
WGS72      (WGS 72)
```

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```
WGS84      (WGS 84)
sphere     (Normal Sphere (r=6370997))
```

Units

```
km         (Kilometer)
m          (Meter)
dm         (Decimeter)
cm         (Centimeter)
mm         (Millimeter)
kmi        (International Nautical Mile)
in         (International Inch)
ft         (International Foot)
yd         (International Yard)
mi         (International Statute Mile)
fath       (International Fathom)
ch         (International Chain)
link       (International Link)
us-in      (U.S. Surveyor's Inch)
us-ft      (U.S. Surveyor's Foot)
us-yd      (U.S. Surveyor's Yard)
us-ch      (U.S. Surveyor's Chain)
us-mi      (U.S. Surveyor's Statute Mile)
ind-yd     (Indian Yard)
ind-ft     (Indian Foot)
ind-ch     (Indian Chain)
```

Datums

```
WGS84
GGRS87         (Greek_Geodetic_Reference_System_1987)
NAD83          (North_American_Datum_1983)
NAD27          (North_American_Datum_1927)
potsdam        (Potsdam Rauenberg 1950 DHDN)
carthage       (Carthage 1934 Tunisia)
hermannskogel  (Hermannskogel)
ire65          (Ireland 1965)
nzgd49         (New Zealand Geodetic Datum 1949)
OSGB36         (Airy 1830)
```

Shift for State Plane

```
NONE
alaska
alhpgn
arhpgn
azhpgn
cnhpgn
cohpgn
conus
cshpgn
emhpgn
eshpgn
```

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ethpgn
flhpgn
gahpgn
guhpgn
hawaii
hihpgn
iahpgn
ilhpgn
inhpgn
kshpgn
kyhpgn
lahpgn
MD
mdhpgn
mehpgn
mihpgn
mnhpgn
mohpgn
mshpgn
nbhpgn
ndhpgn
nehpgn
njhpgn
nmhpgn
nvhpgn
nyhpgn
ohhpgn
okhpgn
pahpgn
prvi
pvhpgn
sdhpgn
stgeorge
stlrnc
stpaul
TN
tnhpgn
uthpgn
vahpgn
WI
wihpgn
wmhpgn
WO
wohpgn
wshpgn
wthpgn
wvhpgn
wyhpgn

Geoids (vertical shift)

NONE
GEOID12A

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GEOID12B
GEOID03
GEOID06
GEOID09
GEOID96
GEOID99
USGG2003
USGG2009
USGG2012
G99SSS

Note: GEOID99 supersedes GEOID96 which has not been tested (6/29/16)
The geoid data files may be downloaded from the Vr Mapping software download page. The geoid data files are from the National Geodetic Survey (NGS) and more information on geoids can be found at http://www.ngs.noaa.gov/GEOID/

Using Coordinate Projections

Warning

The process of coordinate projection transformation changes coordinate values and involve many parameters that influence the output. It is important that the user understand coordinate projections and their associated parameters. It is also important that the results of any transformation be thoroughly checked before use. The coordinate projection computations that are described above are based on the PROJ.4 Cartographic Projection Library. Please see the PROJ.4 website at http://trac.osgeo.org/proj/ for more information including license information and disclaimers.

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If you disagree with the above warning and disclaimer, please do not use coordinate projections in VrOne/VrTwo. These coordinate projections may be turned off as described above.

5.2 Miscellaneous Reference

Vr

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Mapping

Miscellaneous Reference

Mapping Accuracy

NMAS – National Map Accuracy Standards
ASPRS – American Society for Photogrammetry and Remote Sensing

C-Factor

```
Cf = H/Ci
```

Where:
`Cf` = C-Factor
`Ci` = Contour interval (feet)
`H` = Flying height (feet) above mean ground level

Maximum ASPRS and Interpolated NMAS-C Factors

Map Accuracy Standard	Softcopy Workstation	Analytical Stereoplotter
ASPRS Class 1	1600	2000
NMAS	1700	2100
ASPRS Class 2	1800	2200
ASPRS Class 3	2000	2500

Source: Aerial Mapping methods and applications / Edgar Falkner and Dennis Morgan – 2nd edition – Lewis Publishers

Maximum Recommended Enlargement Factors from Photo Scale to Map Scale

Map Accuracy Standard	Softcopy Workstation	Analytical Stereoplotter
ASPRS Class 1	6.0	7.0
NMAS	6.5	7.5
ASPRS Class 2	7.0	8.0
ASPRS Class 3	8.0	9.0

Source: Aerial Mapping methods and applications / Edgar Falkner and Dennis Morgan – 2nd edition – Lewis Publishers

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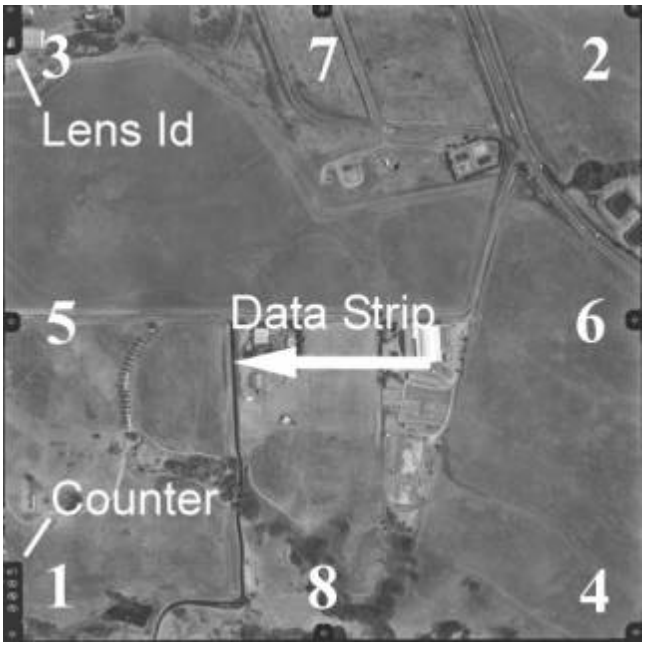
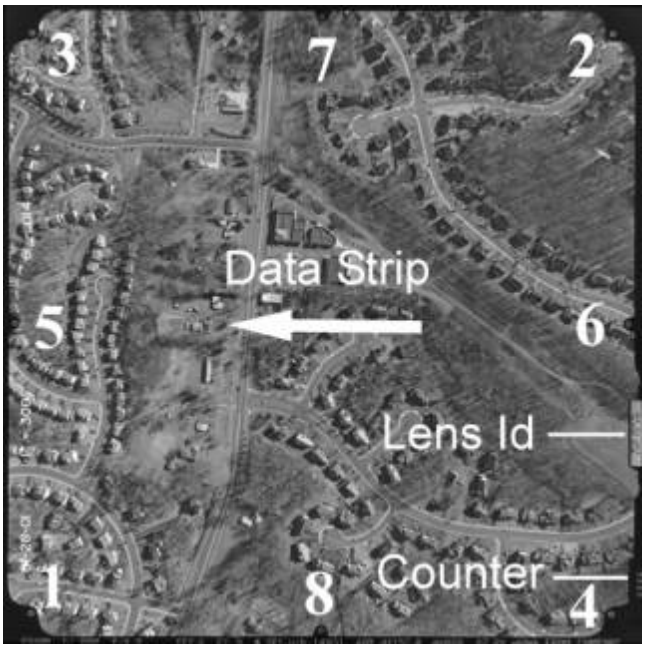
Film Strip Location

Film Strip Location – Zeiss RMK TOP



Source: Z/I Imaging – Denver Co.

Film Strip Location – Wild RC10/20/30



Source: USGS Optical Science Laboratory

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5.3 Vr Mapping Definitions

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Vr Mapping

Vr Mapping Definitions

"He spoke English but I didn't understand anything he said."
- Student after a training class

Active Workspace

Defines the current VrOne workspace into which new entities will be placed. Many operations, such as snapping, work on all opened workspaces but when entities are saved they can only be placed into one workspace.

Application Overlaying

VrOne allows more than one mapping command to be running at one time. Each command that is started suspends (or sleeps) the current command. When the top command is terminated, the next command is restarted or woken up.

For example:
Insert line is started and a road is being collected.
The operator sees a valve cover that he wishes to place now.
The insert symbol command is started.
The un-completed road edge disappears.
The operator places the valve cover and terminates insert symbol.
Insert line wakes up, the road edge re-appears and the instrument is driven to the last point collected on the line.

Up to 20 commands may be running in VrOne. Application overlaying supports all display commands, DTM and all mapping applications.

Construction Line

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Line entities may be flagged as construction, which allows them to be turned off. This line description might be applied to hidden lines, reference lines, or other non-topological lines.

Dig

Dig is the act of digitizing a point. This may be to collect a data point or to identify an entity.

Direction of North

Defines the direction of North in reference to the graphics window. Many times it will be necessary to show north in a direction other than up. If you were to measure an angle from one of the vertical edges of the output device to the North arrow this would be the direction of North. The direction of North is measured clockwise from the Y-axis with zero being up.

Entity

An entity is a single piece of graphic data. An entity may be a line, symbol or text.

Function Keys

Function keys allow the assignment of entity parameters such as layer and graphic pointer to a map feature name. When this name is executed the defined mapping function starts and the defined parameters are assigned.

Graphics Window

A window used by VrOne to display map vectors and images. On Linux and Windows NT/2000, there may be up to eight windows opened at one time.

Key-ins

VrOne has a key-in area in the Main Window which allows commands to be entered at almost any time. Key-ins may be parameter modifications, VrOne commands, or macros.

Keyport 300

This is a 300-button touch pad from Polytel Computer Systems. Serving as a VrOne input device, VrOne key-ins, Function Keys, and Macros may be placed on the touch pad. Normally, the keypad is used when the Xyz digitizer is active, but may be used at any time.

Layer, Mode, Graphic Pointer

See Data Structure.

Line

A line is a collection of points that are connected by line segments. VrOne allows an unlimited number of points on a line. A Line Segment is one line consisting of two points that make up a line.

Line Font

A Line Font is a user-definable design for a line. Fence lines, tree lines and water lines are good examples of line fonts. The VrOne database stores lines as a series of Xyz vertices and a Line

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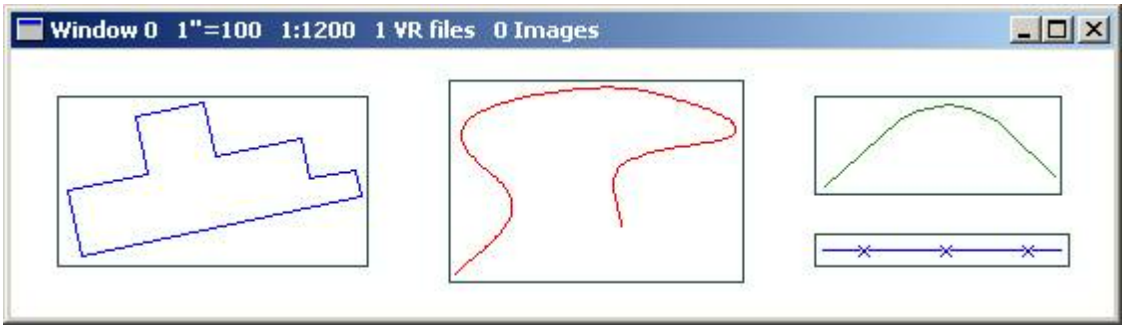
Font is fit along the line points when the line is displayed. Line fonting may be turned off.

Line Box

When locking onto a line, you must be within the line box for that line to be considered. The line box is an imaginary rectangle that starts at the minimum North and East and ends at the maximum North and East of each line entity. A line box is often called a "Minimum Bounding Rectangle". Following are some examples of line boxes:



Macros

Macros contain a group of VrOne key-ins, Function Keys or other macros. Macros may be named and executed as a key-in or menu board command.

Main Window

The main window used by VrOne. This window includes pull-down menus, key-in area, information area, coordinate display and the application (command) stack area.

Menu Board

A menu in which VrOne Function Keys, Entity parameters, and VrOne commands may placed. Items from the menu board may be selected from a Xy tablet. A smaller version of the Menu Board may be placed on the Polytel Keyport 300 keypad.

Menu Keys Window

A Menu Keys Window is a VrOne dialog box used by applications to display entity parameter information and the 12 button assignments. This dialog box appears when an application is started or woken up and disappears when that application is terminated.

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Number Line

A number line may be used to easily enter a group or range of numbers. A number line consists of a number or range of numbers separated by blanks, semi-colons, colons or stars. A dash between two numbers indicates a range of sequential numbers.

```
51-57 77 79 83-86
```

The above example would specify numbers 51, 52, 53, 54, 55, 56, 57, 77, 79, 83, 84, 85, 86. The maximum numbers that a number line may represent is 32001. The following number line examples will yield the same results:

```
51-57 77 79 83-86
51-57;77;79;83-86
51-57:77:79:83-86
51-57*77*79*83-86
51-57;77:79*83-86
```

NOTE: Blanks and commas are used to separate commands on a Vr key-in. When using a number line in a key-in, semi-colons, colons or stars should be used to separate the fields and commas should be used to separate commands. For example; to turn on a group of layers with a number line then execute a zoom all, the command might be: LayOn+ 10 20 30 40-50, ZooA

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Orientations

VrOne supports several types of input orientations. These orientations are responsible for converting input machine coordinates to user coordinates. The three types of orientation are scratch, 2D least squares, and 3D least squares. Scratch and 2D Least Squares are used when a Xy digitizing tablet is active and Least Squares is used when an analog stereo plotter is active.

During the execution of VrOne, it is possible to switch the active input device with the command Digitizer XY (DigXy) or Digitizer Xyz (DigXyz). VrOne will automatically change the type of orientation used to accommodate the current input device. The orientation type may also be changed between 2D least squares and Scratch orientation when the active digitizer is a Xy tablet with the Toggle Dig Mode (TogDig) command.

Analytical stereo plotters and softcopy devices use other orientations and not the ones described above.

Orientation - Scratch

This orientation allows the use of a Xy digitizing tablet as a pointing device. The current scale of the digitizing tablet is the same as the scale of the output screen and changes as the viewing scale does. Scratch orientation is useful for cosmetic editing of map data and does not require a source manuscript to be present. This orientation is unavailable when a Xyz digitizer is active.

Orientation - 2D Least Squares

The two-dimensional least squares orientation should be used when digitizing map data from existing documents. This orientation spreads any map sheet error evenly between chosen control points. Before this orientation can be used, the program Orient 2D (or2d) must be executed to orient the map sheet and perform the least squares adjustment.

Orientation - 3D Least Squares

The three-dimensional least squares orientation must be used when a Xyz digitizer is used for input. Before this orientation can be used an orientation program must be executed to orient the current stereo model and perform the least squares adjustment.

Pen Table

The pen table allows the assignment of pen numbers to layers and modes. These pen numbers might represent graphic screen colors or pen numbers on a line plotter. Each of the four modes in every layer can be given a separate pen number. The use of pen tables in VrOne is optional. Each VrOne entity stores a pen number in its header.

Photo Name Format

Various processes such as aerial triangulation and model orientation require use of an image strip and photo number. These numbers are typically encoded in the image file name. Photo Name Format describes the method for extracting this information.

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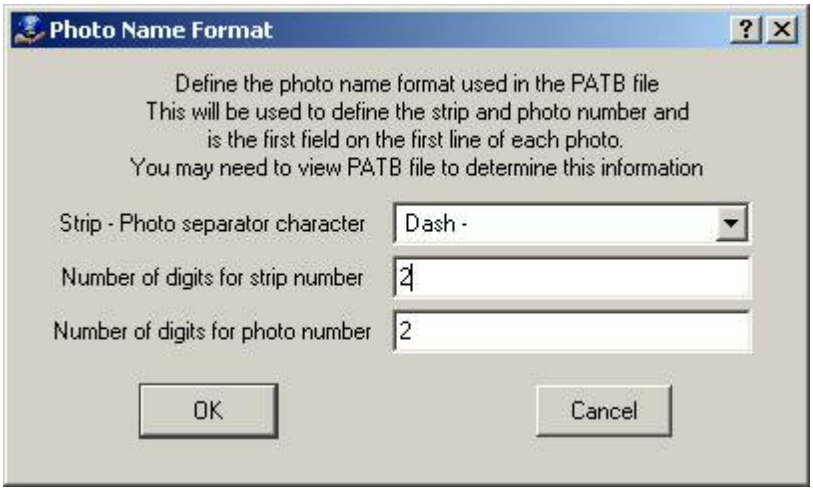

There are three parameters that make up the Photo Name Format: a separator character, number of digits in the strip number, and number of digits in the photo number. If the separator character is used to describe the format then the number of digits for the strip and photo numbers are not needed. If the file name does not have a separator character then the number of digits values must be used.

The photo separator character may be Underbar '_', Dash '-', or Tilde (~) and the number of digits may be from 1 to 9. If the photo separator character is set to None then the Number of digits fields will be used. The following are several examples of the Photo Name Format.

```
Photo name:                         23-56.tif
Photo separator character:          Dash
Number of digits for strip number: any
Number of digits for photo number: any
Strip number:                       23
Photo number:                       56

Photo file name:                    23056.tif
Photo separator character:          None
Number of digits for strip number: 2
Number of digits for photo number: 3
Strip number:                       23
Photo number:                       56

Photo file name:                    23056.tif
Photo separator character:          None
Number of digits for strip number: 3
Number of digits for photo number: 2
Strip number:                       230
Photo number                        56
```

Prompting Units

At times, it makes sense to enter some parameters in as inches or millimeters at map scale. These include symbol and text sizes. This avoids re-entering these parameters for each map

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scale. Normally these values are converted to ground units before being applied to an entity. When a value is to be entered as inches or millimeters the hint (in|mm) will follow the prompt. Prompting units may be set in the VrOne configuration program.

Prompt Hint

When VrOne asks questions using a dialog box, it may offer some hints as to what type of parameter it is looking for. A prompt hint is in parenthesis after the question and will look as follows:

```
Search radius (ground)
```

In this example a search radius can be entered and its value should be in ground units.

Following are some commonly used hints:

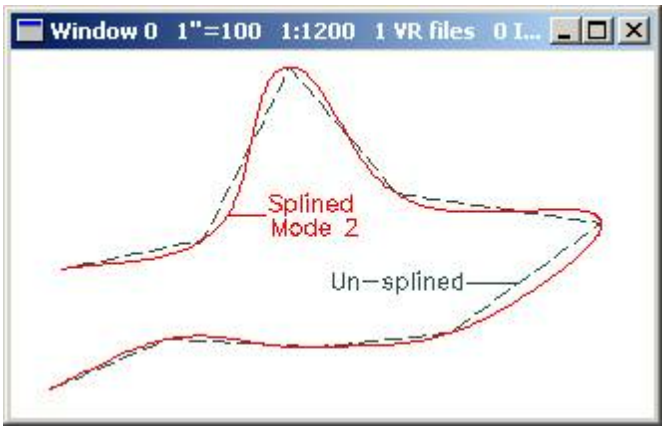
Ground	Ground units in feet or meters.
in|mm	A number in inches or millimeters determined by the prompting units.
NumLine	Number line.
31 char	Up to 31 characters

Saved Coordinate

When Insert Symbol saves an entity, it saves its coordinate position as the Saved Coordinate. This coordinate can be used by applications such as Insert Text to place text based on the last symbol position.

Spline – Cubic – VrOne Line Mode 2

This spline is used in VrOne as a curved line display mode. The splined points are not stored in the VrOne file but are generated when this line is displayed. The curved line generated by this algorithm passes through all the points on the line.



WARNING: A spline line may be aesthetically pleasing but may not be as statistically correct or accurate as a line that has not been splined.

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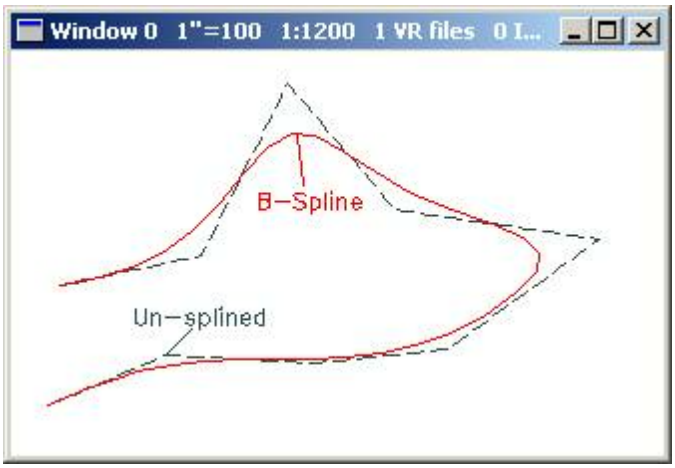
Spline – B Spline

This spline may be used to generate contours from the Digital Modeling application in VrOne. The points on the splined line are stored in the VrOne file. The curved line generated by this algorithm is an approximation and may not pass through all points on the line.



WARNING: A B-spline may be aesthetically pleasing but may not be as statistically correct or accurate as a line that has not been splined.

Snap

Snap is operation of attaching or locking to an existing entity in a VrOne file. Snapping may be used when collecting or editing an entity.

When snap is on and a point is digitized, VrOne searches all workspaces for the closest point to the one just digitized. If snap verify is on, then a tentative cursor will appear on the point snapped to. Pressing button 1 accepts the snap while button 2 will reject the snap and allow the user to try again, or button 3 will search for the next closest entity. A search radius may be specified to optimize the search procedure. If no points are found within the search radius, and "Ignore failed snaps" is set to "Yes", then the position digitized is used.

Target Scale

The target scale is the intended plotting scale of the VrOne file. This is also the scale in which map accuracy statements apply.

Text Font

VrOne supports the inclusion of twelve different text fonts in the same file.

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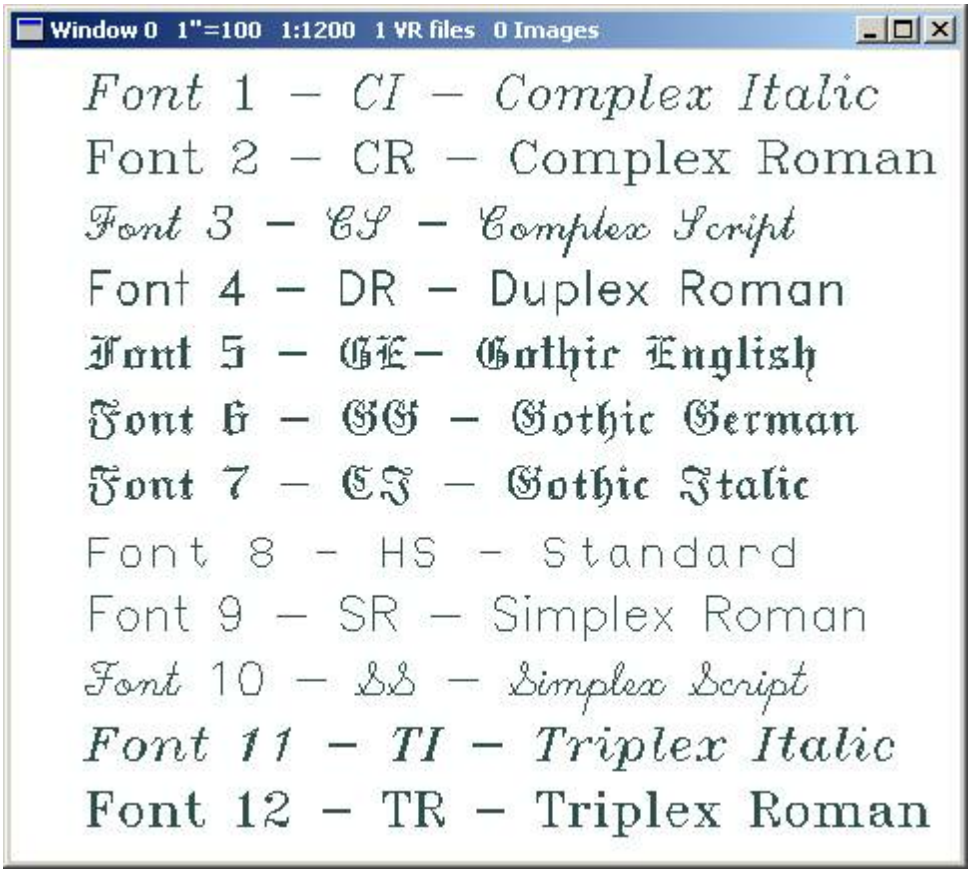
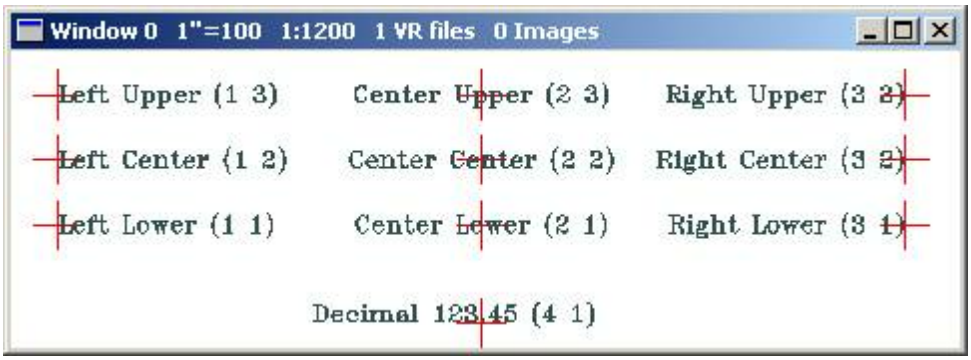


Text Justification

VrOne supports ten justification positions. Text justification determines where the origin point of a text label will be. Each text label carries a X and Y justification as an parameter. The justification is a number from one to three. Text justifications are useful when a scale change is anticipated. For example, if all the text labeled in the center of objects were center, center justification, when the text was enlarged, the text would remain centered. The available text justifications are combinations of lower/center/upper and left/center/right. The text justification nine places the decimal point of a number as the origin.

The ten text justifications are as follows with the X justification listed first:



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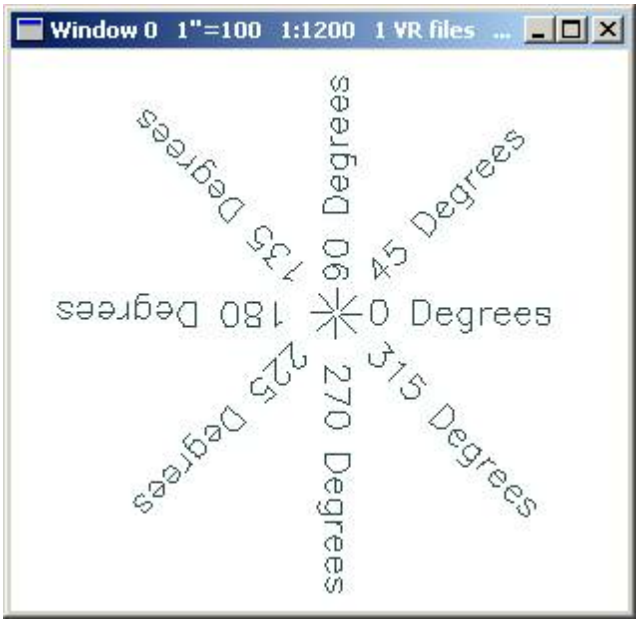
Decimal justification (4,1) is normally located between Center Lower (2,1) and Right Lower (3,1).

Text and Symbol Rotations

All text and symbol rotations are expressed in decimal degrees, counterclockwise, with the positive X axis as zero. Text and symbol rotations will always be referenced to the graphic data base coordinate system and not to the current screen rotation.



Workspace

A workspace is a VrOne file that has been opened and is ready for use. VrOne currently allows up to 256 workspaces to be opened at one time.

Xy Digitizer

An input device that outputs only Xy coordinates and has at least a 12 button puck or cursor. These devices are normally called digitizing tablets and may come in sizes from 12”x12” to 60”x48”. VrOne supports the scratch and 2D least squares orientation from these input devices.

Xyz Digitizer

An input device that outputs Xyz coordinates. These devices include analog stereo plotters such as the Wild B8, Kern PG2 and Zeiss E3, analytical stereo plotters such as the Zeiss P3, Wild BC2 and Kern DSR11, and softcopy software.

Analog stereo plotters support Least Squared transformations. Analytical and softcopy stereo plotters use their own input transformations.

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Z Source

Defines the origin for input elevations.

Xyz digitizer or active Z – The Xyz digitizer is a 3D input device such as a stereo plotter. The active Z is the current elevation and in changed each time a 3D input device is read. It is also changed by the Z command and when an entity is locked onto.

DTM surface if active – The elevation will be obtained from the current DTM surface if a model has been computed (RunDtm). The current Xy location is used to compute the Z.

Force Z value – The elevation will be set to the predefined Force Z value.

Point Drape (High/Low) - The active cursor is draped in the Z axiz to points such as LiDAR or Digital Surface Model (DSM) points. The High/Low Point Search is used to determine this Z value.

These parameters may be set using the Z Source (Zsou) dialog or key-ins.

Z Rules

When one line is attached to another or two lines are noded together, VrOne will display options for the action to be taken on the elevations of the two node points. The four Z rules are as follows.

Original Zs - When two lines are noded, the elevation of each node point is computed from the point in front and behind the node point. When one line is attached to another, the elevation is taken from the input device. This option does not modify the current elevations.

Mean Zs - Mean the two elevations from each line.

Z from 1st line - Set the elevation of the node point from the second line to the elevation of the node point from the first line.

Z from 2nd line - Set the elevation of the node point from the first line to the elevation of the node point from the second line.

5.4 Z Rules

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Mapping

Z Rules

Type: Information

Z-rules noding options.

Detailed Description

When one line is attached to another or two lines are noded together, VrOne may offer options for the action to be taken on the elevations of the two node points. The four Z rules are as follows.

Original Zs

When two lines are nodded, the elevation of each node point is computed from the point in front and behind the node point. When one line is attached to another, the elevation is taken from the input device. This option does not modify the current elevations.

Mean Zs

Means the two elevations from each line.

Z from 1st line

Sets the elevation of the node point from the second line to the elevation of the node point from the first line.

Z from 2nd line

Sets the elevation of the node point from the first line to the elevation of the node point from the second line.

Example:

Consider the following two crossing lines. The table below shows the elevations for each line at the intersection point based on each Z Rule.

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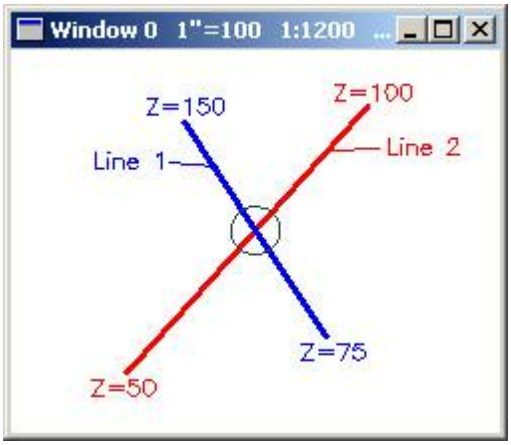

Z Rule ->	1	2	3	4
Line 1	112.2	94.5	112.2	76.8
Line 2	76.8	95.5	112.2	76.8

6 Release Notes

6.1 What's New in Version 5.5

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Vr Mapping

What's New in Version 5.5

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Vr Mapping version 5.5 contains a number of new features and enhancements. This document shows the major changes and additions. Please visit Release Notes for a more detailed list of the changes and additions.

VrOne Vector Database Changes - VrThree (VrLiDAR)

- There are now four possible Vr Point (LiDAR) records in the Vr database representing the LAS (LiDAR Archival System) data formats 0-3. Each VrOne/VrTwo data file is formatted to support one of the four possible formats. See the LAS Specification 1.2 for more information.
- The Vr Layer number has been added for each Vr Point (LiDAR) in the VrOne/VrTwo file.
- Support for GPS time has been added.
- The Intensity range is increased from 0-32767 to 0-65535.
- The Scan Angle is increased from -90 to 90 to -32767 to 32768.
- The database support for Classification is increased from 0-31 to 0-255. Currently the software supports the range of 0 to 31.

For more information about the VrPoint entity please see VrPoint (LiDAR) Entity.

NOTE: Vr Vector (.vr) files that are opened by version 5.5 will be automatically upgraded from database version 6 to database version 7. Because of the latest improvements, the latest database version is not backwards compatible with versions of VrOne/VrTwo under 5.5 and should not be opened by older versions of VrOne/VrTwo. If there is a need to downgrade version 5.5 (database version 7) files to an earlier version, the "Convert VrOne Files" (ConVr) may be used. This batch application is available in version 5.5 under File -> "Convert VrOne Files" or from the ConVr key-in.

Photo Rotations - VrTwo Orientation, VrTwo, VrAirTrig, VrOrtho

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The application of photo rotations has been improved when using cameras such as DiMAC, UltraCam and Rollei. These cameras tend to have larger calibrated principal point offsets and larger radial distortion values. In previous versions, use of non-fiducial, small format cameras required a camera (.cam) file for each image rotation or strip location. Version 5.5 allows for one camera calibration file to be established for photo strip to the left (0 rotation) and the application adjusts for other camera rotations. As in previous versions, the photo rotation is established in Vr Image Utility or Edit Project in VrTwo Orientation, VrAirTrig or VrOrtho by specifying the Strip Location for each photo.

Classify 3D (Cla3D)

This application replaces the original Classify Cube application and now allows VrPoint (LiDAR) classification by cube or polygon. The polygon depth may be extruded along the viewing axis in 3D VrThree for greater control in stereo. For more information, please see Classify 3D.

Roaming in 3D VrThree

Modified to improve roaming. When roaming is turned on (Insert key) in 3D VrThree, the floating mark remains in the center of the view and the LiDAR points roam in real-time. The roaming is supported at any 3D viewing angle and scale. Please note that the smoothness of roaming is dependent on the graphics card and the amount of LiDAR data being displayed. Pressing the Insert key on the system keyboard toggles between static and roaming modes. See Getting Started with 3D VrThree for more information on configuration and usage.

Tile Points (TilPoi)

Tiles VrPoints (LiDAR) from multiple VrOne files and creates new VrOne files. For more information, please see Tile Points.

Polygon Elevation (PolEle)

Changes elevation of symbols and points inside a polygon or group of polygons. This operation may be performed on the points or symbols in a single polygon by identifying the baseline polygon or a group baseline polygons in an interactive batch mode. This batch application may be used to flatten LiDAR points within lake boundaries. See Polygon Elevation for more information.

Model Manager (ModMan)

This is a new command in VrTwo that displays a graphical view of all multiple model footprints, and provides automatic and manual model switching capabilities. See Model Manager for more information.

Edit Point (EdiPoi)

This new interactive application has been added which allows the editing of single points with the ability to copy, move, change and delete single VrPoints. See Edit Point for more information.

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CAiCE In/Out Translators

Modifications and additions have been made to the CAiCE translators. Additions include the addition of the ability to import CAiCE Profile Tables to create skeletal Vr Mapping Function Keys and the addition of the CAiCE in translator. The translator parameters are based on the Florida Department of Transportation specifications. This translator is currently in beta form in release 05.05.01. See CAiCE In/Out for more information.

6.2 What's New in Version 5

Vr Mapping

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What's New in Version 5



Vr Mapping version 5 contains a number of new features and enhancements to version 4. There are over 50 enhancements, additions, and bug fixes in Vr Mapping version 5. This document will give an overview of the major changes, but viewing the Release Notes is recommended for a more detailed list of the changes since version 4.

General Program Enhancements

- **Windows 7 Support -** Vr Mapping is now offered in both 64-bit and 32-bit versions. The 64-bit version of Vr Mapping version 5 is available for Windows 7 64-bit machines. This allows Vr Mapping to take full advantage of available system memory, and is especially useful

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for applications like VrOrtho when working with large images. The 32-bit version of Vr Mapping runs on Windows 7 64-bit and 32-bit and on Windows XP.

- **VrThree (VrLiDAR)** - Introduction of the beta version of VrThree (VrLiDAR) which includes a new points data structure in the VrOne/VrTwo data base, LAS import and export translators, support for LiDARgrammetry, improved roaming speed in VrTwo and the addition of 3D VrThree. See VrThree (VrLiDAR) below for more details.

- **Improved Help System -** The help system has been completely revamped in Version 5. All help is presented in one consolidated web based help system. It is now possible to quickly search through all documentation using keywords and printing of all or parts of the help is supported. Various tutorials have been added to the help system.

- **Apple iPad Support** - Version 5 supports the Apple iPad as a touchscreen device using the Cardinal Systems' VrController app (yes, there's an app for that!). This implementation of an interactive touchscreen as an input device for VrOne and VrTwo is the the best one yet. This application can be downloaded to an iPad from Apple's App Store for free. See VrController for the iPad for more information about this magical and revolutionary input device.

- **VrOne/VrTwo Graphics -** New graphics system for VrOne and VrTwo static mode. The overall graphics speed has been improved, and overlay graphics now uses solid cursors and rubber band lines for an overall better user experience. This change may require a newer graphics card on some systems. See Before Installing Vr Mapping Version 5 at the bottom of this document.

- **3D LCD Stereo Support** - Vr Mapping continues to support the NVIDIA 3D Vision Bundle which includes support the 120Hz LCD Monitors. This support continues in Windows XP and has been extended into Windows 7.

- **Smoother Lines and Pixels** - Added support for smooth, anti-aliased line display in VrTwo roaming mode and the ability to smooth the display of pixels when zoomed in at 1:1 and closer using nearest neighbor or bilinear filters.

- **Plotting to system printers and PDF files** - Added support for plotting directly to any Windows installed printer or directly to PDF files. When plotting using one of these new options, a preview window is displayed showing exactly what will be plotted and how it fits on the output page.

VrThree (VrLiDAR)

Vr Mapping version 5 with the beta version of VrThree (VrLiDAR) contains a variety of enhancements to provide support for working with LiDAR data. In addition to collecting and editing vector data, LiDAR point data can be edited using VrThree (VrLiDAR). Upcoming tools

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such as polygon and cursor draping, bulldozing and Delete Close (DelClo) help the user to manage and refine point data. Now included in the VrOne/VrTwo graphics data base is the capability to store large amounts of LiDAR point data. This point data includes the attributes as defined in the ASPRS LAS data format. Translation to and from LAS files is a fast, simple and easy process. Other point data formats will also be supported by VrThree (VrLiDAR).

Choices for collection and editing include several environments in VrOne and VrTwo. Each environment has the ability to collect and edit vector data and edit LiDAR points. Multiple methods may be used to complete a project. All environments support user-defined point density and size display parameters. Existing VrOne/VrTwo commands and applications are available in each of the four environments.

- **2D ViewPoint** - Very large amounts of LiDAR data can be displayed in this mode with the ability to optionally display rectified images as a backdrop. This environment is useful for cutting and management applications.

- **Photogrammetric Stereo** - LiDAR points can be displayed with traditional photo based photogrammetry using VrTwo in static or roaming modes. Any of the Vr supported camera and sensor types may be used.

- **LiDARgrammetry** - The use of synthetic stereo imagery derived from the LiDAR point intensity data using VrTwo in static or roaming modes.

- **3D VrThree** - Point data is displayed in true three-dimensional stereo and vectors, symbols and text may be collected on top of this data. The data may be viewed from any viewpoint, origin and scale. Each may be dynamically controlled by the user at any time. Two cursor modes include Cursor Draping and Free Motion. Cursor Draping holds the cursor to the LiDAR surface in the Z axis as it is moved in the three-dimensional viewing space. The stereo in 3D VrThree is based on LiDAR points and VrOne vectors and does not need images.

VrThree (VrLiDAR) Features Include:

- A familiar, existing Vr Mapping interface
- Multiple, true three-dimensional working environments
- Ability to store large amount of points along with vector data
- LiDAR point and polygon editing tools
- Ability to collect and edit vector mapping data on top of LiDAR data
- Compatible with aerial and ground based mobile and static LiDAR data
- Support for over 200 existing Vr Mapping commands and applications

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- Automatic Cursor Draping available in the 3D VrThree environment
- Up to 16 LiDAR attributes per point including intensity and classification
- User-defined point density, point size and decimation density
- High speed input and output to and from LAS and other data formats
- Offered as an optional option to VrOne and VrTwo

See Getting Started with 3D VrThree for more information on 3D VrThree. Also see the VrThree (VrLiDAR) Product Brief at the bottom of this document.

NOTE: As of July 2010, VrThree (VrLiDAR) version 05.01.00 is being used in production environments and is currently in beta release. Not all the existing VrOne applications support points and polygon draping, cursor draping and bulldozing are still under development.

Mapping Enhancements

- **Insert Line** - Added option to allow line to be closed with only two current points.
- **Drape** - Added the ability to add wall polygons in which the sides of the draped object (normally buildings) are placed as polygons instead of wall lines from the corners.
- **Line Cross** - Added options to check for overlapping lines and three point lines that are closed.
- **Open Last Mode** - Added user configurable option for opening last VrTwo model at startup.
- **Photo Name Format** - Extended the method of defining the location of the strip and photo numbers within a file name.
- **Corner Orientations** - Added corner orientation option to Image Utility.

New Mapping Commands

- **List Images (LisIma)** - Display detailed information about all open images. Information includes pixel dimensions, depth, origin, and more.
- **3D VrThree Collection (3DSC or Vr3 or VrThree)** - This is a stereo viewer and collection window for LiDAR points. It is capable of real-time display and editing from large scale LiDAR datasets.
- **LAS Import and Export (LasIn, LasOut)** - Added support for translating LiDAR points to and from VrOne/VrTwo using the LAS format.

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- **Line Smooth (LinSmo)** - Toggle line smoothing in VrTwo roaming.
- **Zoom Filter (ZooFil)** - Smooths the display of pixels in VrTwo roaming which results in better image quality when zoomed below 1:1.
- **List Undo (LisUnd)** - Display detailed information about the current Undo state.

Image Enhancements

- Display of rotated TIFF images are now fully supported in VrOne. Please see the following links for more information about rotations support in word files: http://en.wikipedia.org/wiki/World_file and http://webhelp.esri.com/arcims/9.2/general/topics/author_world_files.htm.
- Better handling of 12-bit images.

VrThree (VrLiDAR) Product Brief

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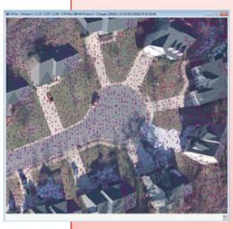
Vr Mapping Software

VrLiDAR

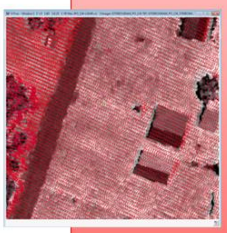
True, Three Dimensional Environments

VrLidar allows you to add value to LiDAR data using the Vr Mapping software

VrLiDAR is the integration of LiDAR data into the time tested Vr Mapping Software packages VrOne® and VrTwo. These packages allow the display and editing of LiDAR point data in 2D and in true three-dimensional stereo. The four configurations available in VrLiDAR enable vector, symbol and text entities to be collected and edited using the extensive VrOne/VrTwo mapping tools.



Mapping professionals now need the ability to collect three dimensional vector data from traditional photogrammetric sources such as aerial and close range photography. There is also a growing need to collect the same vector data from LiDAR in the form of points over photographic stereo images and from point clouds alone without any photography. In today's market one method of data collection is no longer adequate and VrLiDAR offers several methods of vector collection using photography and (or) LiDAR point data.



Features include:

- A familiar, existing Vr Mapping interface
- Multiple, true three-dimensional working environments
- Ability to store large amount of points along with vector data
- LiDAR point and polygon editing tools
- Ability to collect and edit vector mapping data on top of LiDAR data
- Compatible with aerial and ground based mobile and static LiDAR data
- Support for over 190 existing Vr Mapping commands and applications
- Automatic Cursor Draping available in the 3D ViewPoint environment
- Up to 16 LiDAR attributes per point including intensity and classification
- User defined point density, point size and decimation density
- High speed input and output to and from LAS and other data formats
- Offered as an optional option to VrOne and VrTwo



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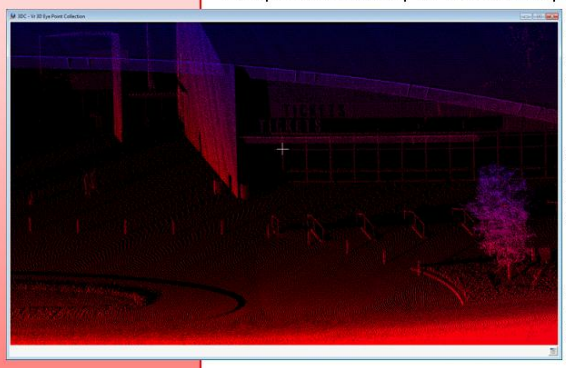
VrLiDAR

True, Three Dimensional Environments

The task remains the same; extract intelligent data from images and (or) LiDAR in the form of vectors and attributes for various disciplines. VrLiDAR offers the environments to utilize existing personnel and software for photogrammetry firms while offering new and powerful environments for other mapping disciplines.

In addition to collecting and editing vector data, LiDAR point data can be edited using VrLiDAR. Tools such as polygon and cursor draping, bulldozing and close delete help the user to manage and refine point data. Now included in the VrOne/VrTwo graphics data base is the capability to store large amounts of LiDAR point data. This point data includes the attributes as defined in the ASPRS LAS data format. Translation to and from LAS files is a fast, simple and easy process. Other point data formats are also supported by VrLiDAR.

Choices for collection and editing include many environments in VrOne and VrTwo. Each environment has the ability to collect and edit vector data and edit LiDAR points. Multiple methods may be used to complete a project. All environments support user defined point density and size display parameters. All existing VrOne/VrTwo commands and applications are available in each of the four environments.



2D ViewPoint—Very large amounts of LiDAR data can be displayed in this mode with the ability to optionally display rectified images as a backdrop. This environment is useful for cutting and management applications.

Photogrammetric Stereo—LiDAR points can be displayed with traditional photo based photogrammetry using VrTwo in static or roaming modes. Any of the Vr supported camera and sensor types may be used.

LiDARgrammetry— The use of synthetic stereo imagery derived from the LiDAR point intensity data using VrTwo in static or roaming modes.

3D ViewPoint - Point data is displayed in true three-dimensional stereo and vectors, symbols and text may be collected on top of this data. The data may be viewed from any viewpoint, origin and scale. Each may be dynamically controlled by the user at any time. Two cursor modes include Cursor Draping and Free Motion. Cursor Draping holds the cursor to the LiDAR surface in the Z axis as it is moved in the three-dimensional viewing space.

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cardinal systems

Before Installing Vr Mapping Version 5

Vr Mapping version 5 requires an OpenGL based graphics card that supports Frame Buffer Objects.

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Your system can be tested for compatibility with Vr Mapping version 5 by downloading and installing a test program. This program is available on the Version 5 download page. The use of this small test program is recommended before downloading the full installation.

NOTE: Users with a **Quadro FX 1400** graphics card should look over the Graphics Drivers help page and make sure they are running a supported driver version.

6.3 Versions 03.02.00 - 03.03.29

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Release Notes

Changes, additions, bug fixes to VrOne and supporting programs

Versions 03.02.00 - 03.03.29

Latest Beta Changes

VrMosaic

General Operation

- Fixed probthlem with assigning a single text label to multiple sheet layouts.
- Polygon and rotated sheets are now supported in batch mode.
- Fixed display when backing up on seam lines.

VrOne

Batch Join (BatJoi)

- Fixed problem with not saving the Z Tolerance and Append to Drive file settings.

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Batch Node (BatNod)
- Added undo support.

Batch Trim (BatTri)
- Added ability to undo.

Clear Polygons (ClePol)
- Added ability to undo.

Cut Polygon (CutPol)
- Added ability to undo.
- Fixed problem where some lines were cut to the boundary but not deleted.

Cut Window (CutWin)
- Added ability to undo.
- Fixed problem where some lines were cut to the boundary but not deleted.

DXF Out (DXFOUT)
- Fixed problem with DXFOUT not translating -1.0 coordinates.

Delete Outside Boundary (DelOut)
- Fixed problem where some lines were cut to the boundary but not deleted.

Drive Grid (DriGri)
- MenuKey display is updated when parameters are changed.

Drive files
- Added option to mark points as complete. When opening a drive file, an option may be set to ignore completed points. New commands are: Drive and Set Complete (DRIANDSET), Drive Set Complete (DRISET, Drive Clear Complete (DRICLE, Drive Reset Complete All (DRIRESCOM), Drive Toggle Skip Completed Points (DRITOG).

Grid Line (GriLin)
- Fixed problem that could cause the graphics window to center on the 0,0,0 coordinate when Window Shift (TogWin) was on.

DTM
- Fixed problems in DTM engine that could cause a crash with certain configurations of crossing breaklines.

Edit Toolbars (EdiToo)
- Fixed problem with Add Separator adding two entiries.

Edit Image (EdiIma)
- Added option to move images. **WARNING: The image world files will be modified, please make a backup of the world files before using this command.**

Function Keys
- Added ability to export and import the functions keys in a comma-delimited format.
- Added new Function Keys to Layer Names (FUNLAY) command. This command will set layer names based on function key descriptions.
- Fixed possible crash when deleting keys with long names.

General
- Added support for file locking for VrOne files. If a Vr Mapping application (VrOne/VrTwo/VrMosaic/VrLite) has a VrOne file open as the active workspace, and another Vr application tries to open it, it will open in READ-ONLY mode. This will prevent multiple

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users from attempting to change data in the same file. The user may configure whether files inactive workspaces are opened in READ-ONLY mode or not.

- Fixed three-way toggles in graphics window settings (from the settings toolbar item in the lower right corner of each graphics window).
- Removed limit of 40 fields in number line strings.
- Added prompts to most dialogs before overwiting existing files.
- Changed most dialogs to display on top of Main Window.
- Added support for an alternate pen table to be used to display inactive workspaces. A new option in the "Vector Graphics" dialog in Vr Configuration allows an alternate pen table file to be specified. If this option is set, the alternate pen table wil be used when displaying inactive workspaces. New commands added include: Load Alternate Pen table (LOAALTPEN), Reset Pen Table (RESPEN), and Reset Alternate Pen table (RESALTPEN). The Reset commands set all pen numbers to 1 in the current or alternate pen table.
- Improved reading of Kork macro files.
- Increased maximum numbers of layers to 32001.
- Added symbol and line font browser button to most dialogs that ask for a graphics pointer.
- Undo and Redo commands display the name of the last redo or undo action taken.
- Commands in Macros are now executed one at a time. Normal commands such as SavAs will wait before continuing to the next command in the Macro.
- The WAIT command now works in Macros to prevent any applications from loading until the current application is completed. This is useful after the RUN command for batch routines.
- Two new command, OVERLAY (Ove) and NOOVERLAY (NoOve) have been added to assist in function key programming. NOOVERLAY turns off application overlay mode so only one more application can be added to the stack at a time. OVERLAY turns back on normal overlay mode. When using NOOVERLAY, always follow it with a OVERLAY command before the function key ends or VrOne will be left in NOOVERLAY mode.
- Added ability to pass in arguments to macro commands. Any occurrence of %# (where # represents any number) will be replaced by the corresponding argument type in after the macro command. Arguments must be separarted by spaces. If an argument contains spaces it must be surrounded by quotes. For example, if a macro named "D" contains the text "DRI %1", and the user types in "D 10", then the command "DRI 10" will be issued.
- Added ability to pass in arguments to python scripts. Any items added to the command line when running python scripts will show up in the VrArgs global list variable. Arguments must be separated by spaces. If an argument contains spaces it must be surrounded by quotes. For example, to run a python script named “drawcircle” that takes arguments for the center point and radius you would type “py drawcircle “10.0 10.0 20.0” 150.0”. In this case the VrArgs variable will contain two elements, and if printing the VrArgs variable will display the following: [‘10.0 10.0 20.0’, ‘150.0’].
- Added option to run python scripts without using the PY command. A new option called “Require PY command to run python scripts” must be turned off to use this new feature.
- Added the Spawn command which runs a command with arguments from the operating system.

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Images

- Added support for displaying color images as grayscale in graphics windows. This option is avaiable form the toolbar button in the lower right hand corner of all graphics windows.
- Added support for reading and writing ECW format images. Files larger then 500MB cannot be written.
- Added support for writing JPEG2000 images to several imaging routines.
- Added abillity to sort by image type in image open dialog.
- Added support for 16-bit per channel images.
- Fixed problem with building image pyramids for Mr. Sid files.
- Fixed crash that would happen if opening a TIFF image with Pyramid creation mode set to internal, but the internal pyramids could not be created.

Insert Line (InsLine)

- Added option to explode spline lines and fonted lines.

Insert Text (InsTex)

- When placing elevations, added the ability to define the number of places to the left of the decimal point. This compliments the existing ability to set the number of places to the right of the decimal point.

Insert Symbol (InsSym)

- If the number of points to define a symbol is set to two and the symbol interactive rotation is on then the scaling and rotation of the symbol is handled as a single step. This reduces the number of digitized points in this case to two. During this process the symbol is shown interactively to display the current scale and rotation.

Layer Control (LAYCON)

- New layer names can now be set from this dialog.

Microstation In (MSTIN)

- Added support for cross referencing line styles in the Level Cross-Reference table.
- Added support for cross referencing cell names in the Level Cross-Reference table.
- Fixed symbol scaling problem during import of cell definitions.
- Fixed saving of translate separate parameter.
- Fixed problem with adding items to xref tables.
- Fixed problem with xref of points.
- Added output of non xref entities to error log.
- Added "Use Microstation cell radius to scale symbols". This option uses the original Microstation cell radius to control the size that is used when placing Vr symbols. This option is only supported with .mst created with Version 1.37 or higher of the MSTOUT MDL program.

Microstation Out (MSTOUT)

- Added "Use Microstation cell radius to scale symbols". This option uses the size of the Microstation cells in the attached Microstation cell libarry to control the size that is used when placing Microstation cells. This option is only supported when using Version 1.37 or higher of the MSTIN MDL program.

Set Dtm (SetDtm)

- Added minimum contour length option.

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Update Workspace (UpdWs)

- Added new command that updates read-only workspaces to reflect the latest changes. This is useful if you have VrOne files open that someone else has edited and you want to have the files display the most recent changes without closing and opening the workspaces. If ran without any parameters, all open workspaces are updated. You can pass in a workspace number to update a single workspace.

Python

- Fixed problem with selecting symbols and text using IdEnt method of PyVrWs class. This could cause a crash if the number of symbols or text entities was greater than the number of line entities.
- Added StartWsWrite, EndWsWrite, SetReadOnly and GetReadOnly methods to PyVrWs class. See the PyVrWs help file for more details. Due to the new option to keep inactive workspaces in a read-only mode, these commands are needed if you write python scripts that change entities in inactive workspaces. The common use is to call StartWsWrite before beginning a batch process that will change inactive workspaces, and to call EndWsWrite when the process is cimpleted. StartWsWrite will return a -1 value if all workspaces could not be opened for writing.

Python Editor

- Saves last window position and size
- Display five most recently opened file in File pull-down menu.

Workspace Control (WsCon)

- Added this new command that allows visibility of workpsaces to be controlled. This will display a dialog listing all workspaces. The visibility for each workspace may be controlled with check boxes, and may be set separately for each graphics window.

Close Workspace (CloWs)

- Added abililty to pass in a number line for workspaces to be closed.

Zoom Fit (ZooF)

- Fixed problem that could cause VrOne to crash using this command.

Hatch Line (HatLin)

- Fixed problem that could cause the hatching angle (HatAng=) to be entered incorrectrly

VrOrtho

General Operation

- Preview window supports transparent black and white pixels.
- Fixed problem with image not being filled out completely with irrefular shapred boundaries.
- Added ISAT exterior orientation import.
- Added option to write GeoTIFF tags.

VrTwo

Correlate Area (CorAre)

- Added maximum seed distance option.
- Fixed problem where grid points that go outside the minimum or maximum elevation would be placed at the minimum elevation. This version will not place the points if they fall outside

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of the min/max range.

General

- Fixed Z interpolation when displaying splined lines in stereo.
- Fixed cursor changing to wide line after placing wide lines in static and roaming.
- Fixed display of imported symbols in roaming. Was displaying extra lines on symbols.

VrTwoOrientation

Zi ISAT Exterior Orientation

- The first two fields have been changed from PhotoNum StripNum to StripNum PhotoNum.

Batch Orientations

- Interior Orientations Batch (IntBat) - Added this batch application which imports interior orientations from several formats.
- Exterior Orientations Batch (ExtBat) - Added this batch application which imports models using exterior orientations from a variety of aerial triangulation formats.
- Measurement Orientations Batch (ExtBat) - Added this batch application which imports models using photo measurement orientations from a variety of areial trianglelation formats.

General

- Change Drive (ChaDri) - Fixed problem that could occur if the models were not in the project folder.
- Added the ability to import Exterior Orienations from the ISAT 'photo' file. This is supported when importing single models or importing modes in batch mode.

VrConfiguration

General Settings

- Added option new option called "Keep inactive woakspaces read-only". This works with the new file locking capabilities in VrOne/VrTwo. If this is on, then any VrOne vector files that are opened but are not active will be kept in a read-only mode. This allows other Vr Mapping products to open the vector files in to open Fixed problem where Project Parameters dialog would display twice
- Added new option in Vector Graphics called "Alternate Pen Table". If this is filled in with a pen table filename, the pen table will be used when displaying non-active workspaces. This can make it easy to visually identify the active workspace when multiple VrOne files are open.

Version 3.3.02 March 12, 2007

VrOne

General

- When running the Windows desktop in "Windows XP style" some dialog boxes with as the VrTouchscreen did not show the proper button colors. This has been fixed. This was

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not a problem when running "Windows Classic style".

Delete Outside Boundary (DelOut)

- Ignores two points lines.

DXF Out (DXFOUT)

- The dxf.err file will now be written to the same directory as the project file.

Insert Fly Line (InsFly)

- Added Attach and Attach and Run options.

Python

- Added IdEnt method to PyVrWs class.

Vr Balance (Version 1.3.03)

General Operation

- Fixed problem with crashing when demo period is below 10 days.

VrOrtho (Version 1.2.04)

General Operation

- Fixed issue with using cameras containing large principal offset values.
- Fixed crash when exiting Inner orientation.

VrMosaic (Version 2.5.03)

General Operation

- Fixed problems with dynamic editing of seam lines.
- Added ability to assign seam lines to images using an image name in the Edit Properties dialog box.
- Added ability to select active image by name when placing polygon seam lines. Assigned to button 5 (Set Image).

Python

- Added IdEnt method to PyVrWs class.

VrOrtho (Version 1.2.03)

General Operation

- Fixed problems that VrOrtho to crash when running multiple images with large DTM datasets.
- Added browse button when selecting output image folder in file selection dialog.

Version 3.3.02 February 20, 2007

VrMosaic

General Operation

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- Fixed problem where cursor would sometimes not display in the overview window.

VrOne

General Operation

- Fixed problem with delay when dialog boxes are displayed.

DTM

- Fixed problems in DTM engine that could cause VrOne to crash when runnning on certain surfaces, and when computing volumes.

Microstation In (MSTIN)

- Fixed pen codes on line fonts when importing linestyles made from arcs. This could cause line fonts to not show up while roaming in VrTwo.

Plot (Plo)

- Fixed problem with images not being plotted.

Python Editor (PYEDI)

- Changed default width to cover at least 80 characters..
- Added Ctrl-E shortcut key to exit the editor.

Python

- Double fields in VrPromBox that are left blank are returned as 0.0. Previous versions returned an undefined number.

VrTwo

DTM

- Fixed problems in DTM engine that could cause VrTwo to crash when runnning on certain surfaces, and when computing volumes.

Insert Parallel Line (InsPar)

- Fixed graphics display in roaming mode.

VrOrtho (Version 1.2.02)

DTM

- Fixed problems in DTM engine that could cause VrOrtho to crash when creating orthos.

Version 3.3.01 February 08, 2007

VrOne

Microstation In (MSTIN)

- Fixed line font scales when importing linestyles.
- Fixed problem with line font 0 getting corrupted during import.

VrTwo

Correlate Area (CorAre)

- Fixed so cursor drives to points in roaming mode.

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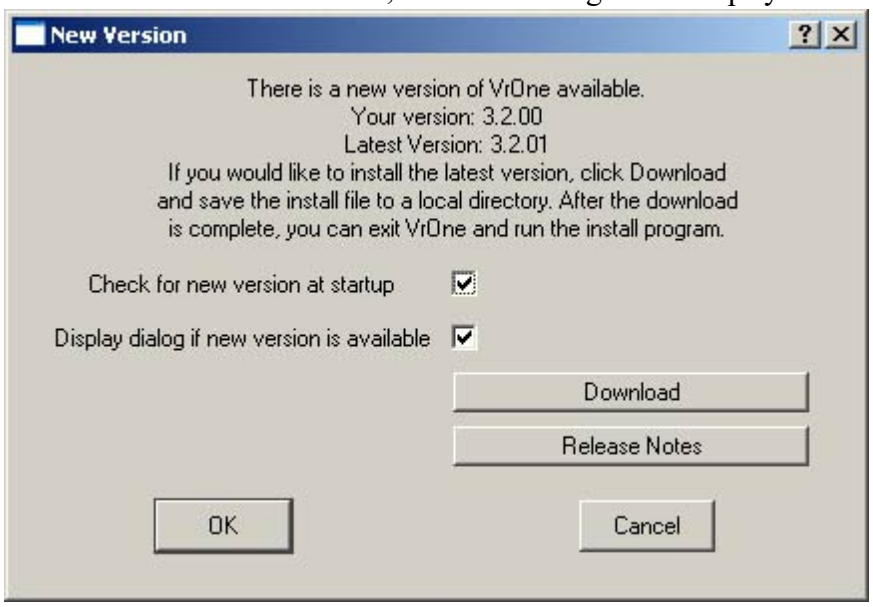
Version 3.3.00 January 30, 2007

General

- Optimziations to code resulting in up to 30% speed increase in many areas of the Vr application suite.
- File open dialog displays size correctly of files larger than 2,147,483,648 bytes.
- Added option to check for new software releases when an application is started. This was added to VrOne, VrTwo, VrLite, VrOrtho, VrMosaic, VrAt, and VrBalance. If a new version is available for download, the follow dialog will be displayed:



From this dialog you can control the startup options, download the new release, and read the release notes.

A new command (CheVer) has also been added to the About and Hellp pull down menus to allow you to check for a new version at any time.

Image Utility

Image Rotation

- It is no longer required to load an entire image into memory when rotating. This should eliminate the out of memory errors that were reported in previous versions.
- Fixed compression option to write out compressed images if compresstion rate was set to anything above 0.

VrOne

Batch Grid (BatGri)

- Added progress bar during grid creation.
- Decreased memory requirements.

Batch Smooth (BatSmo)

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- B Spline options does smoothing correctly at the beginning of closed lines.

Coordinate Dialog

- Changed so that Z changes when entities are locked onto.

Correlate Area (CorAre)

- Added options to load, save and reset parameters.
- Added options to iterate over each grid location.
- Added option to use seed points and lines to improve correlation reliability.

DTM

- Contours are now generated so that lower elevations are always to the right of the contour.
- Contours created with B Spline option are now smoothed correctly at beginning of closed lines.

Image Support

- Fixed support for displaying rotated images based on values in .tfw world files
- Fixed problem with GeoTIFF tags not being recognized in some TIFF images.

Microstation In (MSTIN)

- Fixed import of cell definitions where arcs or circles were part of the definition.
- Added support for translating line style definitions to VrOne line fonts.

VrTwo

Handwheel supprt

- Fixed problem with using the arrow keys to shift the screen with handwheels as the 3D input device.

VrTwo Orientation

Stereo Window

- A Rotate 90 button has been added to the stereo window that is used to clear parallax. This is useful when the images to be measured lie above and below each other instead of side to side. Rotating the images 90 degreeswhen the images are in the orienatation makes stereo viewing easier.

VrAirTrig

Stereo Window

- A Rotate 90 button has been added to the stereo window that is used to clear parallax. This window may be used from Measure in Remeasure. This is useful when the images to be measured lie above and below each other instead of side to side. Rotating the images 90 degrees when the images are in the orienatation makes stereo viewing easier.

Version 3.2.00 December 29th 2006

VrOne

Ascii In (AscIn)

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- Fixed problem with converting more than approximately 550 files.

Ascii Out (AscOut)

- Added layer width options to parameters.
- Added ability to set the output layer field width.
- Added option to write one ASCII file per workspace.
- Added batch mode.

Batch Flow (BatFlo)

- Added this application. This batch application can be used to make the elevations of existing lines flow in a single direction, either with increasing elevations or decreasing elevations. This is useful if your project requirements call for a feature to always flow in a consistent direction, such as when collecting streams. Any single point or series of points that do not flow in the required direction will be replaced by interpolated elevations using the point preceding the incorrect point(s) and the point following the incorrect point(s). If a point or series of points falls at the end of a line, then the previous correctly flowing segment will be used to interpolate the new elevations. The direction of flow can be specified as increasing or decreasing, and the application may be applied to multiple workspaces and multiple layers. A drive file will be written containing all points that were changed.

Batch Join (BatJoi)

- Fixed possible crash problem when using match option.

Batch Node (BatNod)

- Fixed problem that could cause wrong Z value to be assigned when using the Z from line 1 or Z from line 2 rules.

Command Line Arguments

- When starting VrOne/VrTwo the following arguments may be used to change the way VrOne/VrTwo starts. When starting with arguments the software must be started from a Command Prompt window or the shortcut that starts VrOne/VrTwo must be modified. Added following command-line arguments:
  - -a y|n - Allows the macro named AutoStart to run. This macro may be set up and will run when VrOne/VrTwo starts if this argument is not defined or set to Yes. Example: VrOne -a n would start VrOne but the AutoStart macro would not be run.
  - -k keyin - Runs a user-defined key-in when VrOne/VrTwo starts. Example: VrOne -k MyMacro would start VrOne and then run MyMacro as a key-in.

DXF Out (DXFOUT)

- Fixed problem where blocks exploded in AutoCAD 2006 would produce undefined Z values on the exploded entities.
- Added option to use closed flags on closed lines.

DTM

- Fixed Z range reporting when loading surface files.
- Fixed problems with hanging and crashing on certain data sets.

General Operation

- Fixed problem that could cause programs to ask for passwords when switching between VrOne and VrTwo.

GeoTiff

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- Fixed problem that could cause cFixed possible crash problem when using match option.rash when opening GeoTiff files.

Edit Symbol (EdiSym)

- Edit keyboard no longer truncates feature codes to 15 chars.
- Fixed problem where change dialog would not save changes if link field was the only field changed.

Edit Text (EdiTex)

- Edit keyboard no longer truncates feature codes to 15 chars.
- Fixed problem where change dialog would not save changes if link field was the only field changed.
- Fixed problem where change dialog would not save changes if feature code field was the only field changed.

Fix Arcs

- Ignores layers that are turned off.

Image Handling

- Fixed problem with reading past last strip in strip based TIFF files. Could cause image display to run very slow.
- Added .j2k to list of extensions when opening images
- Fixed problem where images that have GeoTIFF data could cause a crash.
- Improved handling of Mr. Sid files.
- Uses center of pixel as upper left origin when opening Mr. Sid and Jpeg 2000 images with internal georeferencing.
- Uses center of pixel as upper left origin when opening Jpeg 2000 images with external world files.

Image Merge (ImaMer)

- Added support for long output file names.
- Fixed problem with using pyramid levels other than 1.
- Fixed problem where processing certain file formats could produce a blank output image.
- Fixed crash when merging overlapping images.
- Fixed intermittent problem with missing a pixel column between images when using output pyramid levels other than 1.

Insert Orthogonal Line (InsOrt)

- Added this interactive application. Inserts an orthogonal line in which results in a squared polygon based on the first two points read and subsequent segment points. The line may be closed back to the original line segment or left open. Each line segment assumes a 90 degree turn from the previous line segment. Each squared polygon is started by reading two points along one side of the polygon. This is normally the longest or most visible side. Subsequent points are read anywhere along following line segments. The polygon must be read in a clockwise or counterclockwise direction from the base line.

Insert Orthogonal Corner (InsOrc)

- Added this interactive application. Inserts an orthogonal line in which results in a squared polygon based on the first two points read and subsequent polygon corner points. The line may be closed back to the original line segment or left open. Each squared polygon is

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started by reading two corner points along one side of the polygon. This is normally the longest or most visible side. Subsequent points are read on polygon corners. The polygon must be read in a clockwise or counterclockwise direction from the base line. A Squaring Tolerance may be specified. If the next corner point is within this tolerance the resulting line will be orthogonal to the original line segment. If the next corner point is outside this tolerance then the the line point will fall where digitized resulting in an un-squared side. Each corner point my turn 0, 90, 180 or 270 degrees from the previous segment. If a corner point is 0 degrees from the previous line segment then the new line will be a straight line from the previous line.

Insert Line (InsLine) / Insert Fly Line (InsFly)

- A Lake Line option has been added to these application which sets the elevations of the points on a line to the first point on the line. The LakLin=1 Local Command may be used to turn this option on.

Layer Control (LAYCON)

- Fixed problem where turning on or off two layers in a row without waiting for the first to replot could cause a crash.

Load Dtm

- Was reporting Unknown command if parameter file could not be found.

Macro Programming

- If the RUNDTM is used in a macro, the macro will not continue until the DTM process is complete.

Microstation Out (MSTOUT)

- Fixed misc. arc handling problems.
- Fixed problem with handling 2 point line segments between arcs.
- Fixed problem with compound and reverse arcs. This problem could invalid arcs when translated to Microstation.
- Added PARFIl and RUN keyins.
- Added log file options.

Plot (Plo)

- Added support for long output file names.

Polygon Elevation (PolEle)

- New application that changes the elevation of symbols inside a polygon.

Python

- Updated to use Python 2.5 libraries. If you have existing scripts, please see the What's New in Python 2.5 document, in particular see the Porting section.
- Fixed VrLayer.CondNumLine
- Added PYEDI command to launch interactive Python Editor.

Redo (Red, Redo)

- New command that will redo the last Undo command. Redo is only available directly following an Undo command. Redo can be issued multiple times if multiple Undo command were issued in succession. If an optional "All" argument can be passed to redo all previous Undo commands. Redo All will only redo multiple Undo commands if they occurred in succession, and if an Undo was the last command entered.

Set Dtm (SetDtm)

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- Fixed problem where dialog would not allow "Area to Model" and "Workspace to Consider" to be chosen.
- Added option to save excluded points to a file. These are points that fall outside the minimum and maximum Z range and may be saved for review.

Shape Out (ShaOut)

- The number of user attribute fields has been increased to 30.
- The version 8.3 file name limit has been removed.
- Fixed default length to 255 on LABEL field.
- Added option to write four theme files. Each theme file can have contents of either Points, Polylines, Polygons, or Text lines.
- Added option to output text entities as 2 point lines. Theme file is written as polylines.

Snap MenuKeys Dialog

- Added Zoom to button 3 of the Snap MenuKeys dialog which zooms the graphics window to the extents of the snapped to entity.

Snap Search Line (SnaSeaLin)

- Added key-in to set Search mode to Closest Line.

Snap Search Point (SnaSeaPoi)

- Added key-in to set Search mode to Closest Point.

Symbol Names

- Extended the number of characters that may be used for a symbol name from 15 to 31.

3D Viewer (3D, 3DS)

- Improved panning.
- Added option to set new rotate point using Shift->Right Click.
- Fixed problems with hidden line removal in 3D viewer.

Volumes

- Fixed problem where some triangles were not being trimmed to the boundary line.

Window Control (WinCon)

- Added this VrOne/VrTwo control. Window control provides a way to control which images are displayed in each VrOne graphics window, and to change the display order of the images. VrOne allows multiple windows to be open at once using the OPEN WINDOW (OpeWin) command. Each window displays vectors and images, and tracks the cursor. When ran, the WINDOW CONTROL application displays a list of all currently open images, along with a check box beside each image.

Window Shift (WinShi)

- New command that allows user shift percentage to be set for panning graphics windows..

Alternate Window (AltWin)

- New command that allows the user to specify an alternate window for zooming commands by holding down the Alt key when using the Zoom keys (Page Up, Page Down, Arrow Keys).

Zoom Visible (ZooVis, ZooV)

- This new command has been added which zooms to the extents of the visible entities/ images

Zooming

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- Fixed zoom direction when using the Alt-PgDn Alt-PgUp keys.

VrTwo

Control Drive (Cd ConDri)

- This command drives to control points in stereo that were used to orient the current model. The normal syntax is Cd n where number is the control point number sequence. Two variations of this command have been added; Cd with no arguments will drive to the next point and Cd P will display the control points and the user can select the control point to use.

DTM (RunDtm)

- There were certain situations in which lines would not be displayed after the DTM surface was processed. This has been fixed.
- Recently collected break lines would disappear from display if roaming in VrTwo and the RunDtm command was used. Using the Home key would display the break lines again.

General Operation

- Added support for disabling overlay mode for interactive graphics. This is useful when using passive stereo mode where two monitors are used.
- Change in how symbols are roamed to try to improve performance on certain stereo cards.
- Fixed F11 snap toggle in static and roaming modes

Image Handling

- Fixed problem that could cause crash when opening GeoTiff files.

Multiple Windows

- When using 2D overview windows in static or roaming mode, and using a 3D input device, the stereo window cursor will only respond to the 3D input device. In roaming mode, you can force the stereo window to roam when the cursor is moved in other windows by turning on Roaming Cursor mode.

Redo (Red, Redo)

- New command that will redo the last Undo command. Redo is only available directly following an Undo command. Redo can be issued multiple times if multiple Undo command were issued in succession. if An optional "All" argument can be passed to redo all previous Undo commands. Redo All will only redo multiple Undo commands if they occurred in succession, and if an Undo was the last command entered.

Window Align (WINALI)

- Fixed to compute correct aligment to stereo model and fixed symbol rotations for different model orientations.

VrOrtho

Image Processing

- Fixed problem where background pixels would sometimes not be written out as pure black or white.
- Fixed problem where window mode was always used during resampling.
- Fixed problem where images that have GeoTIFF data could cause a crash.

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Excluded Points

- Added option to save excluded points to file. These are points that fall outside the minimum and maximum Z range and may be saved for review.

General Operation

- Fixed problem that could cause crash when using surface files.
- Added option to specify a file to write excluded points.
- Added option to specify minimum and maximum input Z range.
- Fixed problem with using image fiducials for ortho area bounds.
- Added option to exclude all pure black and white pixels.
- Fixed problem with processing multiple orthos that could cause orthos to be skipped when using VrOne files for DTM input. This problem did not happen when using a surface file.
- Writes processing information to vrortho.log file in the current project directory.
- Fixed problem where images that have GeoTIFF data could cause a crash.
- Fixed problem where window mode was always used during resampling.
- Fixed problem where background pixels would sometimes not be written out as pure black or white.
- Fixed Z range reporting when loading surface files.
- Fixed problems with hanging and crashing during ortho creation.
- Fixed replotting problems in preview window.
- Does not create surface file unless option is checked

Image Pyramids

- Fixed problem where using a relative path in the output directory would cause external pyramids to get created in the wrong location in the pyramid directory.

Processing Speed

- Improved speed when processing orthos that go outside DTM boundary.
- Improved processing speed on jobs with large DTM data sets.

Import Orientations

- Supports importing of VrTwo orienations where projects are in a folder with a space in the name.

VrAirTrig

Layout

- Show Measured Control - Redesigned the routine to display points faster.
- Added Show Blunder Point - This routine allows the selection of a blunder point from AtAdjust and zooms the window to the photo occurrences of that point. The point may then be viewed and (or) remeasured.
- Added Clear Point Markers - Point markers mark points as a result of Point Search, Show Measured Control, Show Blunder Point and Drive Control.
- Added Drive Control - After a full adjustment has been completed it is now possible to drive to unmeasured ground control points. These points must be in the ground control file. A list of ground control points is show with the control points already on a photo or photos marked. Points that are not on a photo may be displayed with options to place the point on No Photos, One Photo or All Photos in which it falls. This routine requires the AtAdjust

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option.

Remeasure

- Added the handling of point measure flags
- Added Toggle Measure Flag which allows the toggling of the measure flag for each photo.
- Added the ability to hold one or both sides when measuring a point in stereo.

VrAdjust

- Added support for the AeroSys adjustment engine. Two methods of adjustment are available which are "Check Photogrammetry" and "Full". Options include the ability to write an adjusted control file, an unadjusted control file and the exterior orientation file.

VrMosaic

General Operation

- Added automatic seam noding after each seam line is saved.
- Added node seams option to node existing seam lines.
- Added Seam Node Search Distance parameter. This is used during automatic and manual seam noding.
- Fixed problem with segment widths.
- Added option to set feather width on each segment during seam collection. Previously this was only available when editing a seam line.
- Closes existing VrOne files when a project is opened. This prevents problems that could occur from collecting seam lines in the wrong workspace.
- Doesn't allow duplicate images in the project.
- Fixed Edit Seam props crash if strip-photo format invalid.
- Seam line file name is not stored in project defaults.
- Prevents place or edit seams mode if no seam file open.

Snap MenuKeys Dialog

- Added Zoom to button 3 of the Snap MenuKeys dialog which zooms the graphics window to the extents of the snapped to entity.

Zoom Visible (ZooVis, ZooV)

- This new command has been added which zooms to the extents of the visible entities/ images

VrTwo Orientation / VrTwo

Epipolar Resampling

- The dialog boxes in this program now update periodically during Epipolar resampling.
- Batch epipolar resample now works after importing exterior orientations.
- Fixed problem that could cause the program to crash during epipolar resampling.

Image Handling

- Support for Mr. Sid files.

ImageStation ISAT Camera File

- Added the ability to import an ImageStation ISAT camera file.

Import ImageStation ISAT Orientation

- Added ability to read interior orientation measurements from ImageStation ISAT photo

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file. Using this method, the interior orientations do not need to be done before importing a model from this format.

ORIMA Orientation

- Added ability to read interior orientation measurements from ORIMA .iop files. Using this method, the interior orientations do not need to be done before importing a model from this format. NOTE: The corresponding .iop files must be in the same folder as the images to use this feature. The .iop file will have the same name as the image but with an .iop extension.

Project Management

- .vim files are now stored in the project folder. This allows raw images to be used from a read-only folder.

VrConfiguration

Project Parameters Dialog

- Fixed problem where Project Parameters dialog would display twice

Image Utility

Automatic Inner Orientation

- Added options to specifiy search window sizes
- Improved search algorithm
- Added 32x display scale

General Operation

- Fixed crash caused by demo period warning dialog
- Added support for .jpg files in most of the image processing utilities.

Project Management

- .vim files are now stored in the project folder. This allows raw images to be used from a read-only folder.

Microstation MDL translators

General Operation

- Added version of MSTIN and MSTOUT MDL programs to work with Microstation V8 XM edition. File names are mstoutxm.ma and mstinxm.ma.
- Added new option in MSTOUT MDL to output line style definitions. If the keyword LINESTYLES is added when loading the MSTOUT MDL (mdl load mstout styles), then linestyle definitions will be added to the .mst file. These linestyles can then be converted to VrOne line fonts using options in the VrOne MSTIN command.

Vr Balance

General Operation

- Fixed problem where the -l (load file) parameter was being ignored in silent mode.

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6.4 Versions 02.59 - 03.01

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Vr Mapping

Release Notes

Changes, additions, bug fixes to VrOne and supporting programs

Versions 02.59 - 03.01
Release notes file begins with VrOne version 2.59
The latest changes are listed first.

Version 3.01 March 3rd 2006

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VrOne

- **VrTouchscreen** – Increased maximum button size to menu fits into the touch screen when the resolution is set to 1024x768 with no gaps between the buttons. The newer touchscreens no longer support 800x600 and 1024x768 can be used.
- **VrTouchscreen** – When running multiple graphics windows it was possible for the mouse pointer to return to the wrong windows after pressing a button on the VrTouchscreen. This has been fixed.
- **Manage DTM** (ManDtm) - Added header file and project name options to volumes reporting options. Added option to save delta TIN when computing volumes.
- **DxfOut** (DxfOut) - Fixed problem where creating a DXF with mixed dimensions (using per layer settings), could cause 2D lines to inherent Z from previous 3D line. This was a workaround for a bug in the AutoCAD DXF file import process.
- **DxfOut** (DxfOut) - Added option to specify entity linetype and entity color modes per layer (either ByLayer or ByEntity).
- **Coordinate Dialog Box** (CooDia) - Added new Coordinate Dialog command. Displays a floating dialog that displays the current x,y or z location of the cursor. Right-click for options. Options include Font Size, Font Type, Font Color and decimal accuracy.
- **AutoStart Macro** - At startup, if VrOne finds a Macro named "AUTOSTART" it will run it automatically. This provides a way to have VrOne issue a set of commands each time it starts.
- **Range Checking for DTM** - (SetDtm) - Added options for minimum and maximum Z input range. If any input data to the DTM engine is outside this range it will not be used.
- **Shape Out Translator** – (ShpOut) - Was not reading angle conversion options from parameter files. This has been fixed.
- **Batch Areas** (BatAre) - Changes the layer and graphic pointer of lines that meet a user-defined search criteria. Lines will be chosen for change based on each line's area and layer. Lines that are open can still be considered.
- **Batch Direction** (BatDir) – Changes the direction of lines based on their layer and graphic pointer.
- **Batch Grid** (BatGri) - Interpolates points on a grid from existing VrOne data, and writes the grid points as symbols to the current file or to a user specified output file. This is useful for creating a grid of points from existing LIDAR data.
-

VrTwo

- **VrTouchscreen** – Increased maximum button size to menu fits into the touch screen when the resolution is set to 1024x768 with no gaps between the buttons. The newer

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touchscreens no longer support 800x600 and 1024x768 can be used.

- **VrTouchscreen** – When running multiple graphics windows it was possible for the mouse pointer to return to the wrong windows after pressing a button on the VrTouchscreen. This has been fixed.
- **Memory Usage When Roaming –** The method of memory handling for roaming has been redesigned.
  - VrTwo roaming now has the ability to use more available memory when storing image strips which results in smother roaming between image strips.
  - The amount of memory to use may be set in the Vr Configuration program (VrCfig.exe) under Image Graphics -> Maximum Roam Image Memory.
  - A "Memory Low" warning is now displayed if available memory drops below 2%. This is possible when the Maximum Roam Image Memory is set to a high percentage and multiple image levels are used or other programs are started in Windows.
  - The image load thresholds have been moved prevent multiple image loads when moving between two previously loaded strips.
  - The method for loading and displaying the first image strips has been improved.
  - Some pausing may be experienced when starting roaming as VrTwo loads surrounding image strips.
- **Serial Device Interface –** When using 3D input devices such as the Stealth-Z Mouse or Handwheels or the Leica TopoMouse it was possible for the input device to outrun the graphics. This would result in a lag between graphics and the movement of the 3D input device. This was true when dragging complex symbols or long text labels with complex fonts. The input and graphics are now synchronized so there is no longer a lag in these situations. When dragging these types of entities updating will be slower but will remain real-time.
- **Line Fonting** – Fixed problem that could occur then displaying fonted lines in which the first point on the line was displayed at the wrong elevation.

VrAir Trig

- **Layout** – Fixed a problem that could occur when searching for, or adding points where there were photos in the project that were not shown in the Layout.
- **Layout** – Added Show Search List to the points menu that displays the photo names in which the last search point falls within.

VrTwo Orientation

- **JFK Import** – Fixed problem that was causing the interior orientation to fail.

VrOrtho (version 1.70)

- **Progress Bar** - Added progress display during long operations.
- **Image Pyramids** - The program does not generate pyramids for project image until orthos are created.

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- **Image Pyramids** - Added prompt before creating pyramids when displaying orthos in the ortho project view window.
- **Generation Speed** - The speed problem when parts of ortho are outside DTM limits has been fixed.
- **Generation Speed** - Improved processing speed on large DTM data sets.
- **Z Range Checking** - Added option to specify minimum and maximum input Z values.
- **VrOne Files** - The program no longer opens VrOne files when using an existing surface file.
- **ASOP Input** - The ASOP (JFK) import has been changed to use drop-down boxes for rotation angle, and removed option to apply rotation based on strip location.

VrMosaic

- **New Commands** - Added edit symbol and explode symbol.

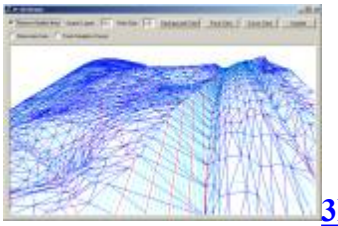
Version 3.00 February 1st 2006

There are over 170 additions, improvements, changes or bug fixes in Version 3.00 of the Vr Mapping Software.

Vr Configuration

- **Help** - Added overall help and help from each data entry dialog box.
- **Highlight Pen Number** - Added Entity Highlight pen number option that allows the setting of the tentative entity color when an entity is "locked onto".
- **Transparent Pixels** - Added option to set black or white pixels as transparent. This is useful when viewing rotated and overlapped images.
- **Levels Adjustment** - Added new option to apply levels adjustment to images. This feature will apply a single levels file to multiple images, or will auto-apply multiple levels files to multiple images.

VrOne

-  3D Viewer (3D,3DS) – Added these new commands displays a 3D viewing window. This is a display only window that allows vector data to be viewed from any perspective and is intended for small to medium datasets. Features include the ability to display 3D lines and points from VrOne layers from the currently

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open files. Options include the removal of hidden lines, the ability to show an axis icon, definition of search layers, point sizes and background, face and cursor colors. It is also possible to display the cursor from a VrOne graphics window into the 3D window.
3D offers three-dimensional viewing in a two-dimensional window, while 3DS allows the view of vectors in 3D if the system is equipped with a stereo graphics card and stereo viewing hardware. The 'Remove Hidden Lines' feature only works when viewing triangles (any closed lines with three points).
The following mouse controls can be used to change the view.

Left button	Up/Down movement=X rotation, Left/Right movement=Y rotation
Right button	Up/Down=Z rotation
Shift-Left button	Pan
Scroll	Zoom In/Out
Shift-Scroll	Faster Zoom In/Out
Ctrl-Scroll	Exaggerate Z scale

- **TIFF Files**
  - Added support for rotated TIFF World files. If a rotation parameter is found in a TIFF world file, it is now used to align vector graphics to the image.
  - Added ability to view color index format TIFF files, such as DOT DRG files. This support is initially limited to viewing images only. Routines that write out new images may not work with color index TIFF files.
- **TIFF Files** - Added support for embedded pyramid images inside TIFF files. This includes reading existing images with embedded pyramid files, and writing embedded pyramid images to existing files. The current version does not have the ability to add embedded pyramid images to compressed files. Embedded pyramids will only be created if the pyramid creation method is set to internal, and there are no existing external pyramid files available. The following options have been added under the Image Graphics section of Vr Configuration:
  - "Pyramid Creation Method" - External - Pyramid files are created externally in the pyramid directory, Internal - Pyramid files are created internally inside the main image.
  - "Add missing pyramid levels" - VrOne normally uses 6 pyramid levels. If an existing file is using internal pyramids, and it has less than 6 levels, the missing levels will be created if this is set to Yes and creation method is set to internal. If set to No, then VrOne will only use the levels available. This may slow down image operations if there are too few levels.
  - "Use internal pyramids?" - If Yes, then internal pyramids are used when found inside an image. If no, then internal pyramids are ignored when reading images.
- **JPEG Files** - Support for standard JPEG (.jpg) files has been added. The user should expect slower display times with JPEG files compared to TIFF files.

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- **Last Windows Open** - VrOne now remembers number of graphics windows open during the last session.
- **Image Levels** (ImaLev) – This is a new command that allows image levels adjustments to be made to opened images. Levels adjustment allows input, output, and gamma settings to be applied to images. An option is given to save the levels adjustment setting with each image so that it is automatically loaded when the image is opened. A new option in Image Utility may be used to apply the levels adjustment permanently. Any image operations that write out new images will also apply the current levels adjustment.
- **Toggle Image Rotation** (TogImeRot) – Added this new command to set toggle the display of rotated image edges. If this is on, then VrOne will attempt to find the true image edge of rotated images, and will display a border around this edge.
- **Image Merge** (ImaMer) – This application now deletes pyramid files correctly. Writes JPEG format files if user specifies .jpg extension.
- **Image Pyramids** - Opening an image from the command-line or from passing the image name to the Open Image (OpeIma) command will now create the image pyramids in the correct location.
- **Image Levels** (ImaLev) – Fixed to work with grayscale images.
- **VrOne/Two Main Window** - Moved DTM category from the Batch pull-down menu to a new pull-down menu titled Dtm.
- **Snap Midpoint** (SnaMid) – The new command has been added for setting snap mode to line midpoint.
- **Snap Commands** – (SnaLayOn) (SnaLayOff) (SnaLayOn+) (SnaLayOff+) (SnaLayRes) – Added these new commands for controlling entity snapping and identification by layer. These commands take the same input as the LAYON and LAYOFF commands, but instead of changing the visibility of entities on the layers, they control whether entities are available for snapping and identifying. This makes it possible to have "view only" layers where the entities can be seen but are ignored for all interactive operations (this does not change the behavior of batch routines). As with the layer commands, the settings are not retained between VrOne sessions.
- **Grid Display and Grid/Cursor Snapping** - There are now three conditions dealing with the display and snapping of grid points in a graphics window
    1. Grid Display in which grid points are displayed as points or lines on the graphics window
    2. Grid Snapping in which the grid is turned on. The behavior of the cursor depends on the Cursor Snap setting.
    3. Cursor Snapping which determines whether to force the cursor to move only between grid points or to snap to a grid when a point is digitized.

  The commands "Grid Snap if Displayed (GriSnaDis)", "Grid Snap On (GriSnaOn)", "Grid Snap Toggle (GriTog)", "Cursor Snap On (CurSnaOn)", "Cursor Snap Off (CurSnaOff)" and "Cursor Snap Toggle (CurSnaTog)" have been added to set the

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parameters for the conditions of described above. These commands are used with the existing Grid commands; "Grid Set (GriSet)", "Grid Display On (GriOn)", "Grid Display Off (GriOff)", "Grid Display Toggle" (GriTog)", "Grid Resolution Set (GriRes)", and "Grid Type (GriTyp)".
Please see the help page on Grid Display and Grid/Cursor Snapping for more information.

- **Brightness / Contrast** – The image display speed when image and brightness is active has been improved.
- **Cut Sheet** (CutShe) - Added option to specify output image type. Added option to overwrite existing files.
- **Batch Join** (BatJoi) - Fixed problem that could cause 'Vrs::DeLine – Line –1 is not valid' message. Added comparison by feature code option.
- **Set Active Dtm** (Adt) – This new command has been added for the support multiple DTM surfaces. VrOne can now have up to 8 active DTM surfaces. The current surface is made active by using the SetAdt keyin. If the key-in is followed by a number from 1 to 8, the number will be used as the active DTM. If no argument is keyed in, then a dialog will be displayed allowing the DTM surface number to be entered.
- **Manage Dtm Surfaces** (ManDtm) – Added this new command to manage new support for DTM surfaces. This dialog displays a list of all 8 DTM surfaces, and the status of each one. A radio button allows any surface to be made active. Buttons are provided to quickly set the parameters or run the DTM on any surface.
- **Manage Dtm Surfaces** (ManDtm)
  - Added volumes support for computing volumes between two surfaces or between a single surface and a set elevation.
  - Saves all volumes parameter settings.
  - Added to pull-down menus under the DTM category.
  - Added an info dialog box that displays information when volumes are computed.
  - Added reporting options for volume calculations. These include writing a report to a file, and reporting information in custom units.
  - Fixed problem that could cause VrOne to crash in certain situations after computing volumes.
- **Set Dtm** (SetDtm) – Redesigned this dialog box with the following changes and additions:
  - Removed initial prompt to load parameters
  - Added 'Load Params', 'Save Params', and 'Reset Params' 'Help' buttons to the dialog box.
  - Help can now be shown by pressing the Help button or by clicking the [?] button in the upper right corner then clicking a parameter field.
  - Fixed window area option.
  - Removed warnings about spline mode options when dialog box is closed. These options are explained in the help.

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- **Run Dtm** (RunDtm) – A problem that was causing depression contours to not always be flagged correctly. This occurred on DTM jobs where the maximum triangle edge length parameters are used.
- **Sheet Grid** (SheGri) – Fixed problem where grid lines could be missed in certain situations.
- **Delete Close Points** (DelClo) – Added option to compare between workspaces. User may choose mode for points and lines.
- **New Folder** – There are various dialog boxes that allow the current folder to be changed. The ability to create new folders has been added at these locations.
- **Undo All Workspace** – (UndoAllWs) – Added this new key-in that will undo the last command in all workspaces.
- **Undo** – (Undo, UndoAllWs) – Added optional key-in argument to allow a set number of commands to be undone or to have All commands undone. If a number is supplied as the argument, then it will be used as an Undo count. If the word All is supplied as an argument, then all commands will be undone.
- **Cut Polygon -** (CutPol) – This application now recognizes the Minimum Line Length parameter.
- **Insert Line** (InsLin) – Fixed attach line when using Original Z mode option.
- **Edit Configuration** (EdiCon) –
  - Added Entity Highlight pen number option that sets the color of the entity when it is locked-onto.
  - Added window background color option.
  - Added option to set "Black Pixels Transparent" and (or) "White Pixels Transparent". This is useful when viewing rotated and overlapped images.
- **Edit Function Keys** (EdiFun)
  - Fixed problem where "QGArray: out of bounds" error message was displayed.
  - Added following options that affect display of function keys in the function key starter dialog: Label color; Visibility; Separator. These settings may be applied to multiple function keys at once by selecting more than one function key in the selection window.
- **Macro Recorder** – Added the ability to record keystrokes and store them as a Vr Macro. The commands Begin Macro (BegMac) and End Macro (EndMac) have been added to automate recording of macros. The Begin Macro command will start the macro recorder. While the macro recorder is running, all commands will be recorded. The End Macro command is used to stop macro recording. When End Macro is executed, you will be prompted for a new Macro name. The commands typed in between the Begin Macro and End Macro commands will be recorded to the named macro. Normally, only the basic key-in used to start a command is recorded to the Macro, any further interaction with the actual applications is not recorded. A few

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interactive applications have been modified to store additional information to the Macro in order to make macro recording more useful. The commands that support this extra functionality currently are: Zoom Windows (ZooW) and Zoom Center (ZooC).

- **Menu Keys** – Menu keys dialogs are now repositioned on the screen if they are found to be off the active screen area.
- **Graphics Windows** - VrOne now remembers number of graphics windows open during the last session.
- **Zoom** (ZOO)
  - Fixed problem of random zooming if command was entered without any arguments.
  - Added optional window number argument to the 'ZOO' key-in command. The window number should follow the zoom scale factor. This is useful when using multiple windows. Normally the ZOO commands works on the active graphics window. By adding a window number, the specified window number will zoom instead of the active window.
- **Number Lock** - Added 'Use asterisk on keypad' to the Num-Lock control settings in Vr Configuration. Normally, the period on the number keypad is used for the * Vr Button. If this setting is on, the asterisk on the number keypad will be used instead.
- **Window Align** (WinAli) – Added this new command to align the Z rotation of the current graphics window with window 1. Also added in Configuration general settings the ability to automatically align new graphics windows with window 1. This is useful when using multiple windows with VrTwo, allowing the 2D windows to be aligned with the orientation of the stereo model.
- **Line Point Inside** (LinPoi) – The results of this batch application are now displayed in the Main Window on successful completion.
- **Sub-pixel Positioning** - Image zooming will now display partial pixels on the left and top window sides when zoomed at sub-pixel levels. This results in the graphics window remaining centered around the same point no matter how far the display is zoomed.
- **Plot** (Plo) – Plots image edges and image names based on the current settings for the first graphics window settings. Previous versions would look at the first unopened graphics window, which could lead to image names and edges being plotted by mistake.
- **List Workspace** (LisWs) – Added this new command that lists all open workspace numbers, filenames, sizes and entity counts in a table format.
- **Drive Files** – Show Drive Points (ShoDri) – Show Drive Points Fit (ShoDriFit) - New Drive File commands have been added to view all drive points in the currently open drive file. Show Drive Points displays the drive points in the current view and Show Drive Points Fit performs a Zoom All before displaying the drive points.
- **Search Elevations** (SeaEle) – Added option to apply the new layer settings as an offset from the existing entity layers.

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- **Delete Duplicates** (DelDup) – Added option to disable display of results dialog upon completion.
- **Tick Lines** (TicLin), **Insert Multiple Parallel Lines** (InsMul), **Shift Workspace** (ShiWs) – Made consistent with other commands by adding WSTC key-in for Workspaces to Consider.
- **Image Merge** (ImaMer) – Fixed problem with an extra row or column of pixels being added to the output image.
- **Delete Points In Polygons** (DelPoi) – New batch routine that allows symbols and text entities to be deleted from inside polygons.
- **Delete Outside Boundary** (DelOut) – New batch routine that allows entities to be deleted outside a boundary line. Line that cross boundary are trimmed.
- **Edit Function Keys** (EdiFun) – Does not allow duplicate key numbers to be entered.
- **Join Lines** (JoiLin) – Fixed bad Z value when using Match Only mode with Line 1 held.
- **ASCII In** (AscIn)
  - Added progress bar.
  - Added support for PARFIL and RUN keyins, allowing AscIn to be used in batch mode.
  - Fixed problem with saving units for new files and default symbol graphic pointer.
- **Shape Out** (ShpOut)
  - Added Pen, Area, Length, Elev, Radius, and Width VrOne attributes.
  - Added new page too allow user specified attribute fields.
  - A rotation attribute has been added to this translator.
- **DXF Out** (DxfOut) –
  - Allows a symbol file to be specified for use during translation.
  - Bulge radius is now converted to ground units during translation.
  - Added option to translate to separate files based on Feature Code.
  - Added option to write each workspace to a separate DXF file. If this option is chosen, the DXF filenames are automatically determined based on the VR filename.
  - Fixed problem with Layer table not being written to DXF file.
- **DXF In** (DxfIn)
  - User may now close the information dialog box if it is left open after closing Dxf In.
  - Fixed display of output filename in information dialog when translating to current file.
  - Added option to translate multiple DXF files into multiple VrOne files.
  - Added ability to display information dialog box with details of translation.
  - Added new HTML based help file.

Microstation Out (MstOut)

- **Report** - Added option to write out report of entities that were translated without a

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cross-reference.

- **Omit Layers** - Added option to specify layers to omit.
- **Global Scale Factor** - Added global scale factor.
- **Scanner** - Added option to scan MST files.
- **Unnamed Cells** - Will translate linear entities that make up unnamed cells as separate entities. Prior version would translate the unnamed cell as a VrOne symbol that was not visible in VrOne.
- **Arc Fix** - Fixed problem where lines without arcs were not getting translated and lines with arcs were getting translating without any points after the last arc.
- **Arc Fix** - Fixed translation of arcs when arc point flags do not contain start or end codes.
- **Cell Scale** - Global cell scale is now saved to the parameter file.

Microstation In Translator (MstIn)

- **Multiple VrOne Files** - Added ability to translate into multiple VrOne files.
- **Run from a Macro** - Added PARFIL and RUN key-ins, allowing MstIn to run in batch mode and from a macro.
- **By Level** - Added option to force ByLevel setting on all entities regardless of settings in imported .mst file.
- **By Level** - Added support for ByLevel color, weight and style attributes.
- **Level Code** - Added support for level code in Microstation V8.
- **Unnamed Cells** - The translator will now translate linear entities that make up unnamed cells as separate entities. Prior version would translate the unnamed cell as a VrOne symbol that was not visible in VrOne.
- **Batch Processing** - Added support for batch processing. This version adds the ability to pass command-line options to the MstIn MDL for translating multiple .MST files into multiple .DGN files. When using this feature, the resulting .DGN files will always have the same filename as the imported .MST files. If a .DGN file with the same filename as the .MST file already exists, it will be appended to. If there is no existing .DGN file, then it will be created from a user specified seed file. The seed file must be including in the command line if .DGN files do not already exist. The command line can be typed in from within Microstation using the command prompt, or the Keyin tool. The MstIn MDL can always be used as a Startup application when launching Microstation from the command line. This allows translations to be started from a DOS batch file, and run unattended.

  NOTE: Substitute mstin8 for mstin in all examples when using Microstation V8.

  Command line syntax from within Microstation (Optional arguments are in brackets, any filename may contain wildcards):

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```
MDL LOAD MSTIN [-s{SeedFileName}] [-l] MstFileName1 {MstFileName…}
```

Command line syntax from DOS prompt (Optional arguments are in brackets, any filename may contain wildcards):

NOTE: -wamstin param MUST be first. The –i must be added to all parameters in order for them to be passed through to the MSTIN MDL.

```
Ustation.exe –wamstin [-i-s{SeedFileName}] [-i-l] -iMstFileName1
[-iMstFileName…]
```

If the –l parameter is added, a log file will be written. The log file will contain a list of all files that were attempted to be translated.

Example command lines:

The following command line will translated all .mst files in the c:\jobs\bigtrans\ folder into .dgn files of the same name. The .dgn files must already exist in the c:\jobs\bigtrans\ folder.

From inside Microstation:

MDL LOAD MSTIN c:\jobs\bigtrans*.mst

From DOS prompt:

Ustation.exe –wamstin -ic:\jobs\bigtrans*.mst

The following command line will translated all .mst files in the c:\jobs\bigtrans\ folder into .dgn files of the same name, and will translated= the c:\jobs\smalltrans\test.mst into c:\jobs\smalltrans\test.dgn. If the .dgn files do not exist already, they will be created from the c:\Program Files\Bentley\Workspace\System\seed\transeed.dgn seed file.

NOTE: that the seed file parameter must be enclosed in quotes because it contains spaces.

From inside Microstation:

MDL LOAD MSTIN "-sc:\Program Files\Bentley\Workspace\System\seed\transeed.dgn" c:\jobs\bigtrans*.mst c:\jobs\smalltrans\test.mst

From DOS prompt:

Ustation.exe –wamstin "-i-sc:\Program Files\Bentley\Workspace\System\seed\transeed.dgn"

-ic:\jobs\bigtrans*.mst -ic:\jobs\smalltrans\test.mst

VrTwo

- **Static Redraw Speed** - Improved static mode redraw speed by 10 to 20 times.
- **Roaming Redraw Speed** - Improved speed when zooming to different levels in roaming mode. Initial zoom to any given level will be the same speed as previous versions, but subsequent zooms will be significantly faster.
- **Sub Pixel** - Improved image sub-pixel positioning in static mode and improved sub-pixel positioning in roaming mode on NVIDIA Quadro FX graphics cards.
- **Multiple Windows** – (OpeWin) - Added ability to have multiple 2D overview windows in addition to the standard stereo viewing window. These windows are enabled using the standard Open Window (OpenWin) command.
- **Window Parameters** - Fixed problem with remembering 2d window positions and sizes.

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- **Last Windows Open** - VrTwo now remembers number of graphics windows open during the last session.
- **Dialog Box Fixes** - Fixed the dialogs in the following commands so the cursor behaves correctly during roaming. Batch Direction, Batch Grid, Batch Offset, Batch Trim, Snap Set, Plot.
- **Changing Levels** - Fixed problem with refreshing of vector when changing levels in roaming mode.
- **0 Key** - Fixed 0 key on the number keypad to toggle snap mode when viewing static images.
- **Last Entity Display** - Fixed problem in static mode where last entity in file was not displayed.
- **Toggle Roaming Cursor** (TogRoaCur) – Added this new command to allow stereo window to roam graphics while moving the cursor in an overview window. This command can be used when multiple windows are opened in roaming mode. To test this feature, enter roaming mode, open a second window, move the cursor to the second window, then key in the TOGROACUR command. As you move the cursor around the second window, the first window (stereo window) will roam to follow the cursor movement.

VrTwo Orientation

- **Coordinates** – New Coordinate File – File Header – Items that do not apply are dimmed based on the coordinate file Format and Units.
- **Coordinates** – Edit – Added Edit Header button to dialog box that allows the coordinate file header to be modified.
- **Camera Calibration** – Added Fiducial Units variable that defines the units of the fiducials and other camera parameters. Options are: millimeters, inches and pixels.
- **Project** – Added Save Project As
- **Interior Orientation** – Added Tip button and cleaned up window placement.
- **Interior Orientation** – Corner Interior Orientations – Added this option which allows the left and (or) right interior orientations to be computed based on the image size. The four corners of the image are used as measurement points. The camera calibration should be completed except for the fiducial coordinates. Radial distortions in the camera calibration may still be applied. **WARNING**: This should only be used in cases where the camera does not have calibrated fiducials. Fake Interior Orientations is in the Orientation pull-down menu.
- **Relative Orientation** – Correlation - If a correlation is rejected the target window returns to its original position.
- **Relative Orientation** - The two Measurement Windows now remember their last scale

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when cycling through the measurement points and remember their scale when returning to Relative Orientation.

- **Absolute Orientation** – The Measurement Window now remembers its last scale when cycling thought the measurement points and remembers its scale when returning to Absolute Orientation.
- **Absolute Orientation** – It is now possible to define coordinates that have an undefined axis using the Null Axis Value. Points with an undefined axis will float that axis for the point in Absolute Orientation. The Null Axis Value may be set in VrTwo Orientation (Vr2Ori) under the Coordinates pull-down. For example: if the Null Axis Value is -1.0 and a coordinate from the control file was defined as "`POINT1 1235382.169 756392.234 -1.000`" then Absolute Orientation would float the Z axis adjustment and assume POINT1 was a horizontal point only with no elevation. This is available to the interactive Absolute Orientation application only.
- **Edit Camera File** – When exiting this routine a save dialog allows the saving of the camera file as the same file name or a new file name.
- **Edit Coordinate File** - When exiting this routine a save dialog allows the saving of the coordinate file as the same file name or a new file name.
- **Image Sub-Pixel** - Improved image sub-pixel positioning in Inner, Relative and Absolute orientations.
- **Point Labels** – It is now possible to turn off the display of point labels in Relative and Absolute orientations. This is done in Preferences (File->Preferences).
- **Atlas Import** – Added the ability to import orientations from Atlas air triangulation measurements. The Atlas .res file is used. This option may be used by selecting Import -> Measurements -> ATLAS Orientation.
- **Project Status** - Project status is shown correctly when creating a new project and importing from Image Utility.

VrOrtho

- **Surface File** - Does not create surface file if 'use surface file' is not checked.
- **Pixel Size** - Fixed problem where pixel size parameter was not saved if other options were changed.
- **Minimized Window** - Graphics window is minimized during output if specified in parameters.
- **Area Editor** - Added ability to display lines from VrOne files in the ortho area editor.
- **Pixel Resolution** - Ortho creation dialog shows pixel resolution of existing orthos, and does not select orthos that have already been created with the current output pixel size.
- **DTM Parameters** - Uses separate default settings from VrOne for DTM parameters.

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- **Directory Selection** - Added directory selection button to output directory parameter.
- **VrTwo Orientation** - Displays specific error information if VrTwo Orientation cannot be imported.
- **Import Orientation** - Added 'Import VrTwo Orientation' under Orientation pull-down menu, and removed 'Import VrTwo' from Import Exterior Orientations

VrAir Trig

- **Change Drive** – Added this function which resets the project parameters when a project has been moved. Change Drive can be used if all the photos for the project are in a single folder and if there is only one camera file for the project. If the move does not meet these requirements then Edit Project should be used.
- **Edit Project** – Edit Point Name Format – Increased the number of pass points possible from five to nine. The method of selecting the pass points to use has also changed.
- **Point Remeasure** – Fixed problem that could place a point in the wrong location in strips with descending numbers with the photo strip to the right.
- **Stereo Window for Clearing Parallax** – If this window was exited with when zoomed all the way in a scale factor of 2 was saved. On re-entry the windows was then scaled to 2. This has been fixed.
- **Measure** – Added check for points outside the photo when Measure is exited. This was possible when measuring points using photos from two strips.
- **Measure** – Improved method for determining points to be measured in the lower photograph when measuring photos from two strips. If the project sidelap was set too small it was possible to orphan a point from the top strip even though it had been read in the bottom strip.
- Remeasure – Added the ability to start Remeasure for the current point from this application. The VrAir Trig Point Remeasure displays image patches for each photo in which the current point is located. Options include the ability to remeasure in mono, correlate or stereo on any image patch(s). After exiting Point Remeasure, Measure is restarted, residuals are recomputed and point measuring is continued at the current point.

VrMosaic

- **Python** - Added python support. The Python support in VrMosaic is equivalent to the support in VrOne.
- **Flight Direction** - Added flight direction parameter to handle flight lines that are not N-S or E-W.
- **Seam Lines** - Fixed joining of seam lines so information that ties seam to image is not lost.

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- **Edit Seams** - Fixed several problems in edit seam lines properties dialog.
- **Output** - Fixed problems with manual output dialog.
- **Overlap** - Fixed some image display overlap issues.
- **Pyramids** - Minor changes to internal pyramid support.
- **Last Project** - The last project file is now saved in the orthomosaiclastfile.par parameter file instead of in the orthomosaic.par file.

VrBalance

- **Vr Balance Program** - This is the first release of a new standalone program for balancing images. This uses the same methods as VrMosaic to balance images across an entire project, but works in a batch mode with any set of input images. VrBalance can be operated from the command-line without any user interaction by using appropriate input arguments. Type VrBalance –h for a list of command-line options. If started without any arguments, VrBalance will prompt for input parameters.

Vr Image Utility

- **Conversion** – Fixed so that converting an image in place works as expected.
- **Rotation** – Fixed rotation of tiled images, and rotating to a pyramid level other than 1.
- **JPEG Support** - Add support for JPEG images
- **Conversion Fixed** - Fixed conversion from scan line to tiled images.
- **Levels to JPEG** - Fixed Apply Image Levels to work with JPEG (.jpg) images.
- **Rotated Images** - Rotated images may now be written to new output images using prefix, postfix, and output directory options. The output images may also be down sampled.
- **Pyramids** - Minor changes to internal pyramid support.
- **Strip Embedded Pyramids** - Added new option to strip embedded image pyramids from TIFF files. Compressed files are recompressed when stripping pyramids, so there will be some image quality loss.
- **Levels Adjustment** - Added new option to apply levels adjustment to images. This feature will apply a single levels file to multiple images, or will auto-apply multiple levels files to multiple images Added support for standard JPEG (.jpg) files. The user should expect slower display times with JPEG files compared to TIFF files.
- **Automatic Inner Orientation Fix** - Fixed problem that could cause Auto Inner orientations to crash.

Python Programming

- Added UseParams to VrGr

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Version 2.60 April 10th 2005

VrOne Touchscreen

The Vr Touchscreen hardware and software is now ready for release. The Vr Touchscreen is designed to be used with VrOne and VrTwo and offers 567 user definable buttons on a dynamic LCD touch surface in a 7-inch form factor. Each button has the ability to output a Vr button number, Vr macro name and (or) start a Vr Function key. Any valid Vr key-in string may be placed on a Vr Touchscreen button. Programming the screen is as easy as touching the program button then the button to program. Each button may have its own text, color, text font and text. The 567 buttons are on 9 overlays of 63 buttons each.

VrOne

- Batch Depression Contours (BatDep) – Some contours were not being flagged as depression contours as specified. This problem has been fixed.
- Drive Grid (DriGri) – When using the Zeiss P Series instruments the Z location definitions are now correct. The Z position on the left handwheel is unsupported and will be placed on the right handwheel.
- Cut Polyon (CutPol) – Added option for the display of the warning dialog before the cut polygon begins processing. If this parameter is set to Yes then a dialog box will be displayed warning that deleted data cannot be recovered. When running this batch application multiple times from a Macro it is desirable to turn this option off.
- SOCET SET – Fixed problem with updating graphics on the SOCET SET screen when in Limited graphics mode.
- Batch Node (BatNod) – The line width is now being transferred to new lines during the noding process.
- Search Radius (SeaRad) – Added this key-in to set the current entity search radius.

VrTwo

- The last model position is now remembered when static or roaming stereo is closed and driven to that position when static or roaming is opened. Since stereo static mode can zoom to any scale and stereo roaming mode must zoom to even image pyramids zoom level 1 is always used when opening stereo.

Microstation In (MstIn)

- Fixed assignment of radius when translating symbols.
- Changed wording in Cell cross-reference table from "Scale" to "Radius" to better

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describe the translation parameters.

VrAir Trig

- Measure – When correlate is rejected the image that was correlated to returns to it position before correlation.
- Measure – When photos to be measured are on two strips the Strip Order from Project Layout is no longer checked. It is assumed the top photo will always be identified first.
- Layout – It is now possible to have descending photo numbers in strips. Prep strip->Swap photo sequence can be used to swap the order of a strip in Layout.
- Point Re Measure – Stereo measured and correlated points were not being saved if no manual measurements were made. This has been corrected.

Version 2.59 March 4th 2005

VrOne

- Batch Node (BatNod) –
  Made speed improvements to better handle large datasets.
  Fixed problem with noding between workspaces.
  Added option to write drive points for only target or only source layers for each pass.
- Manage Symbols (ManSym) – Added this application. Manage Symbols displays all symbols, allows symbols to be created and edited, and allows management of symbol libraries. Symbols may be created or modified in which the Create Symbol application is started.
- Create Symbol (CreSym)
  Added preset options to set origin automatically.
  Added option to keep origin if it is outside symbol bounds.
- Make Polygon (MakPol) – A new version has been released that uses a new polygon detection method resulting in large speed increases. Added ability to process multiple centroid layers in a single pass, and to specify a user-defined work area.
- Drive Grid (DriGri) – Stealth Z Handwheels - Added support for the setting of the Z axis input to the left (X) or right (Y) hand wheels. If the Z is placed on the left or right hand wheels the other two motions are disabled. It is possible to place the Z axis input on the right (Y) motion when using the Stealth Z-Mouse and a forward Y motion will decrease the Z and a backward Y motion will increase the Z (like flying an airplane). Added Z Scale Factor that is applied when the Z is on one of the handwheels. This is useful to correct a backward direction on a handwheel by applying negative one (-1).
- Node Lines (NodLin) - Added extend distance parameter. A status display of last node attempt has been added. A check is now made for valid node before asking user to

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confirm.

VrTwo

- When the input device is the Stealth-Z mouse, Stealth Handwheels or the LH TopoMouse the mouse pointer is parked at the upper-left corner of the graphics window. If the input keyport is the Vr TouchScreen the pointer is returned to this position after each TouchScreen press.

VrOne/VrTwo

- Toolbars - Fixed problem that could cause a crash when creating new toolbars. Fixed problems with toolbar alignment in the main window dock area.

VrOne/VrMosaic

- Window Settings dialog is now forced onto the screen when the graphics window is on the right side of the screen.

VrTwo, Vr2Ori, VrAirTrig, VrOrtho

- NVIDIA Graphics Cards - Modified graphics drivers to fix problem that was caused when using the PNY NVIDIA graphics drivers that were later than version 6.5.7.3. This includes the PNY NVIDIA Quadro4 980 XGL and the PNY NVIDIA Quadro 1300 FX.

VrMosaic

- Made modification to allow projects that contain only one strip of images.
- Window positions are now kept separate from VrOne.
- Removes invalid image files from project.
- Fixed options that convert existing seam lines.
- Allows lines with existing feature codes to be assigned to images.
- Added option to prompt for filename and pixel size when doing manual output.
- Added display of pyramid level when selecting manual output window.
- Added pixel size column to batch output selection dialog.
- Batch output selection dialog does not pre-check image when there is an existing image with the same name and same pixel size.
- Fixed crash that could happen if user closed Batch output progress dialog.
- Doesn't close existing vector files when loading project.
- Added "Save as Default" option to parameters dialog box.

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- All extra windows (Steps, Status, Overview, and Layout) can be closed.
- Added extra options on the "more" menu to open the windows back up.
- Added local command key-ins for new parameters.

Vr Configuration

- Configuration -> General – Screen Number for Dialog Boxes – There are many dialog boxes that deal with the entry of data and are considered temporary. These dialog boxes do not remember their last positions and are placed in the middle of the screen. Since it's possible to configure multiple screens in Windows, this parameter has been added and the old parameter of Left, Center and Right has been removed. To find the screen numbers that are currently configured for Windows, right-mouse click on the desktop and select Properties then click the Settings tab.

Microstation Out (MSTOUT)

- Added ability to assign line styles to symbols that are exploded or placed as points.

All Products

- Image Pyramids - Fixed problem where pyramid images could get created in the wrong location when using image names without paths.

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- AutoCad is a registered trademark of AutoDesk Inc.
- PostScript is a registered trademark of Adobe Systems Inc.
- SentinelPro is a trademark of Rainbow Technologies.
- CADMAP is a registered trademark of Carl Zeiss Inc.
- Linux is a great operating system.
- Windows 2000 is a trademark of Microsoft Corporation and is a good operating system.

- Windows XP is a trademark of Microsoft Corporation and is a great operating system.

6.5 Team Viewer

Vr Mapping

ON-LINE REFERENCE DOCUMENTATION
CARDINAL SYSTEMS, LLC
www.cardinalsystems.net

Team Viewer - Remote Computer Access

Overview

When diagnosing a problem it may be easier for the Cardinal Systems support personnel to see the problem as it appears on a customer's computer. In these cases Cardinal Systems may ask permission to remotely control your computer using a commercial program called TeamViewer. If you grant permission, you will be asked to download the program, start it and send Cardinal Systems an ID and Password.

For security reasons, you control the access to your computer. If TeamVeiwer is not running then access will not be allowed. Each time TeamViewer is started, the password that is send to Cardinal Systems is different.

Installation

TeamViewer may be downloaded and installed from www.teamviewer.com

Allowing Access

When started, the TeamViewer program will show the following dialog box.

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The TeamViewer main dialog box

To allow Cardinal Systems remote access to your computer select the "Remote control" tab and send the numbers in the "Your ID" and "Password" fields. This information may be e-mailed to Cardinal Systems support system at vrsupport@cardinalsystems.net. If you have an open ticket open then this information may be placed in that ticket by replying to a previous e-mail with the ticket number in the subject line (i.e. [vrsupport #4746] Ticket Description).

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