Carlson Survey Desktop
Release 2

Carlson Software Inc.

User's manual

July 20, 2005

Contents

Product Overview 1

Product Overview

Carlson Survey Desktop (CSD) is a companion program for Autodesk Autodesk Land Desktop that adds more tools for surveying. The CSD commands include data collection, raw data processing, Field to Finish and COGO features. These features are fully integrated into the Autodesk Land Desktop project environment.

Data Collection

The power of CSD begins with data collection. CSD handles all major collectors, from Geodimeter and TDS to Leica, Nikon, Sokkia, and SMI. The raw data is stored in RW5 format and can be viewed, edited and processed. The processing, or calculation of coordinates, recognizes "direct and reverse," and other forms of multiple measurement, and processes sets of field measurements. Surveys can be balanced and closed by selective use of angle balance, compass, transit, Crandall, and least squares methods-or simply by direct calculation with no adjustment. Commands exist for finding bad angles and for plotting the traverse and sideshot legs of the survey in distinct colors as a means of searching for "busts" or errors. In addition to downloading data from electronic data collectors, CSD accepts manual entry of field notes directly into spreadsheet format, permitting review, storage, and editing. Alternatively, field notes can be entered for immediate calculation and screen plotting of points, with the "raw notes" stored simultaneously, permitting re-processing and re-calculation as needed.

Field to Finish

The survey world is recognizing the power of coding field shots with descriptions that lead to automatic layering, line work, and symbol work. Office drafting time can be reduced by 50% or more with intelligent use of Field to Finish plotting. For example, breaklines, which act as barriers to triangulation, should be placed on streams, ridges, toe-of-slopes and top-of-banks for more accurate contouring. With the Field to Finish command, breaklines can be created by field coding, with descriptions such as DL, for creating 3D polyline ditch lines. Without Field to Finish, this coordinate data can be simply plotted on the screen as undifferentiated points. However, with Field to Finish, this same data can be plotted in one step, creating 3D polyline break lines, building lines, light poles, manholes, and edge-of-pavements, which are all distinctly layered and fully annotated. CSD's Field to Finish can even adapt to a coding system made up on-the-fly, or one that has been received from an outsourced survey. Field crew coding and office processing using Field to Finish can save valuable hours of drafting and eliminate misinterpretations, paving the way for quick plat generation and supporting supplemental engineering work.

Deed Work

CSD allows you to enter old deeds and plot the linework, then add bearing and distance annotation optionally. Distances can be entered in meters or feet, and even in the old measurement forms of chains, poles, links, and varas. Both tangent and non-tangent arcs can be entered. Closures, distances traversed, and areas are automatically reported. Working in reverse, the Legal Description command creates a property description suitable for deed recording directly from a closed polyline on the screen. If that polyline has point numbers with descriptions at any of the property corners, these descriptions will appear in the deed report (e.g. "...thence N 45 degrees, 25 minutes, 10 seconds E to a *fence post*..."). Deed files can be saved, re-loaded, edited, re-drawn and printed or plotted to the screen as a report.

Utilities

CSD contains many powerful utilities, particularly polyline utilities. You can Join Nearest disconnected polylines, offset 3D polylines, and reverse polyline directions. Extend by Distance lets you create building "footprints" with left and right entries. Reduce Vertices weeds out extra vertices and cuts down on drawing size.

Installing Carlson Survey Desktop

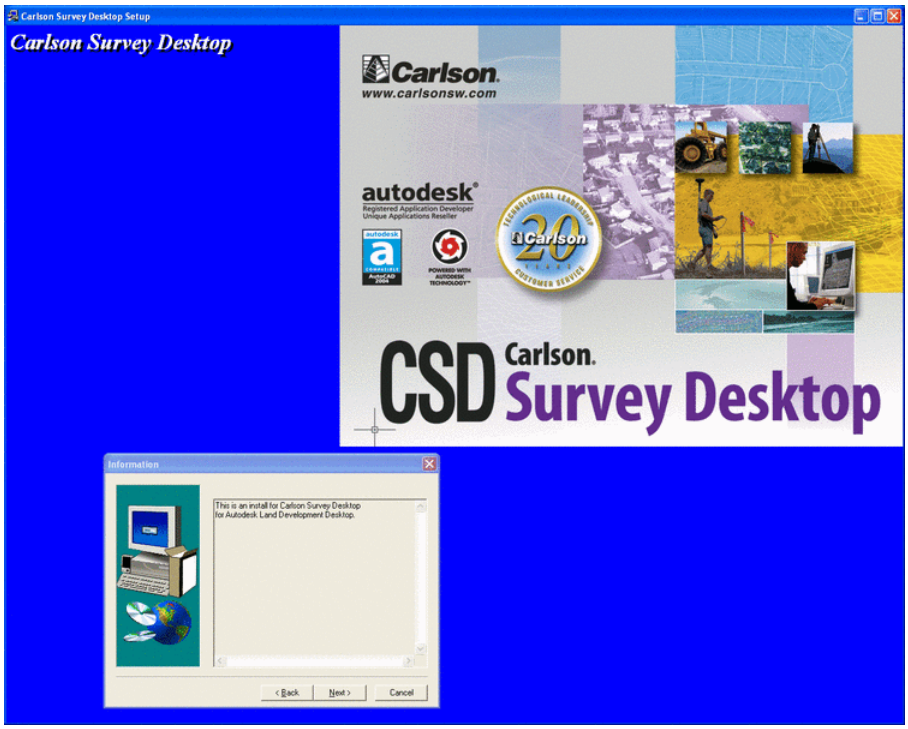
When installing Carlson Survey Desktop, you must have permission to write to the necessary system registry sections. Make sure that you have administrative access on the computer on which you are installing this software.

Before installing Carlson Survey Desktop, close all other applications. Make sure that you disable any virus-checking software. Refer to your virus software documentation for instructions.

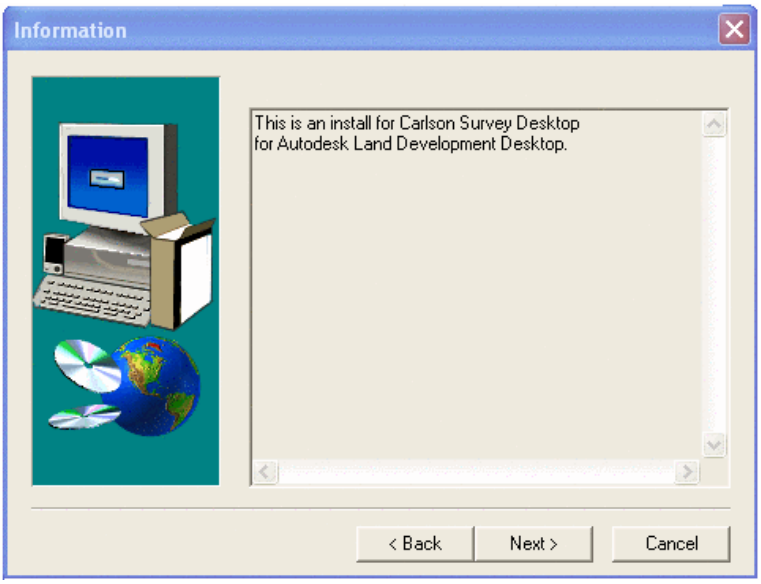
1. Insert the CD into the CD-ROM drive.

- If Autorun is enabled, the setup process will begin automatically when you insert the CD-ROM.
- To stop Autorun from starting the installation process automatically, hold down the SHIFT key when you insert the CD.
- To start the install process without using Autorun, from the Start menu (Windows), choose Run. Enter the CD-ROM drive letter, and setup (e.g. d:\setup).

2. Windows will begin the installation of Carlson Survey Desktop. Depending on your operating system, the initial window will look something like this:

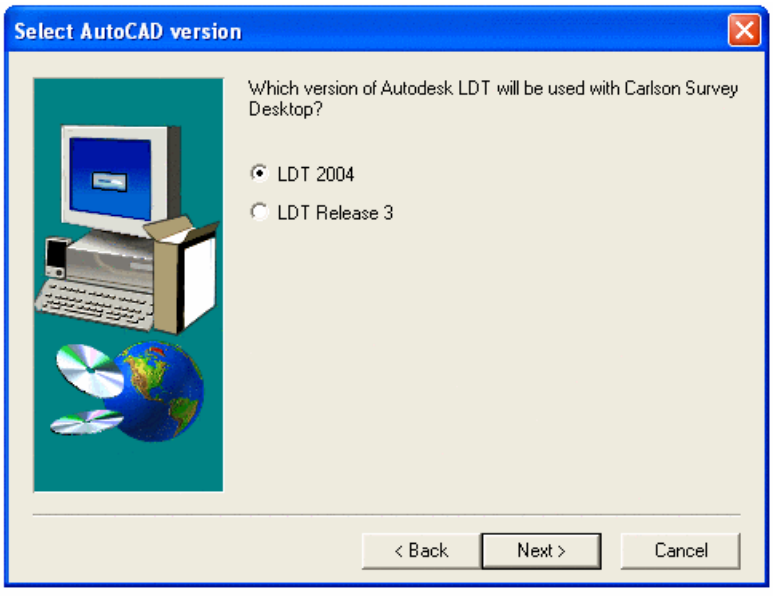


The information dialog box initially displayed in the setup process is shown below:



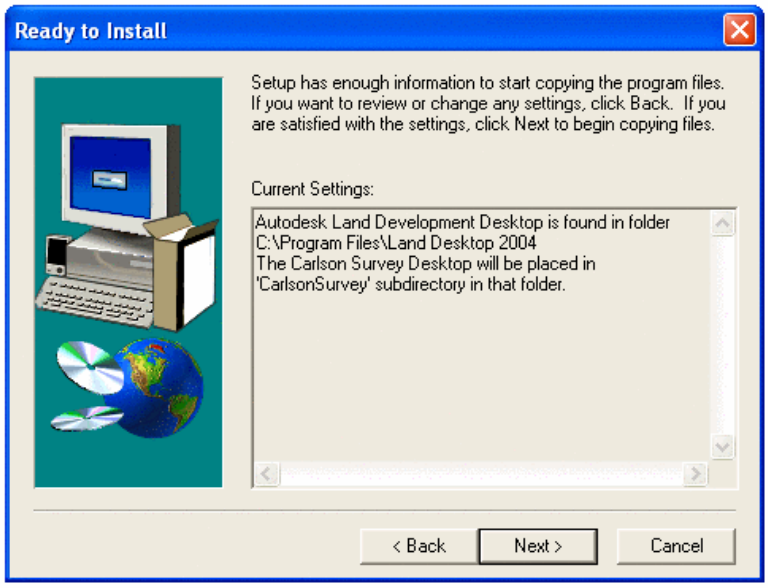
Select Next to continue the Setup process.

3. Choose which version of AutoCAD you are using.

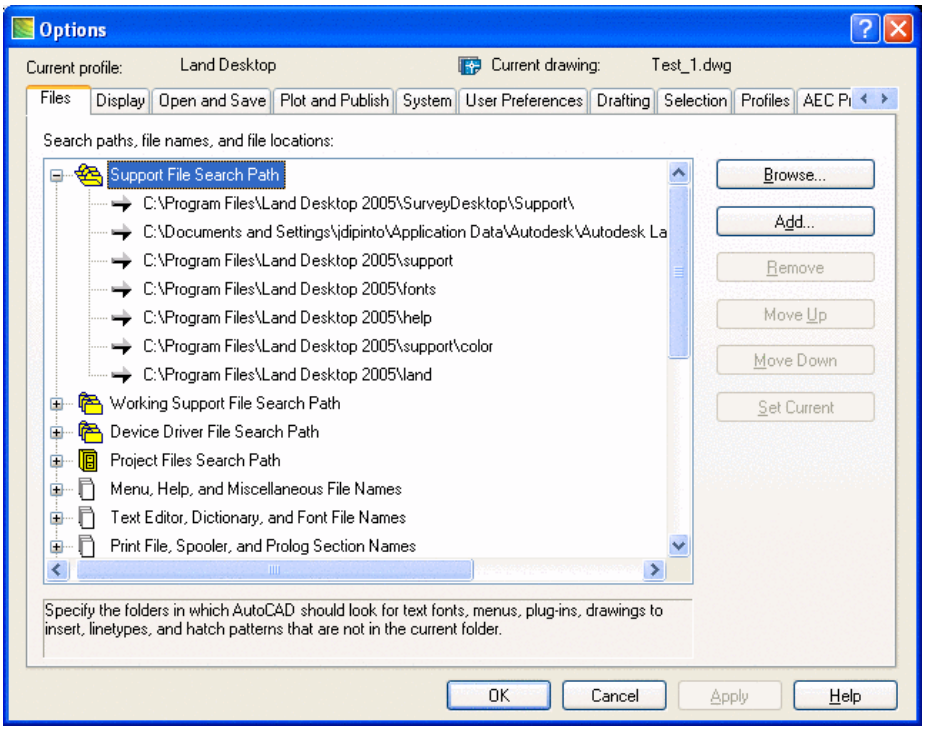


Select Next to continue the Setup process.

4. When Carlson Survey Desktop is ready to download , the following dialog box will appear:



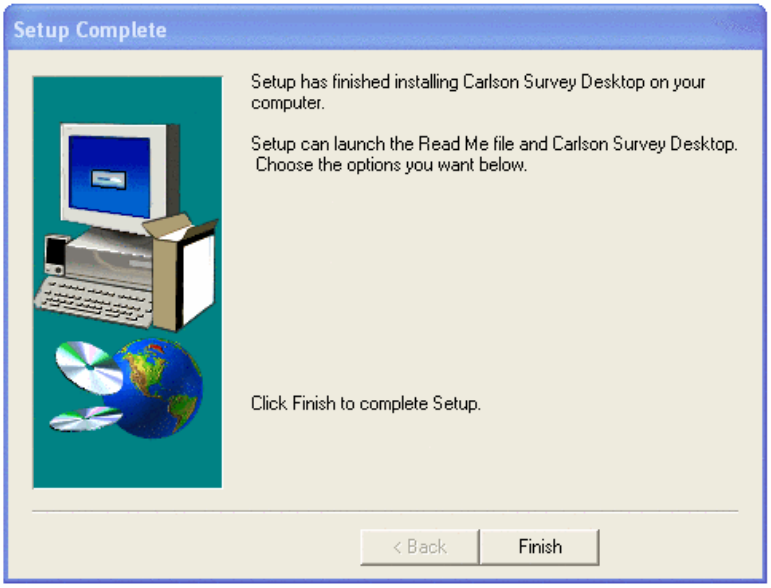
- **Note**: Carlson Survey Desktop installs itself as a subdirectory within Autodesk Autodesk Land Desktop. To verify that this directory has installed correctly, a check may be done within Autodesk Land Desktop.
  - from the command line, type Options
  - Select the File tab within the Options dialog
  - Select Support File Search Path
  - Depending on your operating system and AutoCAD software, you should see a file path that reads: C:\Program Files\Land Desktop 2004\SurveyDesktop\Support



Select Next to continue the installation

5. Carlson Survey Desktop will now be installed on your computer. Depending on your computer, this may take a few minutes.

6. When the installation is complete, this dialog box will appear:



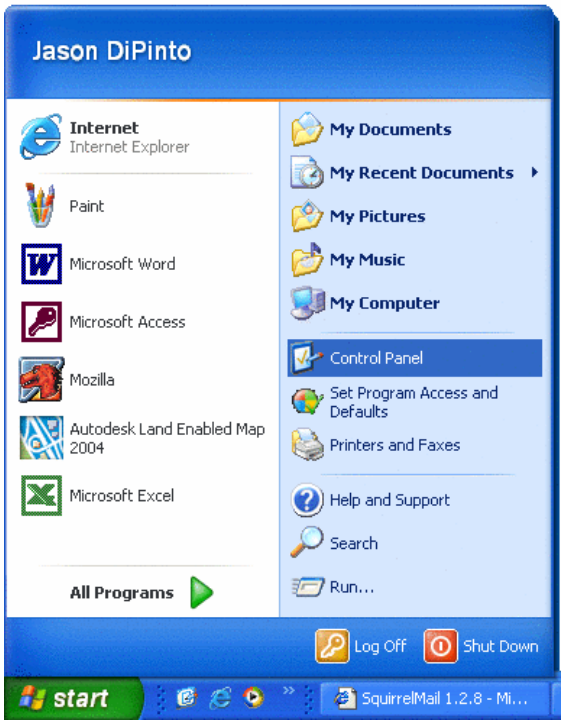
Select Finish to complete the installation.

Uninstalling Carlson Survey Desktop

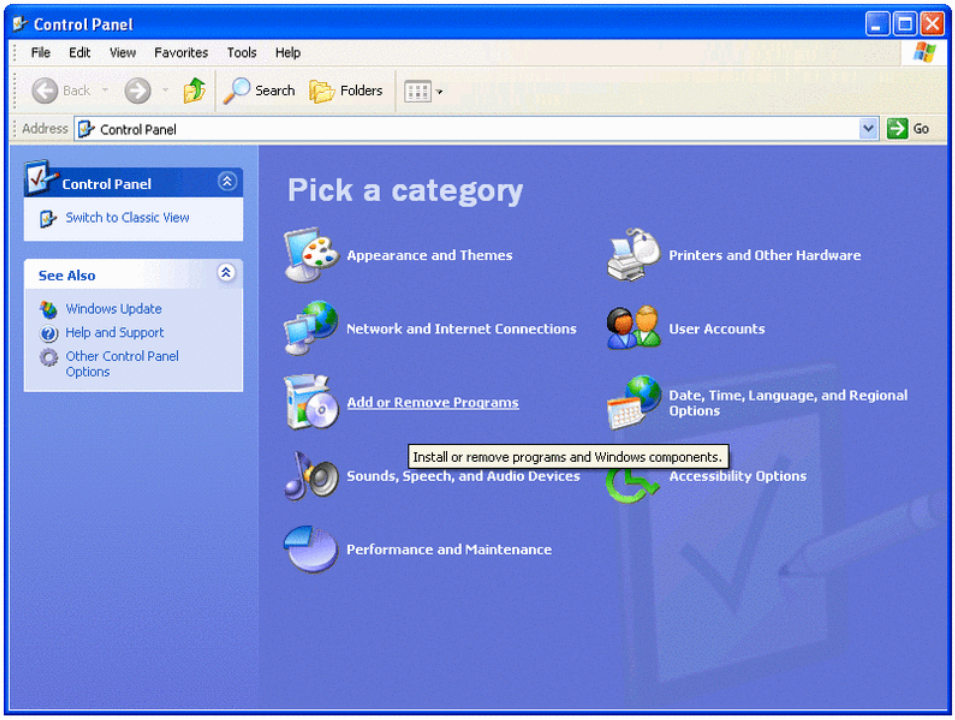
CSD may be uninstalled using the standard Windows Add/Remove Programs option.

NOTE: If you uninstall Carlson Survey Desktop, and then re-install, any created special symbol libraries will be lost.

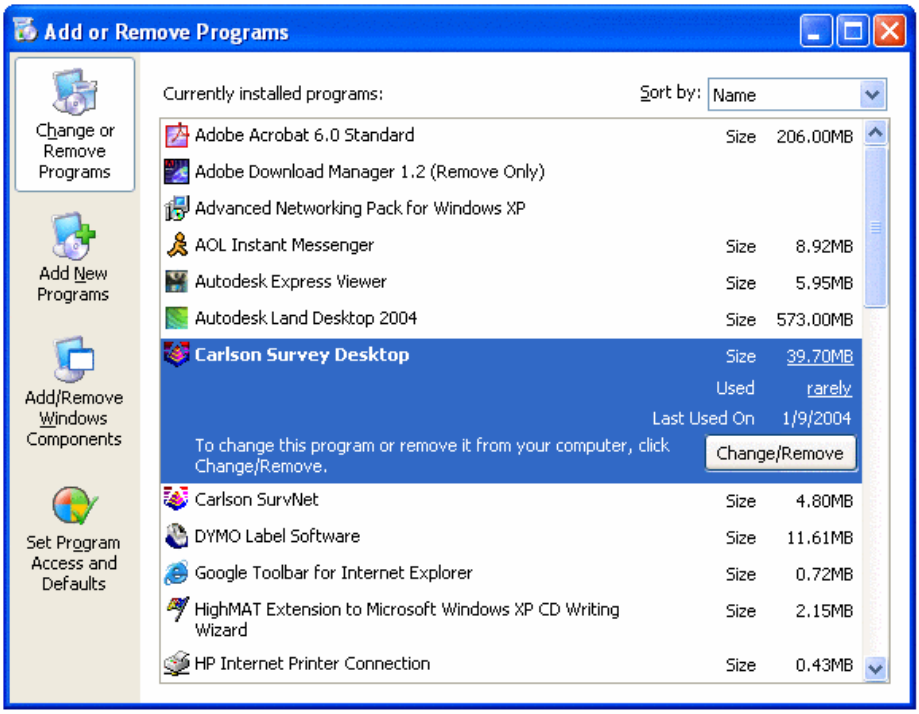
1. Use the Windows Start menu to open the Windows Control Panel



2. From the Control Panel, select Add/Remove Programs



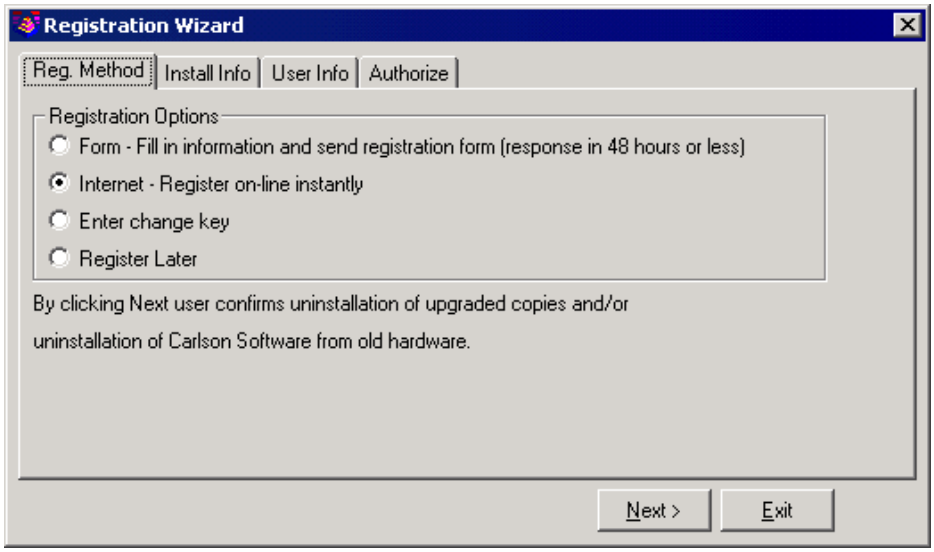
3. Add/Remove Programs generates a list of programs available for uninstall. Select Carlson Survey Desktop.



Select Change/Remove to uninstall Carlson Survey Desktop and all of its components.

Authorizing Carlson Survey Desktop

The first time you start Carlson Survey Desktop, the Registration Wizard is displayed.

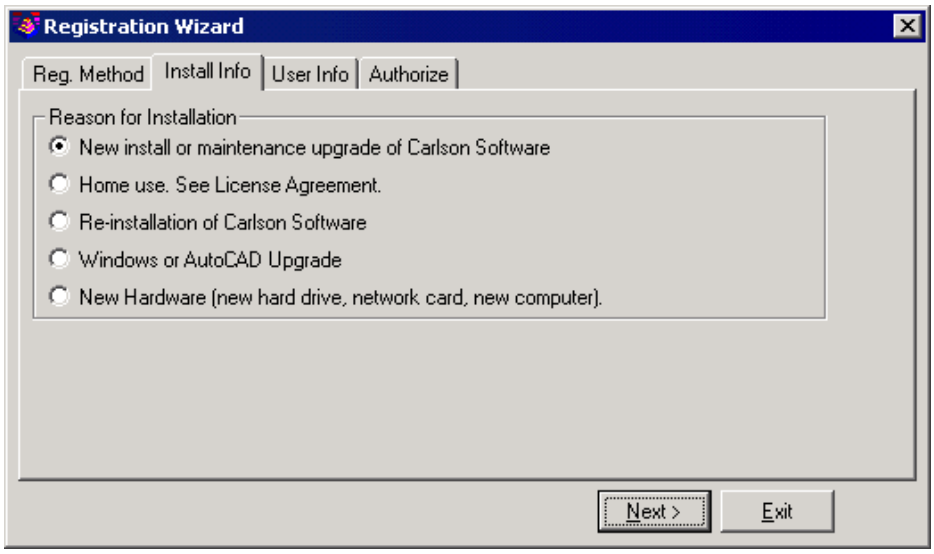


- **Note**: Carlson Software has implemented an automated procedure for registering your software license. **Change keys are no longer given over the telephone.**

1. Please choose one of the following registration methods.

- **Form**: This method allows you to fill out a form that you can print, and fax or mail to Carlson Software for registration.
- **Internet**: If your computer is online, you may register automatically over the Internet. Your information is sent to Carlson Software, validated and returned in just a few seconds. If you are using a dial-up connection, please establish this connection before attempting to register.
- **Enter change key**: Choose this method after receiving your change key from Carlson Software (if you previously used the Form method above).
- **Register Later**: You may run CSD for up to thirty (30) days before you are required to register. Choose this method if you want to register later.

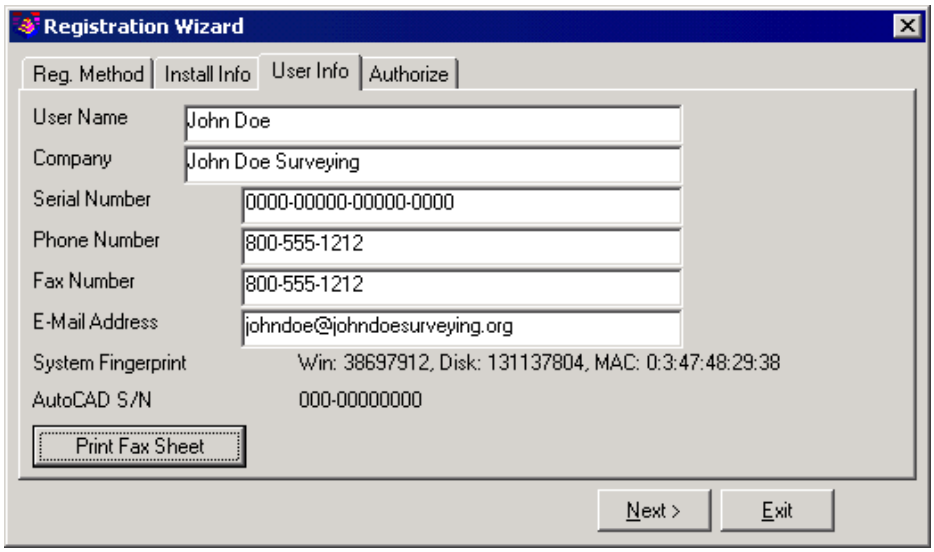
After you choose the registration method, press Next.



2. Determine the reason for installation. **The first time you install CSD is the only time you will select New install**. All subsequent installations require a choice from the remaining options.

- **New install or maintenance upgrade of Carlson Software**: If you are installing CSD for the first time, choose this.
- **Home use. See License Agreement**: Choose this reason if you are installing on your home computer. **See your license agreement for more details.**
- **Re-Installation of Carlson Software**: Choose this if you are re-installing on the same computer with no modifications.
- **Windows or AutoCAD upgrade**: Choose this reason if you are re-installing CSD after installing a new version of Microsoft Windows.
- **New Hardware**: Choose this if you are installing CSD on a new computer, or if your existing computer has had some of its hardware replaced (such as the hard disk, network adapter, etc.).

After completing Reason for Installation, select Next.



3. Enter the required information into the dialog, as shown above.

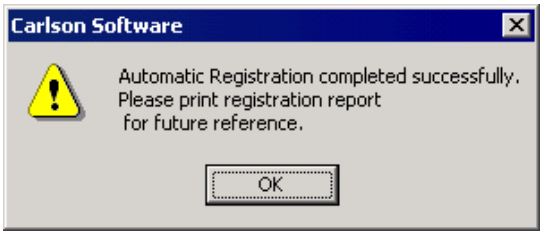
- If you are using the Form method for registration, press the Print Fax Sheet button to print out the form. You may fax your registration to 606-564-9525, or mail it to:

Carlson Software
102 W. Second St., Suite 200
Maysville, KY 41056-1003.

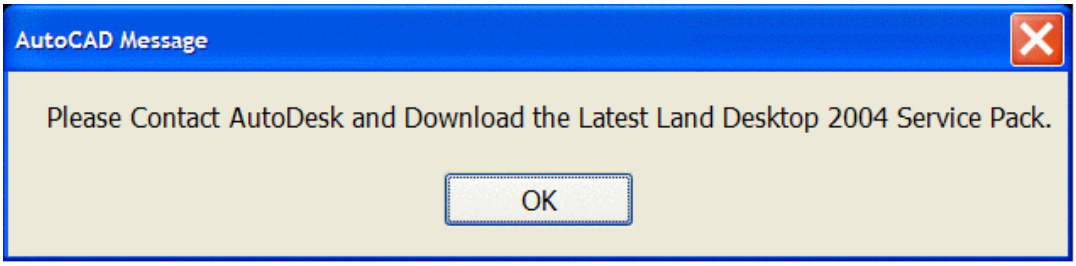
- If you are using the Internet registration, press Next. After a few seconds, your registration will complete.

- If your registration is successful, you will receive a message like the one below. If your registration is unsuccessful, please note the reason why and try again. Keep in mind that each serial number should be registered to a single computer only.

- If you do not have access to the internet and do not have a printer, you must write down the information from the User Info tab Print Fax Sheet button (shown above in the Registration Wizard), and fax it or mail it to Carlson Software.



IMPORTANT NOTE FOR Autodesk Land Desktop 2004 USERS: The first time you attempt to access a CSD menu, you may receive the following message:

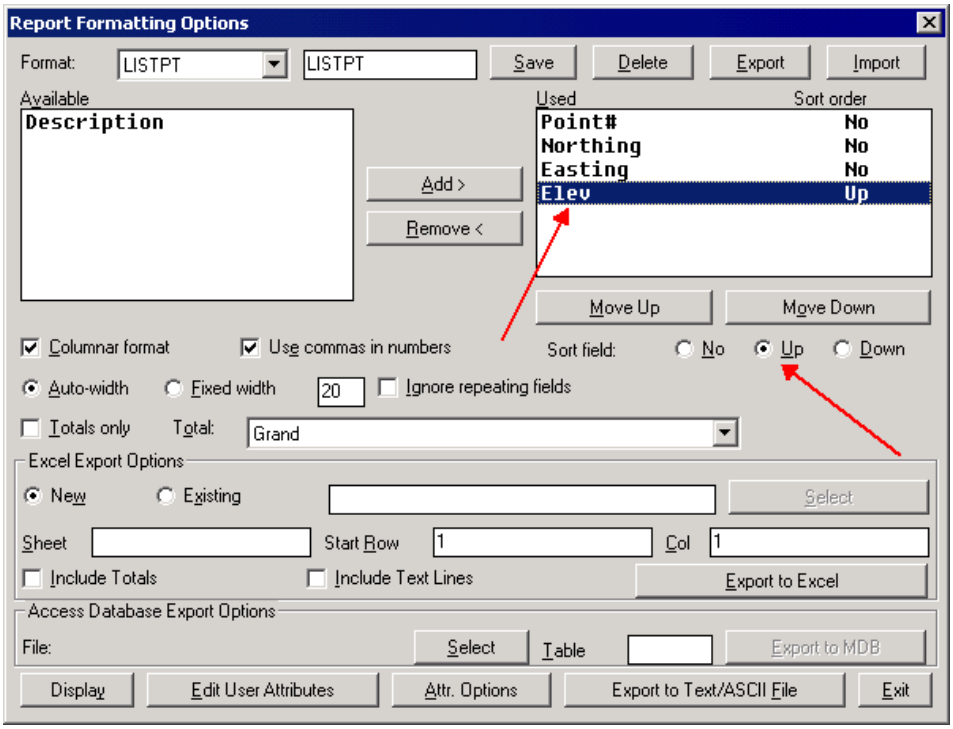


If you receive this message, visit the Autodesk website, www.autodesk.com,and follow the links and instructions for downloading the latest Autodesk Land Desktop Service Pack before attempting to use Carlson Survey Desktop. This service pack must be installed before Autodesk can properly communicate with CSD.

Report Formatter

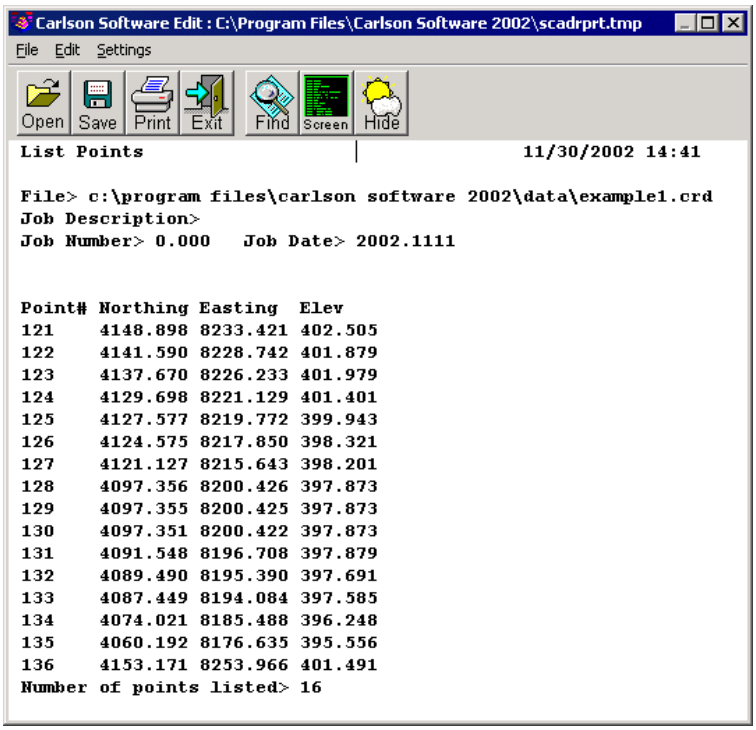
A number of CSD features use the Report Formatter tool to allow you to specify how and which calculations should be presented in the report. Anytime you see the option Use Report Formatter, as in the Cut Sheet command, you may direct the output to the Report Formatter rather than directly to the Report Viewer. The report can be displayed below in either the standard viewer described in the next section, Microsoft Excel or Microsoft Access.

The data set in the Report Formatter may be thought of as a spreadsheet, where columns are various fields related to a single item such as northing, easting, elevation, etc. Each new row represents a new item. Descriptions of these field names are displayed in the Available list of the Report Formatter. To include a data field in the report, highlight the field name in the Available list on the left and select the Add button. This moves the field name to the Used list on the right. The order of items on the right defines the order in which they will be displayed. Items are initially sorted by the first column, then items with the identical values in first column are sorted as specified for the second column, and so on. In the example below, this report will show Point numbers, northings, eastings, and elevations. It will be sorted by elevation value from high to low.



Subsequent sortings do not modify the sortings of previous columns.

To generate the report after selecting columns and other preferences, click on Display button. It will bring up a standard built-in viewer with the report. Upon exiting the viewer you may return to the Report Formatter for further data manipulation, if needed. The other data output options include saving the specified data into comma-delimited text file, or direct export to Microsoft Excel. Below is the List Points report described above.



You may define new columns as equations based on existing columns. Click on the Edit User Attributes button to add a new field name. A list of the existing attributes is available for reference.

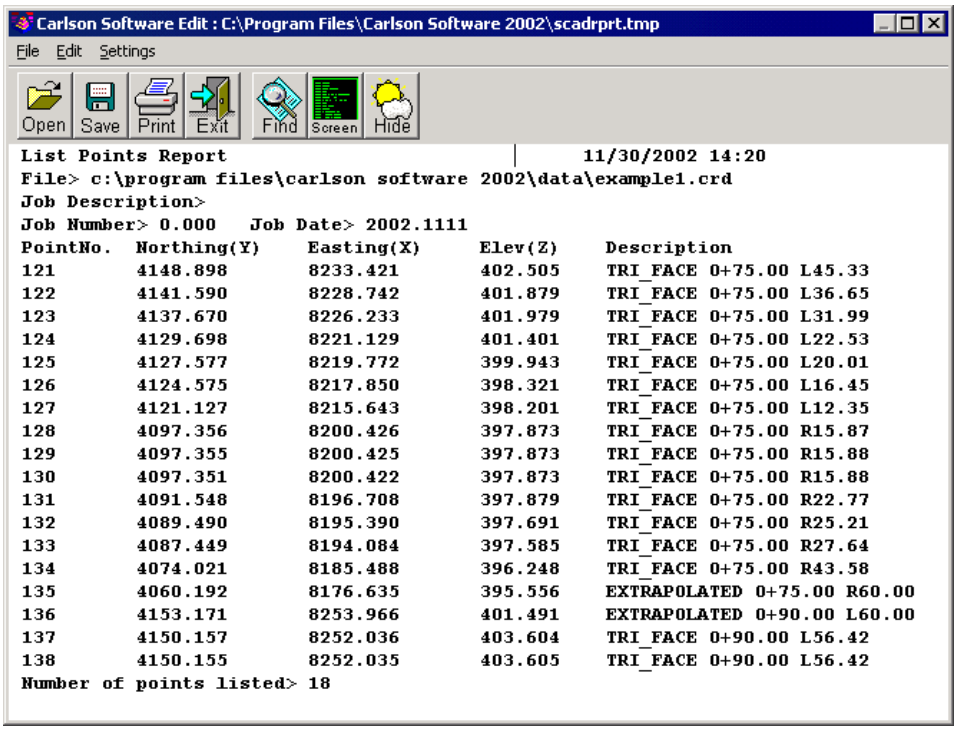
User attributes may have one of several summation options, similar to program-generated ones (although these options are set by program). The summation level is defined by the Total pop-up list in the middle of the dialog. By default only the grand total will be displayed at the bottom of the list. Selecting the next item in that box provides you with subtotals, added each time the value in the first column is changed. Use this kind of summation if the corresponding column is sorted. For example, if the first column is "Area Name" and it is sorted, and Total is set to "Grand, Area Name," the report will have a sub-total for each distinct area name. This feature makes the Report Formatter a flexible tool for results exploration, before ever using a spreadsheet. Various forms of reports may be saved and recalled using controls in the top line of the dialog.

To save a new version of the format, type in a new name (or use default to overwrite the old one) and click on the Save button. The next time that you choose the Report Formatter from the same CSD command it will recall this last format. To select another format, pull down the list of formats in the left top corner and select which format to use. To Delete an unwanted format, choose it from the list and then click the Delete button.

There are several Microsoft Excel export options provided. You may specify a spreadsheet file to load before export, as well as a left upper cell to start with and sheet number to use. Totals which are reported when using built-in viewer may be skipped when using Microsoft Excel export.

Standard Report Viewer

Many CSD features display output in the Standard Report Viewer as shown below.



The report can be edited directly in the report viewer. Report Viewer commands are described below.

- **Open**: Opens an ASCII file and displays the contents in the report viewer.
- **Save**: Saves the contents of the report viewer to a text file.
- **SaveAs**: Saves the contents of the report viewer to a particular file.
- **Append To**: Appends the contents of the report viewer to another file.
- **Print**: Prints the contents of the report viewer. This will open your regular Windows print dialog where you can choose the printer and modify any of the printer settings before printing.
- **Screen**: Draws the report in the current drawing. The program will prompt you for a starting point, text height, rotation and layer.
- **Undo**: Reverses the effect of your last action. If you inadvertently delete some text, stop and choose the Undo command to restore it. The key combination Ctrl-Z also performs this action.
- **Select All**: Selects all the text in the report viewer.
- **Cut**: Deletes the selected text and places it on the Windows clipboard.
- **Copy**: Copies the selected text to the Windows clipboard.
- **Paste**: Inserts ASCII text from the Windows clipboard into the report viewer at the cursor.
- **Search**: Opens the Find Text dialog, allowing you to search for specific items in the report viewer.
- **Replace**: Opens the Find and Replace Text dialog. Allows you to search for text and replace it.
- **Options**: Opens the Report Viewer Options dialog. In this dialog, you can specify print settings, such as lines per page and margins. You can also specify the font (used for both the display and for printing).
- **Hide**: Minimizes the report viewer window and returns to AutoCAD. This allows you to continue working in AutoCAD without closing the report. You can re-examine the report at any time by selecting the minimized report viewer icon.

*

License/Copyright

Use of this software indicates acceptance of the terms and conditions of the Software License Agreement.

Carlson Survey Desktop End-User License Agreement

This End-User License Agreement (henceforth "EULA") is a legal agreement between you, the individual or single entity (henceforth "you"), and Carlson Software, Inc. (henceforth "Carlson Software") for the software accompanying this EULA, and may or may not include printed materials, associated media, and electronic documentation (henceforth "this software"). Exercising your right to use this software binds you to the terms of this EULA. If you do not agree to the terms contained herein, do not use this software.

SOFTWARE LICENSE

This software is protected by United States copyright laws and international copyright treaties, as well as applicable intellectual property laws and treaties. This software is licensed, not sold.

GRANT OF LICENSE:

This EULA grants you the following rights:

- You may install and use one copy of this software, or any prior version for the same operating system, on a single computer. The primary user of the computer on which this software is installed may make a second copy for his or her exclusive use.
- Additionally, you may store one copy of this software on a storage device, such as a network server, used only to install or run this software on other computer over an internal network. However, you must acquire and dedicate a license for each separate computer on which this software is installed or run from the storage device. A single license for this software may not be shared or used concurrently on more than one computer, unless a license manager has been purchased from Carlson Software.

OTHER RIGHTS AND LIMITATIONS:

- You may not reverse engineer, decompile, or disassemble this software, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this limitation.

- This software is licensed as a single product. Its component parts may not be separated for use on more than one computer.
- Under certain circumstances, you may permanently transfer all of your rights under this EULA, provided that the recipient agrees to the terms of this EULA.
- Without prejudice to any other rights, Carlson Software may terminate this EULA if you fail to comply with the terms and conditions of this EULA. In this event, you are required to destroy all copies of this software, and all of its component parts.

COPYRIGHT:

- All title and copyrights in and to this software, including, but not limited to, any images, photographs, animations, video, audio, music, text, or "applets" incorporated into this software, the accompanying printed materials, and any copies of this software, are the sole property of Carlson Software and/or its suppliers. This software is protected by United States copyright laws and international copyright treaties, as well as applicable intellectual property laws and treaties. Treat this software as you would any other copyrighted material.

U.S. GOVERNMENT RESTRICTED RIGHTS:

- Use, duplication, or disclosure by the U.S. Government of this software or its documentation is subject to restrictions, as set forth in subparagraph (c)(1)(ii) of the Right in Technical Data and Computer Software clause at DFAARS 252.227-7013, or subparagraph (c)(1) and (2) of the Commercial Computer Software Restricted Rights at 48 CFR 52.227-19, as applicable. The manufacturer is:

Carlson Software, Inc.
102 W. Second St.
Maysville, KY 41056

LIMITED WARRANTY:

- CARLSON SOFTWARE EXPRESSLY DISCLAIMS ANY WARRANTY, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NONINFRINGEMENT REGARDING THESE MATERIALS. CARLSON SOFTWARE MAKES SUCH MATERIALS AVAILABLE SOLELY ON AN "AS-IS" BASIS.
- IN NO EVENT SHALL CARLSON SOFTWARE BE LIABLE TO ANYONE FOR SPECIAL, COLLATERAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH, OR ARISING OUT OF, PURCHASE, USE, OR INABILITY TO USE THESE MATERIALS. THIS INCLUDES, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION OR ANY OTHER PECUNIARY LOSS. IN ALL INSTANCES, THE EXCLUSION OR LIMITATION OF LIABILITY IS SUBJECT TO ANY APPLICABLE JURISDICTION.
- IF THIS SOFTWARE WAS ACQUIRED IN THE UNITED STATES, THIS EULA IS GOVERNED BY THE LAWS OF THE COMMONWEALTH OF KENTUCKY. IF THIS PRODUCT WAS ACQUIRED OUTSIDE OF THE UNITED STATES, THIS EULA IS GOVERNED BY THE LAWS IN ANY APPLICABLE JURISDICTION.

Tutorials 2

Field to Finish from Coordinate Data

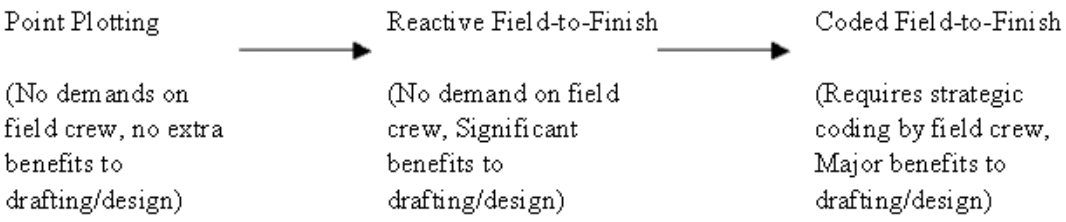
Reactive Field to Finish

Field to Finish is used to create a partial or nearly complete drawing based on a field survey. Field to Finish features draw not only points and coordinate data, but also add symbols and linework to designated layers, and even change text styles according to instructions built into the Field to Finish coding.

Autodesk Land Desktop conducts Field to Finish using the raw survey data file, which is known as the Fieldbook (.fbk) file. Carlson Survey Desktop (CSD) performs Field to Finish using the point file (typically named points.mdb within Autodesk Land Desktop). The use of Field to Finish by surveying, engineering, construction and mining companies places additional demands on survey crews to do intelligent coding, and on the office team to design an effective coding system. Field to Finish is used by 30% of survey crews, depending on software and geographic region.

Field to Finish remains the single greatest software-based method for increasing efficiency and speed of work of the combined field and office team. The ease of Field to Finish with CSD encourages increasingly more companies to utilize these benefits.

There are two approaches to Field to Finish, "reactive" and "planned." Tutorial 1 focuses on reactive Field to Finish. This makes no demands on the field crew to carefully code their survey points. This method can be used to get linework and symbols drawn from surveys conducted by outside firms, over which you may have no influence on coding, and from in-house survey crews who don't follow any particular code system. With "reactive" Field to Finish, you assign instructions to whatever codes were found. You make a new code table with each job, read in the descriptions used, assign linework, symbols and layers, then plot out the results. The process still saves much time over standard point plotting followed by line-by-line and symbol-by-symbol drafting. It is one step on the way to maximum efficiency, as illustrated below:



Landfill Point File

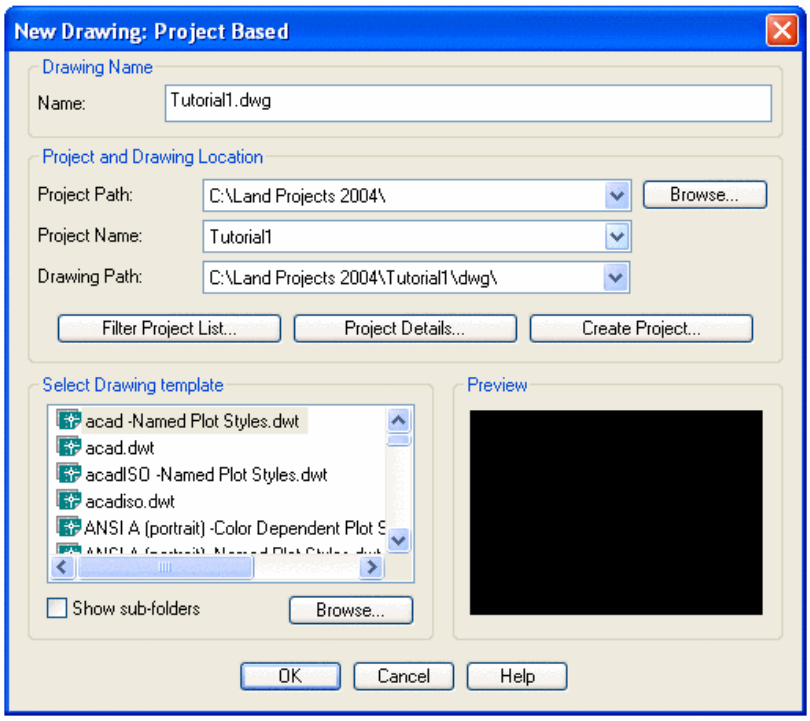
Carlson Survey Desktop includes an ASCII file called Tutorial1.txt with the software package. The file is found in a subdirectory of Autodesk Land Desktop which, for Autodesk Land Desktop 2004, would be:

C:\Program Files\Land Desktop 2004\SurveyDesktop\Data.

This is a file of survey points in the form Pt#,N,E,Z,D (D for description). This file might represent a typical survey conducted by an outside firm under contract, where you are not able to instruct the crew how to code their survey shots. In this instance, your only option is to deal with whatever descriptions (codes) they used to describe the points.

New Project

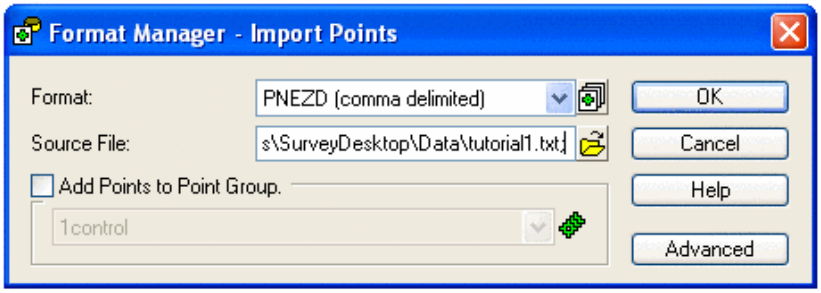
Choose Create Project to start a new Project, and name it Tutorial1 as shown below, with the drawing name Land1.dwg (or Tutorial1.dwg). The exact names are not critical, but may help you to follow along closely.



A scale of 1"=50' (imperial or English) is appropriate for this data set.

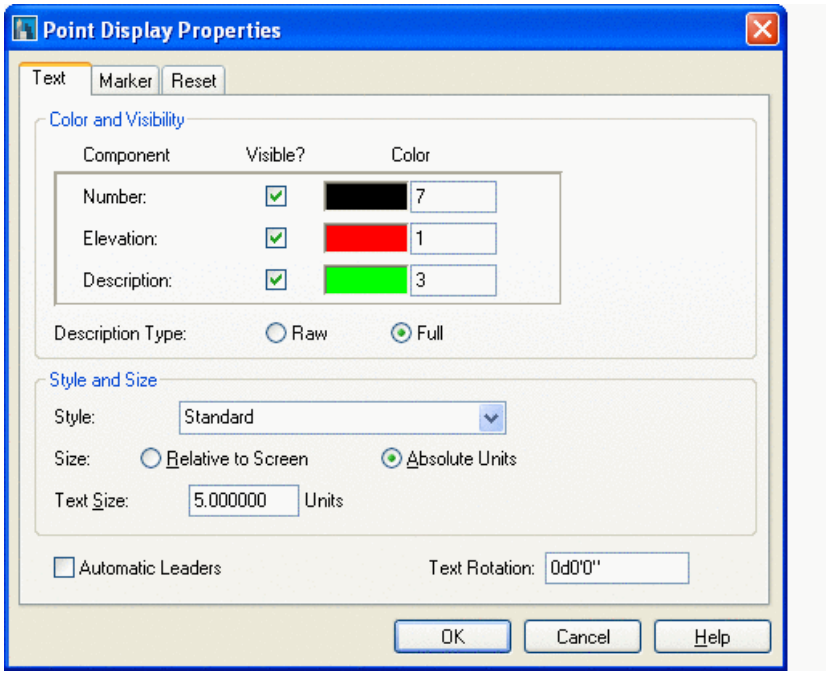
Importing Tutorial1.txt

After the project and drawing are started, select Import/Export Points under the Points menu of Autodesk Land Desktop. From the Import/Export Points fly-out, select Import Points. Complete the dialog (shown below):

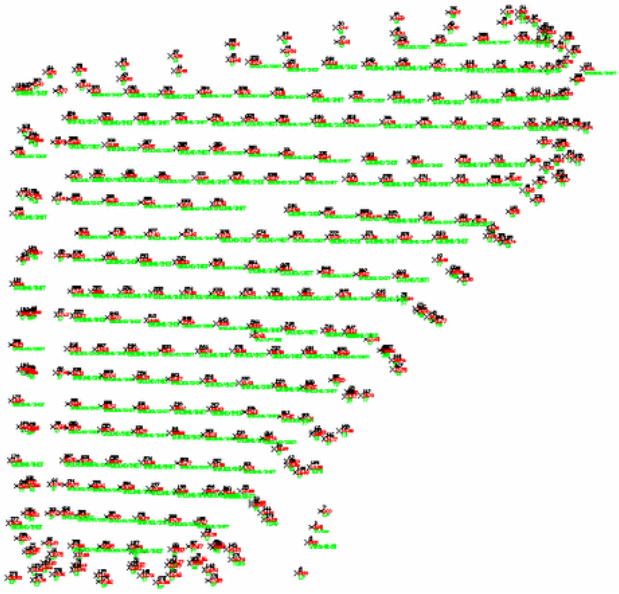


Select OK, and then select OK again to the default settings in the COGO Database Import Options Screen. The points are then read in, added to the Points.mdb file and plotted on the screen.

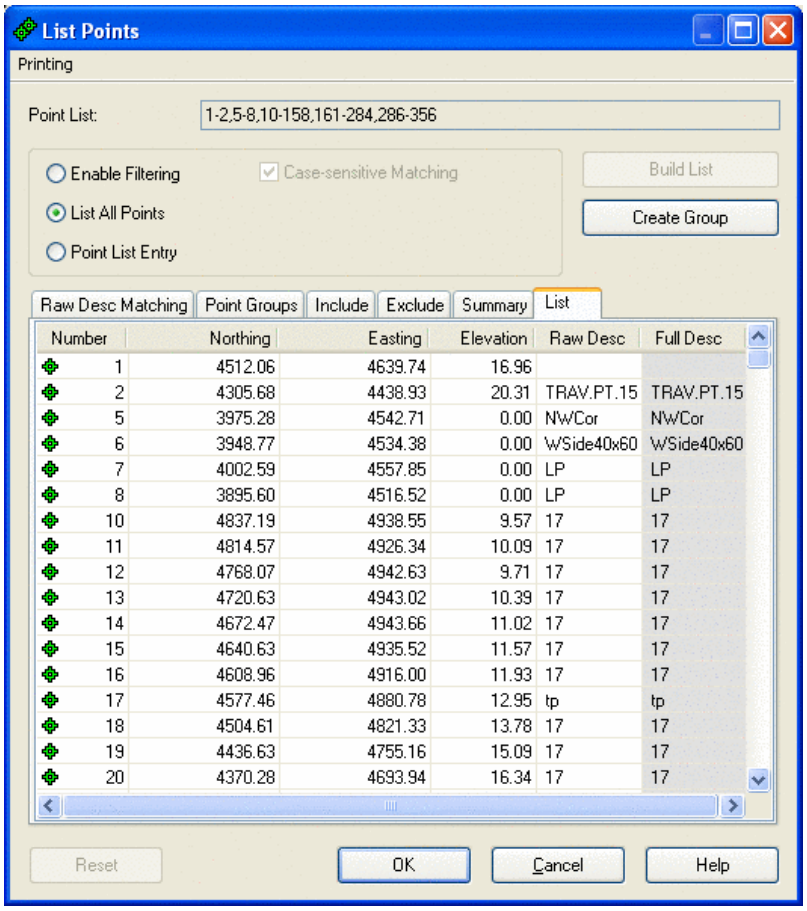
TIP: For greater contrast, change the color of the point numbers to black by selecting the Points pulldown, Edit Points, and Display Properties. From the command line, choose S for Selection, and when asked "Select Civil Points:" enter All for all points. In the Point Display Properties dialog (shown below), select the color box for the point numbers and change the yellow to the black (7) color as shown below:



After selecting OK, the point plot appears as shown here:



Study the point coordinates and descriptions by choosing List Points under the Points menu. Select List All Points to bring up the following dialog:

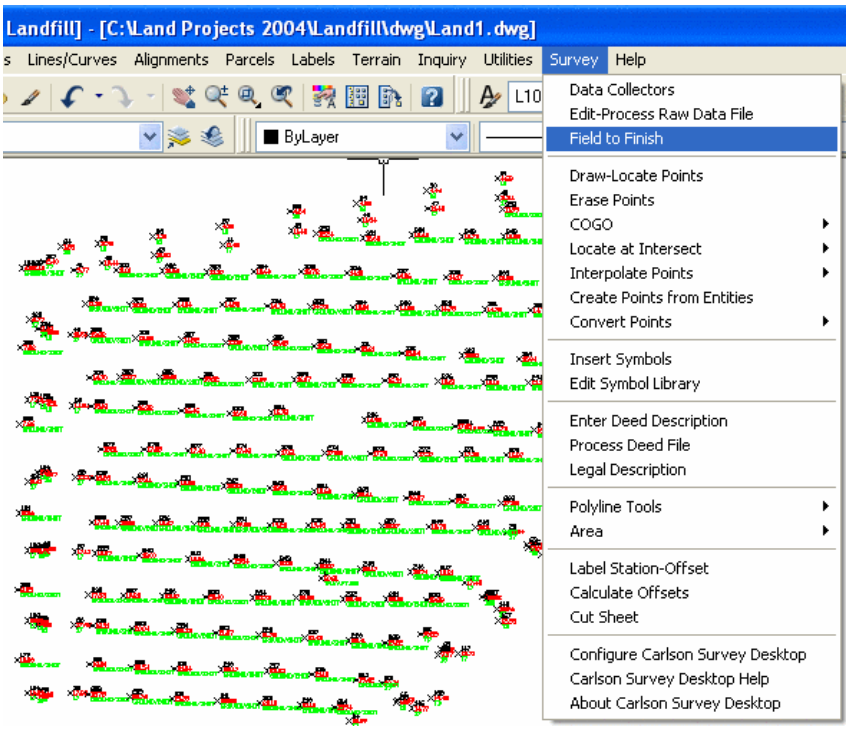


Under Raw Desc column, you see the descriptions used in this file. Code LP is used more than once. We may assume for this exercise that it indicates a Light Pole. Code 17 is more mysterious, but it is used repeatedly, and if you examine the drawing, you will note that these codes circle the site. Code 17 and its companion code 18 are candidates for linework. Note that the elevations are less then 50. No matter who conducted the survey, we can jump-start a drawing by making some assumptions that create linework and symbols.

Starting a New Field to Finish Code Table

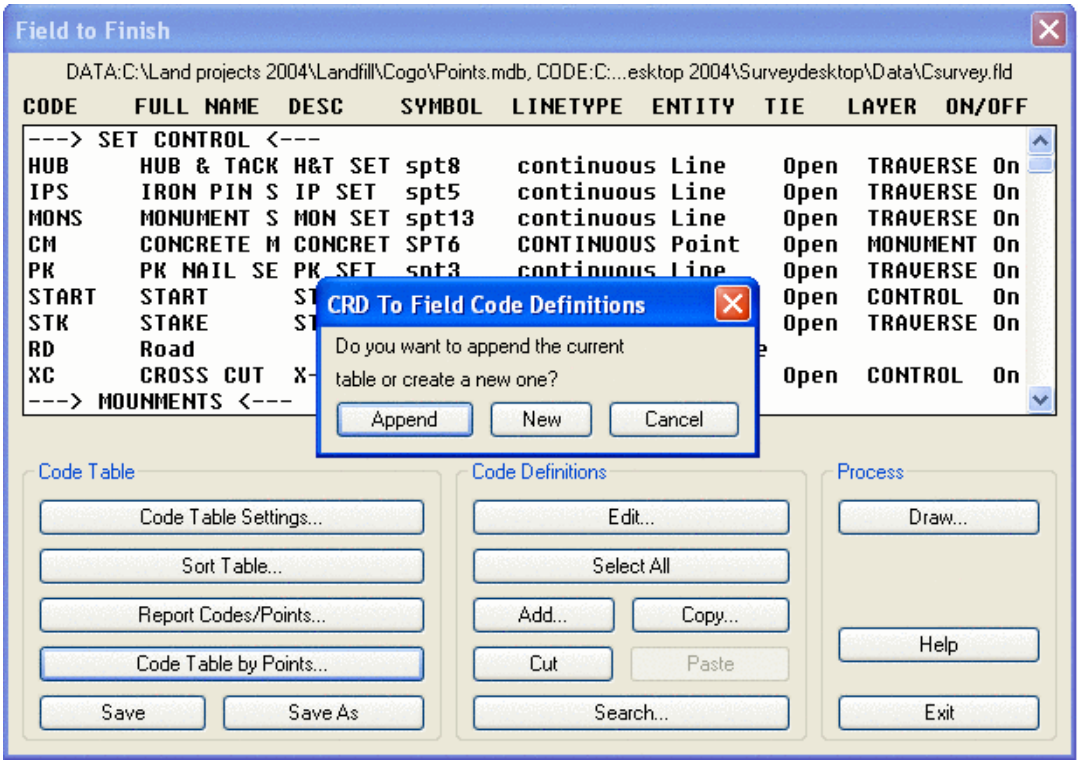
Most companies using Field to Finish have a coding system that is deliberately designed. A code such as EOP might be "edge of pavement" and DL might be "ditch line", etc. But in our case, we must react to a coordinate file with random descriptions. You can plot the points, but why not do more by making some automatic lines and symbols?

To begin, select Field to Finish in the Survey pulldown menu.



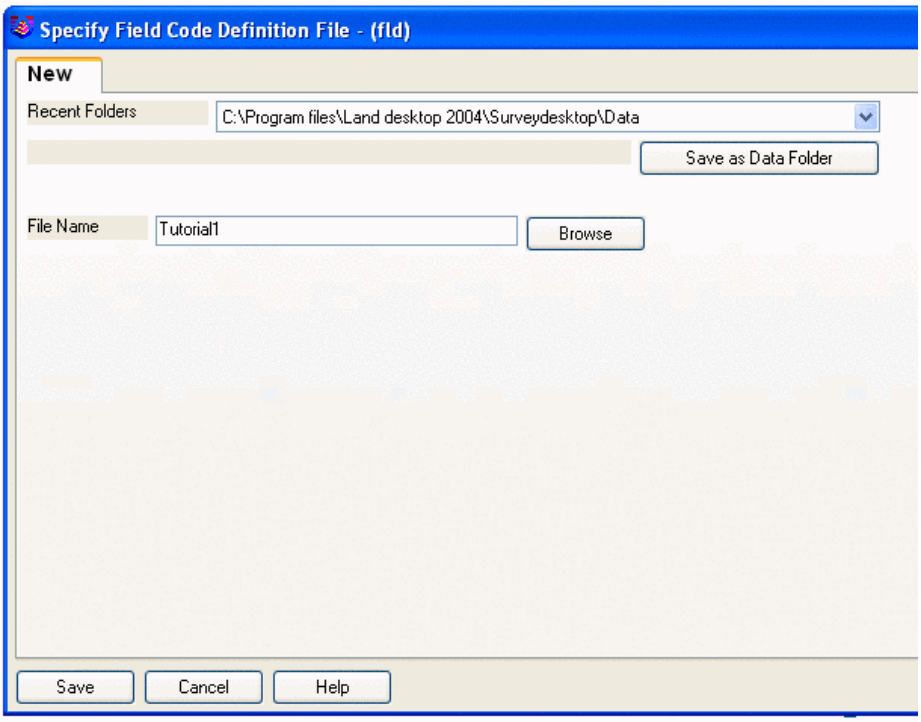
The first time you select Field to Finish, it displays a dialog to load an existing Field to Finish code table. Load "Csurvey.fld," to get started.

The Possible Multiple Codes Found dialog box may appear. If this dialog box is displayed, select the default, Split all multiple codes, and press ok.



To create a table from new, unexpected or third party coordinate point descriptions, choose Code Table by Points

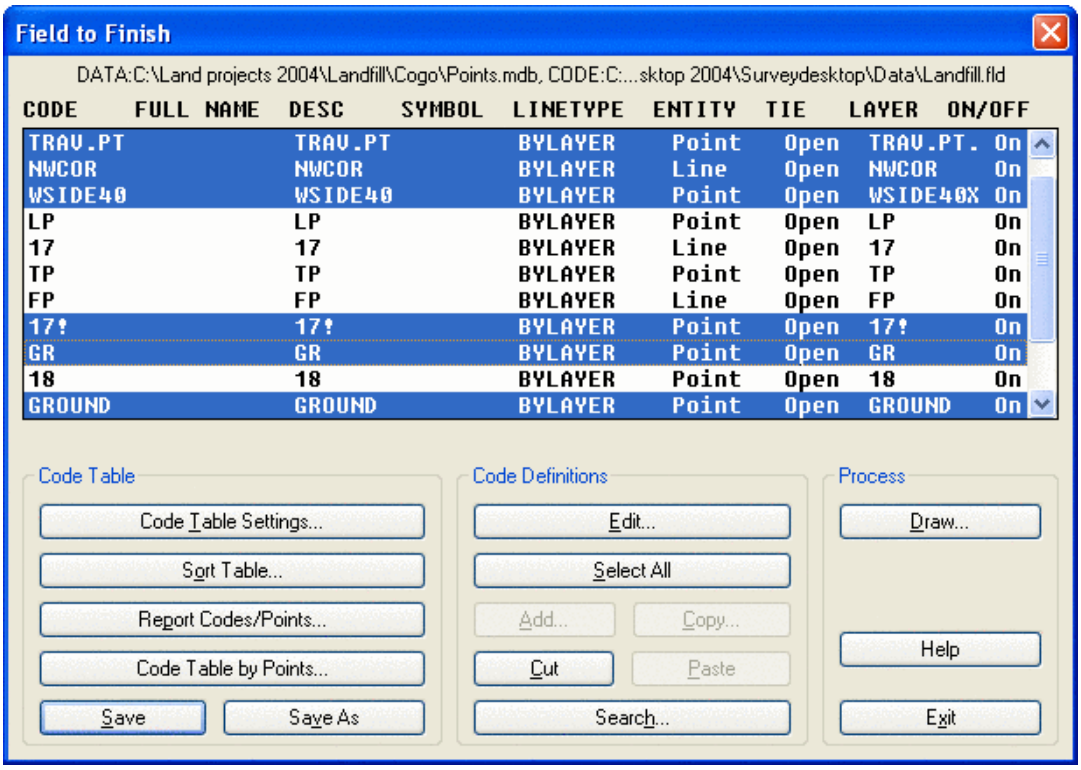
and select New to create a new table. The dialog shown below is typical of those used in CSD to create new files.



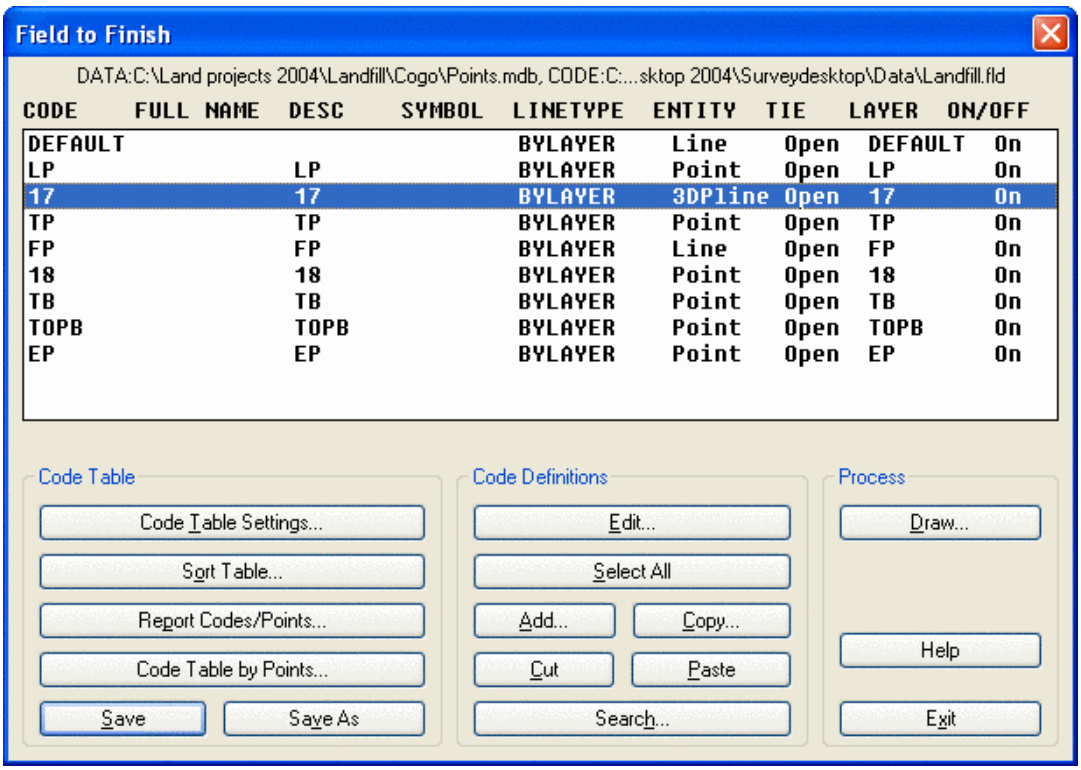
Name the new coding file "Tutorial1" and click Save to create the file. The Field to Finish coding files have a .fld extension, as shown at the top of the dialog.

Deleting Table Entries

This brings you to a table that is preset to show all descriptions found in the coordinate file. If you examine the drawing closely, note that many of the displayed descriptions appear once or are used as generic descriptions (e.g.. Ground Shot and gr), and therefore aren't useful for linework or for meaningful symbol selection. We can select these as shown by holding down the Ctrl key and selecting each one (standard Windows procedure for selecting multiple objects) and then select Cut from the dialog box to remove them from our list.



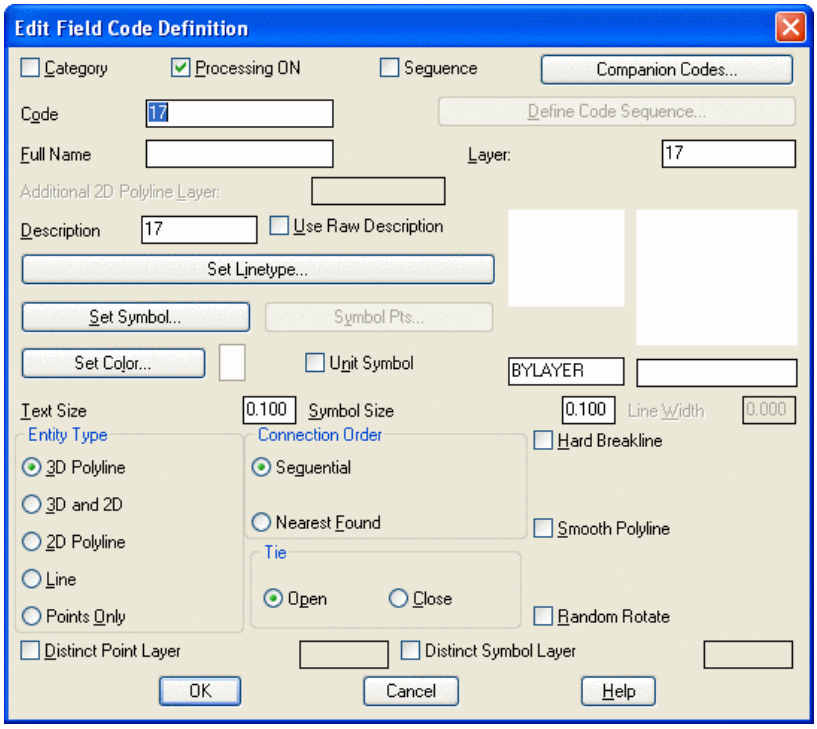
The following shorter list remains, which can be used for assigning symbols and linework, with layering.



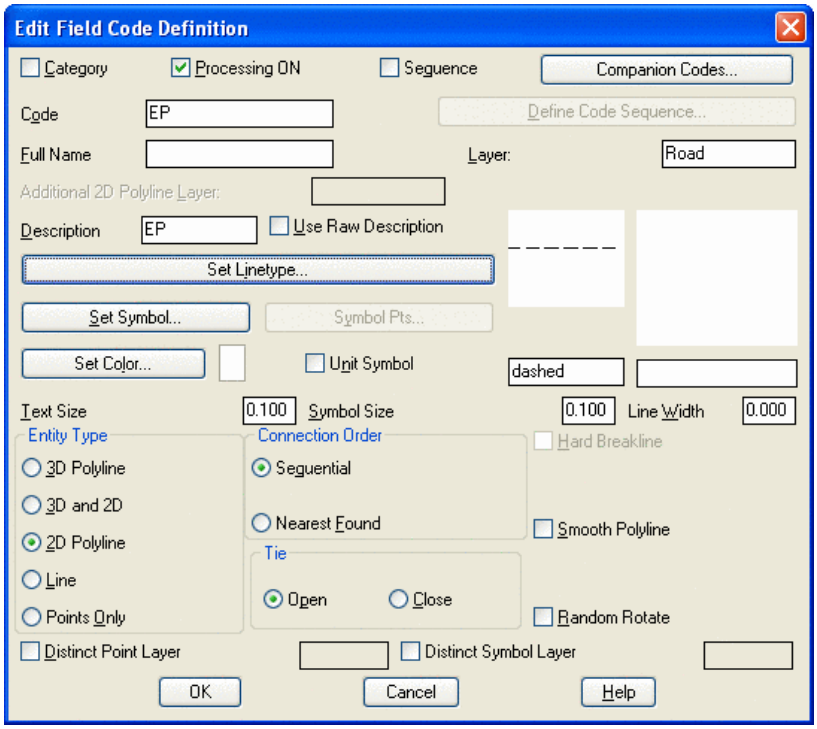
Defining Linework Coding

Select Code 17, and edit it into a 3DPline by choosing Edit under Code Definitions. There are many options here,

but you will note that the program has already layerized code 17 to the same layer as the description, namely layer 17. You can change this to "Ditch" or "TopofBank" or "BreakLine" as desired, but for efficiency in the processing, all we need to do is make sure the entity type (lower left in dialog) is a 3D polyline. This will assist in making accurate contour maps and defining break lines. The default linetype will be continuous. Repeat this process for code "18".

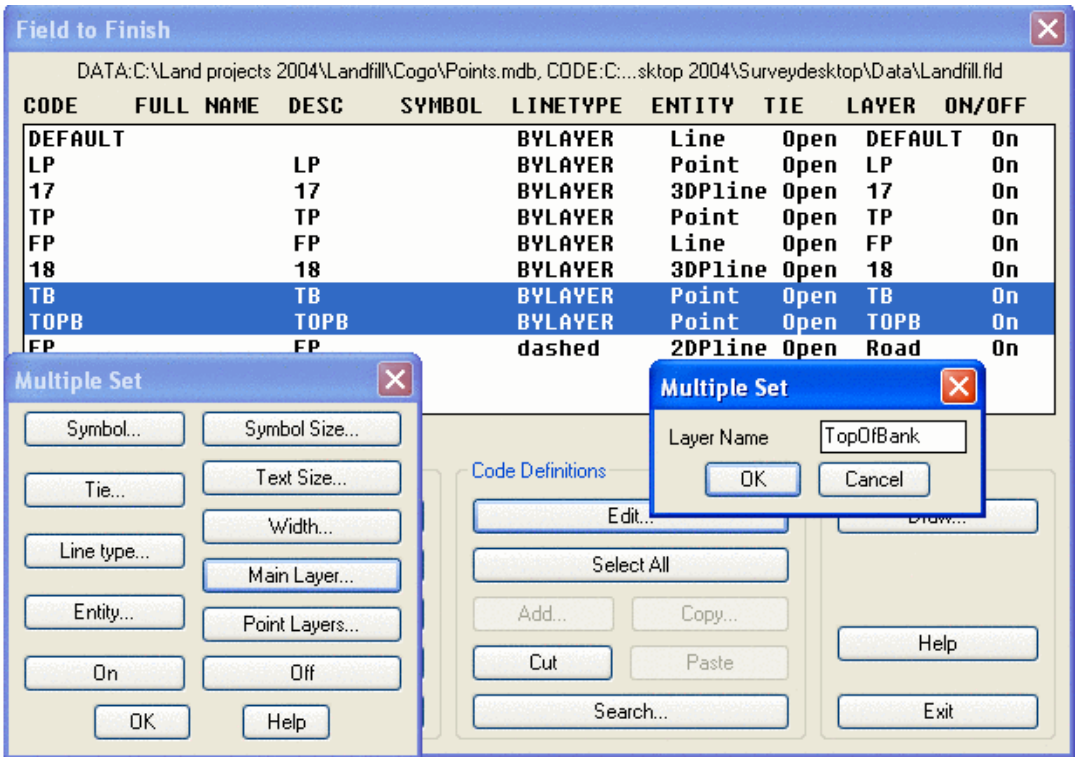


You can also revise the default layers and linetypes. Try this with the EP code. Make the layer Road, the entity a 2D Polyline and the linetype dashed.



You can also edit two at a time, if the descriptions TB and TOPB both refer to "top of bank." To make a 3D Polyline in the layer TopOfBank, select TB then hold down the Ctrl key and select TOPB also. With both highlighted, choose Edit.

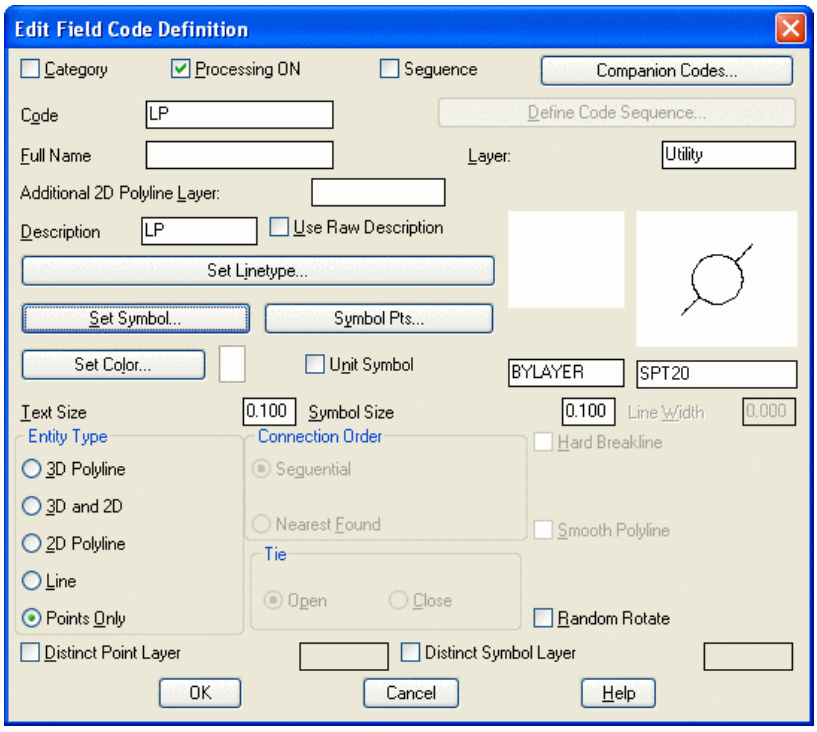
Note that you have a smaller set of options based on your multiple selection. You can only do things that apply to multiple codes at once. To change the layer for both, select Main Layer, then enter TopOfBank, as shown here:



Repeat the process for Entity and set it to a 3D Polyline. Any survey point can be part of a line or polyline, as well as having a defined symbol.

Defining Symbol Coding

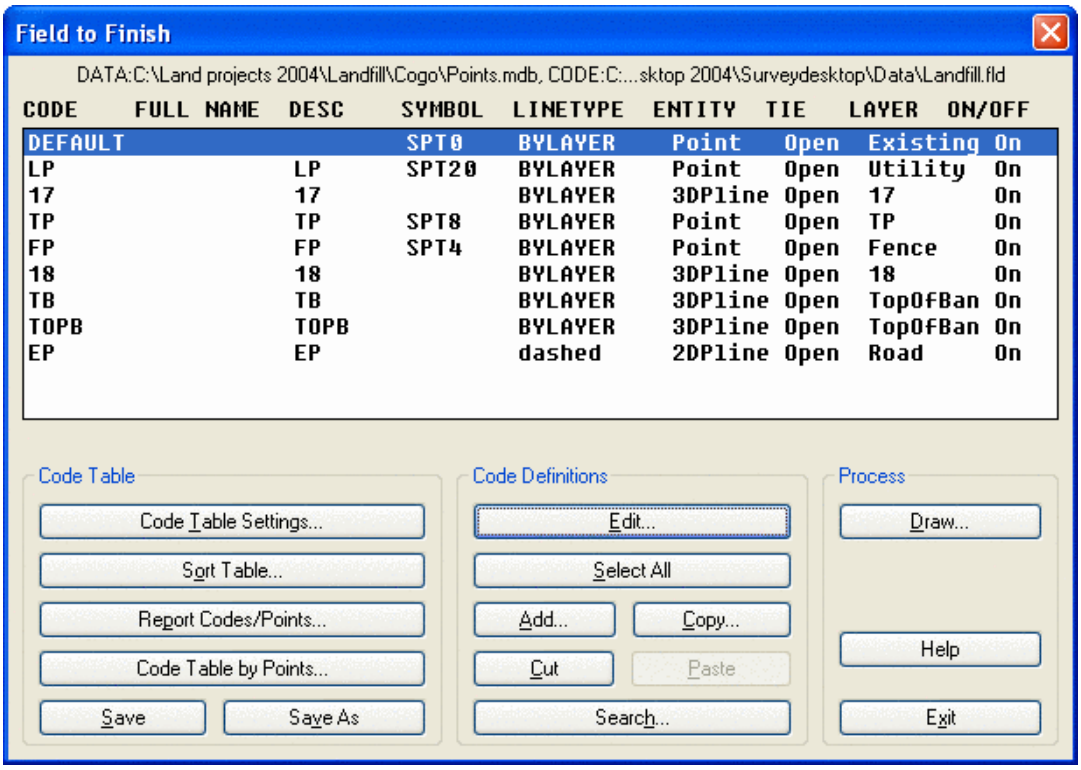
Codes FP, LP and TP represent points that benefit from layering and special symbols to assist in drafting and design. Although reactive Field to Finish makes sense for linework, some codes may be distinguishable as specific points (e.g. LP as Light Pole, FP as Fence Pole and TP as Traverse Point). Click LP in the list above and select Edit. Place LP in layer Utility and choose Set Symbol and choose a symbol icon such as SPT20 (scroll down to locate this symbol) after selecting Set Symbol.

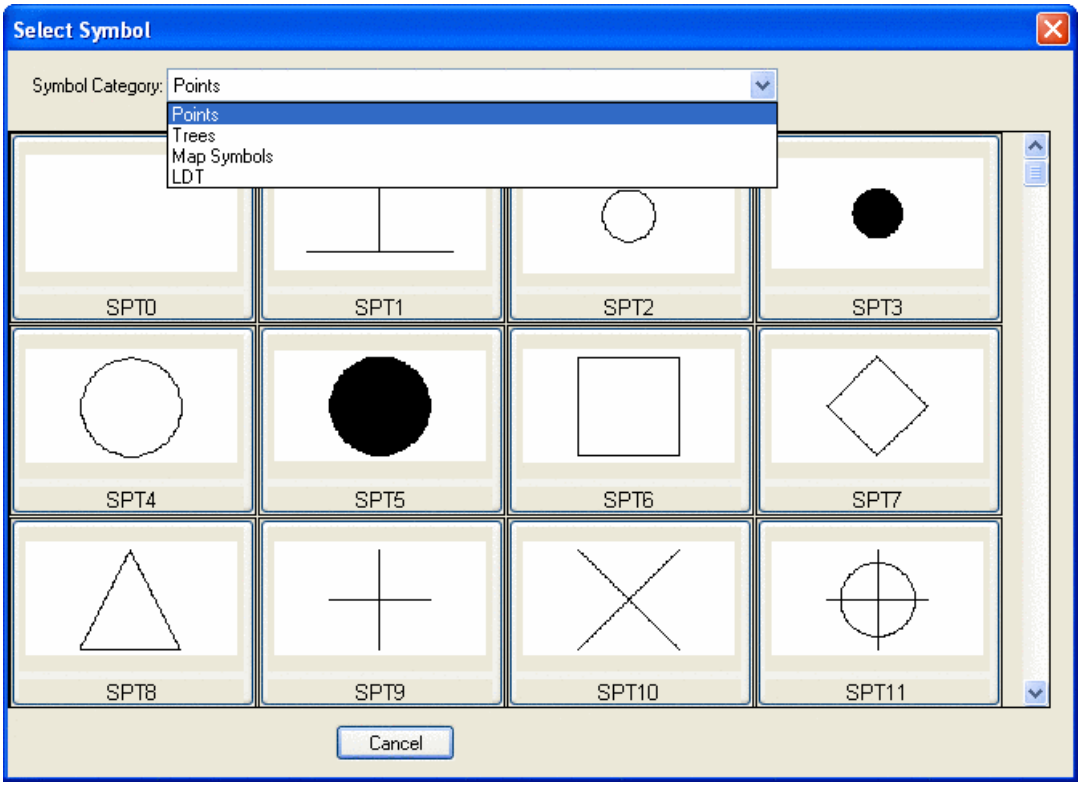


For this exercise, use symbol SPT8, the triangle, for the traverse point (TP) and symbol SPT5, an open circle, for the fence post (FP).

Use of the Default Code

This defines everything except the "Default" code. Whatever layer and symbol is used for the default code will be applied to all descriptions not found in the code table. For this exercise, choose no symbol at all for the extra codes by selecting the blank symbol (SPT0). Change the layer for default entities to Existing.

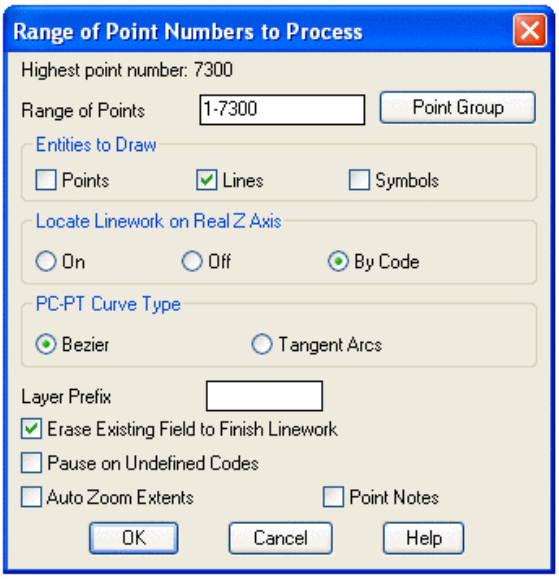




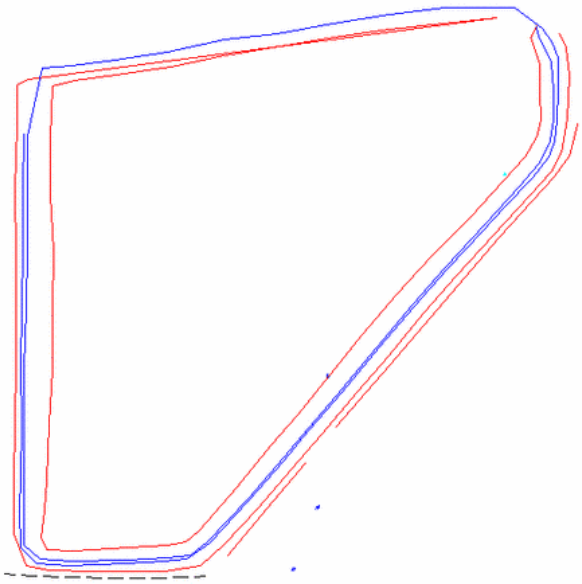
Drawing Lines and Symbols

The purpose of Field to Finish is to draw lines and symbols that wouldn't draw if you simply plotted the points to the screen. With the points already on the screen as a reference, select Draw found under Process in the Field to Finish

dialog, and under Entities to Draw, de-select Points and select Lines and Symbols, as shown here:



If we freeze the points, the following linework and point symbols have been created.



We're done with our "reactive" Field to Finish. All that is necessary now is a little editing using some of the Polyline Utilities found in CSD.

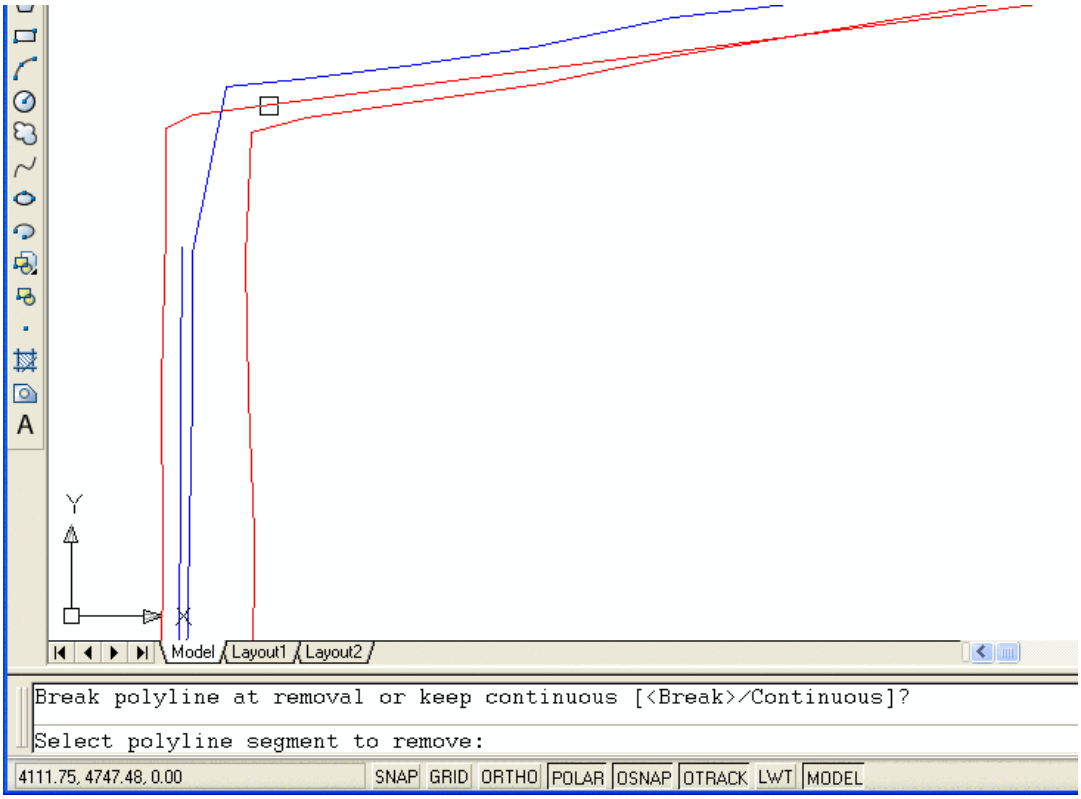
The Polyline Utilities of Carlson Survey Desktop

Reactive Field to Finish will usually require some editing. True Field to Finish techniques involve codes for starting and stopping polylines, creating rectangles for buildings, closing polylines, and even automatically creating offset polylines. A file that contains only raw descriptions, with no special instruction codes, can produce linework and symbols, but there is usually a little "chaos" that needs correction. CSD's polyline utilities are perfect for this cleanup process.

The blue ditch line (Layer 18 can be set to blue in Layer Control) is crossed in the NW corner by a wayward red, Layer 17, polyline. In this instance, one polyline connected arbitrarily to what should have been a distinct new polyline. This occurred because there was no start-stop logic. See Tutorial 2 for examples of polyline start-stop, curve, rectangle and other techniques. For reactive Field to Finish these must be cleaned up. The wayward red polyline segment in the NW corner, cutting across the blue polylines that represent a trapezoidal ditch, can be removed by the Remove Polyline Segment command.

Remove Polyline Segment

Select the Survey pulldown menu, then Polyline Tools, then Remove Polyline Segment. The command line prompt is:
Break polyline at removal or keep continuous [<Break>,Continuous]? Press B for Break or simply press Enter. Any option in the <> brackets is the default response.



When prompted to pick the segment to remove, select as shown. This completes the process. The drawing is cleaner, but there is still work to do.

Inverse to Determine a Distance or Find a Point

If the top of bank layer is set to magenta, you can see that the survey crew coded a combination of TB and TOPB, where one description ended and another began, creating a gap. Gaps like these can be quickly closed using the command Join Nearest, under Polyline Tools.

Before using the command, it's a good idea to measure the gap. You can use AutoCAD's Distance command and snap to the endpoints, or for the true 2D distance, use CSD's Inverse command.

To locate the Inverse command, select Survey, then COGO, then Inverse. The prompting is:

Traverse/SideShot/Options/Arc/Pick point or point number: Pick one side of the gap

Northing(Y) Easting(X) Elev(Z)

4078.95 4537.39 15.32

Traverse/SideShot/Options/Arc/Pick point or point number: Pick the other side of gap

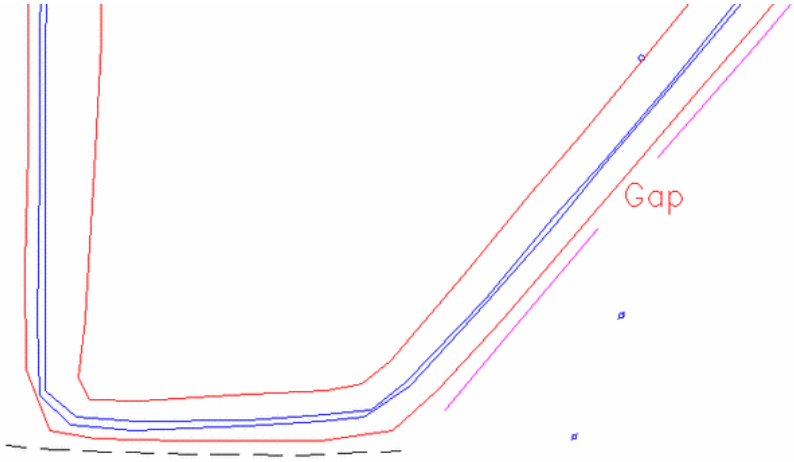
Northing(Y) Easting(X) Elev(Z)

4141.59 4589.89 14.48

Bearing: N 39d58'01" E Horizontal Distance: 81.7397854

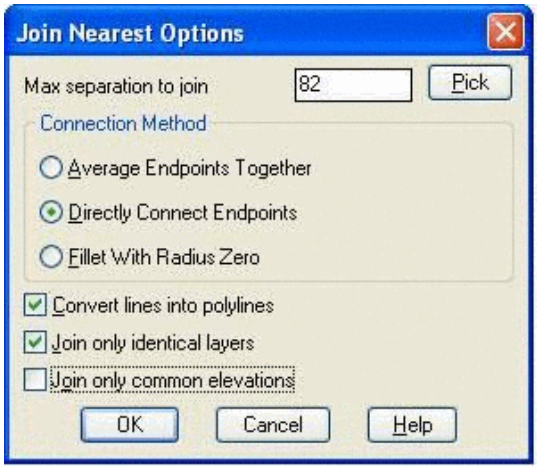
Traverse/SideShot/Options/Arc/Pick point or point number: Enter to end

NOTE: Inverse is very handy. You can Inverse from point numbers (e.g.. 169 to 168 in this case) or by picking or by a combination of picking and point numbers. If you do not know where point 52 is, Inverse to it and you will "rubber band" from it immediately! So the gap in question is about 82 units.

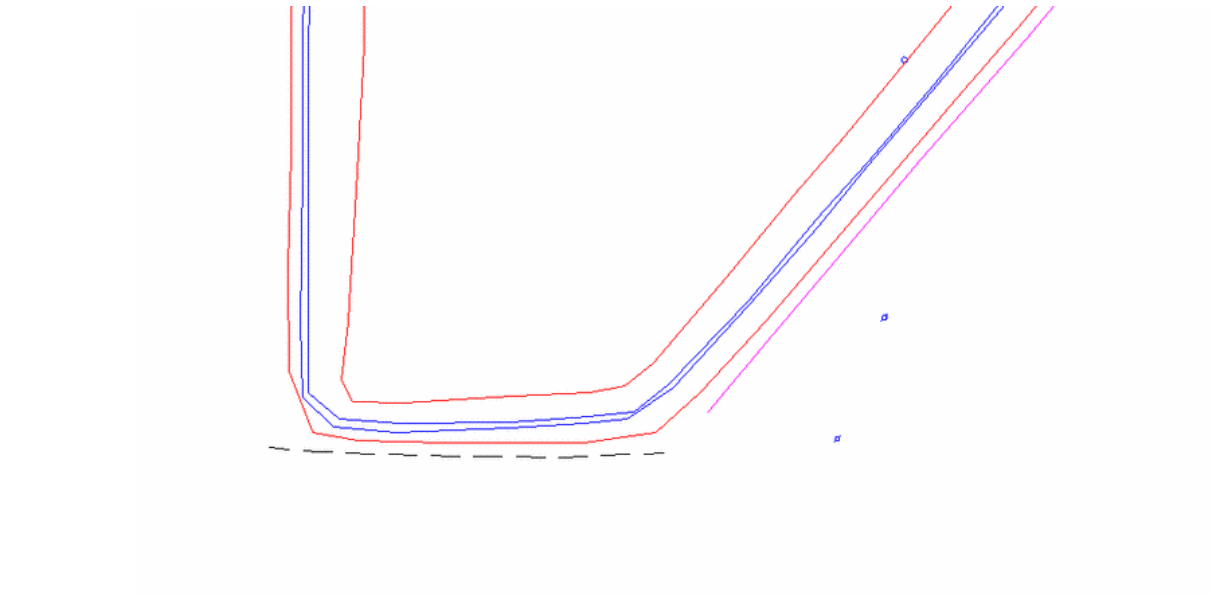


Join Nearest

Now that you know the gap to close is just under 82 units (feet, in this case), select Join Nearest under Polyline tools, and enter a tolerance of 82 or less, and that the endpoints may be different elevations, as shown here:

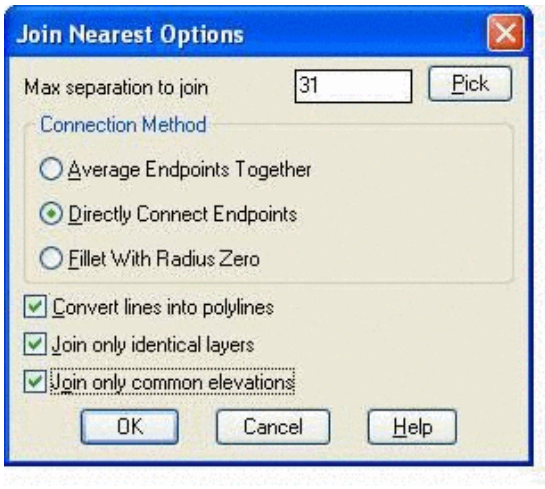


This means the "join" will directly connect the two polylines and deal with a separation of up to 82 feet, and will also allow for different endpoint elevations. Select OK, and the result is shown below. Note that Join Nearest is also useful for joining contour lines that are composed of small, unattached segments into single entity contours for each elevation. In this case, you would set the "Max separation to join" to 1 (never try to join if the gap exceeds 1 unit) and you would select "Join only common elevations." Join Nearest has many distinct uses, as you will see below.

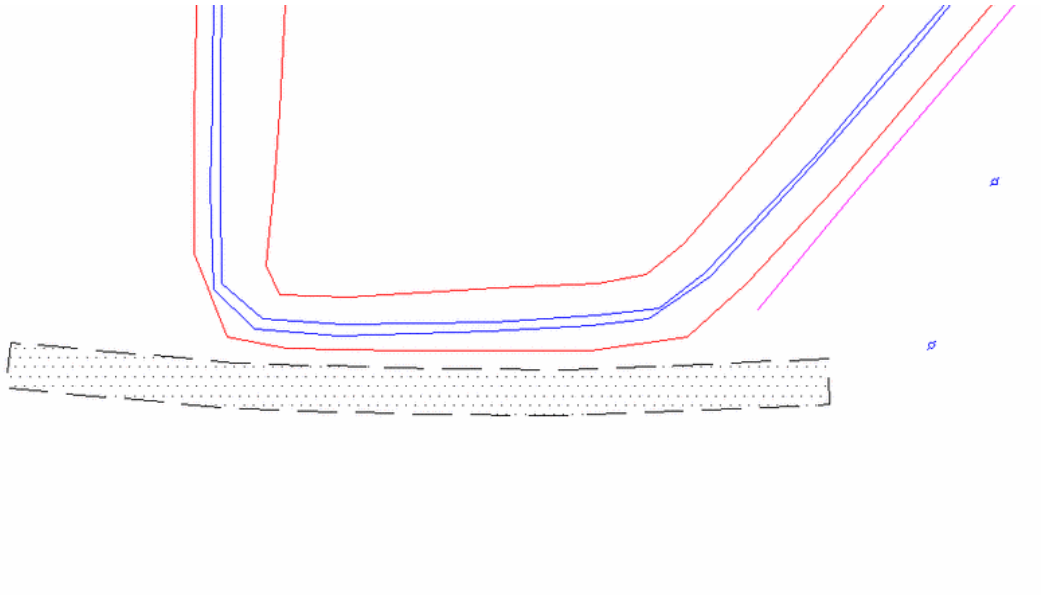


Extend by Distance

One goal might be to create a hatched area for a 30 unit wide road, by offsetting the dashed line, closing its ends, then hatching it, then removing the two end segments. First, however, you might want to make the road a little longer than was actually surveyed. You can do this visually, simply choosing how much to extend each end, using the command Extend by Distance. After selecting Extend by Distance, pick very close to the left end of the dashed polyline, then select an appropriate distance to the left to extend it. You can extend by selecting Repeat for the right side. You may notice that the program will auto-pan in some cases, so just zoom and pan as you desire in response. Now that you have a longer dashed line for the north road edge, use the standard AutoCAD Offset command to offset 30 units to the south. Now select Join Nearest and tolerate a 31 unit gap and require matching endpoint elevations, and directly connect the endpoints. These controls prevent you from joining the wrong gaps-other polylines with bigger gaps or different endpoint elevations. It is best to constrain your join effort as tight as possible, in case you inadvertently select the wrong thing.



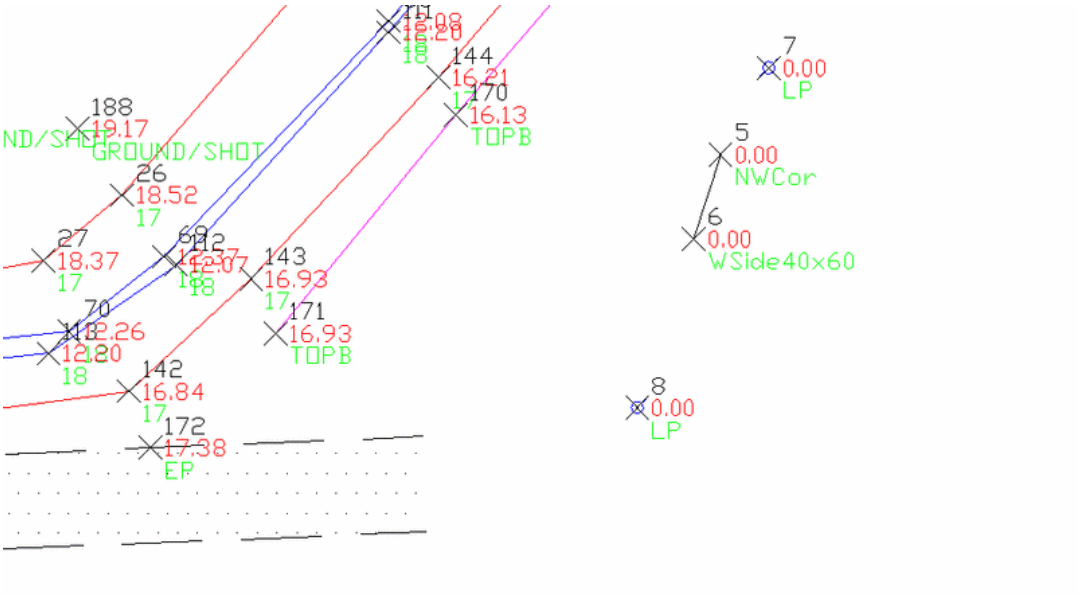
Now you have a closed figure you can hatch. Try hatching with the dots pattern at 100 scale, and you obtain the following:



Remove the end segments of the road, to make the drawing more appealing, by a repeat use of the command Remove Polyline Segment, option Break.

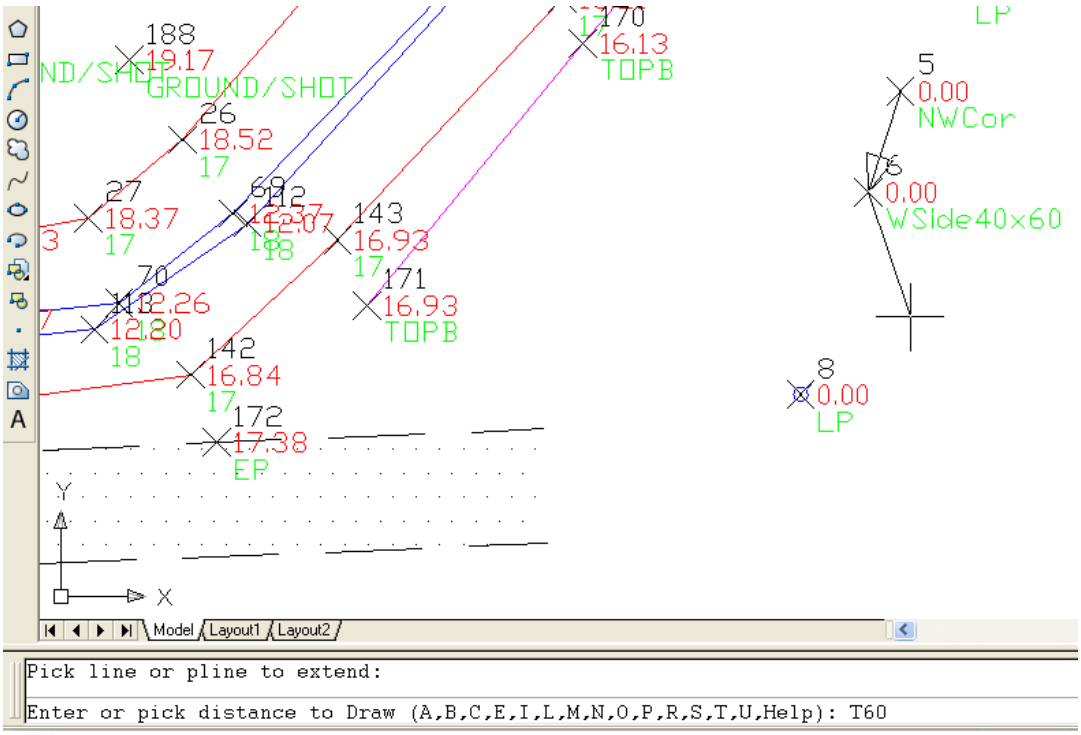
Extend by Distance by Direction and With Close

The simplest use of Extend by Distance is selecting how far to extend on the screen. More advanced usage involves changing direction and closing the figure. If we thaw back the point numbers (layer 0 or as you assigned them), you will note the point plot in the vicinity of our two light poles.

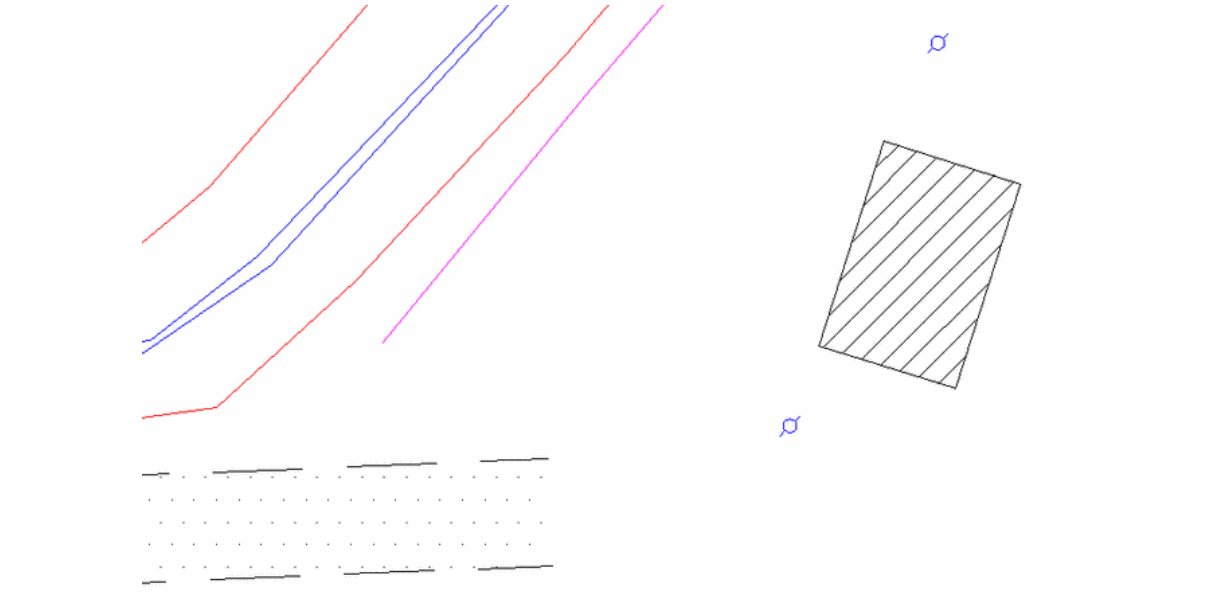


We conclude that there is a building edge from point 5 to point 6 that represents the NW portion of a 40x60 building. Start by connecting a polyline from point 5 to 6 using the node snap. The rest can be accomplished by Extend by Distance.

After choosing Extend by Distance, select the segment from 5 to 6 on the half of the segment closer to 6. That places the arrowhead for the direction to extend pointing southward from point 6.

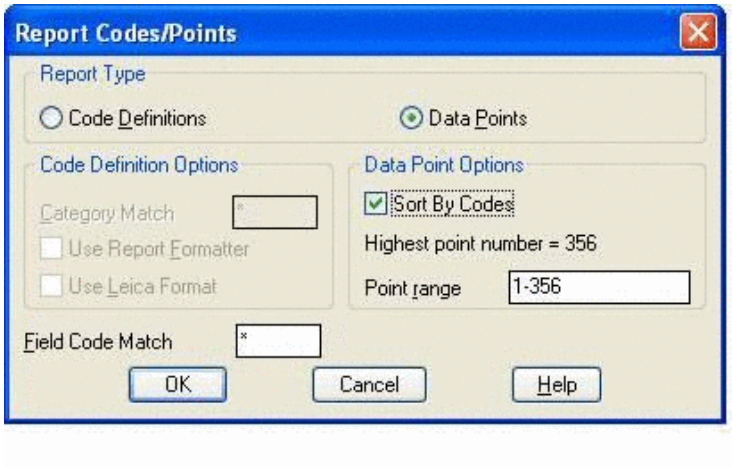


Several command line options are available (A is for angle, C for Close, etc.). The T option is for Total Distance (or if you prefer, TO a distance). So entering T60 goes to a total distance of 60. Then you enter L40 (for left 40), then L60 (for left 60), then C for Close, and you have your building, shown below hatched with diagonal lines.

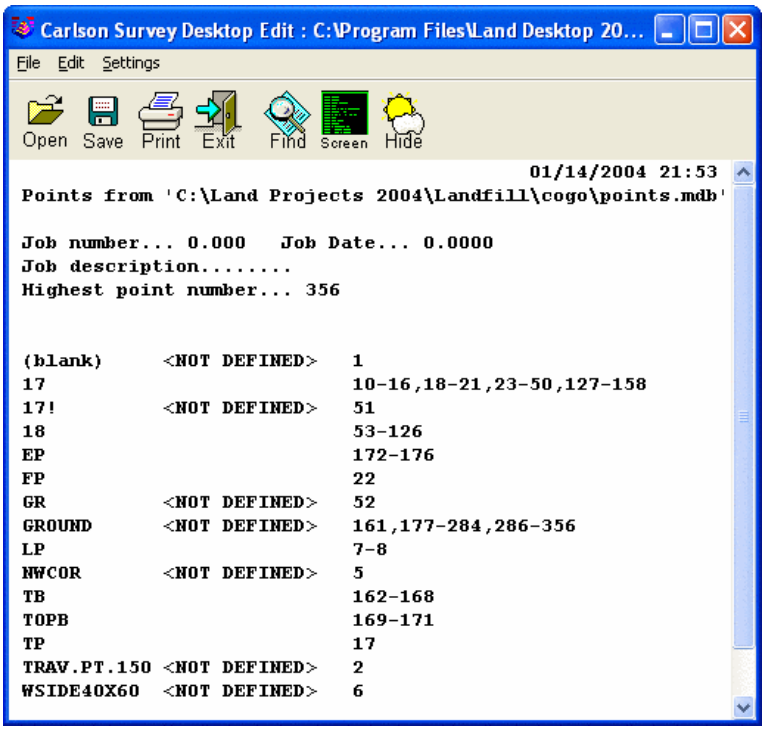


A Trick to Help Analyze your Survey Data

Reactive Field to Finish is often used by companies who have deliberate, well-designed coding systems of their own. When Survey work is outsourced, the codes used can't be controlled. In this instance, it is possible to obtain only a point file, but that is often enough to get a drawing started with decent linework and symbol plotting. Report Codes/Points in the main Field to Finish dialog helps you analyze the source coordinate files prior to Field to Finish processing. Click on Data Points and Sort by Codes as shown below:



This leads to a report that helps you quickly identify the range of descriptions and how many coordinate points are associated with each description found.

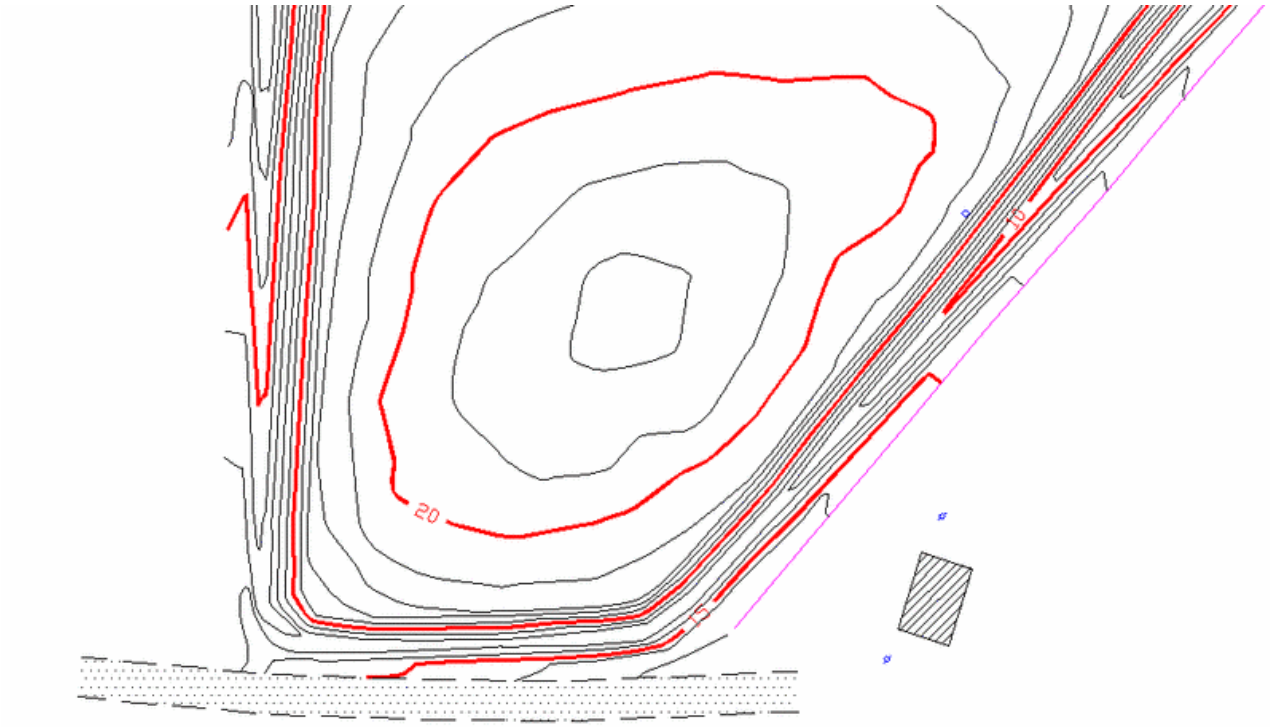


NOTE: This report is presented in a standard Carlson Survey Desktop report screen that allows full editing, and lets you plot to the screen, print to a printer, save to file, or simply Exit.

Conclusion

Carlson Survey Desktop offers increased automation by permitting use of coordinate files with descriptions to be used for "on-the-fly", reactive Field to Finish. The process does not use, nor require, a raw survey data file (.rw5 or .fbk). This process, with some advance detective work on the type of descriptions used, can jump-start a drawing and save office personnel significant time, even when a formal Field to Finish system has not been established.

You analyze the codes, start a new Field to Finish table, assign linework and symbols and layers to particular important codes, and get the beginnings of a complete drawing. Supplement Field to Finish with strategic use of various Polyline Utilities, and the designers and drafters can take it from there. The 3D breaklines for the perimeter ditch around the landfill saved minutes if not an hour of detailed study and point-to-point polyline creation, leading directly to a quality contour map as shown below.



Planned Field to Finish

Planned Field to Finish

Tutorial 1 illustrated a uniquely powerful feature of Carlson Survey Desktop: the ability to "react" quickly to any set of descriptions in a coordinate file and make the best possible drawing from those descriptions. This is useful when working with third party coordinate data (from contract surveying) or when trying to make the best of in-house survey work where no coding system has been developed. But the real promise, the real potential of Field to Finish is to design a coding system that is used by all in-house field-crews, leading to even more complete drawings created directly from field coding. The challenge here is to design a system of descriptions that fits your crews and fits your data collector. For example, if you don't have a data collector with access to the full keyboard range of letters and numbers (rare these days), you may prefer to design a very simple system, where numbers represent descriptions like "ep" (edge of pavement) and "fl" (fence line) and codes such as ".." are used for end line. Some companies print out cards with field codes that fit in a shirt pocket for reference. Other companies limit the range of codes to a list that can be memorized easily (10 to 15 descriptions). Whatever system you design, a planned system of Field to Finish, used daily by in-house survey crews, leads to the greatest time saving and automation.

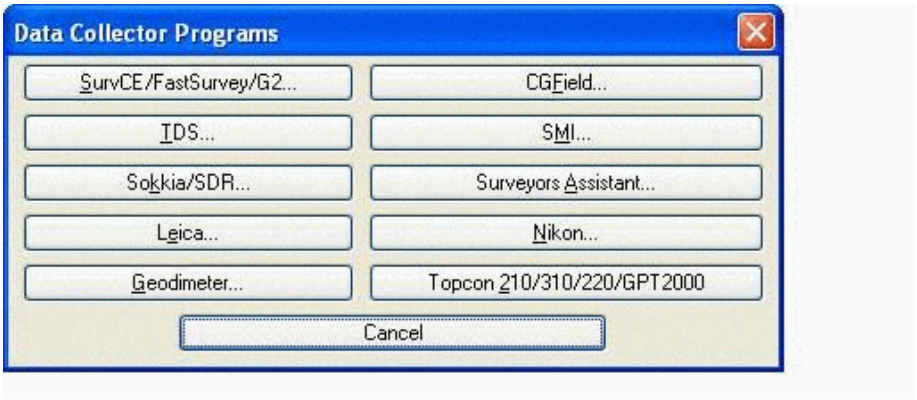
You can follow Tutorial 2 without prior practice on Tutorial 1. Tutorial 2 requires access to two files: Tutorial2.FLD and Tutorial2.TXT. These two files are found in your \SurveyDesktop\Data subdirectory, as in C:\Program Files\Land Desktop 2004\SurveyDesktop\Data.

- Tutorial2.fld is a field code file developed by a New Jersey firm for in-house use. It is an example of a highly developed coding system requiring a reference card initially, until committed to memory by the field crews.

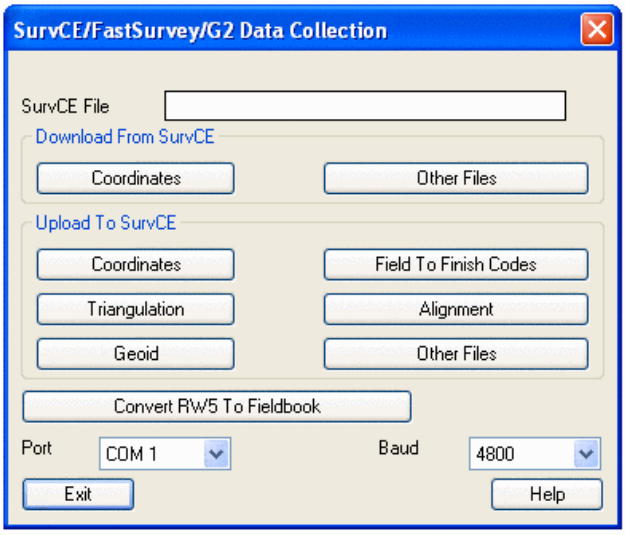
- Tutorial2.TXT is a sample coordinate file that must be imported and then can be plotted automatically using Field to Finish.

Importing the Points versus Data Collector Download

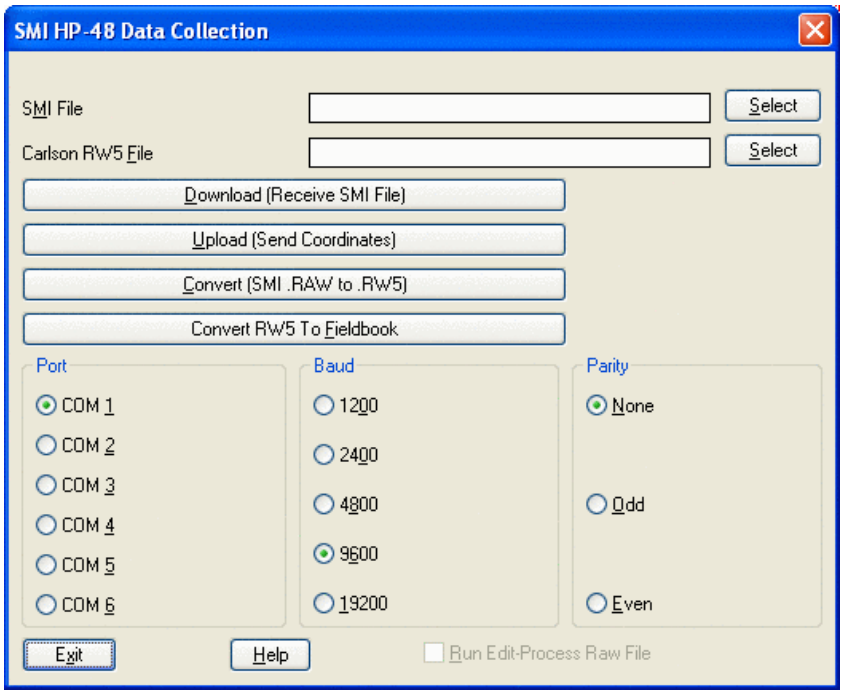
For the purpose of this Tutorial, we will use imported ASCII coordinate files (point files). Use the standard Import/Export Points command found in the Points menu. In actual practice, you will typically download points from a data collector used by the field crew. The very first command in the Carlson Survey Desktop (CSD) pulldown menu (titled "Survey" and located near the far right of your menu options), is Data Collectors. This Data Collectors command loads the points from all collector types listed in the dialog box below:



Some of these options apply to hardware-based data collection, such as the on-board, built-in collectors on total stations supplied by Leica and Topcon. Other options apply to software brands such as Carlson SurvCE, TDS and SMI. CSD will download these types from a variety of hardware platforms. You can download with coordinates (points) and raw files. When downloading raw files of survey data, the default form is the .RW5 file, but using the SurvCE option, you can convert to the more familiar Autodesk Land Desktop Fieldbook format. However, converting to Fieldbook is not necessary to utilize CSD's Field to Finish command.



Sometimes the conversions to Fieldbook form may take two steps, as in the case of an SMI download shown below. First convert the SMI RAW file to RW5, then convert RW5 to Fieldbook.

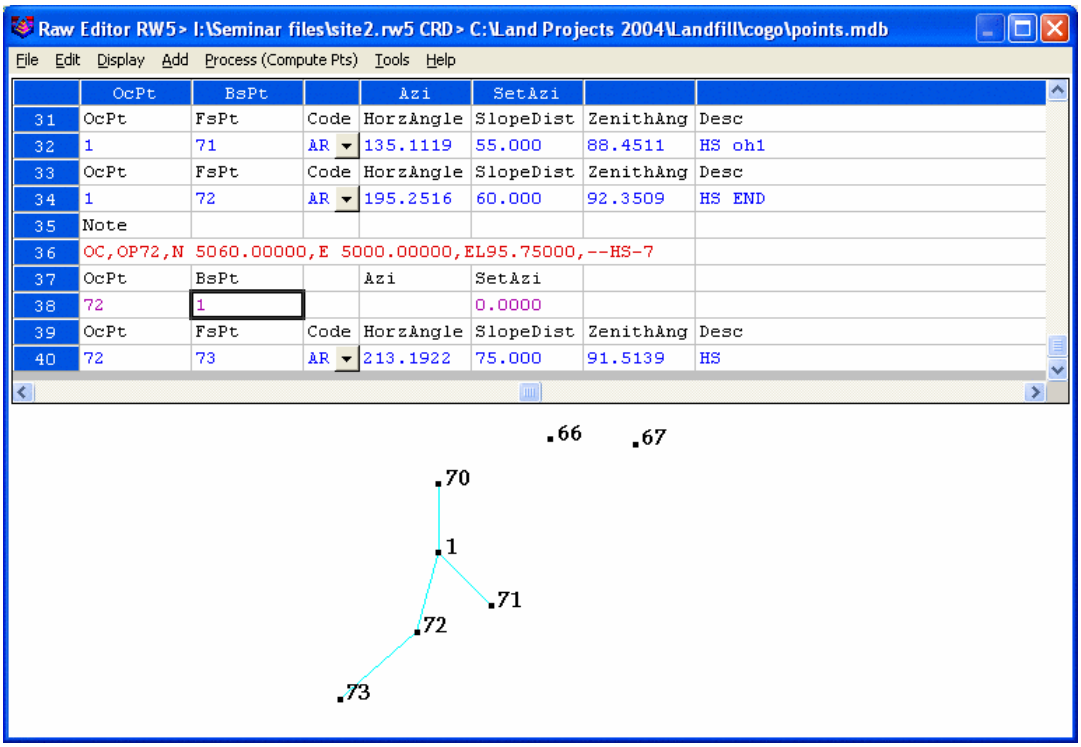


NOTE: With Autodesk Land Desktop, it is the Fieldbook file, complete with special note fields to do curves and start and stop lines, that is needed for Field to Finish. With CSD, the point file drives Field to Finish. The descriptions on the points do it all. The raw file is used only for re-calculating the coordinate data based on the selected method of adjustment (eg. Compass Rule with Angle Balance as an option or SurvNET).

Raw Survey File Editing and Processing

One of the great strengths of CSD is its intelligent raw editor. It is good survey practice to recalculate coordinates based on the raw data. That is why the Edit-Process Raw Data File command is placed between Data Collectors and Field to Finish in the Survey pulldown menu. This is the normal order of business: download the data collector, process the raw data and recalculate coordinates, then conduct Field to Finish. Only for the most basic type of radial survey, GPS survey or pure stakeout project should raw data processing be bypassed.

CSD's raw editor has options for color coding record types (notes, foresights, instrument heights, etc.), hiding and restoring record types for more condensed viewing of key data, and displaying the survey graphically during the editing process, so the impact of changes can be seen (see below):



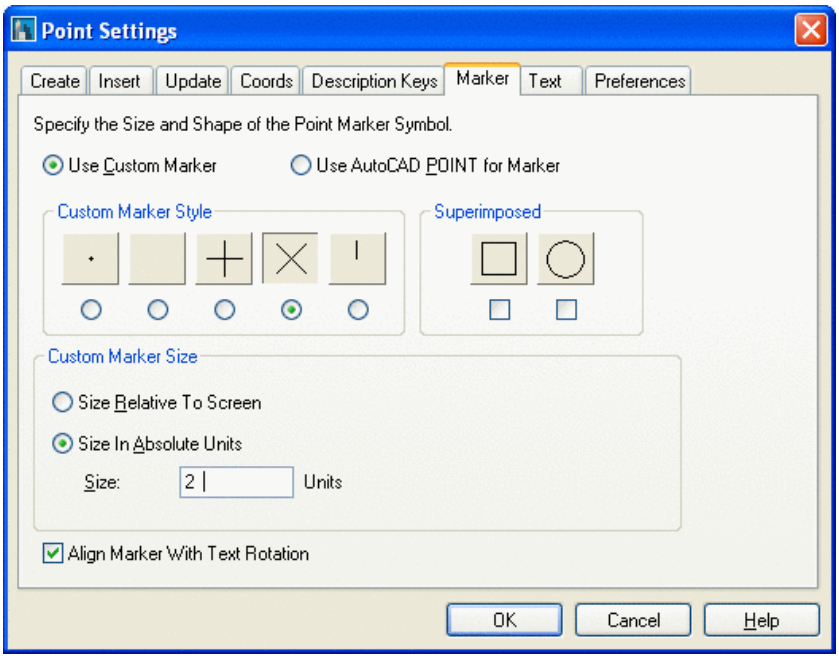
Note the description coding. The description HS has been appended with OH1. OH is a reserved expression for "offset horizontal". In Field to Finish, the polyline defined by HS will be drawn, and a second polyline would also be drawn at 1 unit offset to the right, in the direction of the polyline. This might plot, for instance, the face of a wall and the back of a wall, with only the face of wall shots actually measured in the field. The expression END is used to end this sequence, and on foresight point 73, another use of HS would start a new polyline.

You can substitute for END, such as using ".." to end as noted above. Field to Finish has a button called Code Table Settings, where all reserved special codes can be substituted with codes of your own design. This makes adapting to CSD much easier. You don't abandon most of your existing coding system, but simply re-apply it. In fact, CSD can import your existing coding systems from both LDD and Eagle Point.

NOTE: If you end a polyline or line sequence, the start of a new one is assumed if the same text is used. Similarly, if you don't use END, but prefer to start a new polyline with BEG (or whatever code you select), the polyline will end on that last use of that description, and a new polyline will be started. There is no need for simultaneous use of BEG and END.

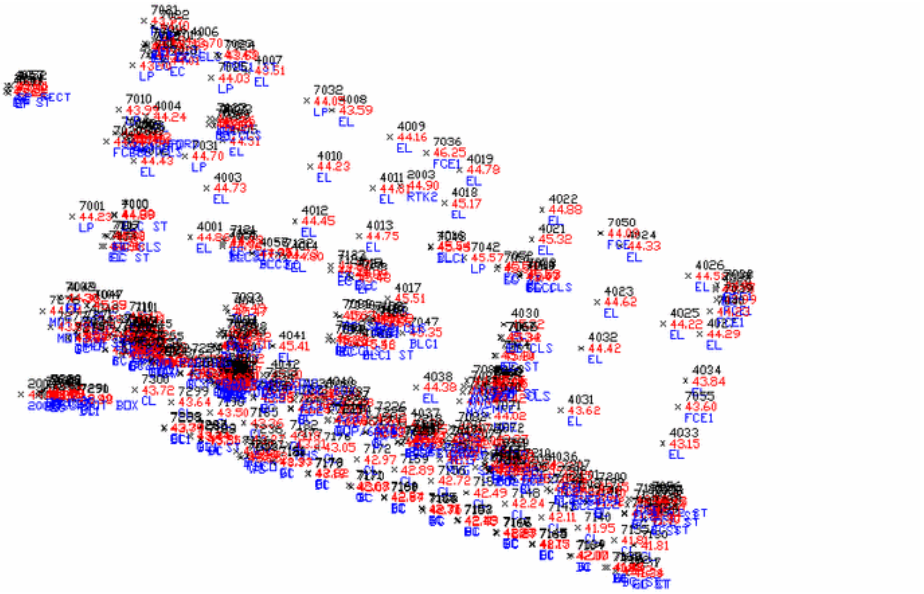
Importing Tutorial2.TXT at 20 Scale

To follow along with this tutorial, it is recommended that you begin a new project called Tutorial2 and a new drawing within the project called Tutorial2_1. (Many people consider it good practice not to name the drawing the same name as the project.) When asked for scale, choose 1"=20', Imperial. At a 20 scale, points look good if plotted about 1/10 the size of the scale, or 2 units in height. Because we plan to import the points in Autodesk Land Desktop, and the points will plot in the process of importing, we need to set the point height ahead of time. This is done with the command Point Settings, found at the top of the Points pulldown menu. Within Point Settings dialog box, choose the Marker tab, and set the height to 2, as shown below:



Now select Import Points, within the Import/Export Points selection, under the Points pulldown menu. Set to PNEZD (comma delimited) and select the file Tutorial2.TXT in the SurveyDesktop/Data folder within Autodesk Land Desktop. Press OK at the next screen, then Zoom Extents when done. Under Edit Points, Display Properties, S for Selection, you can select all points and then change the coloring of the point numbers, elevations or descriptions for better viewing.

You will obtain a very dense plot of points, which appears in part as shown below:

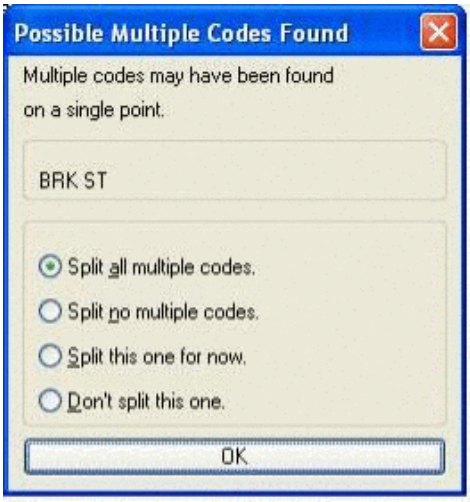


Field to Finish Linework Only using Tutorial2.FLD

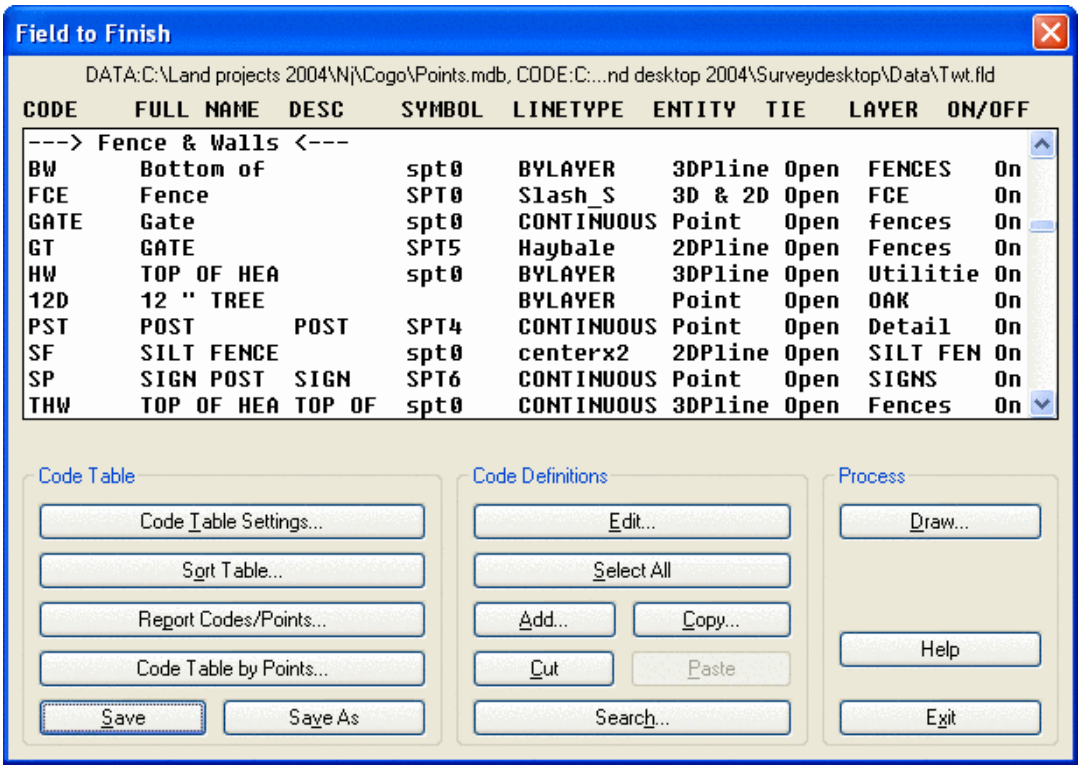
The point plot shown above is "busy", but with some zooming and panning, most points can be identified. But what exactly are we looking at? Without Field to Finish, someone must sort through the maze of point data to make sense of the entities to draw. With a planned Field to Finish coding system, the drawing will be revealed in seconds. Begin

by selecting Field to Finish in the CSD pulldown menu.

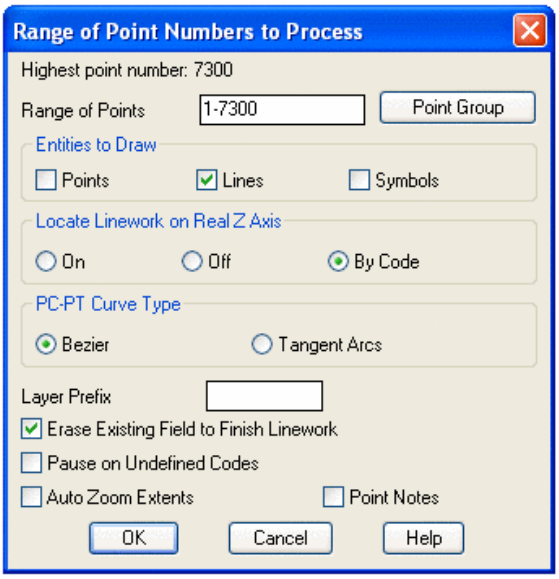
You will be confronted with a dialog asking if you wish to split multiple codes. The normal answer is Yes. When you code a line EP END, the END might indicate the End of the polyline. If you code EP MH, that might actually be two codes (edge of pavement and manhole at the same point). Only if your codes actually have spaces in them will you want to not split the codes and consider the full text one description. It is far easier to design a coding system with no spaces in field codes, and to always answer split multiple codes, as shown here:



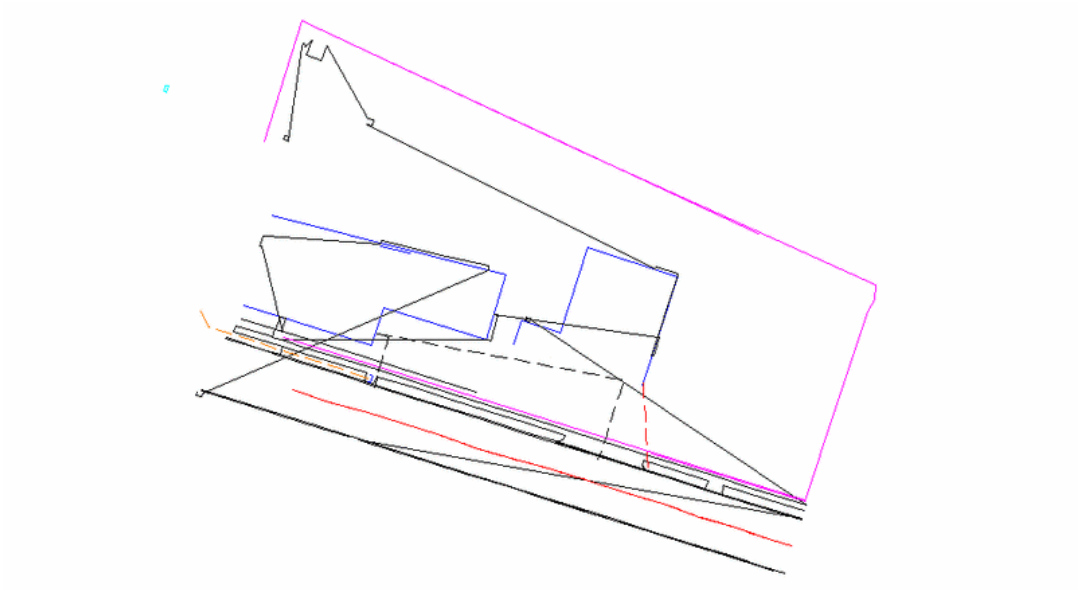
This brings you to the Field to Finish table. The table can be organized into headings. If you scroll down, you can find the "Fences and Walls" portion shown below:



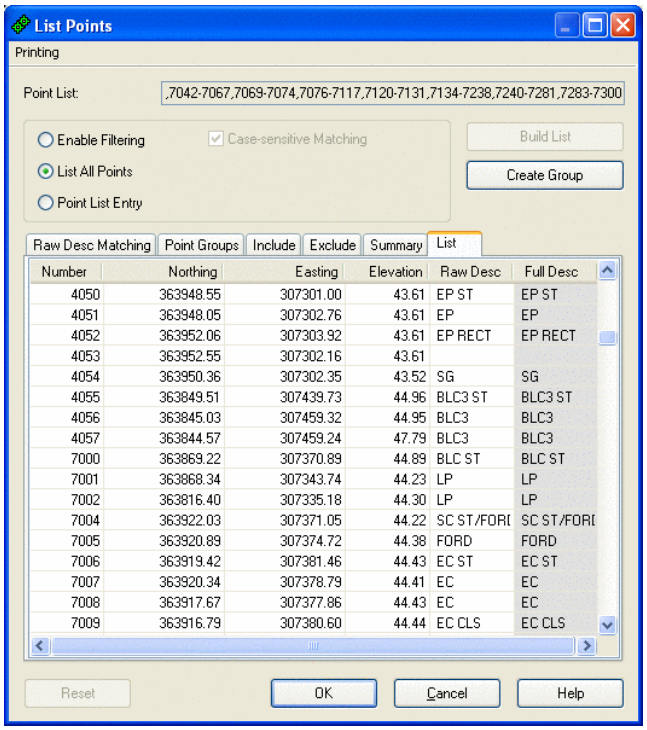
To draw the linework only, using this pre-defined table, click Draw. This brings up the following dialog of options, and here under Entities to Draw, de-select Points and Symbols, but keep Lines selected, as shown:



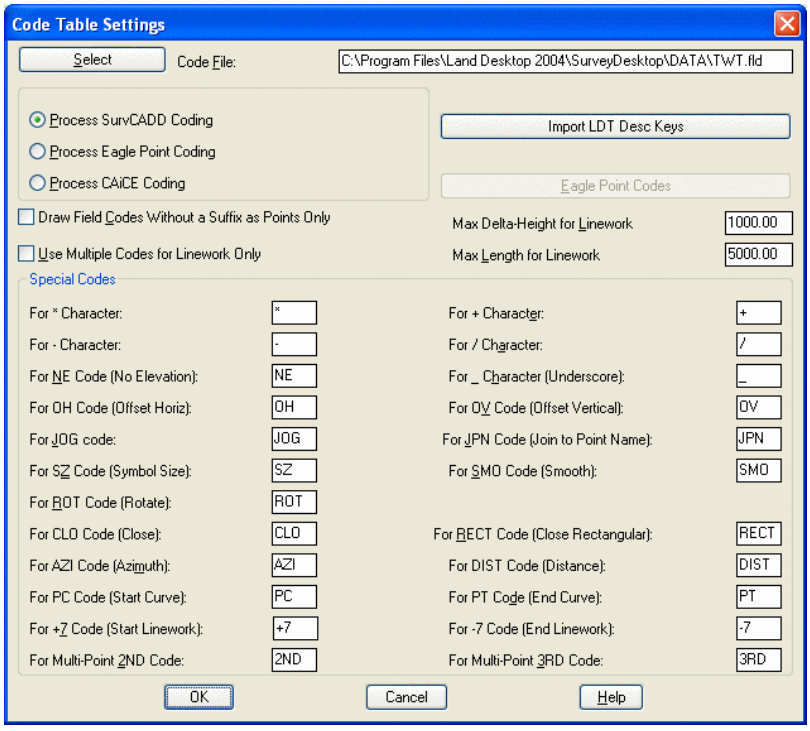
If you freeze the 0 layer containing the points, you will obtain something like this:



This is a start, and the pattern of the project is now more obvious, but it is also obvious that there is work to do. Some of the zigzag polylines should probably start and stop. We may not have applied the proper start/stop logic. First, review the coordinates by going to List Points and selecting List All. Scroll down to look at, for example, points 4050 to 7009.

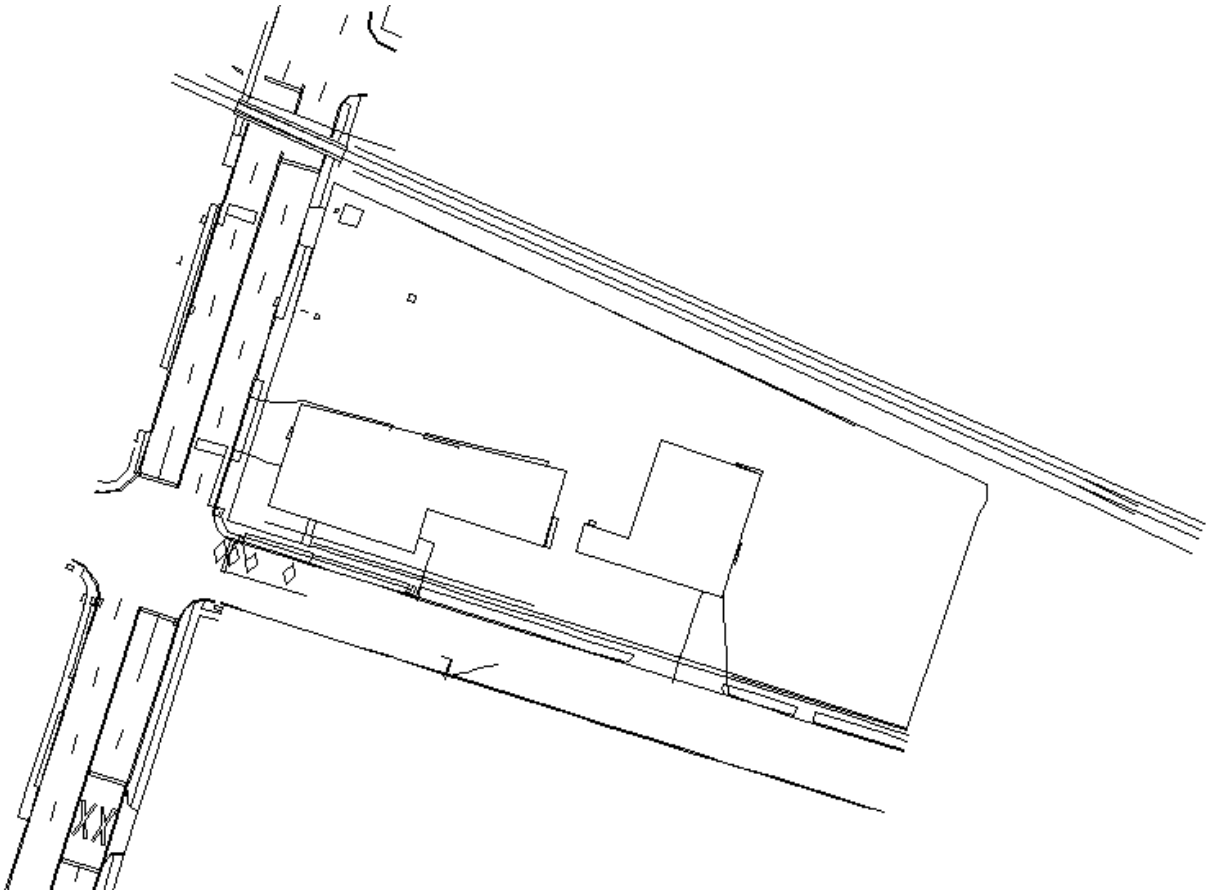


NOTE: While ST was used to start polylines, the classic RECT was used to close rectangles and CLS was used to close polylines in general. To make these instructions work (i.e., to adapt to this coding system), select Code Table Settings within Field to Finish. This brings up this translation table, where you can substitute the special codes you wish to use:



Change +7 to ST for start. Many Autodesk Land Desktop users may prefer to use BEG for starting a new polyline or line. Change CLO to CLS to close. Now OK, and select SAVEAS. Save these changes as Tutorial2_2 or Tutorial2_2a (so others can use this tutorial unaltered!). Back in Field to Finish, select Draw.

Then when you redraw the linework, you obtain the more complete, well-defined drawing shown below:



You can also choose to plot both symbols and linework. You can choose, as well, to erase the Autodesk Land Desktop-style points and plot points, symbols and linework with CSD's Field to Finish. This will layerize not just linework and symbols but even the points as well. Later on, if you wish to freeze point layers, it is advisable to define the points plotted within Field to Finish to Distinct Point Layers, using the Edit option in Field to Finish.

Network Least Squares

This tutorial is divided into four lessons covering the process of reducing and adjusting raw survey data into final adjusted coordinates using the SurvNET program. The purpose of the tutorial is to describe the typical work flow used to process raw data from a data collector into final coordinates. The tutorial will describe the reviewing and editing of the raw data prior to the processing of the raw data. Next, the least squares system settings will be described. The next lesson will cover the processing of the raw data. Lastly, the reports created by the least squares program will be explained

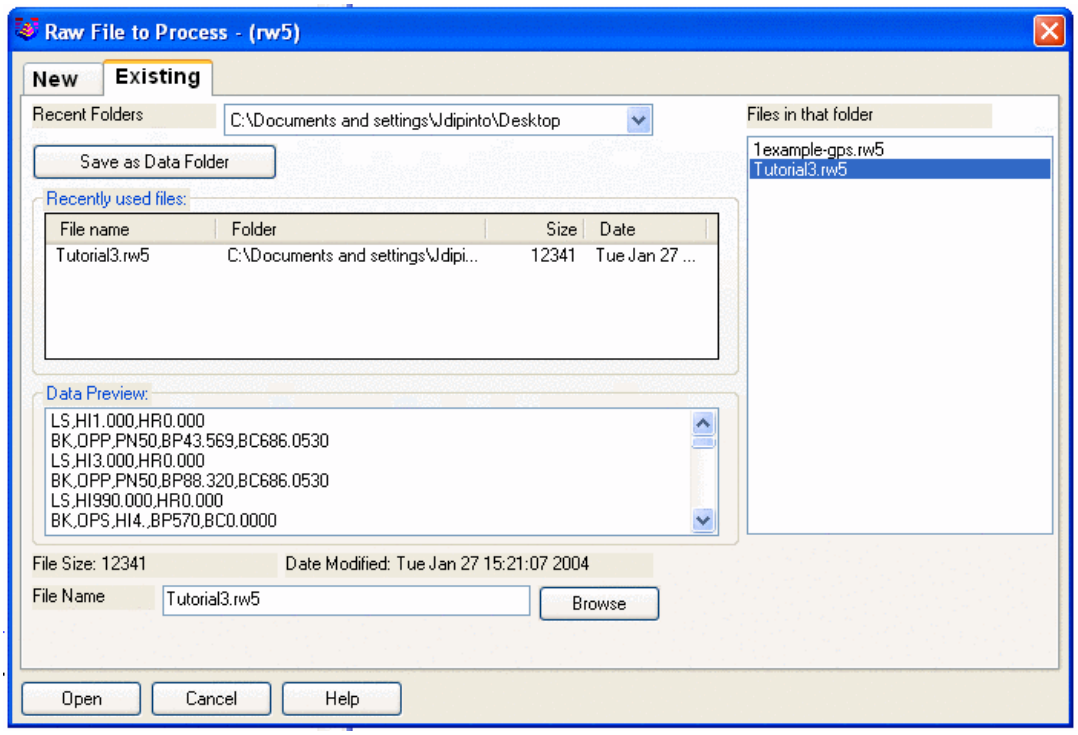
The raw data file associated with this tutorial is located in the SurveyDesktop\Data folder under LDD installation folder on your computer (ex. C:\Program Files\Land Desktop 2004\SurveyDesktop\Data). The raw file to be processed is called Tutorial3.rw5. This data comprises a network that is to be reduced to NAD83 grid coordinates. The zone used is North Carolina. Both direct and reverse angles were collected in the raw file.

Lesson One- Raw data Review and Editing

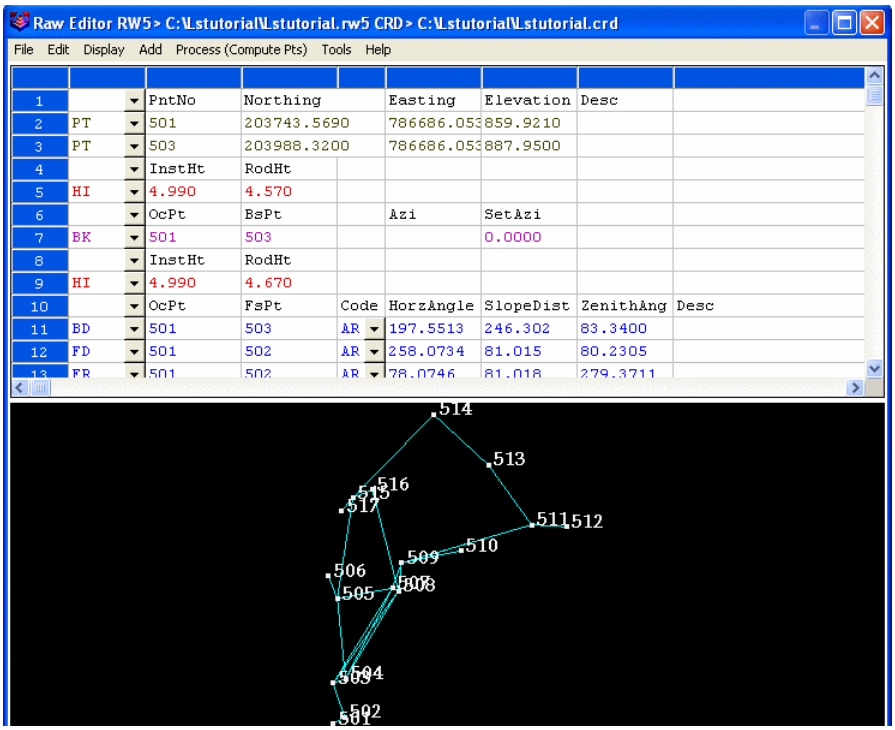
Step 1: Click the icon for Autodesk Autodesk Land Desktop and launch Autodesk Land Desktop. You may be

presented with a Startup Wizard dialog box. If so, click Exit.

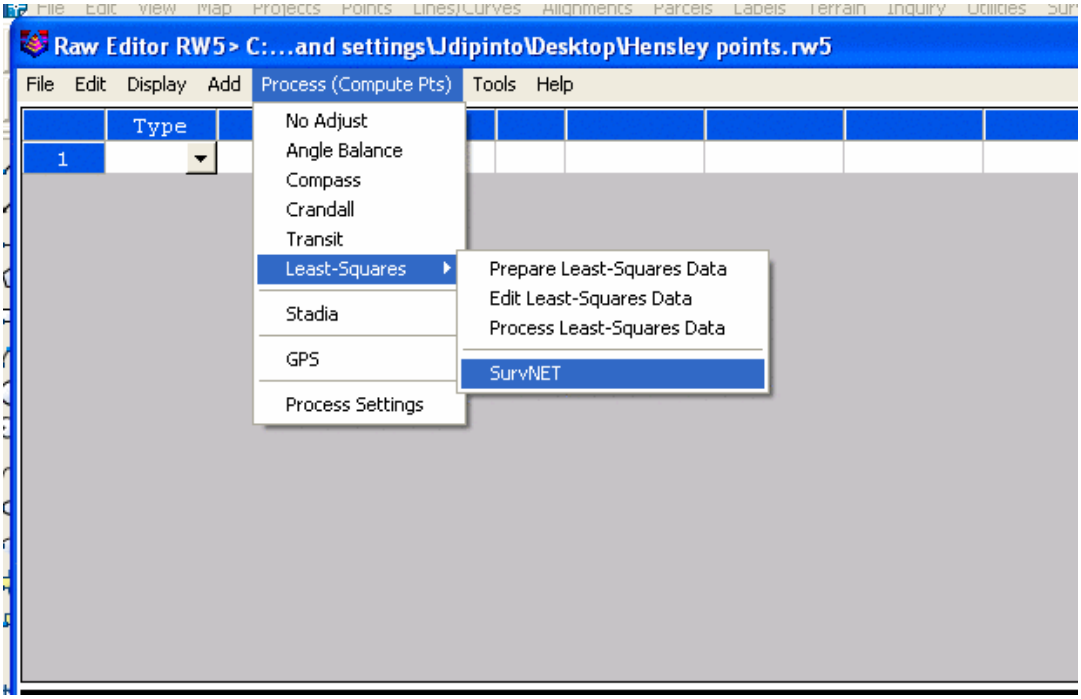
Step 2: The Carlson Survey Desktop (CSD) menu is titled "Survey." Under the Survey menu, choose Edit-Process Raw Data File. The Raw File to Process dialog box is displayed. Choose the Existing Tab and enter Tutorial3.rw5. Once the correct file name has been entered press the Open button. Make sure both the path and file name are correct.



Step 3: The raw data editor is now displayed. The top half of the window is a grid view of the raw data. The bottom half of the window displays a graphical view of the data. Use this editor to make changes to the raw data file, if errors exist. As the raw data used in the tutorial contains no errors, we may proceed to process the data.

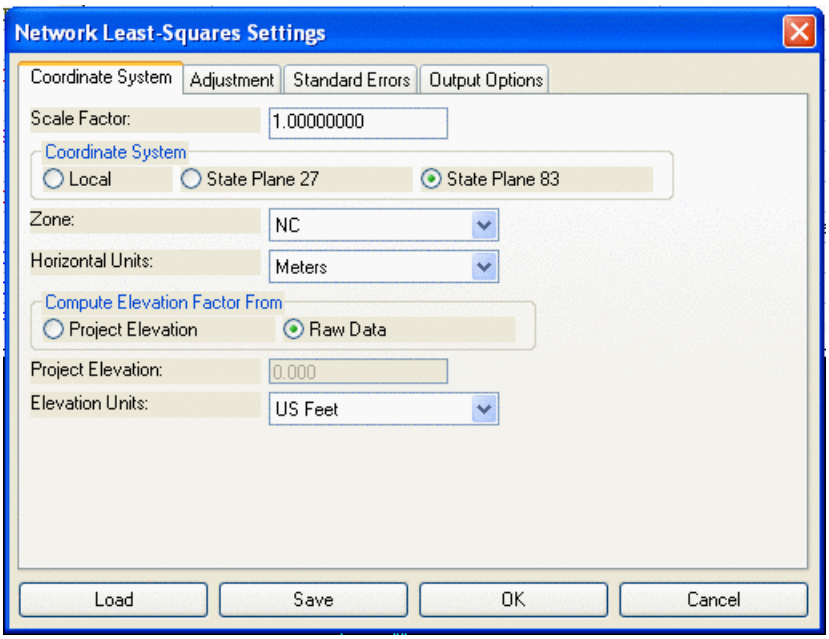


Step 4: From the Process (Compute Pts) pulldown menu choose the Least-Squares/Network Least-Squares option as shown below.



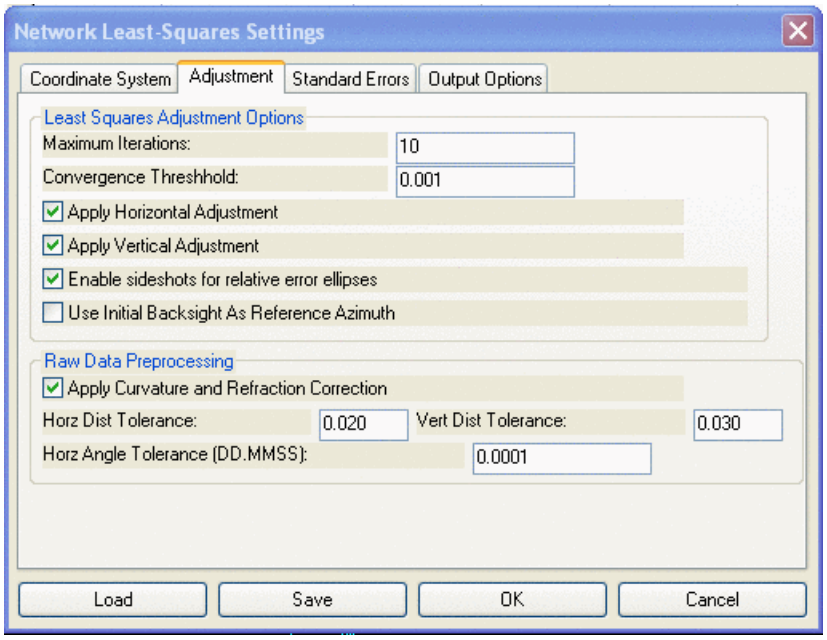
Lesson Two - Least Squares Settings

Step 5: The Network Least-Squares Settings dialog box is displayed. In this dialog box the different settings required for the Least Squares reduction are available. The Load button at the bottom of the screen allows the user to recall previously saved settings. The Save button allows the user to save the current settings. Press Cancel to return to the raw data editor. When all the settings are set as desired press OK to process the raw data. For the purpose of this tutorial, the Coordinate System settings should look as follows before proceeding to the next step.



For more information on the content of this dialog box, please review the SurvNET chapter of this manual.

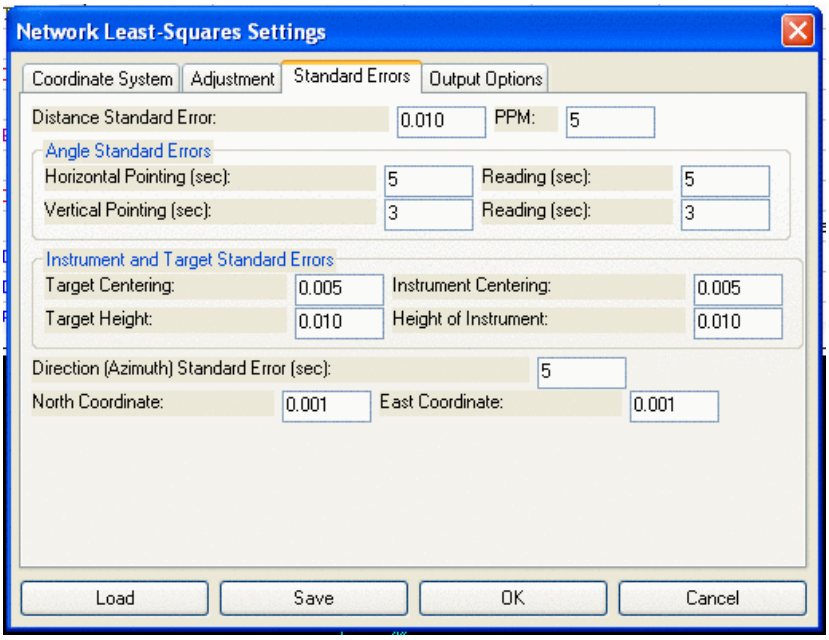
Step 6: Choose the Adjustment tab to review the least squares adjustment settings. For the purpose of this tutorial, the Adjustment settings should look as follows before proceeding to the next step.



For more information on the content of this dialog box, please review the SurvNET chapter of this manual.

Step 7: Choose the Standard Errors tab to review the standard error settings. The standard error settings should look as follows before proceeding to the next step.

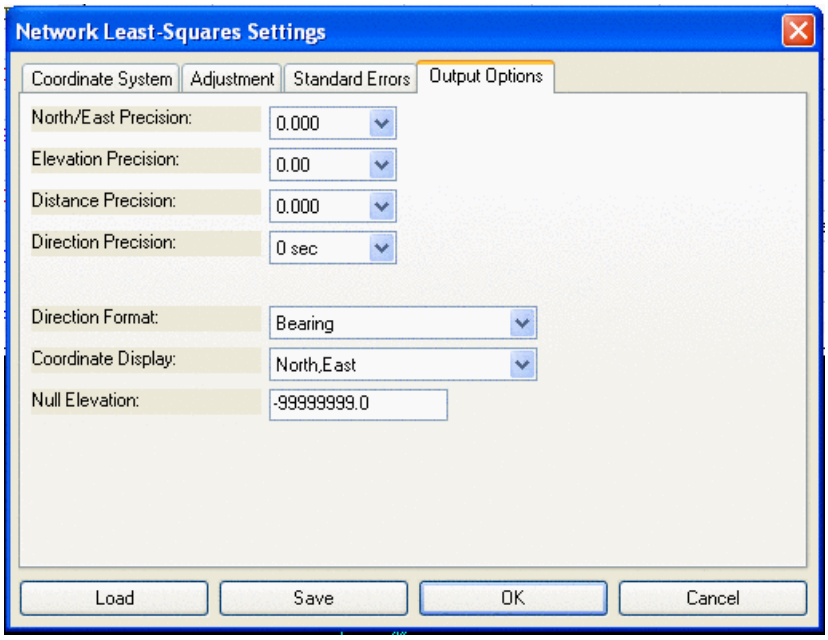
Standard errors are an estimate of the different errors you would expect to obtain based on the type equipment and field procedures you used to collect the raw data. For example, if you are using a 5 second theodolite, you could expect the angles to be measured within +/- 5 seconds (Reading error).



For more information on the content of this dialog box, please review the SurvNET chapter of this manual.

Step 8: Choose the Output Options tab to review the output settings. For the purpose of this tutorial, the Output Options settings should look as follows before proceeding to the next step. These settings apply only to the output of data to the report files. These settings do not affect computational precision. Press OK and the least squares

adjustment will be performed.

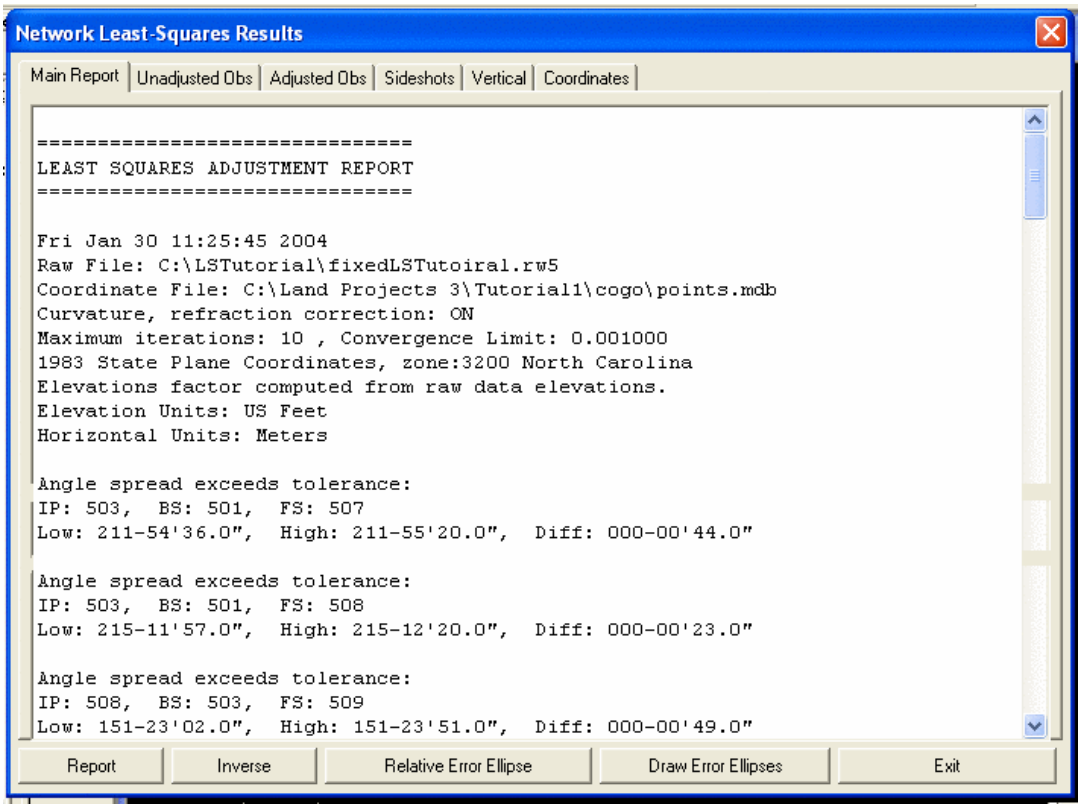


For more information on the content of this dialog box, please review the SurvNET chapter of this manual.

Lesson Three - Least Squares Processing

Step 9: After pressing OK from the previous dialog box the Least Squares adjustment is performed and the Network Least-Squares Results window is displayed. If the solution converged correctly the report should look similar to the following window. If there were errors or the solution did not converge, an error message dialog will be generated.

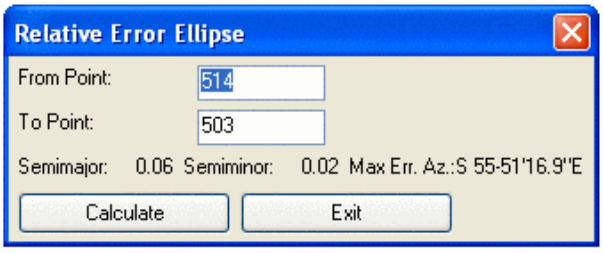
If there are errors you will need to return to the raw data editor to review and edit the raw data. Since the tutorial example should have converged we will next review the reports generated by the least squares adjustment. Press the Report button at the bottom of the window to review the results of the Least Squares adjustment.



Relative Error Ellipses

Relative error ellipses are a statistical measure of the expected error between two points. Regular error ellipses are a measure of the absolute error of a single point. Some survey accuracy standards such as the ALTA standards state the maximum allowable error between any two points in a survey. Relative error ellipses can give you this information.

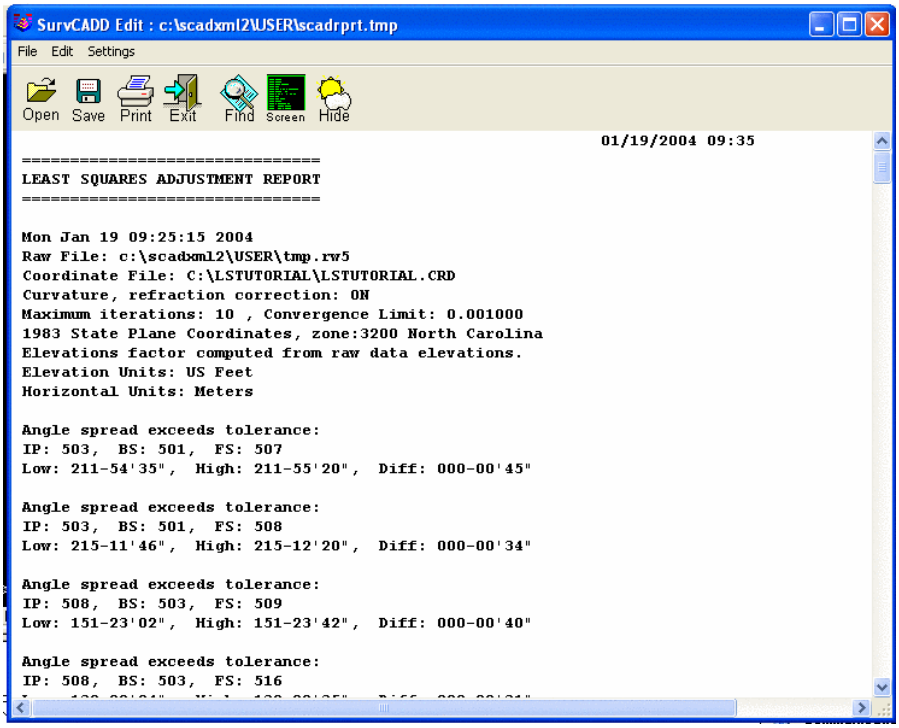
Press the Relative Error Ellipse button and enter 514 and 503 in the From Pt. and To Pt. fields. Press Calculate. The dialog box should look as follows.



At the 95% confidence level there should only be around .06 meters of error between points 514 and 503. If you need to compute relative error ellipses for sideshots make sure the "Enable sideshots for error ellipse" toggle is set in the Settings dialog box.

Lesson Four - Review of the Least Squares Report

Step 10: After pressing the Report button from the previous dialog box the least squares report is displayed. In this lesson the different sections of the least squares report are explained. To save the report to an ASCII text file use the File/Save As menu option.



Preprocessing and Header Information

The following excerpt from the report shows the header information and the preprocessing results. The header information consists of the date and time, the input and output file names, the coordinate system, the curvature/refraction setting, maximum iterations, and distance units.

During the preprocessing process multiple angles are reduced to a single angle and multiple slope distances, vertical angles, HI's, and rod heights are reduced to a single horizontal distance and vertical distance. During this process the horizontal angle, horizontal distance, and vertical difference spreads are computed. If the spreads exceed the tolerance settings from the Settings dialog box a warning message is displayed showing the high and low measurement and the difference between the high and low measurement.

```
|
     ==============================
     LEAST SQUARES ADJUSTMENT REPORT
     ==============================

Mon Jan 19 09:25:15 2004
Input File:  c:\scadxml2\USER\tmp.rw5
Output File: c:\scadxml2\USER\tmp.RPT
Curvature, refraction correction: ON
Maximum iterations: 10 , Convergence Limit: 0.001000
1983 State Plane Coordinates, zone:3200 North Carolina
Elevations factor computed from raw data elevations.
Elevation Units: US Feet
Horizontal Units: Meters

Angle spread exceeds tolerance:
  IP: 503,  BS: 501,  FS: 507
  Low: 211-54'35",  High: 211-55'20",  Diff: 000-00'45"

Angle spread exceeds tolerance:
  IP: 503,  BS: 501,  FS: 508
  Low: 215-11'46",  High: 215-12'20",  Diff: 000-00'34"
        .
        .

Vertical Distance from 501 to 503 exceeds tolerance:
  Low: 27.451,  High: 28.038,  Diff: 0.587

Vertical Distance from 501 to 502 exceeds tolerance:
  Low: 13.442,  High: 13.859,  Diff: 0.418
        .
        .
```

Unadjusted Measurements

The following excerpt from the report shows the unadjusted measurements. Measurements consist of some combination of control X, and Y, horizontal distances, horizontal angles, and azimuth measurements. These measurements consist of a single averaged measurement. For example, if multiple distances were collected between two points only the single averaged measurement is used in the least squares adjustment.

Also, standard errors for the measurements are displayed in this section of the report. The standard errors are computed from the standard error setting in the Settings dialog box using error propagation formulas. The standard error of an angle that was measured several times would typically be lower than an angle that was measured only once.

Since this data was adjusted into NAD 83 coordinates both the ground distances and the grid distances are displayed. The grid, elevation, and combined factor are displayed in this section of the report. The horizontal angles with and without the t-T correction applied is displayed. The t-T correction is usually not significant unless the angle measurements encompass a large area or the survey is of a high order.

```
Unadjusted Observations
=======================

Control Coordinates:     2 Observations,     0 Fixed Points,     0 Approx. Points
 Sta.            N:             E:          StErr N:   StErr E:
 501          203743.569     786686.053     0.0010     0.0010
 503          203988.320     786686.053     0.0010     0.0010

Distances:   25 Observations
 From Sta.   To Sta.         Ground Dist.      StErr
 501           503              244.750       0.0079
 501           502               79.877       0.0088
 502           503              216.460       0.0090
        .
        .
Angles:   31 Observations
 BS Sta.   Occ. Sta.   FS Sta.          Angle          StErr (Sec.)
 503          501         502         060-12'14"     17.3
 501          502         503         101-07'06"     18.6
 501          503         502         341-19'24"      9.6
        .
        .

Grid Distances:   25 Observations
 From Sta.   To Sta.       Grid Dist.  Grid Factor  Z Factor   Combined Factor
 501           503            244.712     0.99988817  0.99995820  0.99984637
 501           502             79.865     0.99988808  0.99995854  0.99984662
 502           503            216.427     0.99988818  0.99995787  0.99984606
        .
        .

Grid Horizontal Angles:   31 Observations
 BS Sta.   Occ. Sta.   FS Sta.          Angle       StErr (Sec.)  t-T
 503          501         502         060-12'14"    17.3          0.0
 501          502         503         101-07'05"    18.6          0.0
        .
        .
```

Adjusted Coordinates

The next section of the report shows the final adjusted coordinates. Additionally, the computed standard errors of the coordinates are displayed. As this project was reduced to NAD 83 the final latitude and longitudes are displayed. Error ellipses computed to the 95 percent confidence interval are also displayed.

```
Adjusted Coordinates
====================

Adjusted Grid Coordinates
 Sta.            N:             E:          StErr N:   StErr E:
 501          203743.570     786686.053     0.0018     0.0018
 503          203988.319     786686.053     0.0018     0.0018
        .
        .

Adjusted Geographic Coordinates
 Sta.        Latitude          Longitude          Conv. Ang.    Grid Factor  Z Factor   Combined Factor
 501      35-34'15.46712"N  77-02'46.11932"W   001-07'40"  0.99988806   0.99995887   0.99984693
 503      35-34'23.40778"N  77-02'45.92799"W   001-07'40"  0.99988827   0.99995753   0.99984581
        .
        .

Adjusted Coordinates Error Ellipses 95% CI
 Sta.              Semi Major     Semi Minor      Max. Error Az.
                     Axis           Axis
 501                0.005          0.005          N 90-00'00"E
 503                0.005          0.005          N 90-00'00"E
        .
        .
```

Adjusted Measurements

The following section from the report shows the final adjusted measurements. This section is one of the most important sections to review when analyzing the results of the adjustment. In addition to the adjusted measurement the residual is displayed. The residual is the amount of adjustment applied to the measurement. The residual is computed by subtracting the unadjusted measurement from the adjusted measurement.

The standard deviation of the measurement is also displayed. Ideally, the computed standard deviation and residual

and the standard error displayed in the unadjusted measurement would all be of similar magnitude. The standard residual is a measure of the similarity of the residual to the a-priori standard error. The standard residual is the measurements residual divided by the standard error displayed in the unadjusted measurement section. A standard residual greater than 2 is marked with an "*". A high standard residual may be an indication of a blunder. If there are a lot of high standard residuals it may indicate that the original standard errors set in the Settings dialog box were not realistic.

```
Adjusted Observations
=====================

Adjusted Distances
 From Sta.   To Sta.        Distance      Residual     StdRes.    StdDev
 501           503          244.7489      0.0367    *    4.6   0.0025
 501           502           79.8791      0.0143         1.6   0.0101
        .
        .

Adjusted Angles
 BS Sta.  Occ. Sta.   FS Sta.              Angle      Residual   StdRes   StdDev(Sec)
 503          501          502          060-11'49"   -25.8       1.5    17.9
 501          502          503          101-07'33"    27.5       1.5    20.3
 503          508          504          355-46'57"   -15.7     * 2.1     2.8
        .
        .
```

Statistics

The next section displays some statistical measures of the adjustment including the number of iterations needed for the solution to converge, the degrees of freedom of the network, the reference variance, the standard error of unit weight, and the results of a Chi-square test.

The degree of freedom is an indication of how many redundant measurements are in the survey. Degree of freedom is defined as the number of measurements in excess of the number of measurements necessary to solve the network.

The standard error of unit weight relates to the overall adjustment and not an individual measurement. A value of one indicates that the results of the adjustment are consistent with the a priori standard errors. The reference variance is the standard error of unit weight squared.

The chi-square test is a test of the "goodness" of fit of the adjustment. It is not an absolute test of the accuracy of the survey. The a priori standard errors which are defined in the project settings dialog box or with the SE record in the raw data file are used to determine the weights of the measurements. These standard errors can also be looked at as an estimate of how accurately the measurements were made. The chi-square test merely tests whether the results of the adjusted measurements are consistent with the a priori standard errors. Notice that if you change the project standard errors and then reprocess the survey the results of the chi-square test change, even though the measurements themselves did not change.

In our example the chi-square test failed at the 95% significant level. But all distance residuals were all less than .01 meters. The largest angle residual was 42 seconds. There were some preprocessing angle spreads in the 30 to 45 seconds range. The angle standard errors in the Setting screen are probably set too low for the quality of the actual measurements. If we were to increase the pointing and reading standard error in the Settings screen by 5-10 seconds we would probably pass the chi-square. Also notice that if you change the standard errors by only 5-10 seconds and reprocess the data the final coordinates will not change significantly.

```
Statistics
==========

 Solution converged in 2 iterations
 Degrees of freedom:26
 Reference variance:3.19
 Standard error unit Weight: +/-1.79
 Failed the Chi-Square test at the 95% significance level
 13.844 <= 82.844 <= 41.923
```

The next part of the report displays the results of the vertical adjustment. The horizontal and the vertical adjustments are separate least squares adjustment processes. As long as there are redundant vertical measurements the vertical component of the network will also be reduced and adjusted using least squares. In the vertical adjustment benchmarks are held fixed.

```
                LEAST SQUARES VERTICAL ADJUSTMENT REPORT

Mon Jan 19 09:25:15 2004
Input File:  c:\scadxml2\USER\tmp.rw5
Output File: c:\scadxml2\USER\tmp.RPT
Curvature, refraction correction: ON

                          FIXED VERTICAL BENCHMARKS

      Station            Elevation
     501                859.9210
     503                887.9500

                          POINTS TO BE ADJUSTED

      Station
     502,504,507,508,505,509,511,516,515,514,513


                               MEASUREMENT SUMMARY

      From          To           Elev. Diff.
                                 (unadjusted)    StdErr
     501           503              27.9230      0.0147
     501           502              13.7517      0.0165
        .
        .
                               ADJUSTED ELEVATIONS

      Station     Adjusted Elev   Standard Dev.
     501            859.9210        0.00000
     503            887.9500        0.00000
     502            873.7621        0.03873
        .
        .
                           ADJUSTED MEASUREMENT SUMMARY

      From          To          Elev. Diff.       Residuals
                                (adjusted)
     501          503              28.0290        0.1060
     501          502              13.8411        0.0894
        .
        .

Sideshots
 Station               Elevation

 510                     874.746
```

This is the final step in the tutorial. The final adjusted coordinates are now stored in the current project point database and can now be used for mapping and design.

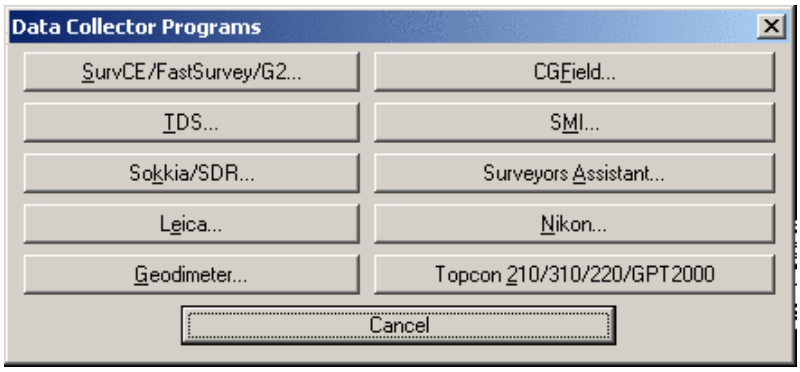
Data Collectors 3

Data Collectors

Function

The Data Collector Programs dialog box (shown here) allows you to perform two main functions for a variety of popular data collectors. First, this command transfers (uploads and downloads) data between the data collector and Carlson Survey Desktop (CSD). Second, this command converts data formats between the data collector format and CSD format. If you already have the data file on the computer, you can skip the transfer function and just run the conversion function.

The transfer function does the conversion automatically. In most cases the download from the data collector produces a RW5 file (field notes) and/or a Points.mdb file (coordinate points). Several of the download programs allow you to automatically run the Edit-Process Raw File command after you download raw data. You can also send or upload coordinates from the current project point database.



NOTE: CSD downlaods raw survey notes and processes them in the .RW5 format. However, the .RW5 files may, at any time, be converted to classsic .FBK format for use in other features.

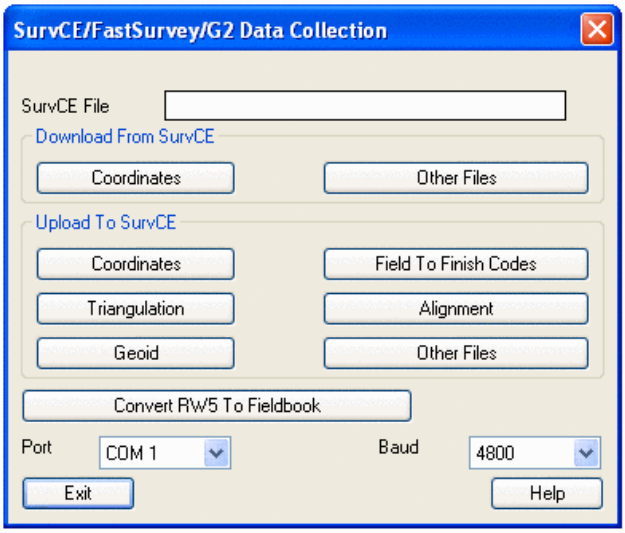
Data Collectors	
Data Collector	Description
SurvCE/FastSurvey/G2	For Carlson Sorfware data collection programs and SurvCE and SurvStar. Also works with Sokkia G2 and Thales FastSurvey
CG Field	For the C&G data collector program.
TDS (Tripod Data Systems)	For data collectors that use TDS software (Ranger, HP48, HP95, Husky FS-2 & FS-3, Corvallis MC-V and TOPCON FS2, FC95 and FC48).
SMI	For SMI data collectors on the HP48
Leica	For Leica GIF-10 module and Leica instruments.
Sokkia/SDR	SDR2 through SDR 33 and other collectors that have a SDR format like the Trimble.
Nikon	For Nikon DTM and DR-48 total stations.
Geodimeter	For the Geodimeter Geodat collector
Surveyors Assistant	For data collectors running Surveyors Assistant software (Corvallis MC2, MC5, and Pentax SC5.
Topcon 210/310/220/GPT2000	Supports these Topcon models.

SurvCE/FastSurvey/G2

NOTE: Unless otherwise indicated, the term SurvCE will apply to Carlson SurvCE, SurvStar, Thales FastSurvey and Sokkia G2 in this section.

First, connect the serial cable. Then select Data Transfer on the hand-held. Choose SurvCADD/Carlson Survey Download. This leads to a File Transfer screen on SurvCE, which says "Awaiting Connection". SurvCE is ready. Now all the action is on the PC side.

In the Survey Menu, choose Data Collection->SurvCE. This brings up the Carlson SurvCE transfer dialog.



- **Download Coordinates** shows a list of the coordinate files on Carlson SurvCE. Select a file to download. The point data will be stored in the point database for the current Autodesk Land Desktop project.

- **Download Other Files** shows a list of all the data files on Carlson SurvCE. Select a file to download. The file will be transferred and stored in the Survey folder for the current Autodesk Land Desktop project. The files are transferred in their original form without any conversion.

- **Upload Coordinates** transfers points from the current Autodesk Land Desktop project to Carlson SurvCE. Before running this command, you need to supply a name in the Carlson SurvCE File edit box. This name is used to name the point file on the Carlson SurvCE collector.

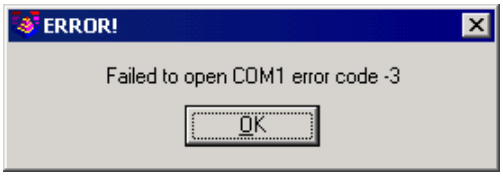
- **Upload Triangulation and Alignment** features will transfer triangulation surfaces and horizontal alignments from Autodesk Land Desktop to Carlson SurvCE.

- **Upload Geoid** transfers a portion of the specified geoid to Carlson SurvCE. The geoid data files require a large amount of disk space and are not included in the CSD install. Instead they are installed separately. You can download the install for the latest geoid data files from the Carlson Software web page.

- **Upload Field To Finish Codes** transfers a code table to Carlson SurvCE.

When you connect the cable from Carlson SurvCE to the PC, a program such as Microsoft ActiveSync may interfere and say "Connect to PC?" Answer, "No" to this prompt.

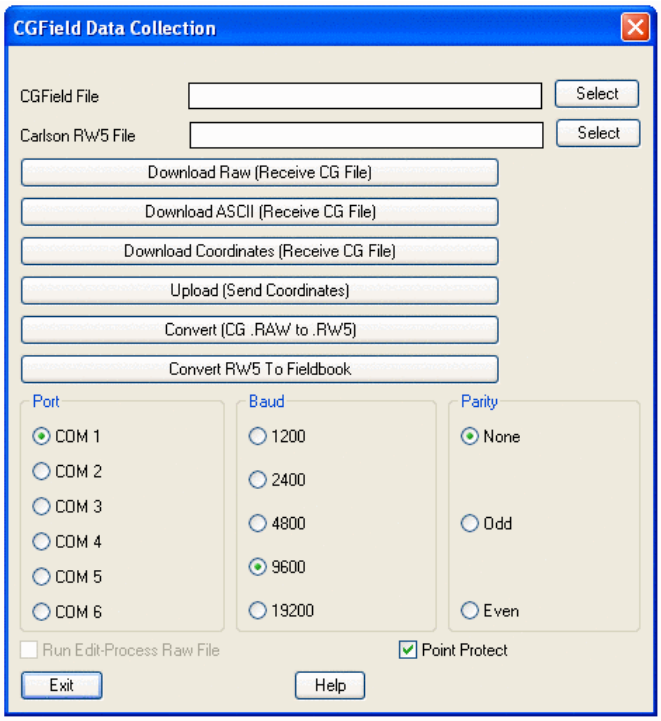
If any other program is using the COM port, you will not be able to connect properly and CSD may respond with the following message:



If you receive this error, determine what program has control of the COM port and terminate this program. Programs to look for include Microsoft ActiveSync, PalmPilot synchronization, fax programs, etc.

- **Convert RW5 to Fieldbook:** The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

CG Field



In CSD, select Data Collection and choose CGField. Make sure the communication parameters in CSD are set to the following

- Baud 9600
- Parity NONE

Receiving a Raw data File from CGField

1. In CGField, select the UTILS menu and choose C&G Transfer.
2. Select Send Raw Data
3. In CSD, leave the FILE fields blank. Press the Download Raw button to ready CSD to receive the file.
4. In CGField, select the raw data file to be sent. The transfer will begin. The C&G .RAW file will be transferred and saved in the data folder. After the transfer is complete, you will be asked for the RW5 file name. The RAW file will be automatically converted to a Carlson RW5 file.

Receiving a Coordinate File from CGField

1. In CGField, select the UTILS menu and choose C&G Transfer.
2. Select Send Coords, and choose the Coordinate file to send.
3. In CSD, leave the FILE fields blank. Press the Download Raw button to ready CSD to receive the file.
4. In CGField, select the points to send for all points, to select blocks of points, or from a .pts file (the set of points in a Batch Point File).
5. The coordinates will be transferred. After the transfer is complete, you will be asked for the coordinate file name. The C&G CRD file will automatically be converted to a Autodesk Land Desktop coordinate file.

Receiving an ASCII file from CGField

This will allow you to transfer a C&G report file (RPT) or an ASCII NEZ file to CSD
1. In CGField, select the UTILS menu and choose C&G Transfer.
2. Select Send ASCII.
3. In CSD, leave the FILE fields blank. Press the Download ASCII button to ready CSD to receive the file.
4. In CGField, select the ASCII file to send.
5. After the transfer is complete, you will see the file in the CSD editor. You can then select FILE and SAVE (or SAVEAS) to save the ASCII file.

Sending a Coordinate File to CGField

1. In CGField, select the UTILS menu and choose C&G Transfer.
2. Select Receive Coords to ready the data collector.
3. In CSD, leave the FILE fields blank. Press the Upload (Send Coordinates) button. Select the points to send.
4. Press the Start Transfer button.
5. CSD will send the file name to CGField and a coordinate file with the same name will be automatically created or opened in CGField.
6. If the file exists you will be asked how you want to handle duplicate points:

- Overwrite
- Don't Overwrite
- Ask for each Point

The point transfer will begin.

Convert CG .RAW to CSD .RW5

This utility allows you to convert a C&G raw data file to a Carlson raw data file. Select the C&G .RAW file to convert. Then enter the file name of the destination Carlson RW5 file.

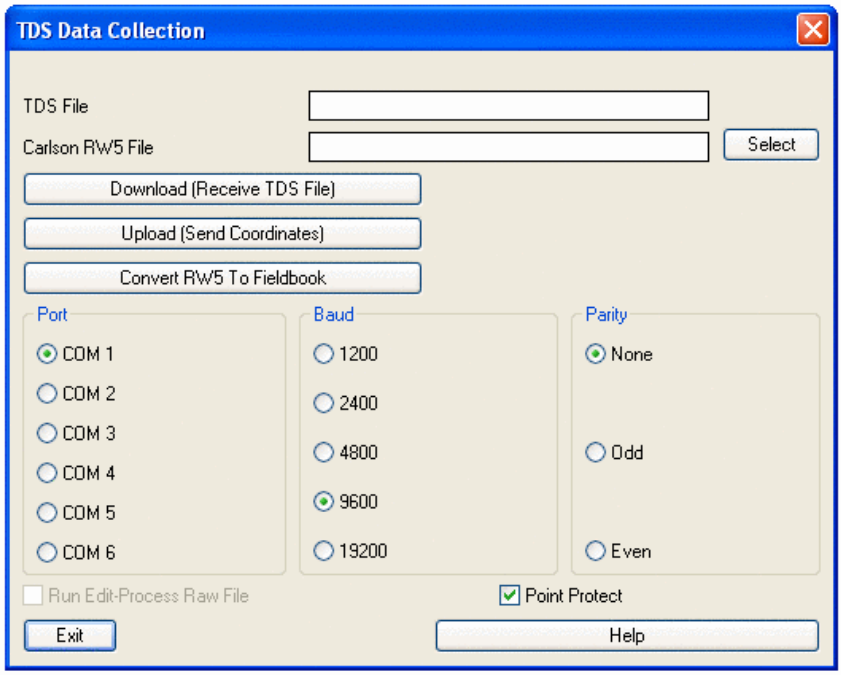
Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Prerequisite: None

Keyboard Command: DATACOLT

TDS Data Collection



Downloading (HP-48 and Husky)

1. In the TDS program, go to the File Transfer command. Choose the type of data to transfer (CRD or RAW).
2. Select the Send function key.
3. Stop here on the TDS and go to CSD.
4 Select Data Collection and pick TDS. Make sure that the COM port and baud rate are set correctly.
5. Select the Download button. CSD will now wait to receive the TDS file.
6. Within ten seconds, select the file to send on the TDS.

Downloading (Ranger and Windows CE)

1. In the TDS program, go to the Transfer command and pick the Send File function. Set the Connecting To field to HP-48.
2. Make sure that the COM port, baud rate and parity are set correctly and then select OK.
3. In the Type field of the file selection dialog, choose Coordinate Files or Raw Files.
4. Stop here on the TDS and go to CSD.
5. Select Data Collection and pick TDS. Make sure that the COM port and baud rate are set correctly.
6. Select the Download button. The CSD program will now wait to receive the TDS file.
7. Within ten seconds, select the file to send on the TDS, and select OK in the TDS dialog.

Uploading (HP-48 and Husky)

The LDT point database can be converted to a CR5 file and uploaded into TDS.
1. Start in the TDS program, select the File Transfer command.

2. Stop here on the TDS and go to CSD.
3. Select Data Collection and pick TDS.
4. In the CSD dialog, enter a TDS File name. This name should not include the drive and directory path or file extension.
5. Check that the COM port and baud rate are set correctly.
6. Select the CSD Upload button. A dialog now allows you to specify the range of point numbers to upload.
7. Enter the range of points.
8. Before clicking the Start Transfer button go to TDS and select the Receive function key.
9. Within ten seconds go back to CSD and click the OK on the range of points. The file will then transfer.

Uploading (Ranger and Windows CE)

The LDT point database can be converted to a CR5 file and uploaded into TDS.
1. Start in the TDS program, select the Transfer command and choose the Receive File function.
2. Set the "Connecting To" field to HP-48. Make sure that the COM port, baud rate and parity are set correctly and then select OK.
3. Stop here on the TDS and go to CSD.
4. Select Data Collection and pick TDS.
5. In the CSD dialog, enter a TDS File name. This name should not include the drive and directory path or file extension.
6. Check that the COM port and baud rate are set correctly.
7. Select the CSD Upload button. A dialog now allows you to specify the range of point numbers to upload.
8. Enter the range of points and click the Start Transfer button.

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

SMI

Downloading

1. To send point data from the SMI data collector, go to the File Transfer command by typing [More] [NXT] [TOPC] [COMM].
2. In SMI version 6 or later, type [Job][KERM][SEND]. Also in version 6, make sure that the first function key reads [NE] and not [XY] in the [Job][KERM] screen. Otherwise the coordinate northing and easting will be reversed. The [NE] stands for North-East coordinate order which is the format that CSD expects. Also in the [Job][KERM] screen, make sure that the second function key reads [COMM] and not [SPACE]. The [COMM] stands for comma separators.
3. Enter the first point to send, followed by the last point to send.
4. Before pressing Enter for the last point, stop here and go to CSD.
5. Run Data Collection and choose SMI. Check that the COM port and baud rate are set correctly.
6. Select the Download button.
7. Within 10 seconds go back to SMI and press Enter for the last point to send.

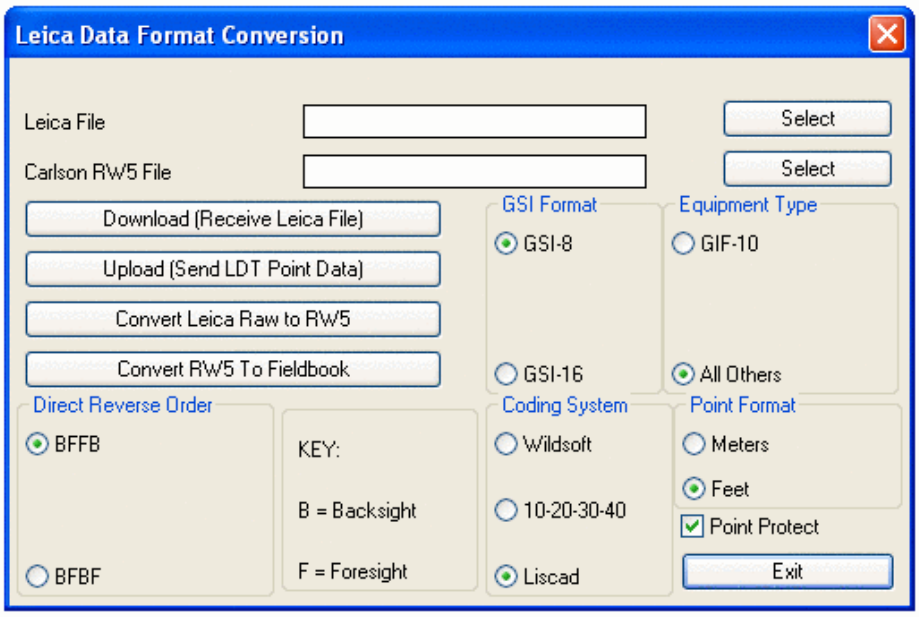
To send raw data, use the [Print][Raw] command in SMI along with the same CSD procedure used for point data.

Uploading

1. From the SMI data collector, go to the File Transfer command by typing [More] [NXT] [TO48] [COMM].

2. In SMI version 6 or later, type [Job][KERM][RECV]. Also in version 6, make sure that first function key reads [NE] and not [XY] in the [Job][KERM] screen. Otherwise the coordinate northing and easting will be reversed.
3. Enter the first point to send followed by the last point to send.
4. Enter the job name.
5. Before pressing Enter, stop here and go to CSD.
6. Run Data Collection and choose SMI.
7. In the CSD dialog, specify the same job name as entered in SMI.
8. Check that the COM port and baud rate are set correctly.
9. Select the Upload button.
10. A dialog allows you to specify the range of point numbers to upload. Enter the same range of points as entered on the SMI.
11. Return to SMI and select Enter for job name.
12. Choose the OK button for range of points in CSD.

Leica



There are two types of Leica transfers: GIF-10 and GeoCom for all other Leica instruments. The type is set in the Equipment Type field on the main dialog. For transferring with the Leica instruments, the GeoCom program shows a dialog of the available COM ports on your computer. The first time you transfer to an instrument, you will need to pick the Instruments button and register the instrument from the list. Select the Port Settings button to make sure that the communication settings match the instrument.

Downloading (GeoCom)

1. To download a file with GeoCom, make sure that the instrument is ON and connected to the computer by serial cable. The instrument also needs to be in GeoCom mode.
2. Select Download in the CSD dialog.
3. In the GeoCom program, open the computer COM port that the instrument is connected to by picking the '+'. Then open the Memory Card and GSI folders.
4. Select the file to transfer and click the OK button.

Uploading (GeoCom)

1. To upload a file with GeoCom, specify the file name to be created on the instrument in the Leica File field.
2. Select the Upload button in the CSD dialog. CSD will prompt for the range of points to transfer.
3. Fill out the range and select the Start Transfer button.
4. The GeoCom program will start. Open the computer COM port by picking the '+'. Then open the Memory Card folder and highlight the GSI folder and click OK.

GIF-10 communication settings

The upload and download file transfer works with the GIF-10 data collector. The GIF-10 communication settings should be the following:

- **Baud**: 9600
- **Parity**: NONE
- **Protocol**: NONE

- **Stop Bit**: 1
- **End Mark**: CR/LF
- **Connected As**: some computers use DCE and others use DTE

Downloading (GIF-10)

1. From the GIF-10, go to the file transfer command.
2. Go to CSD. Run the Data Collection and choose Leica. Check that the COM port and baud rate are set correctly.
3. Select the Download button. Within 10 seconds go back to GIF-10 and select the file to send.
4. When the transfer is complete, the program will ask you to create a CSD coordinate file if you haven't already specified a file name.

Uploading (GIF-10)

1. From the GIF-10 data collector, go to the file transfer command.
2. Go to CSD. Run the Data Collection and choose Leica.
3. In the CSD dialog, specify the job name in the Leica File field.
4. Choose the Select File button next to the CSD coordinate File edit box and choose the coordinate file to send. Check that the COM port and baud rate are set correctly.
5. Select the Upload button. A dialog now allows you to specify the range of point numbers to upload.
6. Before clicking the OK button for range of points, go to GIF-10 and start the receive by highlighting Receive and pressing the Run button.
7. The GIF-10 now shows the available job numbers. Choose a job to receive the transfer using the arrow buttons and then press the Run button.

Converting

CSD supports raw and coordinate data collected using three different Leica Operation Codes: Wildsoft, 10-20-30-40, and the newer LISCAD. Data can also be in the GSI8 format or the newer GSI16 format.

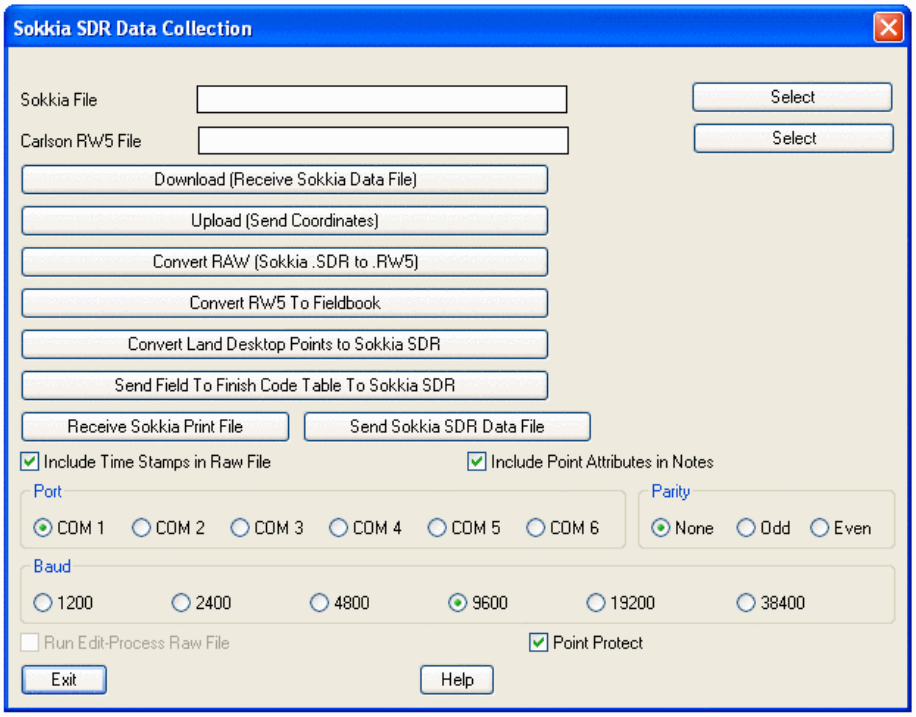
Leica raw files usually have a .RAW or .GSI extension. The primary difference between the GSI8 and GSI16 formats is that, in the GSI16 format, information is contained in data blocks of 16 characters , while it is contained in blocks of 8 characters in the GSI8 format. Leica instruments make it possible to have both the GSI8 as well as GSI16 data formats in the same raw file. Lines with the GSI16 format data always start with an asterisk (*) sign, to distinguish them from the GSI8 format. There is no distinction between Leica raw files collected in the Wildsoft and LISCAD operation codes.

1. The Convert Leica button can be used to convert any Leica format file into a CSD format file. (e.g., if you have a Leica PCMCIA card, no serial cable transfer is needed. Instead use the Convert command to make the RW5 and coordinate files). Since there is no distinction between Wildsoft and LISCAD files, you must know in advance which format has been used in the file.
2. Select that particular option (Wildsoft, 10-20-30-40, or LISCAD) under the "Coding System" option at the bottom of the dialog box. You must choose the order in which foresight-backsight readings were recorded in the raw file, BFFB or BFBF, as explained in the dialog box.
3. Select the Convert Leica button. The command prompts for the input Wild/Leica File (raw file), the output RW5 file and the coordinate file, if you have not entered them.

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

SDR/Sokkia/Leitz Data Collection



This command applies to the Sokkia SDR-20, SDR-22, SDR-31 and SDR-33 as well as other collectors that have SDR format transfer, such as the Trimble and C & G.

Downloading

1. From the SDR data collector, select the Communications command from the main menu. Choose Data Format SDR.
2. Select the Send function key. Then choose Select Jobs.
3. From the list of jobs, highlight the job to transfer and set it to Yes with the arrow keys.
4. In CSD, run Data Collection choose Sokkia/SDR. Check that the COM port and baud rate are set correctly.
5. Select the Download button, and within ten seconds go back to SDR and press OK.
6. The SDR format contains both coordinate and raw data. The coordinate data is converted to a CSD coordinate file and the raw data is converted to a CSD raw data (.RW5) file. The original SDR transfer file is stored on the computer as a RAW file.

SDR-33

The SDR-33 has different modes for storing and transferring data. In coordinate mode, the download will create points in the coordinate file and the raw data (.RW5) file will only contain some basic header lines. In the raw data mode, the download will create all the measurement data in the raw file and no points will be created in the coordinate file. For this raw data mode, you will need to run Edit-Process Raw Data to calculate the points from the raw data. The third mode in the SDR-33 creates both raw data in the raw data (.RW5) file and points in the coordinate file. The Include Time Stamps in Notes option sets whether all the date-time records for each point are put in the raw data (.RW5) file as description records. The Include Point Attributes in Notes option will store SDR code 13(AT) codes to the point note (.NOT) for the point database.

Uploading

Point data from the current project point database can be uploaded into the SDR.
1. Select the Communications command in the SDR main menu. Choose Data Format SDR.
2. In CSD, run Data Collection choose Sokkia/SDR. Check that the COM port and baud rate are set correctly.
3. Select the Upload button. A Sokkia Options dialog appears for setting the job parameters for the file to be created on the collector. Be sure to choose the Distance Unit that matches your coordinate file (meters, US feet or international feet).
4. Click OK. The next dialog allows you to specify the range of point numbers to upload.
5. Before clicking the Start Transfer button for range of points, go to the SDR and hit the Receive function key. The SDR is now waiting to receive.
6. Return to CSD and click Start Transfer on the range of point dialog.

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Communication Settings

Besides matching the baud rate between CSD and the collector, make sure that the collector is set to word length of eight (8), and one (1) stop bit under the communication settings.

Print File

The Receive Sokkia Print File function downloads a print report from the SDR33 data collector. This file is only used for printing report purposes in CSD. This file is not used by CSD to generate coordinate files or raw files.
1. The first step is to choose Data format=Printed in the Communications menu of the SDR33.
2. Choose the Receive Print File button in CSD.
3. On the SDR33, choose the Send function and select a job to send. At this point the file is transferred.
4. After downloading, the job report is displayed in the CSD standard report viewer.

Nikon

Download

1. Choose the equipment and data type under the Transfer Type list. Check that the communication and data format settings match your collector.
2. Select the Download button and follow the on-screen directions.

Upload

1. Check that the COM port and baud rate are set correctly
2. Select the Upload button. Specify the range of point numbers to upload.
3. Set the points and then click the Start Transfer button.

Convert

The Convert button will translate the Nikon raw file format (.TRN or .RAW) into CSD coordinate and raw (.RW5) files

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Geodimeter

This transfer routine applies to the Geodimeter Geodat 600 collector.

Downloading

From the Geodimeter data collector, go to the file transfer command by pressing the PRG (Program) key and entering program 54. Then choose Imem (option 1) as the source. Next choose the file type to send as either Job (measurement data) or Area (point data). The Geodimeter will then prompt for the job name. Next enter Serial (option 3) as the destination. A confirmation screen appears showing the serial port settings. Here are some typical settings:

COM=1,8,0,9600

Before pressing enter (ENT key), go to CSD and run Data Collection in the Survey menu and choose Geodimeter. Then click the Download button and within 15 seconds, go back to the Geodimeter and press Enter. The file transfer should now go. When the transfer is complete, the program will ask you for the CSD coordinate file and raw file to create if you haven't already specified a file name in the dialog.

Uploading

In CSD, run Geodimeter under Data Collection in the Survey menu. Pick the Select File button next to the CRD File edit box and choose the coordinate file to send. Check that the COM port and baud rate are set correctly and then click the Upload button. A dialog now allows you to specify the range of point numbers to upload. Enter the points to send but before clicking OK, go to the Geodimeter data collector. Start the file transfer routine by pressing the PRG key and entering program 54. Then choose Serial (option 3) as the source. The Geodimeter will display the serial port settings. Check these values and press enter. Next choose Area (option 2) as the destination. Then enter the job name. The Geodimeter is now listening for data. Quickly go back to CSD and click OK on the points to send dialog. The file transfer will now go

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Communication Settings

If the Geodimeter is not communicating with CSD, run function 79 on the Geodimeter and make sure that it is set to 4. This setting is for the transfer message end of sequence format.

Surveyor's Assistant

Downloading

1. From the Surveyor's Assistant data collector, select the Transfer command from the main menu. Fill out the transfer screen as follows:

- **Direction**: OUTPUT
- **Format**: LIETZ
- **Data**: Coordinate or All Data
- **Port**: COM1 or COM2
- **Ckh Hold**: NO
- **Protocol**: NONE

2. Check the settings under the PORT menu. Typical port settings are baud=9600, parity=none, data=8, stop=1 and handshake=XON/XOFF.
3. Now in CSD, run Data Collection and choose Surveyor's Assistant. Check that the COM port and baud rate are set correctly.
4. Select the Download button and within ten seconds return to Surveyor's Assistant and press GO.
5. If the All Data option is used, then the Leitz format will contain both coordinate and raw data. The coordinate data is stored to project point database and the raw data is converted to a CSD raw data (.RW5) file.

Uploading

1. Point data from the CSD coordinate file can be uploaded into the Surveyor's Assistant. First go to the Transfer command on the main menu. Fill out the screen as follows:

- **Direction**: INPUT
- **Format**: LEITZ
- **Port**: COM1 or COM2
- **Protocol**: NONE

2. Go back to CSD and run Data Collection, selecting Surveyor's Assistant. Check that the COM port and baud rate are set correctly.
3. Click the Upload button. A dialog now allows you to specify the range of point numbers to upload.
4. Before clicking the OK button for range of points, return to Surveyor's Assistant and hit the GO function key. The Surveyor's Assistant is now waiting to receive.
5. Return to CSD and click OK on the range of point dialog.

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Topcon

The various Topcon instruments in this list can be downloaded directly from the instrument to Carlson Software, using the appropriate cable supplied by Topcon. The cable has a round end to connect to the Topcon instrument and a 9-pin serial port end to connect to the PC. This download is commonly used, for example, by companies who collect data and store the data onboard the instrument itself, with no 3rd-party handheld data collector involved. This is a fairly common practice, for example, in construction stakeout.

The procedure outlined below is for the Topcon GTS 226, which has a 4-button keyboard (F1 through F4)

providing access to all onboard commands and even allowing direct, multi-keystroke entry of coordinates. Most Topcon instruments follow similar procedure.

Uploading

Upload Procedure (PC to Topcon): At the main menu, you will see the following options:

- F1: DATA COLLECT
- F2: LAYOUT
- F3: MEMORY MANAGER

Press the F3 key twice, paging down to DATA TRANSFER. Then select COMM. PARAMETERS (F3). Protocol must be "ONE-WAY", BAUD RATE 9600 and CHAR/PARITY must be 8/NONE.

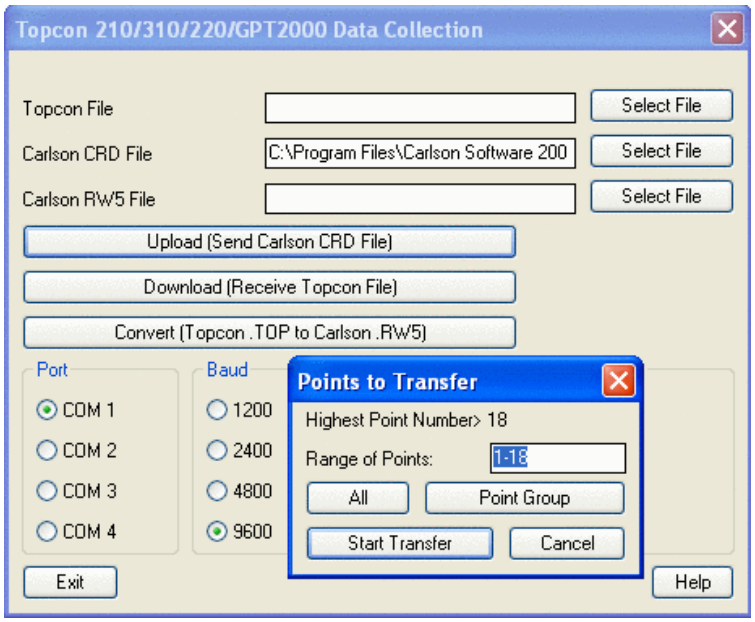
NOTE: This is a one-time process. Once the protocols are verified, you can send and receive data by going directly to the screen shown below.

Return to the COMM. PARAMETERS selection screen, which displays the following 3 options:

- F1: SEND DATA
- F2: LOAD DATA
- F3: COMM. PARAMETERS

Press F2 to LOAD DATA. Then press F1 to select COOR. DATA. The program on the Topcon will ask you to enter a file name. You must enter this name on the Topcon instrument, using the 4 function keys to access letters and numbers. This will be the name of the file that you will use for stakeout. If you entered a name such as 11 or Smith or whatever you choose, your coordinate file on the PC will be converted to this name as it stored on the Topcon.

LOAD COOR. DATA. OK? F3=YES. Press F3. The instrument will say "Waiting Data..." At this point, you need to be in the Topcon data transfer option. There you pick Upload, or prior to picking upload you can specify your coordinate file name, as shown below. After Upload is clicked, you specify the point range to send, and click OK. You have a certain amount of time within the "Waiting Data.." mode to start sending the data over to the Topcon instrument.



When all the selected coordinates are transferred, it will say "Completed" on the PC. At this point, press F4 on the Topcon for STOP and review the points within the Topcon screen to verify that they are there. Then you are ready to stakeout with the points using the onboard features of the Topcon instrument.

Downloading

Download Procedure (Topcon to PC): Follow the same steps outlined above and obtain the following screen, using the function keys on the Topcon instrument:

- F1: SEND DATA
- F2: LOAD DATA
- F3: COMM. PARAMETERS

Select SEND DATA and answer the questions up until the only remaining option is OK to begin the download. This gets the Topcon side poised and ready. On the PC, choose Download (Receive Topcon File), as shown in the dialog box above. Note that you do not need to fill out any of the 3 top dialog boxes in the download screen. The program will default to the job name on the Topcon instrument, and will prompt you if you wish to change the name. After clicking Download on the PC side, it will say "WAITING...". Back on the Topcon instrument, press OK to start the download. The points will download into the PC and when completed, the Topcon instrument will typically beep. At this point, exit the download dialog and return to the main menu on the PC.

Convert .RW5 to Fieldbook

The Fieldbook conversion converts a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead of the CSD Edit-Process Raw file command. The Fieldbook conversion is also located in the Edit-Process Raw Data command under File->Export->Fieldbook.

Edit-Process Raw File 4

Edit-Process Raw File

Functions

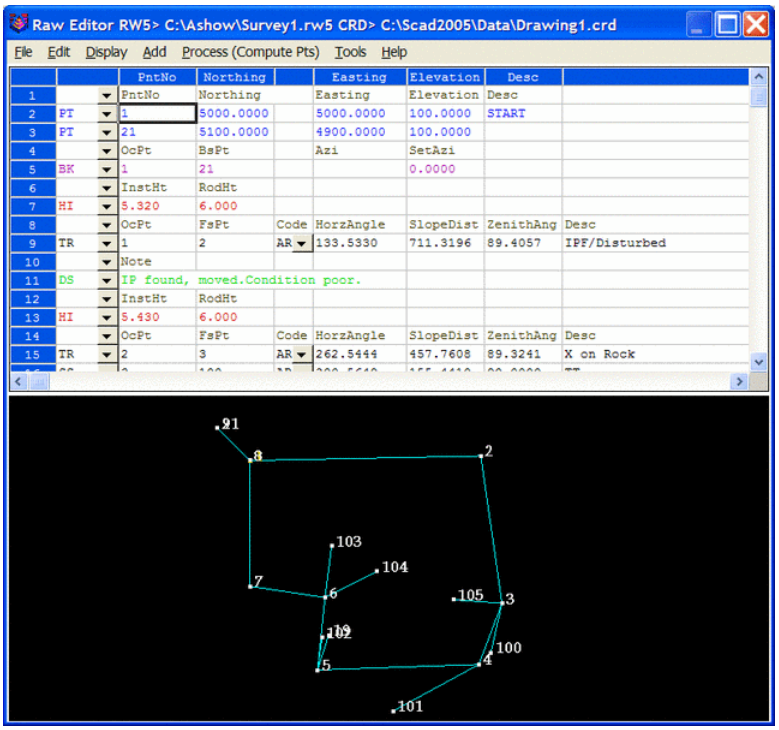
This program reads or creates a raw data (.RW5) file that contains various lines of data (records) that could be likened to a surveyor's field book. You can specify point coordinates, job information, notes, and the angles and distances that make up traverse or sideshots records. Once the raw data is created or read it can be processed/reduced to coordinates that are stored in the current point database.

The raw file can also be created or appended using the *Locate Point, Traverse, Sideshot,* and *Inverse* commands. To store the data inputs from these commands into a raw file, first toggle on the *Raw File ON/OFF* command on the Cogo menu. It is possible to always have the raw data file open to store data inputs. To enable this option, choose Configure Carlson Survey Desktop and turn on the Automatic Raw File toggle in this dialog.

The raw files created by TDS data collector programs are also compatible without conversion. The command *Data Collectors* on the Tools menu has options for reading other data collectors native file formats and converting them to raw data (.RW5) format. Within the raw data editor, the File menu includes an import menu for converting raw data from other formats.

When you select the *Edit-Process Raw Data File* command you are prompted to specify the name of the raw data (.RW5) file. The point database for the current project is used automatically.

Edit-Process Raw Data File uses a spreadsheet for editing the raw data as shown. Each row of the spreadsheet is represented by a number located at the far left side of the editor. Various messages and reports often reference possible problems with the data by this row number. Each row of the spreadsheet represents one record of data. There are 14 types of data records. The type of data record is shown in the first column. Different record types use different numbers of columns. Whenever the data record type changes between rows, a record header is added to the spreadsheet that describes each column of data in the following row. To edit the raw data, simply highlight the cell and type in the new value. To change the type of record, pick on the down arrow in the first column and choose a new data type from the list. To delete a row, highlight any cell in the row and hit the Delete key or choose Delete Row from the Edit menu. Records can be added pressing the Insert key, pressing the down arrow key from the last line in the spreadsheet, or by choosing one of the add records from the Add menu.



The different record types are described below.

TR (Traverse)

The traverse record contains the occupied point number, foresight point number, angle mode, horizontal angle, distance, vertical angle and description. When processed, this record will calculate and store the coordinates for the foresight point. Traversing also moves the setup by making the traverse foresight point the next occupied point and the traverse occupied point becomes the next backsight point. The different angle codes are NE for northeast bearing, SE for southeast, SW for southwest, NW for northwest, AZ for azimuth, AL for angle left, AR for angle right, DL for deflection angle left and DR for deflection angle right. To set the angle code, pick on the Code down arrow and choose from the list. The horizontal and vertical angles should be entered as dd.mmss. For example, 45.2305 is 45 degrees, 23 minutes and 5 seconds. The vertical angle can be shown as vertical angle (0 degrees level), zenith angle (90 degrees level) or elevation difference. The vertical angle mode is set in the Display menu. The distance mode is also set in the Display menu as either slope or horizontal distance. The description field is used as the foresight point description.

SS (SideShot)

The sideshot record is the same as the traverse record except that sideshot does not move the setup.

HI (Instrument and Rod Height)

This record sets the instrument and rod heights used in elevation calculations. This record should precede any traverse and sideshot records that you want the heights applied to.

BK (BackSight)

The backsight record contains the occupied point number, backsight point number, backsight azimuth and the set azimuth. This record should precede any traverse and sideshot records that use this setup. If no backsight point is entered, the program uses the backsight azimuth to turn angles from. The Set Azimuth is the circle reading of the instrument when sighting the backsight. A Set Azimuth of zero is the default.

PT (Store Point)

The store point record consists of a point number, northing, easting, elevation and description. When processing, this data will be stored as a point in the coordinate file. If the first Occupied point and/or the initial Backsight point

are not defined in the coordinate file set for processing to, both points will need to be added to the rw5 file as PT (Store Point) records.

DS (Description)

The description record is an additional note that appears in the spreadsheet editor and printouts. This record can contain various information that is recorded in data collectors during field operations. This data can vary from user, temperature and general data to each line of data associated with "Set Collection". When "Sets" of data collected using various brands of data collection software is converted/imported into the raw editor, the actual measurements made during the spinning of the angles and distances are recorded as DS records and the mean value of the angle and distance is recorded as a SS record. DS records are not used in processing.

CL (Closing Shot)

The closing shot record is the traverse record where the foresight point is the closing point for the traverse. This record is used by the adjustment commands in the Process menu. There should be only one CL record in each Traverse loop (Name Record) in the raw file. If there is no CL record, the process adjustment routines will prompt for which shot is the closing shot. The closing shot can also be define in the field by using special codes defined in the Open Settings found under the File pulldown within the editor. Please refer to the "Open Settings" documentation below for more information on these codes.

AB (Angle Balance)

The Angle Balance record is the measurement data observed that closes the angles of the traverse. Typically this record is the measurement data recorded from the closing shot to the initial backsight point. The backsight could be either external or internal to the traverse. Angle Balance routine in the Process menu uses this record and compares the angle between the occupied point and foresight point of this record with a user-specified reference angle. There should be only one AB record in the raw file. If there is no AB record, then the Angle Balance routine will prompt for which shot to use as the angle balance.

CL + AB (Closing Shot and Angle Balance)

This record is used as both the closing shot and angle balance records.

FD (Foresight Direct)

The foresight direct is a traverse record used in a direct and reverse set. When the program finds one the of direct-reverse measurement records, it will look for the other three records to complete the set.

FR (Foresight Reverse)

The foresight reverse is a traverse record used in a direct and reverse set.

BD (Backsight Direct)

The backsight direct is a traverse record used in a direct and reverse set.

BR (Backsight Reverse)

The backsight reverse is a traverse record used in a direct and reverse set.

EL (Elevation Only)

This record sets the elevation in the CRD file for the specified point number. Often used when an existing point with good vertical control is being traversed through. Using this record type for the point would keep the elevation from changing on the existing point regardless of the measurement data.

AZ (Azimuth Only)

Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

CSE (Control Standard Error)

Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

SSE (Set-up Standard Error)
Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

MSE (Measurement Standard Error)
Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

NAME (Traverse Name)
This record acts as an identifier for the group of records that make up a traverse. All the records after the NAME record belong to that traverse up to the next NAME record or the end of the file. This record allows you to have multiple traverses in one raw file. When running one of the Process commands, the program will bring up a list of all the traverse names. Simply choose which traverse to process. If you have only one traverse in the raw file, then you don't need the NAME record.

GPS
This record contains the Latitude and Longitude of a point as measured by GPS surveying equipment using Carlson SurvCE data collection software. This record has additional information tied to it such as localization files, geoid files, coordinate projection systems etc. This record has its own processing routine in the Process pulldown within the editor. Processing procedures are discussed in the Process (Compute Pts) pulldown documentation.

Raw Data Editor Pulldown Menus

File Menu

Save
This saves the rw5 file. If the file hasn't been named you will be prompted for the file name and the location to save the file. After you preform the first save, this command acts as a quick save and saves the file to the name and location specified during the initial saving of the file.

Save As
This command saves the file and always prompts for file name and location to save.

Print
This command outputs the raw data file to the *Standard Report Viewer*. From here, you can print the report, draw it in the drawing or save it to a file. See *Standard Report Viewer* for more information. See example printout:

```
Raw File> c:\scadxml\data\survey.rw5
   Note
   Survey Example
```

```
   PntNo   Northing Easting   Elevation Desc
   1       5000     5000    100       START
   OcPt    BsPt     SetAzi
   1
   InstHgt RodHgt
   5.32    6.0
   OcPt    FsPt     HorzAngle SlopeDist ZenithAng Desc
TR 1       2     AR 268.5330  711.420   89.4050   P2
   InstHgt RodHgt
   5.43    6.0
   OcPt    FsPt     HorzAngle SlopeDist ZenithAng Desc
TR 2       3     AR 262.5448  457.760   89.3236   P3
   InstHgt RodHgt
   5.4     6.0
   OcPt    FsPt     HorzAngle SlopeDist ZenithAng Desc
TR 3       4     AR 208.5710  201.310   89.1803   P4
TR 4       5     AR 247.1657  497.120   88.5235   P5
TR 5       6     AR 277.4835  223.980   90.2926   P6
TR 6       7     AR  92.4113  233.880   90.2746   P7
   InstHgt RodHgt
   5.42    6.0
   OcPt    FsPt     HorzAngle SlopeDist ZenithAng Desc
TR 7       8     AR 261.2756  387.250   91.4405   CLOSE
SS 7       19    AR 289.3456  112.450   91.3423   SS1
```

Import

These routines convert raw data from other formats into the current Carlson RW5 format. The converted raw data will be added to the end of any existing data in the editor. In many cases, the raw data file to import can be downloaded directly from the data collector or instrument using the *Data Collectors* command. The following supported formats (along with their standard file extension) are listed here. Some Sample File Formats are listed at the end of this section.

C&G (.CGR;.RAW;.TXT;∗)

CalTrans (.DMP)

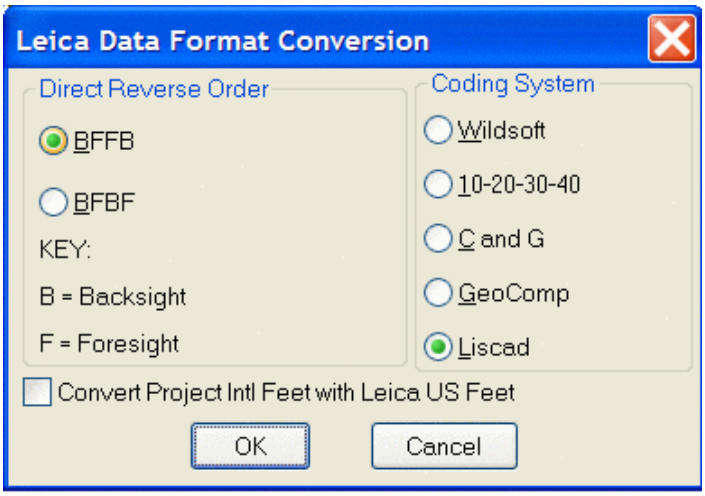
Carlson (.RW5)

Fieldbook (.FBK): From Softdesk or Land Development Desktop.

Geodimeter (.OBS; .RAW; job;∗)

LandXML (.XML)

Leica (.GSI; .RAW; GRE): This reads the Leica raw file in Wildsoft, Liscad, 10-20-30-40, C&G, or GeoComp format. There are options to specify direct-reverse shot order if any and to convert from International Feet to Leica US Feet.

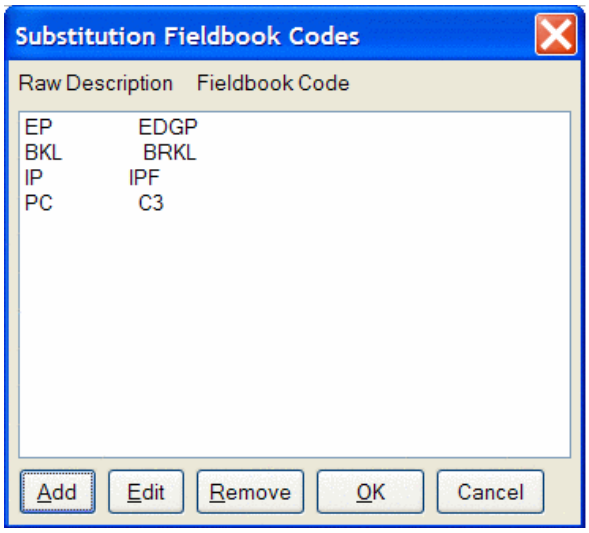


Maptech (.FLD)
MDL Laser (.CDS)
Nikon (.TRN; .RAW)
PC Cogo (.BAT)
SDMS (.prj;*)
SMI (.RAW)
Sokkia SDR (.SDR; .RAW;*)
SurvCOGO (.RAW or .TXT)
Survis (.RAW)
TDS (.RW5; RAW)
Topcon (raw;*)
Trimble (.dc)
3TA5 (.TXT)
Zeiss (.DAT)

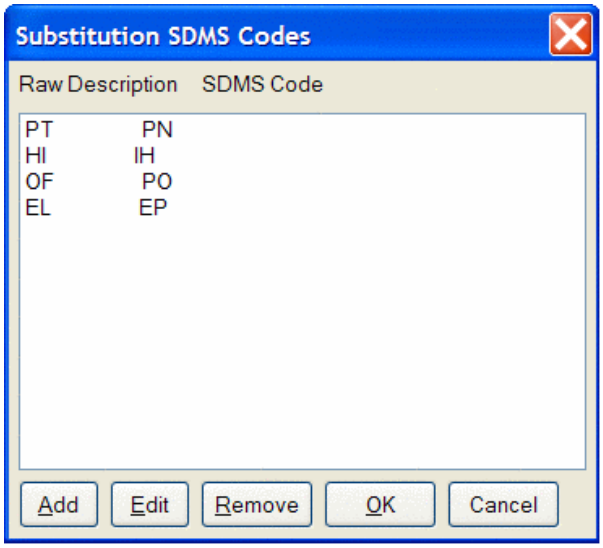
Export
These routines convert the Carlson raw data (.RW5) file to other formats. The following file formats are supported.

CalTrans (DMP)

Fieldbook (.FBK): This export routine provides an option to "Setup Fieldbook Codes". This allows the user to substitute the raw description contained in the rw5 file with the fieldbook code used in AutoDesk Land Desktop.

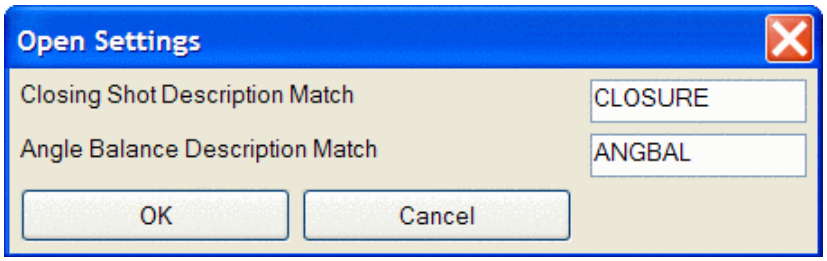


FL DOT (.OBS)
GPS Data (.TXT;*)
Land XML (.XML)
MOSS (.MOS)
SDMS (.PRJ) This export routine provides an option to "Setup SDMS Codes". This allows the user to substitute the raw description contained in the rw5 file with the SDMS codes used in SDMS program.



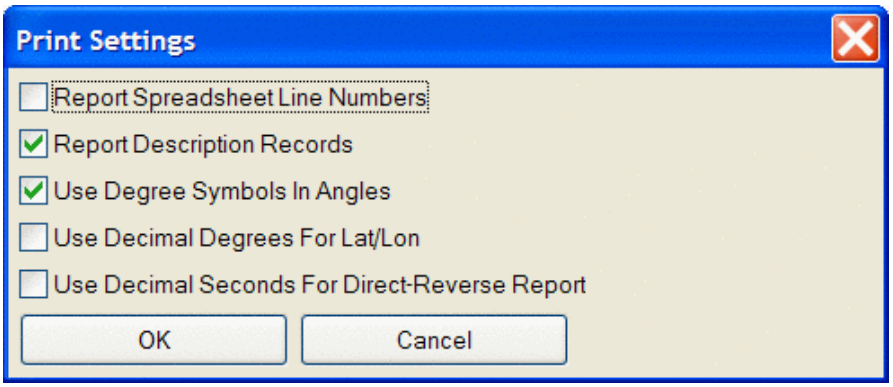
Sokkia (.SDR)
TDS (RW5;RAW)
VA Dot (TOP)

Open Settings
This option allows for defining codes that represent the closing shot and angle balance shot of a traverse. These codes can be entered in the description of a point while in the field. When the rw5 is opened in the raw file editor, the measurement data containing the closing shot code will be set to a CL record and the measurement data containing the angle balance code will be set to an AB record. This allows for quick processing of the survey data and saves the time spent setting up the file for processing.



Print Settings

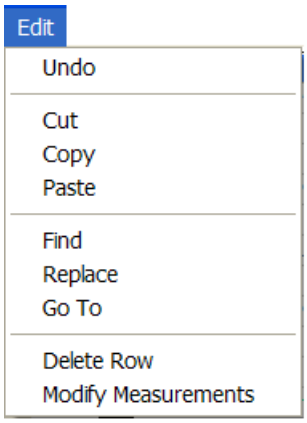
Provides control of various options for printing the rw5 file in theStandard Report Viewer.



Exit

Exits the raw file editor.

Edit Menu



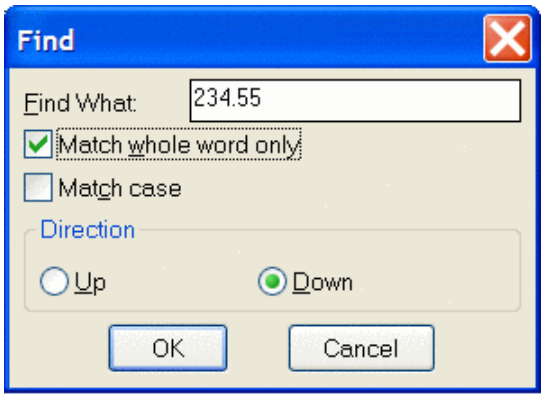
Undo:This command undoes the last data entry or the last copy, cut or delete command performed on keyboard entered data only. This will not undo a change to the Type or Code columns, nor a cut or copy command to a row.

Cut:Standard windows cut command. Removes data from editor and places it in the windows clipboard.

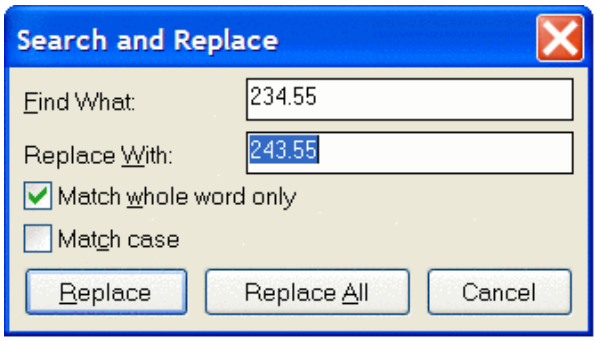
Copy:Standard windows copy command. Copies selected data to windows clipboard.

Delete: Deletes selected data or row of data. Will not delete headers if data is present below the header.

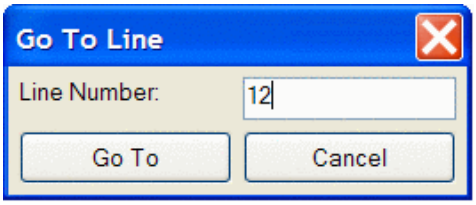
Find: Tool to search and find a particular word, letter, numeric value or a combination of all. Provides options to Match whole word only and/or case. Allows for a up or down directional search from the active cell in the editor.



Replace: Tool to search and replace a particular word, letter, numeric value of a combination of all. Options to Match whole word only and /or case is provided for the search criteria. Provides further options to Replace individual items one at a time or to Replace All.

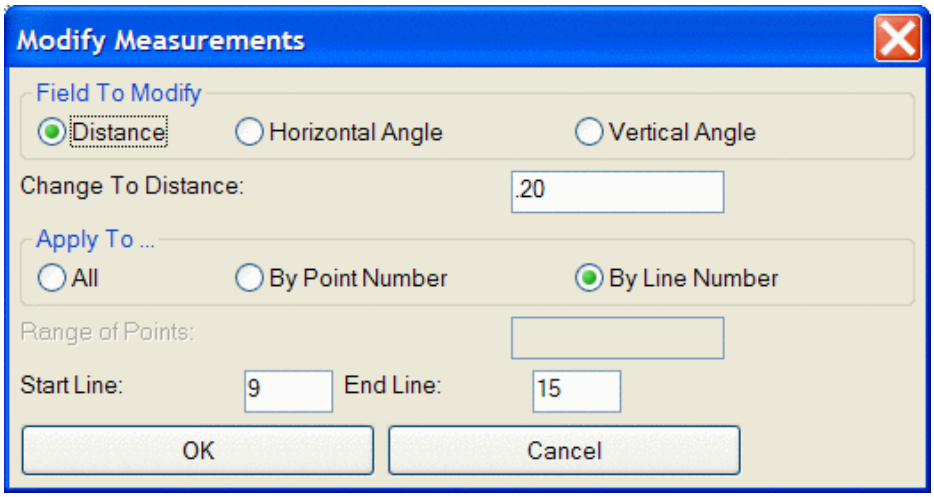


Go To: Tool to advance the focus of the active cell to a specified line number.

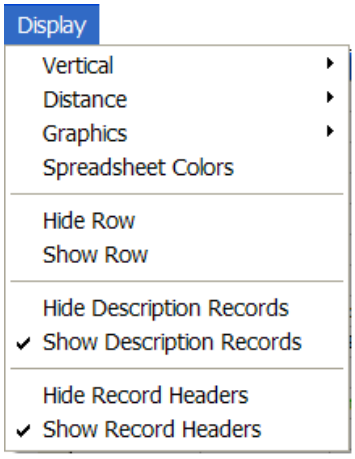


Delete Row: This command deletes the row containing the active cursor or cell. You can delete a row by placing the cursor in any of the cells in the row that you wish to delete, or by picking on the row number at the far left of the editor.

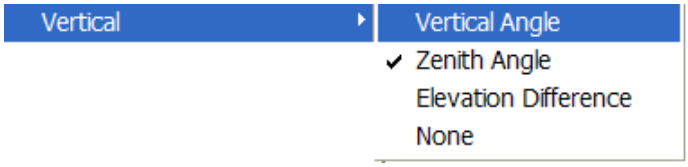
Modify Measurements:This option allows for a change in distance, horizontal angle or vertical angle by a specified amount for the entire file or for a specified point number or line number range.. To modify a measurement, choose which field to modify, enter the change in either distance or angle in dd.mmss format. Next choose how to apply the modification. If all is selected, the change will be applied to all records in the specified field. If By Point Number is chosen, enter the point number or range of numbers in the Range of Points field. If by Line Number is chosen, then define the area for the change by specifying the Starting and Ending line.



Display Menu



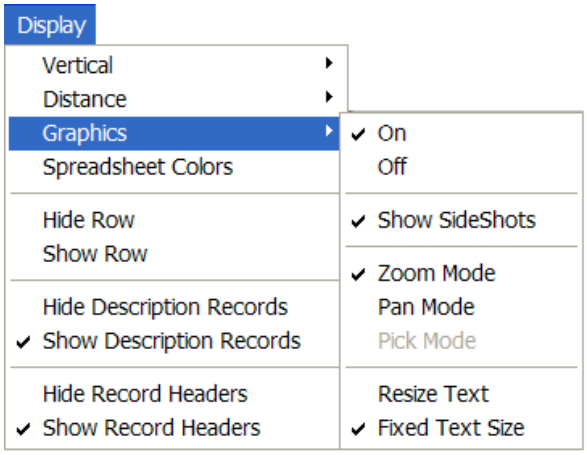
Vertical: The options contained in this menu allow for specifying the type of vertical measurement information you will input or is contained in the rw5 file. The Vertical Angle selection assumes the barrel or scope of the instrument is level when reading 0 (zero). With this setting, the vertical component of a measurement record will have a header of VertAng. The Zenith Angle selection, most commonly used, assumes the barrel/scope to be level when reading 90. Using this setting results in a header of ZenithAng. Elevation difference displays the elevation difference between the occupied and foresight points. If the Distance option is specified as Slope, this elevation difference will be used to calculate the horizontal distance of the measurement. The header for this record is ElevDiff. The None selection assumes all distances are horizontal distances and removes the vertical component for a measurement from the editor. Switching modes can be performed at any time.



Distance: This option controls the display of either Slope or Horizontal Distances. Changing the display results in the distance data adjusting to reflect the correct value for the selection made. The Vertical data, VertAng, ZenithAng

or VertDiff, is used to convert the distance value when changing this display option.

Graphics: The Raw Data Editor uses an optional graphics window to display the points and traverse lines in real time. As data is entered or edited, the graphics window will be updated to show the configuration or new configuration of the traverse. The option of whether to show sideshots is also available. When a cell is selected, the traverse or sideshot line in the display window will change to the color yellow for a graphical reference. The graphics window is toggled on or off from the Display — Graphics Window menu inside the raw file editor.



Graphics>On: Turns the graphics window on.

Graphics>Off: Turns the graphics window off.

Graphics>Show Sideshots: Controls the display of the sideshot data in the graphics window. Figure 1 shows the graphics window with sideshots on. Figure 1A shows the graphics window with sideshots off.

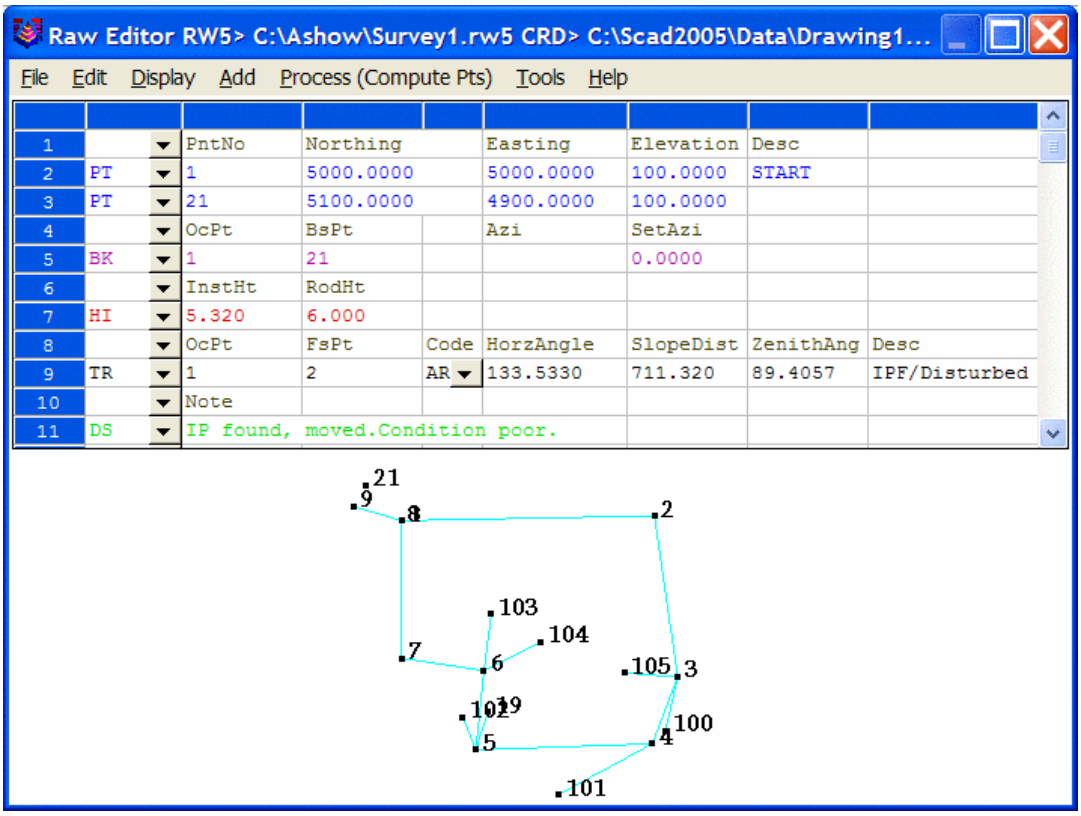


Figure 1 Sideshots On

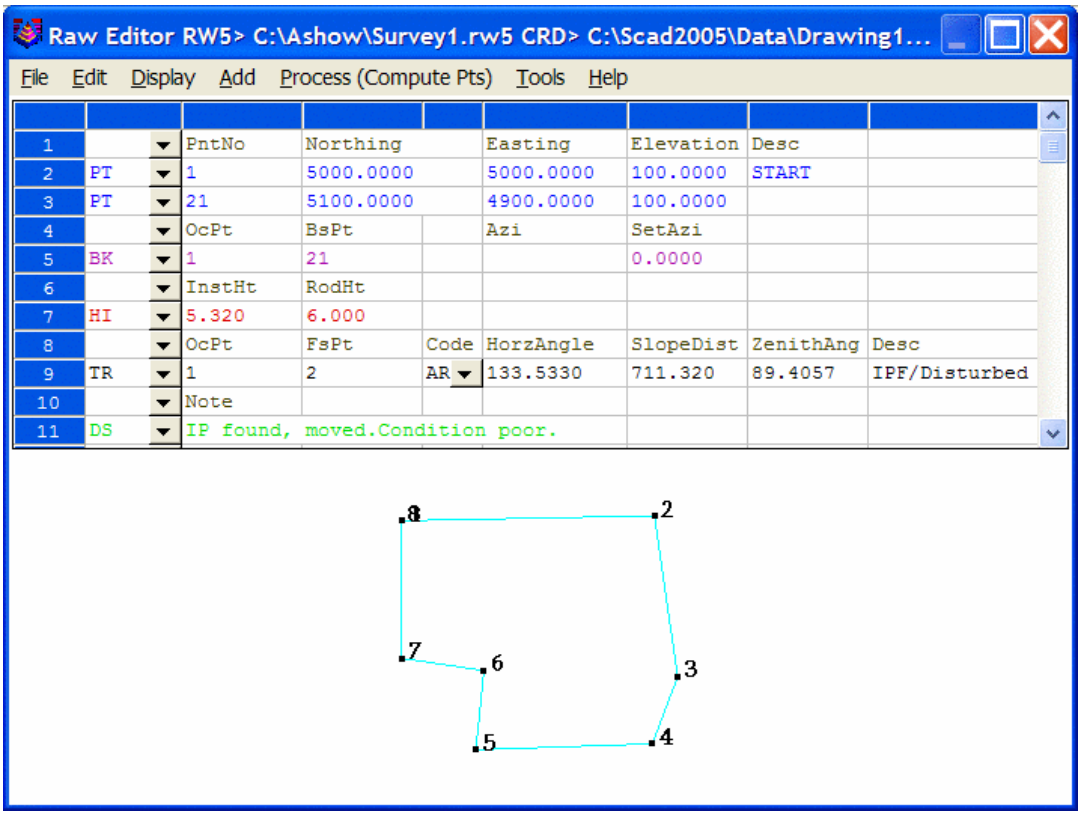


Figure 1A Sideshots Off

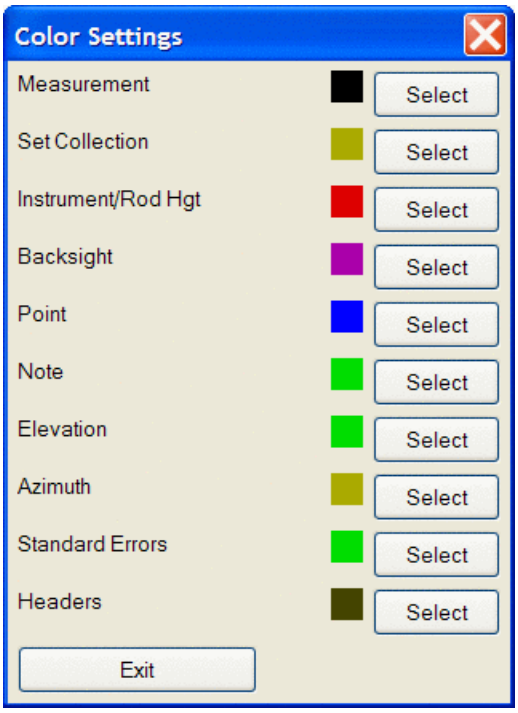
Graphics>Zoom Mode: Within the graphics window, real time zoom is available. To zoom in press and hold the left mouse button and drag in the direction of the + symbol. To zoom out, press and hold the left button and drag in the direction of the - symbol.

Graphics>Pan Mode: Real time pan is available within the graphics window. To pan, set the graphics window to pan mode, then press and hold the left mouse button and then drag to desired position.

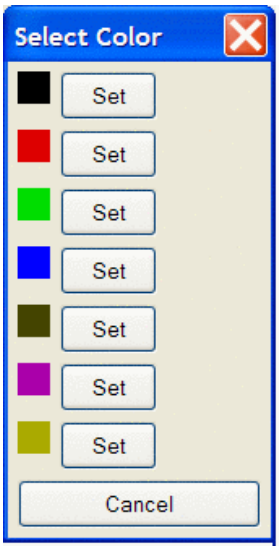
Graphics>Resize Text: With the this option on the text becomes smaller/larger in the view when you zoom in/out.

Graphics>Fixed Text Size: With this option on, the text stays a fixed size while zooming in and out.

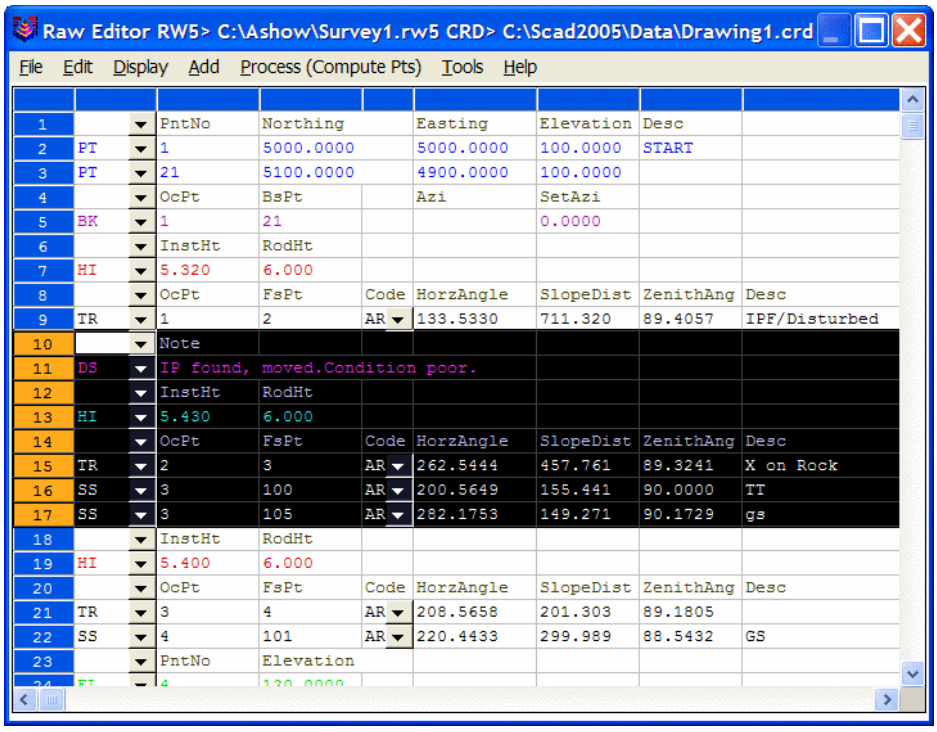
Spreadsheet Colors: This option allows for the assignment of colors to record types. To change/define the color for a particular record, select Spreadsheet Colors from the Display pulldown within the raw editor. From the Color Settings dialog select the record to edit by clicking on the select button next to the desired record.



The color slide beside the select button shows the current setting for the record. After selecting the record, the Select Color dialog box will be display. Select the Set button next to the desired color for the record.

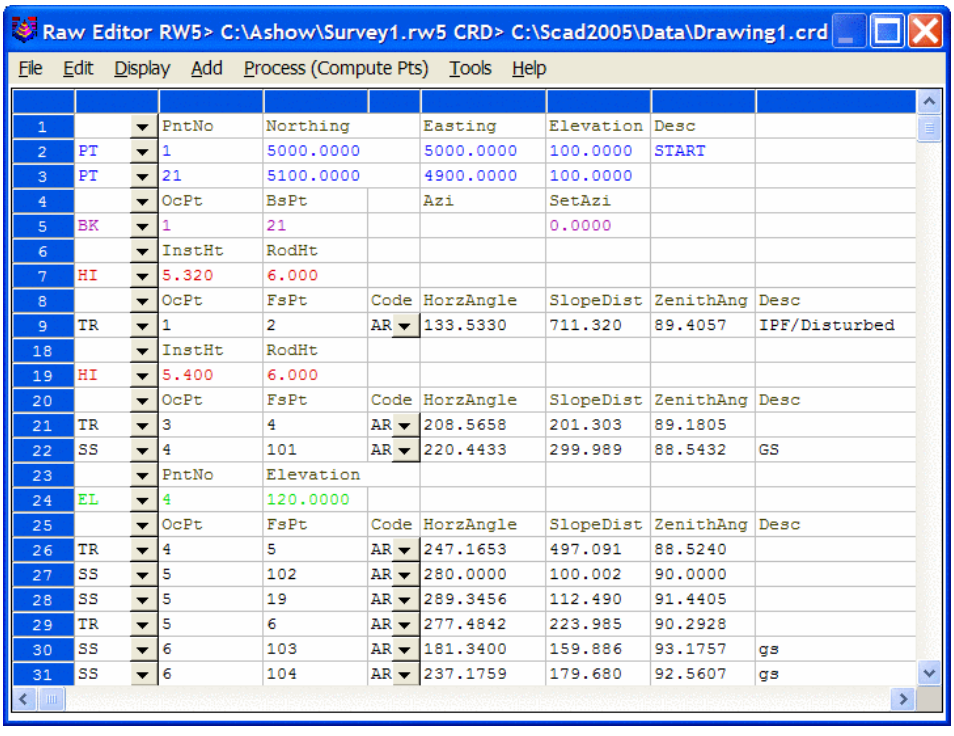


Display>Hide Row: This option allows for hiding single or multiple rows. This could be used to prevent crucial information from being accidently altered during editing of data or data entry. Hiding a record does not exclude it from processing. To hide a record click on the row number at the far left of the editor. The entire row of data will highlight, now select the Hide Row option. Multiple rows or data can be selected by selecting the first row of data to hide then while holding down the shift key on the keyboard, select the last row to hide. All rows in between these two selections will be highlighted, now select Hide Row. When a row or rows of data are hidden, the row numbers will reflect the hidden rows. For example, Figure 2 below shows a multiple selection of rows 10-17 to hide. Figure 2A shows the editor with the rows hidden. Notice that the row numbers indicate hidden rows by showing a gap from rows 9-18.



1		PntNo	Northing		Easting	Elevation	Desc	
2	PT	1	5000.0000		5000.0000	100.0000	START	
3	PT	21	5100.0000		4900.0000	100.0000		
4		OcPt	BsPt		Azi	SetAzi		
5	BK	1	21			0.0000		
6		InstHt	RodHt					
7	HI	5.320	6.000					
8		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
9	TR	1	2	AR	133.5330	711.320	89.4057	IPF/Disturbed
10		Note						
11	DS	IP found, moved.Condition poor.						
12		InstHt	RodHt					
13	HI	5.430	6.000					
14		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
15	TR	2	3	AR	262.5444	457.761	89.3241	X on Rock
16	SS	3	100	AR	200.5649	155.441	90.0000	TT
17	SS	3	105	AR	282.1753	149.271	90.1729	gs
18		InstHt	RodHt					
19	HI	5.400	6.000					
20		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
21	TR	3	4	AR	208.5658	201.303	89.1805	
22	SS	4	101	AR	220.4433	299.989	88.5432	GS
23		PntNo	Elevation					
24	EL	4	120.0000					

Figure 2

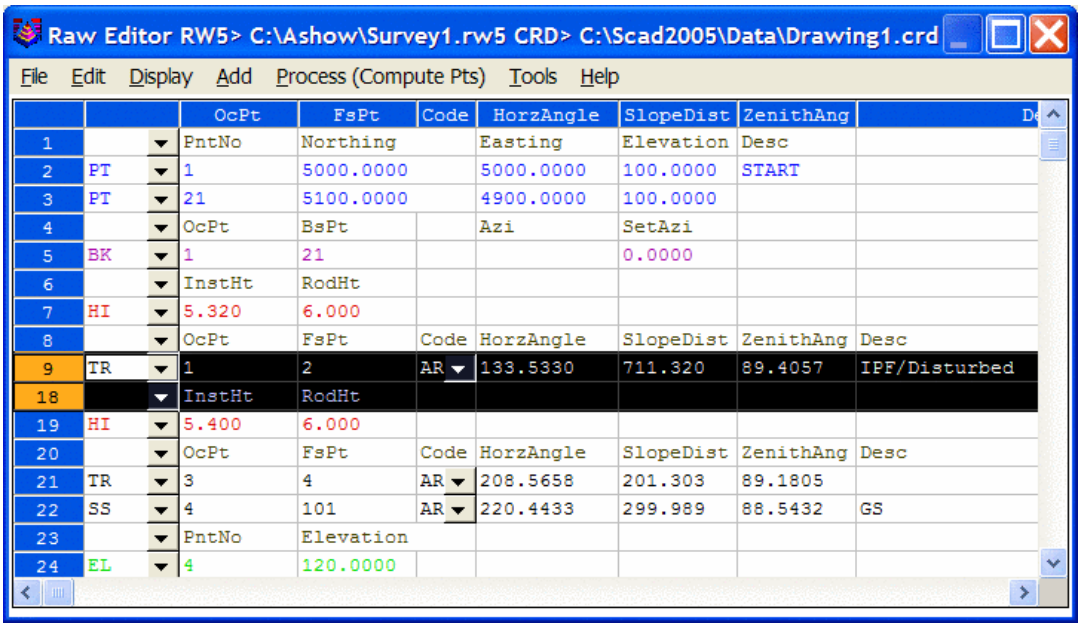


1		PntNo	Northing		Easting	Elevation	Desc	
2	PT	1	5000.0000		5000.0000	100.0000	START	
3	PT	21	5100.0000		4900.0000	100.0000		
4		OcPt	BsPt		Azi	SetAzi		
5	BK	1	21			0.0000		
6		InstHt	RodHt					
7	HI	5.320	6.000					
8		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
9	TR	1	2	AR	133.5330	711.320	89.4057	IPF/Disturbed
18		InstHt	RodHt					
19	HI	5.400	6.000					
20		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
21	TR	3	4	AR	208.5658	201.303	89.1805	
22	SS	4	101	AR	220.4433	299.989	88.5432	GS
23		PntNo	Elevation					
24	EL	4	120.0000					
25		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
26	TR	4	5	AR	247.1653	497.091	88.5240	
27	SS	5	102	AR	280.0000	100.002	90.0000	
28	SS	5	19	AR	289.3456	112.490	91.4405	
29	TR	5	6	AR	277.4842	223.985	90.2928	
30	SS	6	103	AR	181.3400	159.886	93.1757	gs
31	SS	6	104	AR	237.1759	179.680	92.5607	gs

Figure 2A

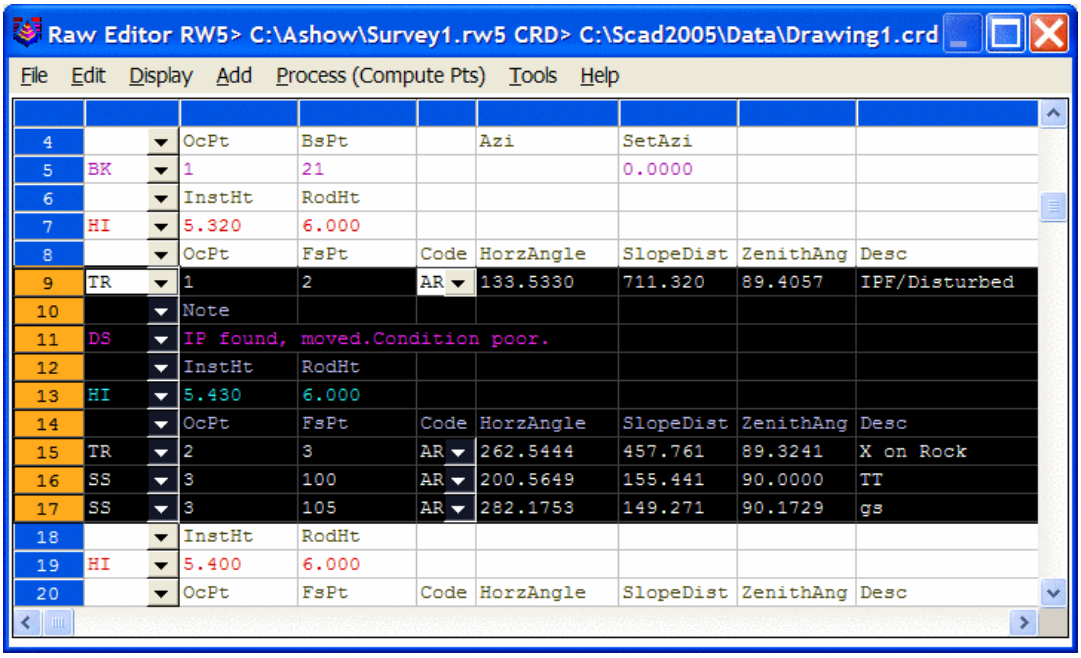
Show Row: This option shows rows that have been hidden. To show hidden rows, the row above the first hidden row and the row below the last hidden row must be selected by using the shift key selection method described in Hide

Row above. After selecting the appropriate rows, select the Show Row option. Figure 2B shows the selection of rows 9 & 18 in order to show the hidden rows 10-17. Figure 2C shows the editor after the Show Row option has been selected.



		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	D
1		PntNo	Northing		Easting	Elevation	Desc	
2	PT	1	5000.0000		5000.0000	100.0000	START	
3	PT	21	5100.0000		4900.0000	100.0000		
4		OcPt	BsPt		Azi	SetAzi		
5	BK	1	21			0.0000		
6		InstHt	RodHt					
7	HI	5.320	6.000					
8		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
9	TR	1	2	AR	133.5330	711.320	89.4057	IPF/Disturbed
18		InstHt	RodHt					
19	HI	5.400	6.000					
20		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
21	TR	3	4	AR	208.5658	201.303	89.1805	
22	SS	4	101	AR	220.4433	299.989	88.5432	GS
23		PntNo	Elevation					
24	EL	4	120.0000					

Figure 2B



4		OcPt	BsPt		Azi	SetAzi		
5	BK	1	21			0.0000		
6		InstHt	RodHt					
7	HI	5.320	6.000					
8		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
9	TR	1	2	AR	133.5330	711.320	89.4057	IPF/Disturbed
10		Note						
11	DS	IP found, moved.Condition poor.						
12		InstHt	RodHt					
13	HI	5.430	6.000					
14		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
15	TR	2	3	AR	262.5444	457.761	89.3241	X on Rock
16	SS	3	100	AR	200.5649	155.441	90.0000	TT
17	SS	3	105	AR	282.1753	149.271	90.1729	gs
18		InstHt	RodHt					
19	HI	5.400	6.000					
20		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc

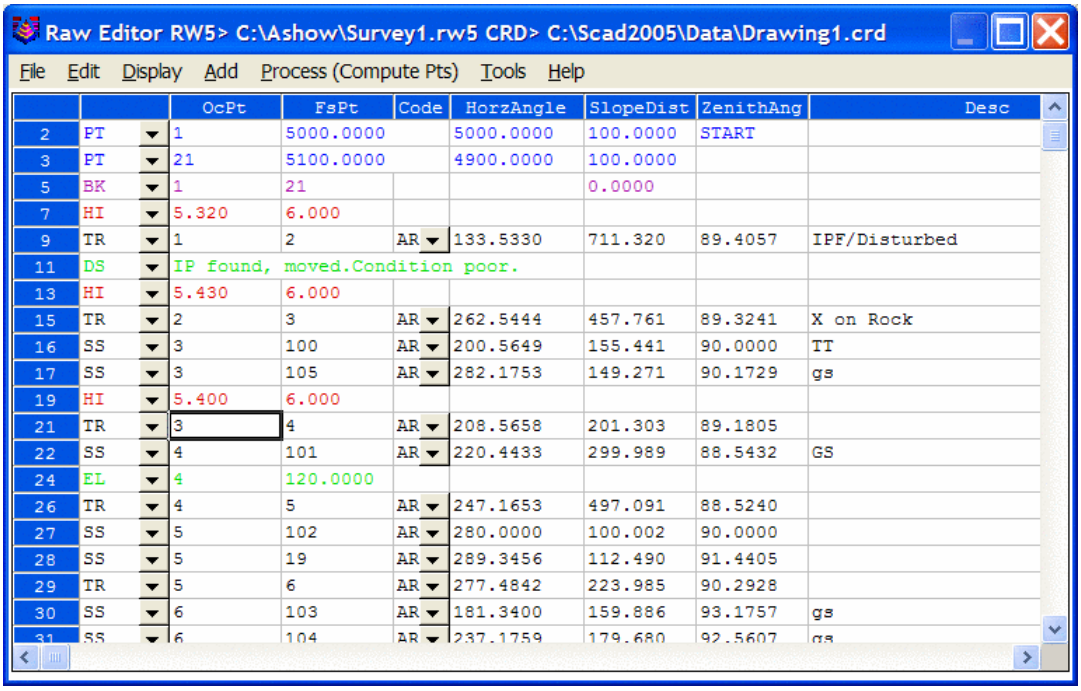
Figure 2C

Hide Description Records: This option controls the visibility of the Description records contained in a rw5 file. The description record is an additional note used to store useful information in addition to typical point data. Sometimes these records clutter the raw file and make it hard to review actual survey data. The ability to control the description

record visibility is a useful tool when reviewing survey data.

Show Description Records: This option shows (unhides) description records contained in the rw5 file.

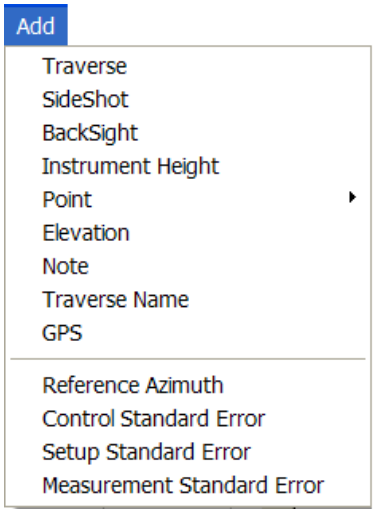
Hide Record Headers: This option hides the in-line headers such as the PntNo, OcPt, FsPt, etc. The editor contains "Smart Headers" that changes with the type of data that is in the active row. These headers are not in-line and are always displayed at the top of the editor. Figure 2D shows the editor with the record headers hidden and the Smart Header active. Row #21 contains the active cell, the automatic header at the top of the editor shows traverse (TR) record headers.



		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
2	PT	1	5000.0000		5000.0000	100.0000	START	
3	PT	21	5100.0000		4900.0000	100.0000		
5	BK	1	21			0.0000		
7	HI	5.320	6.000					
9	TR	1	2	AR	133.5330	711.320	89.4057	IPF/Disturbed
11	DS	IP found, moved.Condition poor.						
13	HI	5.430	6.000					
15	TR	2	3	AR	262.5444	457.761	89.3241	X on Rock
16	SS	3	100	AR	200.5649	155.441	90.0000	TT
17	SS	3	105	AR	282.1753	149.271	90.1729	gs
19	HI	5.400	6.000					
21	TR	3	4	AR	208.5658	201.303	89.1805	
22	SS	4	101	AR	220.4433	299.989	88.5432	GS
24	EL	4	120.0000					
26	TR	4	5	AR	247.1653	497.091	88.5240	
27	SS	5	102	AR	280.0000	100.002	90.0000	
28	SS	5	19	AR	289.3456	112.490	91.4405	
29	TR	5	6	AR	277.4842	223.985	90.2928	
30	SS	6	103	AR	181.3400	159.886	93.1757	gs
31	SS	6	104	AR	237.1759	179.680	92.5607	gs

Figure 2D

Add Menu



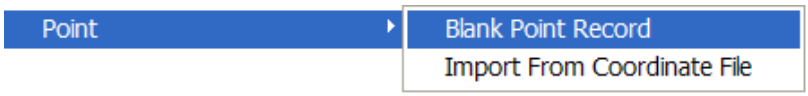
Traverse: Adds a traverse record (TR) to the spreadsheet editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

SideShot: Adds a sideshot record (SS) to the spreadsheet editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

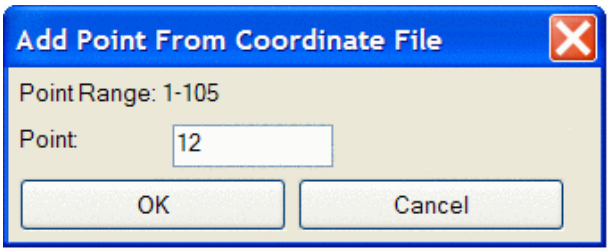
Backsight: Adds a backsight (BK) to the spreadsheet editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

Instrument Height: Adds an instrument height (HI) record to the editor. This record contains both the instrument and rod height setting.

Point: Adds a point (PT) record to the editor. Provides options to either add a Blank Point Record or Import From Coordinate File.



Inserting a blank record allows for manual input to define the coordinates for the point. Import From Coordinate File imports the coordinate values from an existing point or range of points contained in the coordinate file. Enter the point number or range of points and select OK. The points will be read into the rw5 file at the top of the file.



Elevation: Adds an elevation (EL) record to the editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

Note: Adds a note (DS) record to the editor. Note records need to be added below the measurement record containing the foresight point that the note is intended for.

Traverse Name: Adds a traverse name (Name) to the editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

GPS: Adds a GPS record to the editor. The new record will be insert above the row that contains the active cell unless this row is the last row in the file. If so, you will be prompted to insert above or below the current row.

Reference Azimuth: Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

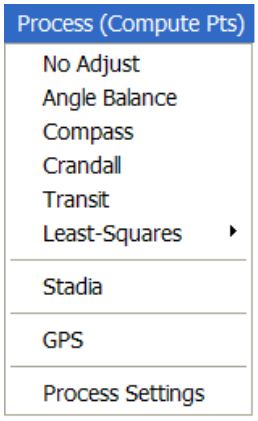
Control Standard Error: Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

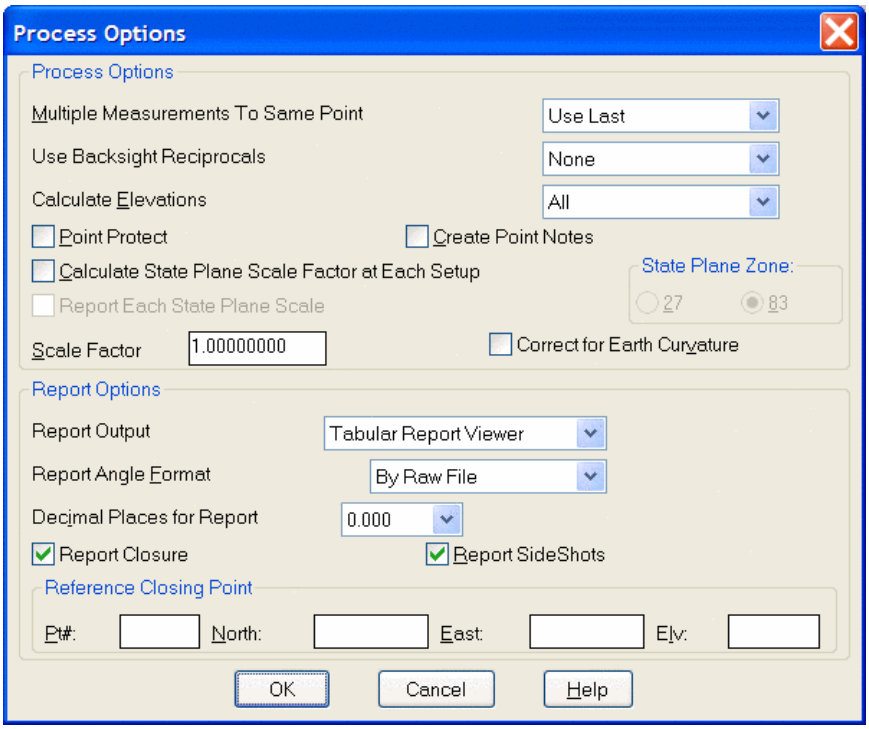
Setup Standard Error: Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

Measurement Standard Error: Applies to SurvNET, the optional Network Least Squares analysis and adjustment routine.

Process (Compute Pts) Menu

This menu contains tools to process raw data by various methods. The calculated coordinates and notes if specified are stored to the active specified coordinate file. The coordinate file can be specified using the Set Coordinate file under the Points pulldown within the drawing screen or from the tools menu of the editor discussed later in this section. Processing Options are specified on the Process Options Dialog box. This dialog box is displayed before processing data using any of the available methods with the exception of the Least Squares method.





Multiple Measurements To Same Point: This option sets the method of how to handle multiple measurements to the same point. There are three available options, Use Last, Average or Use First. Use last uses the last measurement to calculate the position of the point. Average uses the average of all the measurements for the position calculation and Use Last takes the last measurement to the point as the data to use.

Use Backsight Reciprocals: The Backsight Reciprocal options treat reciprocal measurements "special". A foresight to point 15 from a setup on 14, followed by a backsight from 15 to 14, makes a pair of "reciprocal" measurements. The backsight "reciprocal" measurement can be ignored for its impact on recalculating the occupied point (None Option), or the elevation of component of the reciprocal measurements can be averaged (Average Elevation option), or both the elevation and distance can be averaged (Average Elev & Dist) to recalculate the setup (occupied point) coordinates.

Calculate Elevations: This option determines whether the elevations of the points will be calculated and written to the coordinate file. Options of whether to calculate All elevations or just the Sideshots Only are provided.

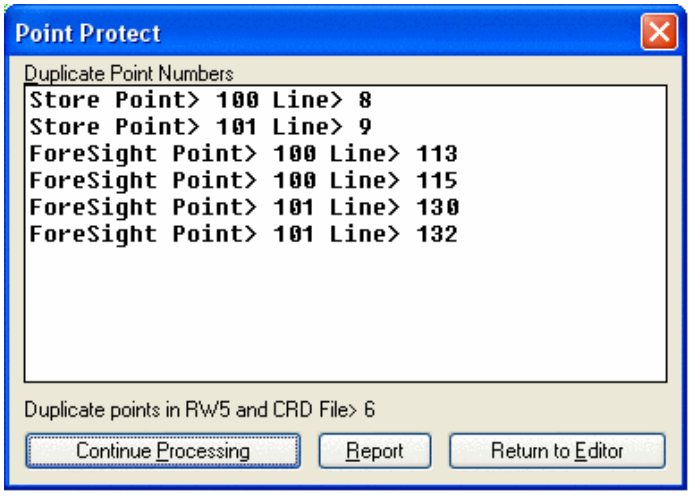
Direct-Reverse Vertical Angles: Specify whether to balance all or process the direct-reverse shots and use only the foresight direct shot.

Report Angle Format: Specifies the angle format for the report. The By File option makes the report use the angle format in the raw data (.RW5) file.

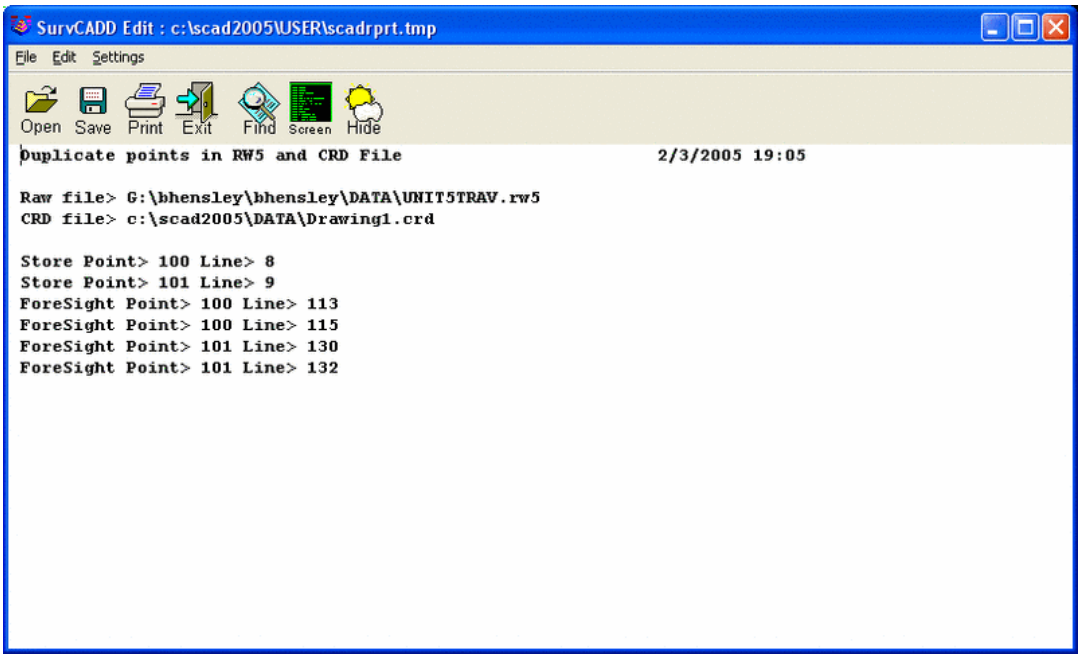
Calculate Elevations: This option controls which point elevations will be calculated. For example, if the traverse point elevations have already been adjusted and you need to recalculate the sideshot elevations, then use the SideShots Only option.

Report SideShots: Specify whether to include the sideshot data in the process results report.

Point Protect: This option will check the point database for existing point data before processing. If the foresight point number for any traverse or sideshot record already is a stored coordinate in the point database, then the program shows a list of conflicting point numbers. You can either continue processing and overwrite the point database coordinates with the calculated raw file coordinates or cancel the processing to go back to the editor to change foresight numbers.



A report of the conflicting point numbers can be generated to the standard report viewer by selecting the Report option on the Point Protect dialog box. From the report viewer, the report can then be printed, sent to the screen or saved to a file.



Create Point Notes: This option will generate a note (.NOT) file named after the coordinate file. The note file contains additional descriptions for points. With this option active, the text from all note records (DS records) will be stored to the note file for the foresight point number preceding the note records.

Calculate State Plane Scale Factor at Each Setup: This option will calculate a scale factor for each TR and SS record. This scale factor is calculated as the average of the scale factors at the occupied and foresights points. At these points the scale factor is calculated as the state plane grid factor multiplied by the elevation factor which is the earth radius divided by the elevation plus the earth radius [SF = Grid Factor * (Earth Radius / (Elevation + Earth Radius))]. In order to calculate these state plane scale factors, the traverse coordinates must be in state plane coordinates. When this option is selected, the program will prompt for the state plane zone to use. The Datum to use, NAD 27 or 83, must also be selected. This selection option becomes available after selection the Calculate State Plane Scale Factor at Each Setup option.

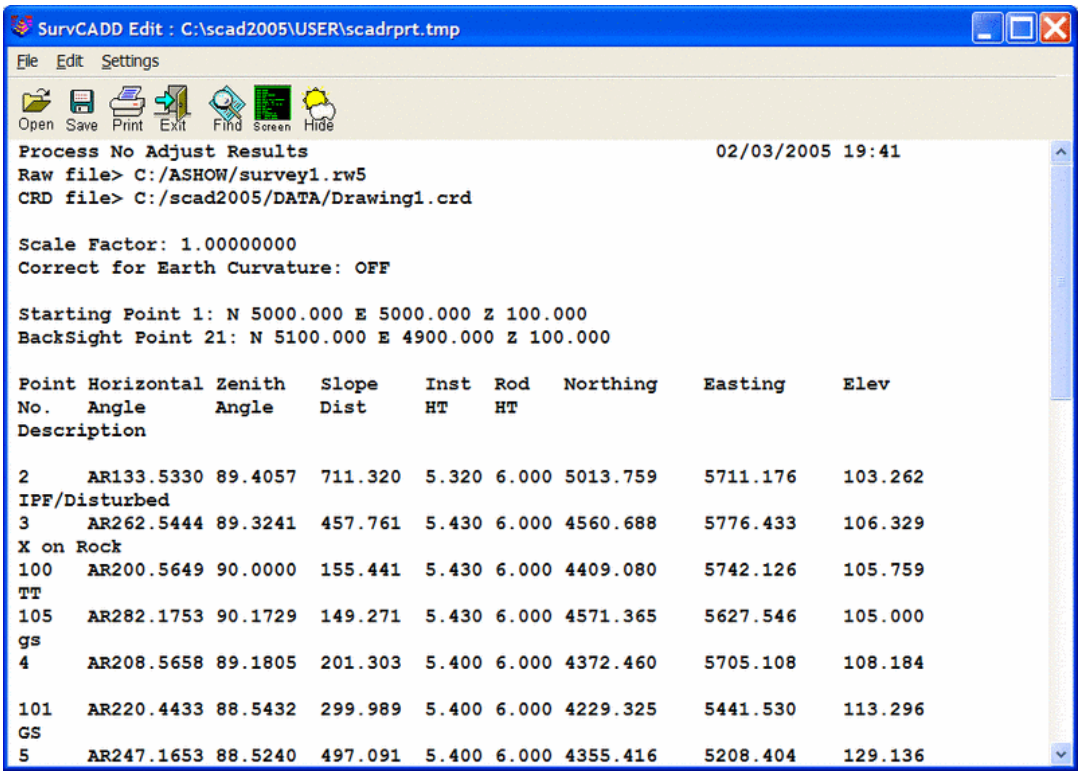
Report Each State Plane Scale: This option becomes available if the Calculate State Plane Factor at Each Setup has been selected. With this option on, the scale factor at each point will be shown in the process results report.

Scale Factor: This value is multiplied by the slope distance for the traverse and sideshot records.

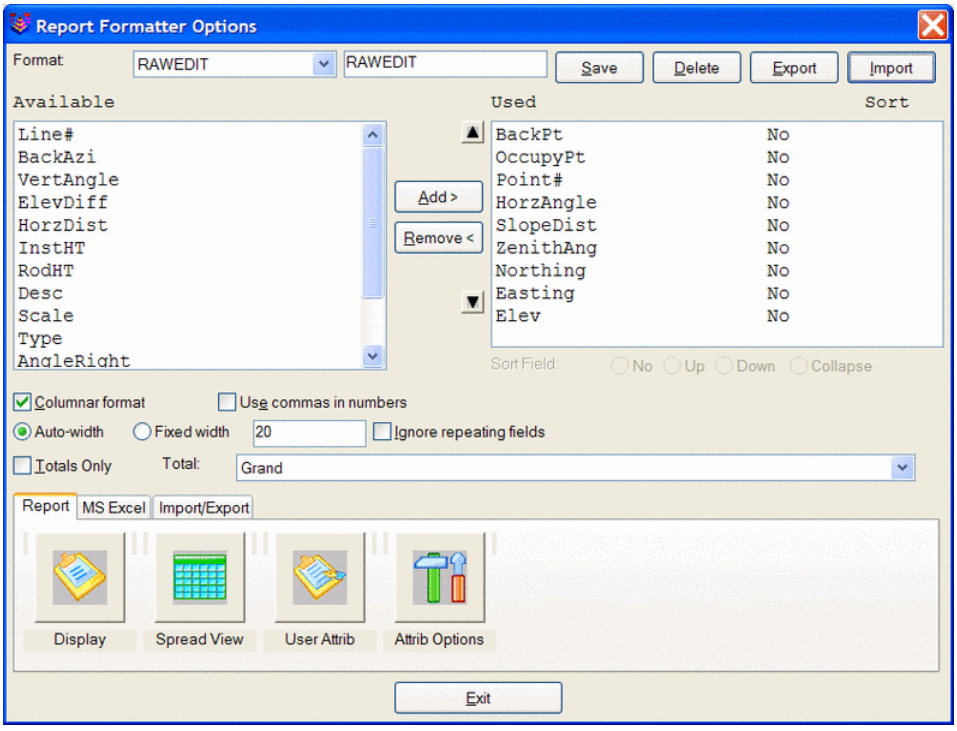
Correct for Earth Curvature: This option adjusts the calculated points for the effect of the Earth's curvature. Typically this adjustment is small and adjusts the elevation more than the horizontal.

Report Output: There are three report output options contained in the raw editor, the ***Standard Report Viewer***, the ***Custom Report Formatter*** and the ***Tabular Report Viewer***. Each is documented below.

The ***Standard Report Viewer*** is the default report viewer throughout the program. Any routine that generates a report has this option and the data contained in the report depends upon the routine executed. The report viewer is also a text editor. It allows for addition and deletion of text in order to customize the report for printing or for saving to a particular format for a file. Options to print, send to the screen in the drawing window as text or save to a file are available.

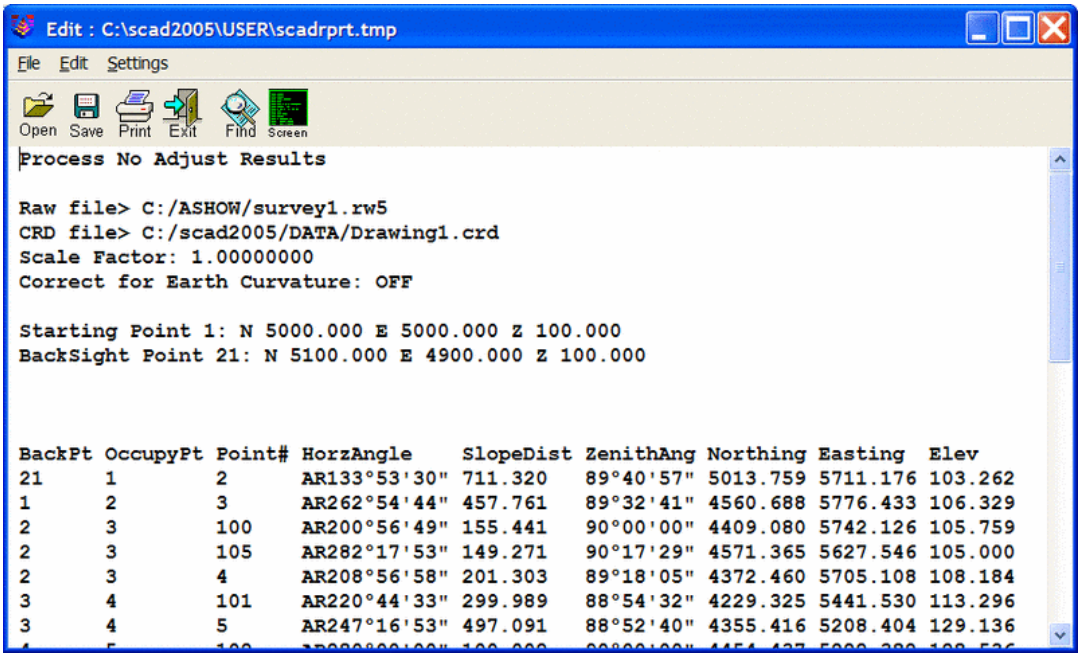


The ***Custom Report Formatter*** allows for customization of the process results by selecting the fields and the layout of the fields to display. The settings can be saved to a format name and recalled when needed. Options to Delete, Export and Import saved Formats are also available.

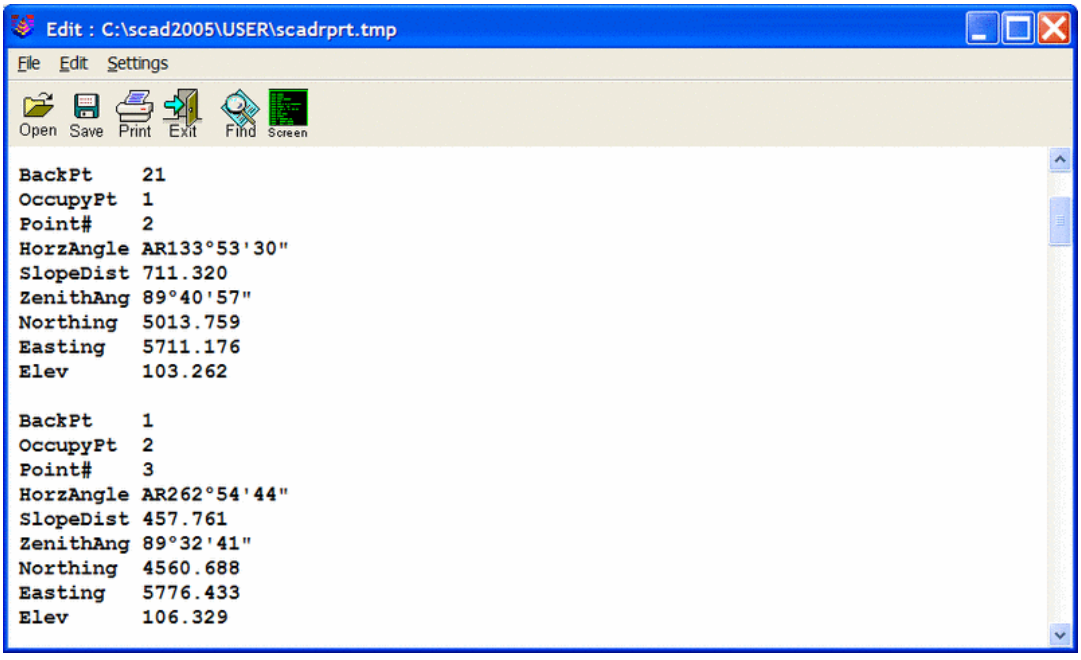


To create a report, select data from the Available list and then select the Add button. This will populate the Used field with the selected data. Standard window selection methods can be used when selecting the data to report. Holding

the ctrl key while selecting data allows for making random selections. Holding the shift key while selecting data will select the first item picked, last item picked and all items between. With ***Columnar format*** "checked" on, the report is displayed as follows:



With ***Columnar Format*** off, the report is displayed as follows:

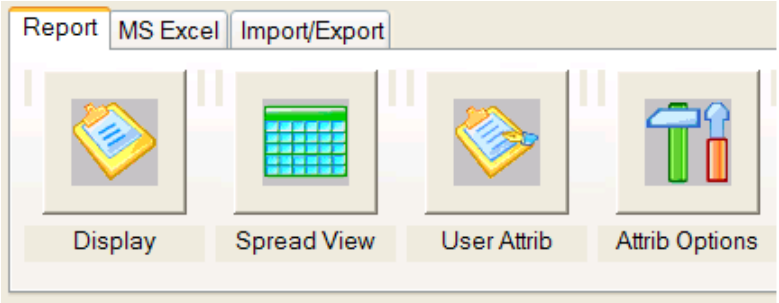


The ***Auto-Width*** option displays each column width based upon the data contained within it. The ***Fixed Width*** option allows for a specified column width for each field of data.

Totals Only: This option does not apply to the process raw data results but is useful in other reports to report total values of certain data.

Total: This field reports totals for various combinations of the attributes selected to report.

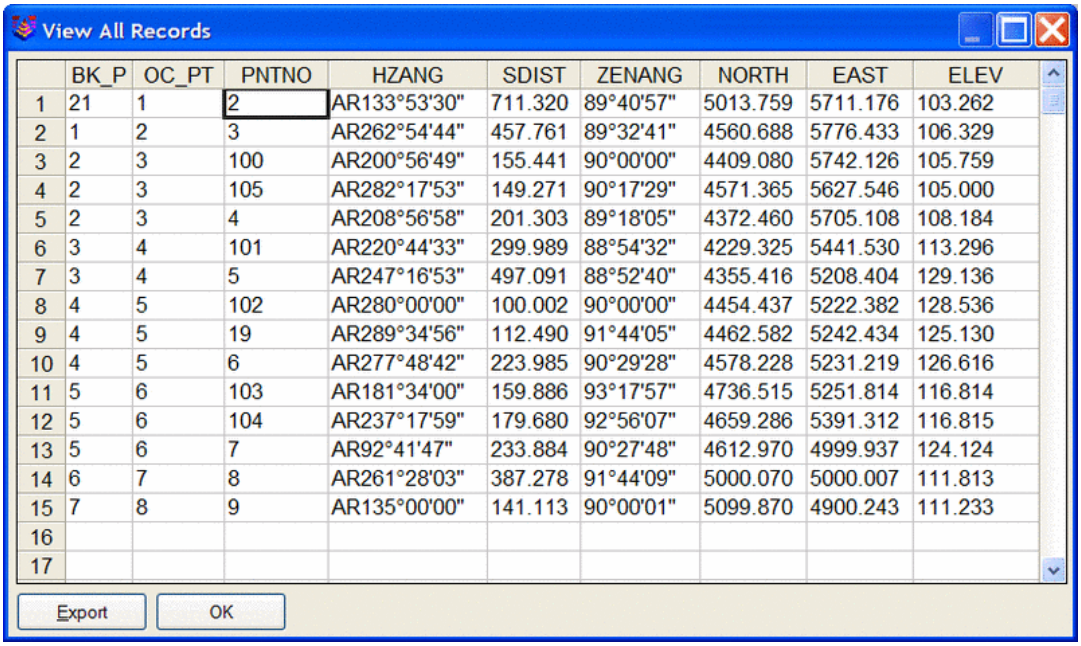
The icons and tabs at the bottom of the Report Formatter Options dialog box provide display options, Import/Export options and User Attribute creation, editing, importing and exporting.



Report Tab:

Display: Displays the selected data and field arrangement.

Spread View: Displays the selected data in MS Excel format.

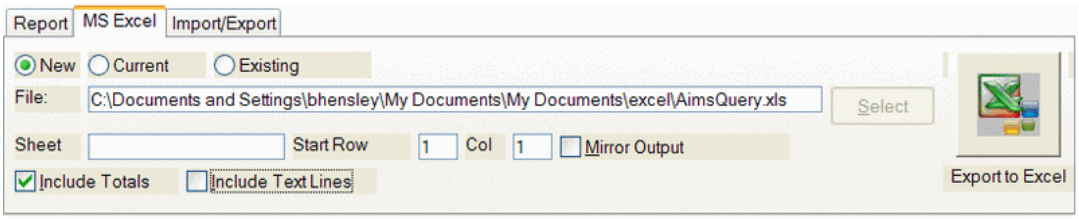


	BK_P	OC_PT	PNTNO	HZANG	SDIST	ZENANG	NORTH	EAST	ELEV
1	21	1	2	AR133°53'30"	711.320	89°40'57"	5013.759	5711.176	103.262
2	1	2	3	AR262°54'44"	457.761	89°32'41"	4560.688	5776.433	106.329
3	2	3	100	AR200°56'49"	155.441	90°00'00"	4409.080	5742.126	105.759
4	2	3	105	AR282°17'53"	149.271	90°17'29"	4571.365	5627.546	105.000
5	2	3	4	AR208°56'58"	201.303	89°18'05"	4372.460	5705.108	108.184
6	3	4	101	AR220°44'33"	299.989	88°54'32"	4229.325	5441.530	113.296
7	3	4	5	AR247°16'53"	497.091	88°52'40"	4355.416	5208.404	129.136
8	4	5	102	AR280°00'00"	100.002	90°00'00"	4454.437	5222.382	128.536
9	4	5	19	AR289°34'56"	112.490	91°44'05"	4462.582	5242.434	125.130
10	4	5	6	AR277°48'42"	223.985	90°29'28"	4578.228	5231.219	126.616
11	5	6	103	AR181°34'00"	159.886	93°17'57"	4736.515	5251.814	116.814
12	5	6	104	AR237°17'59"	179.680	92°56'07"	4659.286	5391.312	116.815
13	5	6	7	AR92°41'47"	233.884	90°27'48"	4612.970	4999.937	124.124
14	6	7	8	AR261°28'03"	387.278	91°44'09"	5000.070	5000.007	111.813
15	7	8	9	AR135°00'00"	141.113	90°00'01"	5099.870	4900.243	111.233
16									
17									

User Attrib: This option allows for the creation of attributes that allows for mathematical calculations. The math functions allowed are addition, subtraction, multiplication and division. This option is detailed further in the General section of this manual.

Attrib Options: This option allows for the addition, editing importing and exporting of pre-defined and user attributes. This option is detailed further in the General section of this manual.

MS Excel Tab: This tab contains options and settings for exporting the report to MS Excel.



There are options to export to a ***New***, ***Current*** or ***Existing***excel file. The ***New*** option will create a new excel file and will begin populating the file at the Starting Row and Column specified. The ***Current*** option will export the data to the current open excel file and willbegin populating the file at the starting row and column specified. The ***Existing*** option will export the data to an existing excel file and will beginpopulating the file at the starting row and column specified. If exporting to a New or Existing MS Excel file, a file name needs to be specified or selected. To specify the name of the ***Sheet*** for exporting to within the MS Excel spreadsheet type the name of the sheet in the sheet field. The ***Start Row*** and ***Col***,tells the export routine where to start populating the specified MS Excel file. The ***Mirror Output***option organizes the data exported in rows instead of columns. TheInclude Text Lines option exports the header information and the closure information to the MS Excel file.

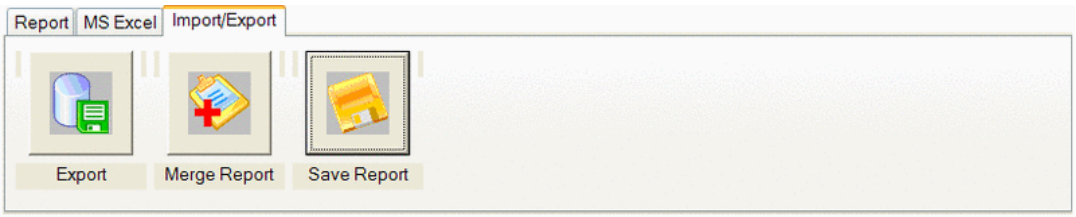
	A	B	C
1	BackPt	21	1
2	OccupyPt	1	2
3	Point#	2	3
4	HorzAngle	AR133°53'	AR262°54'44"
5	ZenithAng	89°40'57"	89°32'41"
6	Northing	5013.759	4560.688
7	Easting	5711.176	5776.433
8	Elev	103.262	106.329

Example of Mirror Output Option

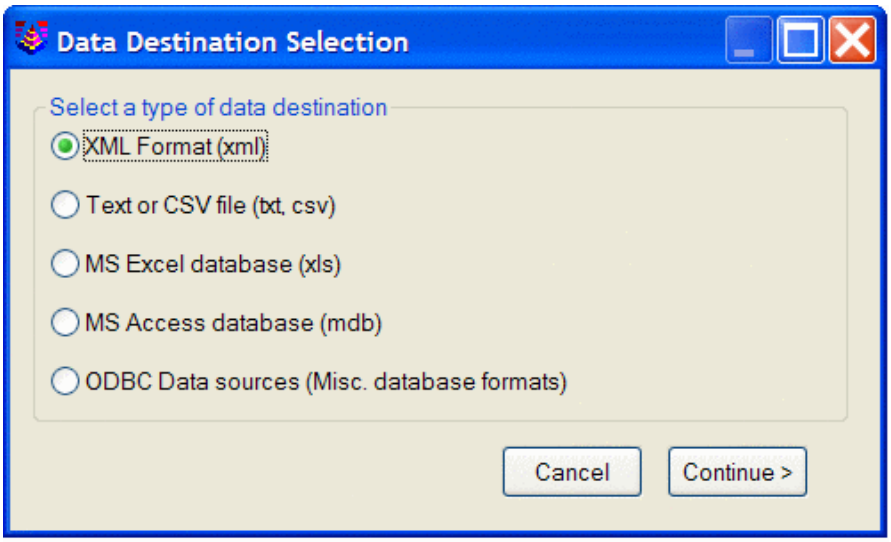
10	BackPt	OccupyPt	Point#	HorzAngle	ZenithAng	Northing	Easting	Elev
11	21	1	2	AR133°53'30"	89°40'57"	5013.759	5711.176	103.262
12	1	2	3	AR262°54'44"	89°32'41"	4560.688	5776.433	106.329
13	2	3	100	AR200°56'49"	90°00'00"	4409.08	5742.126	105.759
14	2	3	105	AR282°17'53"	90°17'29"	4571.365	5627.546	105
15	2	3	4	AR208°56'58"	89°18'05"	4372.46	5705.108	108.184
16	3	4	101	AR220°44'33"	88°54'32"	4229.325	5441.53	113.296

Without Mirror Output

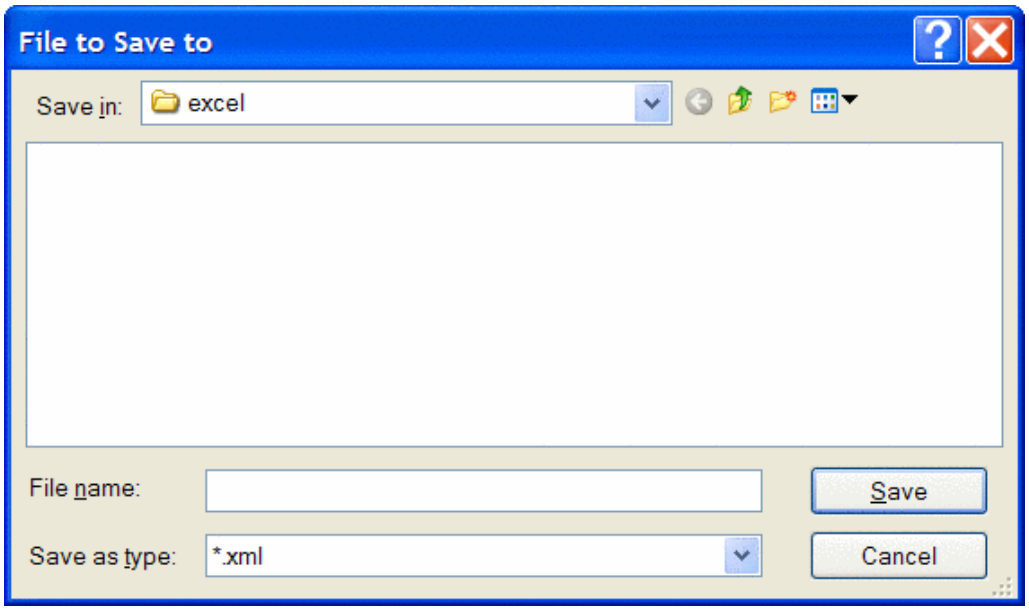
Import/Export Tab: This tab provides controls to Export files and manage Reports.



Export: This option contains various output options for the process report. Options to output to the following formats are available:
XML Format (xml)
Text or CSV file (txt, csv)
MS Excel database (xls)
MS Access database (mdb)
ODBC Data sources (Misc. database formats)



After selecting the format of the destination file select the continue button and the file to save dialog will appear. Input the file name to save, the type will be automatically selected based upon the destination format.



Merge Report: This options merges the current report with existing reports. This option is to be used in conjunction with the Save Report command. For example, process the file and save the report. When processing again, select the Merge Report option and specify the previous report file created. The resulting report will have the current data as well as the previous data.

Save Report: This option save the current report to the specified file.

Report Angle Format: This option controls the angle format displayed on the process result report. The option of ***By Raw File*** will display the angles in the format that is contained in the rawfile. The ***Bearing*** option will display the angle in a bearing format. The ***Azimuth*** option will display the azimuth of the measurement and the ***Angle Right*** option will display the angle right measurement of the observation.

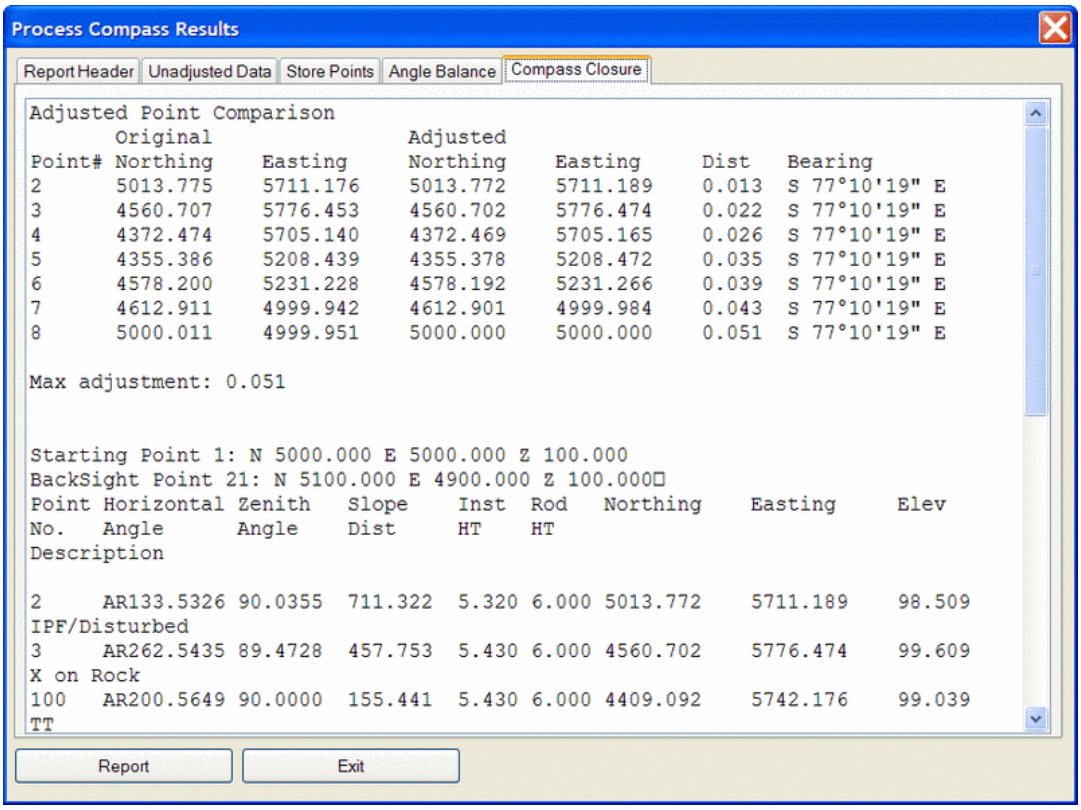
Decimal Places for Report: This option controls the number of decimal places for the reported data.

Report Closure: This option determines whether the closure report will be displayed after processing. If processing a topo survey where the traverse has not been closed, then turn this toggle off for quick processing..

Report Sideshots: Controls whether the sideshot data is shown on the process report.

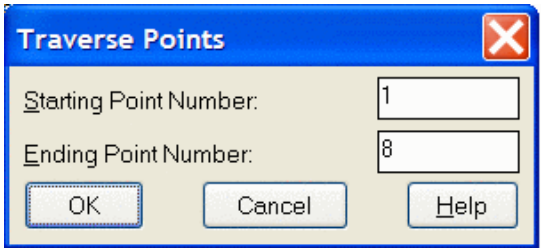
Reference Closing Point: This is an optional field for entering the coordinates to compare the ending traverse point with. This reference closing point is used to calculate the closure. Without using this option the program will by default use the starting coordinate as the reference closing point.

The ***Tabular Report Viewer*** displays a report viewer consisting of tabs. Each tab organizes and displays different data depending upon the process option chosen. The process results using the No Adjust method results in three tabs the Report Header, Unadjusted Data and the Store Points tabs. Each of these tabs display different information which corresponds to the tab title. Using an adjustment method results in five tabs. In addition to the three listed above, an Angle Balance and Compass Closure tab is added. From the Tabular Report Viewer, the Standard Report Viewer can be switched to by pressing the Report option at the bottom of the dialog. This is useful when wanting to combine all tabs into one report for printing or saving to a file. An example of a Tabular Report for a compass rule adjustment is shown below.



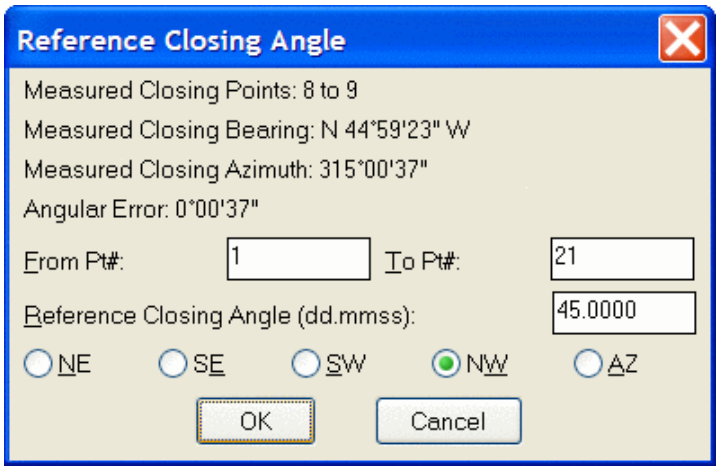
Processing Methods

No Adjust: No Adjust means that no angle balance or traverse adjustment will be applied. Options are specified in the Process Options dialog. After picking OK for the process options dialog, a Traverse Points dialog appears for entering the starting and ending point numbers.



The program reads the raw file to set the defaults for these point numbers which are used to calculate the closure. The difference between the ending point and the reference closing point is the closure error and the sum of the traverse distances from the starting to the ending point is used as the total distance traversed. After picking OK for the second dialog, the program starts processing the raw file from the top record down. The result is displayed in the Standard Report Viewer which can save, print or draw the report.

Angle Balance: This process method applies an angle balance to the traverse lines when calculating the coordinates. The angle balance takes the angular error divided by the number of traverse lines and adjusts the angle of each traverse line by this amount. The angular error is the difference between the angle balance shot and a reference angle. The angle balance shot is specified as a type AB or CL+AB record in the raw file. If no AB record is found in the raw file, then the program will prompt for which traverse shot to use as the angle balance shot. The angle from the angle balance shot is calculated as the angle from the occupied point to the foresight point. The reference angle can be specified as a bearing, azimuth or by two point numbers in the dialog shown.



The angle balance report shows the unadjusted points, the unadjusted closure, the angular error, the adjusted points and then the adjusted closure. Typically but not always, applying the angle balance correction will improve the traverse closure.

Compass, Crandall, Transit: These process methods apply the selected rule to the traverse lines when calculating the coordinates. After adjusting the traverse, the sideshots are also recalculated. The closure error is calculated as the difference between the closing shot and a reference point. The closing shot is specified as a type CL or CL+AB record in the raw file. If no CL record is found in the raw file, then the program will prompt for which traverse shot to use as the closing shot. The foresight point is used as the closing coordinate. The reference point can be specified by point number or by entering the northing, easting and elevation. The process results report shows the unadjusted points, closure error, adjustments to each traverse point and adjusted point.

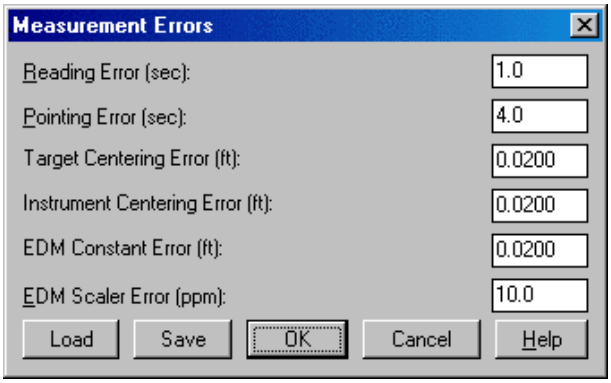
Prepare Least Squares Data: From the raw file data, this routine makes initial calculations for the coordinate points in the traverse. This data along with the control point coordinates and angle and distance measurements is stored to a data file with the same name as the current RW5 file except with a .LSQ extension (ie: survey.lsq goes with survey.rw5). The constraints of the routine are:

All angle readings must be in angle right mode.

The coordinates of the starting and the ending points must be known.

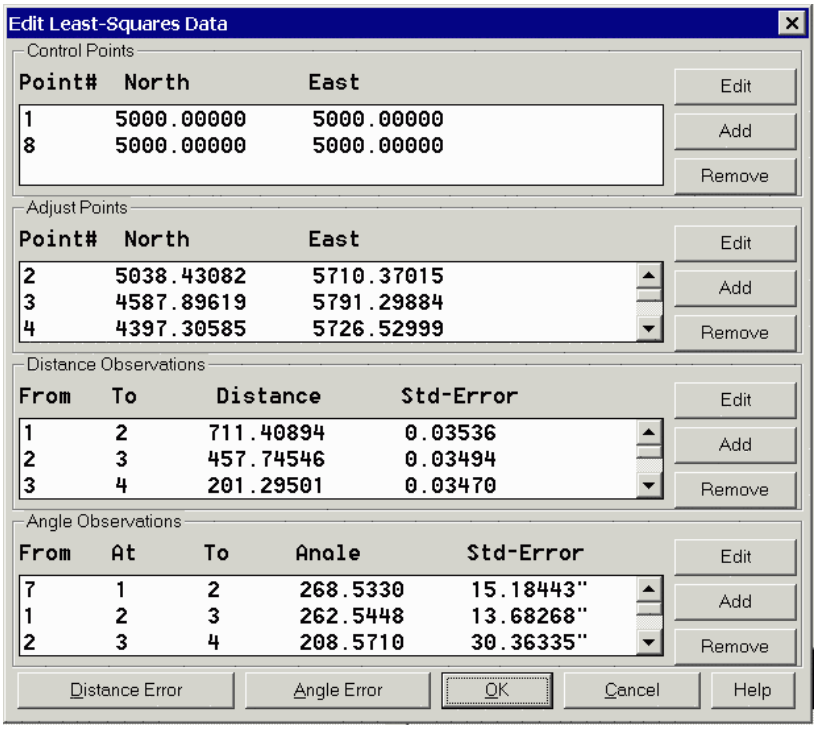
The routine begins with a dialog for specifying the reference closing coordinates and any scale factors to apply to the distance measurements. The Reference Closing Point is the last point in the traverse, whose coordinates must be known. If an angle balance shot is used in the traverse, the Reference Angle Balance Angle must also be specified, either as a value or as the angle between known points.

Since angles and distances have errors of different magnitudes, they are normalized using weights, based on the accuracy and confidence with which these quantities have been measured. There is a dialog for specifying the estimated measurement errors. The Reading Error is the horizontal angular error in the instrument. For example, for a "5-second" instrument this error would be 5. The Pointing Error accounts for several factors in the horizontal angle reading including accuracy lining up the crosshairs on the target, the target size and the optical quality of the instrument. The Target and Instrument Centering Errors are the distance off the point due to faulty centering. The EDM Constant Error is the accuracy of the instrument distance measurements. The EDM Scaler Error is entered in parts per million for the increased error in longer measurements. These settings can be saved and loaded as a way to store settings for different equipment.



The program will calculate the weights for each distance and angle measurement using these measurement errors. The control points, points to adjust, distance and angle measurements with weights are reported. You can edit these measurements and weights using the Edit Least-Squares Data routine or go directly to the Process Least-Squares Data routine.

Edit Least Squares Data: This routine edits the points, measurements and weights stored in the .LSQ file associated with the current RW5 file. The editor works through the dialog shown. You can edit, add or remove the control points, adjust points, angle measurements or distance measurements. The program does not check that the editing is valid. So you need to make sure that your changes keep a good set of least-squares data (i.e. don't delete a needed control point). The Distance Error button allows you to set the distance standard error weights for all the distance measurements to the same value. Likewise the Angle Error button sets the standard error weights for all the angle measurements.



Least-Squares Input Data:

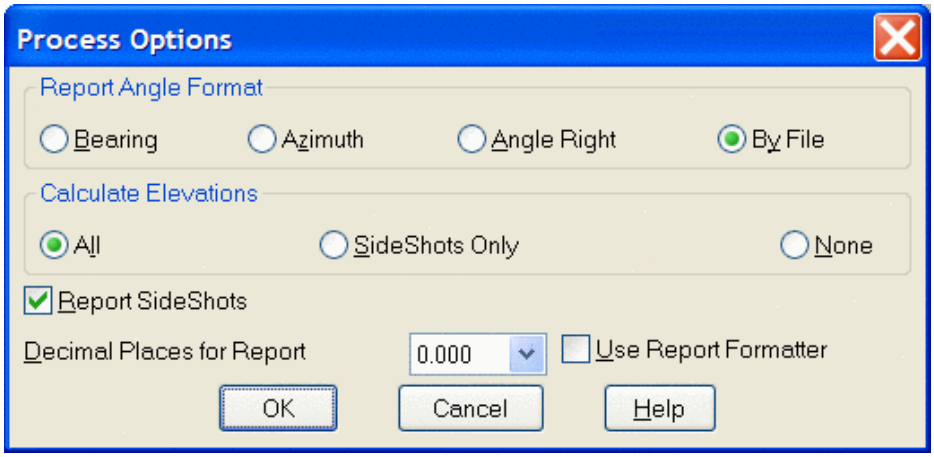
```
Control Points
Point# Northing Easting
1      5000.000 5000.000
8      5000.000 5000.000
```

```
Distance Observations
Occupy FSight Distance StdErr
1      2      711.409  0.018
2      3      457.745  0.017
3      4      201.295  0.017
4      5      497.024  0.018
5      6      223.972  0.017
6      7      233.872  0.017
7      8      387.073  0.017
```

```
Angle Observations
BSight Occupy FSight Angle          StdErr
7      1      2      268d53'30''     7.617''
1      2      3      262d54'48''     6.869''
2      3      4      208d57'10''    15.194''
3      4      5      247d16'57''    14.222''
4      5      6      277d48'35''    12.262''
5      6      7       92d41'13''    15.818''
6      7      8      261d27'56''    12.991''
7      1           S 01d59'18'' E   0.001''
```

Process Process Least Squares Data

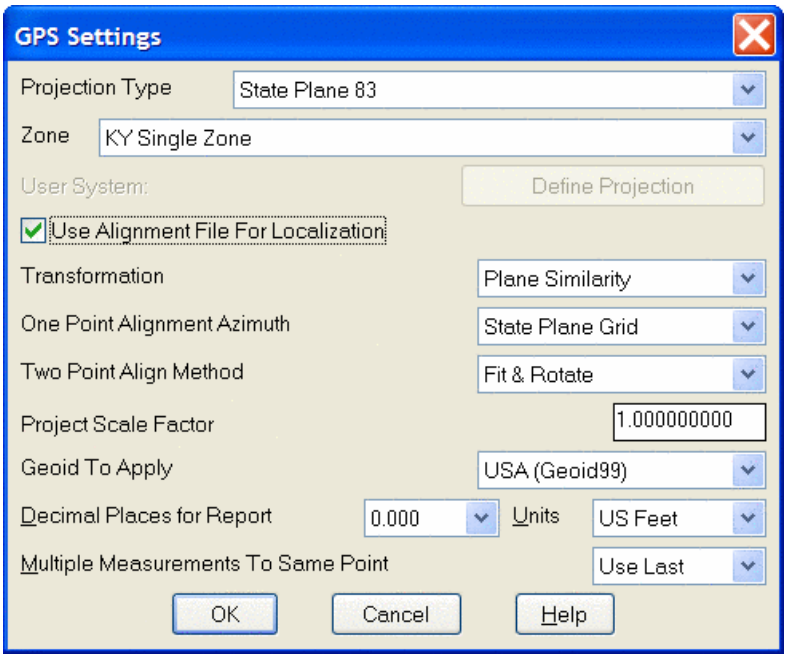
This routine applies a least-squares adjustment to the data stored in the .LSQ associated with the current raw data (.RW5) file. The closing errors are distributed among the other points, using the "Method of Least Squares" (Ref : Wolf, P.R. and Ghilani, C.D., 1996, "Adjustment Computations", John Wiley and Sons, NY,Third Edition). After the adjustment, the rest of the raw file is processed to recalculate the sideshots. There is an option to draw standard error ellipses around the adjusted points. The ellipse axes are multiplied by Ellipse Scale Factor to make the ellipse larger for easier viewing.



The least-squares process report shows the input data and the results. For each point, the amount adjusted and the standard error in X and Y are reported. The Reference Standard Deviation is based on the sum of the residuals and the initial estimated standard errors. The Chi-Squares test is a goodness-of-fit test that checks the reference standard deviation with the least-squares model. If this test fails, there may be a blunder in the measurement data or the initial estimated standard errors were too low or too high.

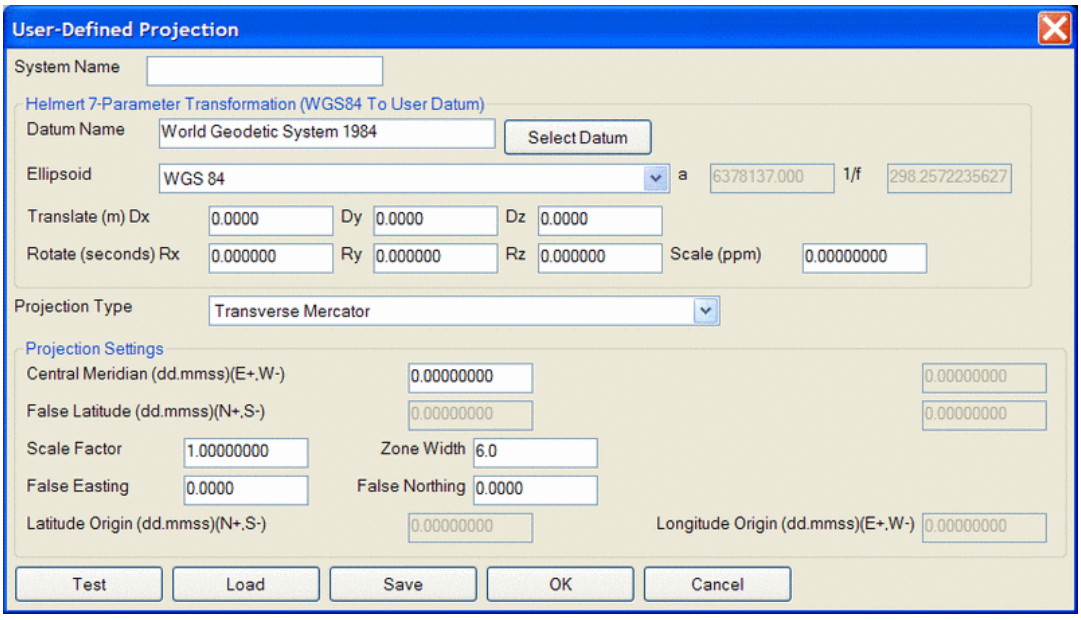
Stadia Processing Method*:* Provides functionality to process Stadia surveying notes. Stadia sighting depends on two horizontal cross-hairs, known as stadia hairs, within the telescope. These hairs are parallel to the horizontal cross-hair and are equally spaced above and below it. The distance between the two stadia hairs is known as the intercept. The distance from the instrument to the rod is 100 times the intercept. For example, an intercept of 3.10 would represent a distance of 310 (3.10 X 100). For entering in stadia notes, you would enter the horizontal angle, the distance (entered as the intercept X 100) and the vertical angle.

GPS: The process GPS routine allows for reduction of GPS records that reside in a raw (*.RW5) file from latitude, longitude and WGS84 Ellipsoid Height to State Plane or local coordinates. When selected, the GPS Settings dialog will appear as shown below.



GPS>Projection Type:
Defines the datum coordinate system to be used for converting the latitude, Longitude and WGS84 Ellipsoid height collected from the GPS receiver into Cartesian coordinates. The supported projection types are State Plane 83, State Plane 27, UTM, Lat/Long, Great Britain-OSGB36, Australia, New Zealand-NZGD2000, New Zealand-NZGD49, and France NTF-GR3DF97A. A User-Defined option is also available for defining a user projection.

The supported geoids include: Geoid99 (USA), Geoid03 (USA), EGM96 (World), GDA94 (Australia), CGG2000, HT 2.0, HT HT 1.01 (Canada) and)SGM02 (Britain). GeoUser-Defined projections are supported. To define a new projection select the Define Projection option. This will bring up the following dialog.

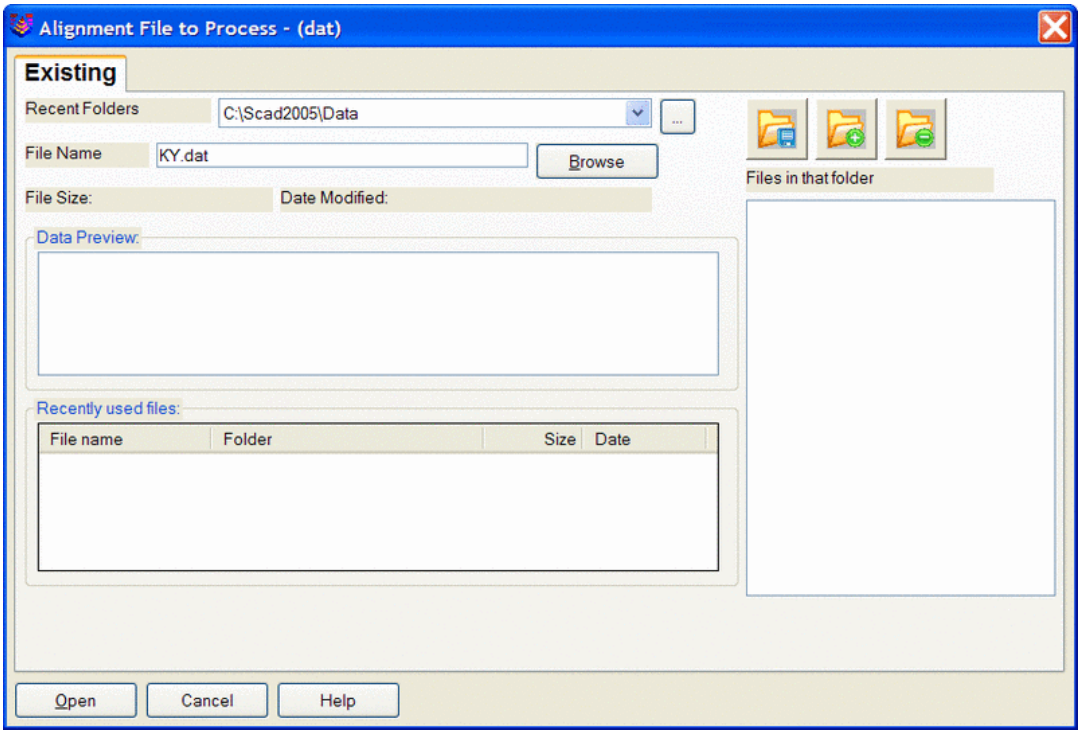


Enter a name for your system (e.g. PRVI for Puerto Rico/Virgin Islands), then select a Projection type and enter the appropriate parameters. Note that all latitude and longitude values are in Degrees Minutes and Seconds (dd.mmss) and False Northing and False Eastings are always presented in meters. Define a Datum shift by selecting the Select Datum radial button. You may select a predefined Ellipsoid or set your own parameters by typing in a new ellipsoid name in the Ellipsoid field and entering values for a and 1/f. When you enter in a new Ellipsoid name, the Datum name field will be blank. The values for Dx, Dy, Dz, Rx, Ry, and Rz and scale are "to WGS84". If the values you have are "from WGS84", simply reverse the sign of each value (positive becomes negative and vice versa).

You may save your system to a "udp" file. To Load a user defined coordinate system from a file, select the Load radial button. A list of user defined systems will be displayed. Select the desired system and press OK.

GPS>Zone: for State Plane projections, you must select the correct state zone that you are working in. For UTM, the Automatic Zone option will have the program automatically user the program automatically use the correct UTM zone for your location. Otherwise for UTM, you can manually set a specific UTM zone. This manual option applies to working on the border between zones and you want to force the program to always use one of those zones.

GPS>Use Alignment File For Localization: With this option toggle on, a prompt for the Alignment File to Process will be displayed. This file is typically created by SurvCE (Carlson's Data Collection System) using the Localization routine or by Carlson Field Using the Align to Local Coordinates routine. This file (*.DAT) contains the parameters to transform the derived State Plane coordinates to the defined local coordinates.



At the end of the process, the coordinates will be written to the current point database file and a report will be presented in the Carlson editor for saving or printing purposes.

GPS>Transformation: The transformation in the align Local Coordinates command can either be by plane similarity or rigid body methods. The difference is that the rigid body method does a transformation with a translation and rotation and without a scale The plane similarity does a rotation, translation and scale. This option only applies when two or more points are used in Align Local Coordinates or the Localization routine in SurvCE.

GPS>One Point Alignment Azimuth: This option applies to the rotation when using one point in Align Local Coordinates or the Localization routine in SurvCE. For this alignment method, the state plane coordinate is translated to the local coordinate. Then the rotation can use either the state plane grid or the geodetic as north. No scale is applied in this transformation. The state plane and geodetic true north diverge slightly in the east and west edges of the state plane zone. This option allows you to choose which north to use.

GPS>Two Point Alignment Method: There are two option when using this method, Fit & Rotate and Rotate Only. Fit & Rotate will use the second point in the localization file for direction and scaling. The Rotate Only option allows you to use the second point in the localization file for direction but not for scaling. When using the Rotate Only option, any scale factor entered in the Project Scale Factor will be used.

GPS>Project Scale Factor: For most applications, the Scale Factor should be set to 1.0. The scale factor represents the "combined" grid/elevation factor that reduces ground distances to grid. After converting the LAT/LONG from the GPS records to state plane coordinates and applying the coordinate alignment (Localization) file, the Project Scale Factor is applied as the final adjustment to the coordinates. This adjustment is used on the X, Y, and not the Z. The Project Scale Factor is applied by dividing the distance between the coordinate and a base point by the Project Scale Factor. The coordinate is then set by starting from the base point and moving in the direction to the coordinate for the adjusted distance. The base point is the first point in the alignment (Localization) file. If there are no points specified in the alignment file, then 0,0 is used as the base point. If using an alignment file (Localization File) this value will be automatically calculated and displayed. Manual entry of a scale factor is also permitted and is often used with the Two Point Alignment Method when a scale factor is known.

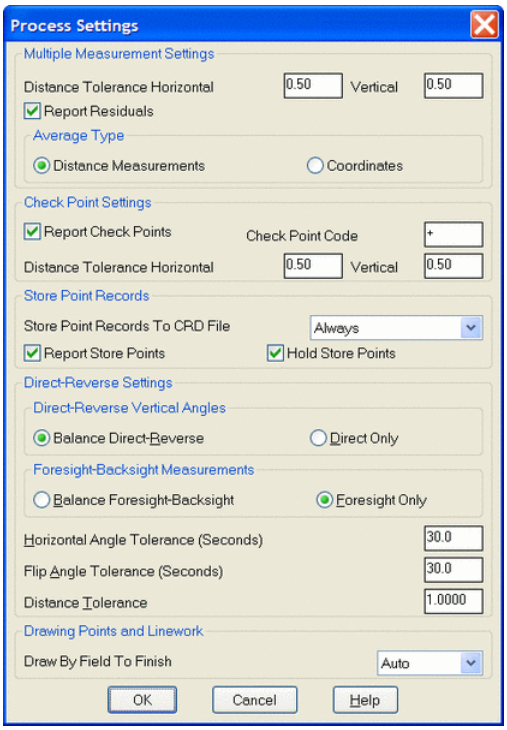
GPS>Geoid to Apply: The supported geoids include: Geoid99 (USA), Geoid03 (USA), EGM96 (World), GDA94 (Australia), CGG2000, HT 2.0, HT HT 1.01 (Canada) and SGM02 (Britain).

This option will account for the geoid undulation in determining the orthometric elevation of the measurement. The definition of the geoid model as currently adopted by the national Geodetic survey is the equipotential surface of the Earth's gravity field which best fits, in a least squares sense, global mean sea level. Orthometric elevation measurements are used in survey calculations. In order to convert ellipsoid heights (He) as measured by GPS into orthometric elevations (E0), you must provide for a correction between the GPS-measured ellipsoid (reference ellipsoid) and a constant level gravitational surface, the geoid. This corrections is the geoid undulation (Ug). The formula is He=Eo + Ug.

The program applies the Geoid model by subtracting the Geoid undulation from the GPS elevation. The resulting elevation is then used and displayed. In practice, the Geoid model is most applicable to two types of alignment scenarios. One of these types is when setting up the base over a know point and having no alignment control points. The other is when there is one alignment control point. When using multiple alignment control points, the Geoid model is not as important because the program can model the elevation difference which can generally pick up the local Geoid undulation.

GPS>Units: Coordinates can be reduced into one of three available units, Metric, US Feet or International Feet.

Process>Process Settings: This option allows for the setting of user preferences and tolerances to be used during processing and generation of reports.



Process Settings>Multiple Measurement Settings*:* These options provide control for managing how multiple measurements to the same pointare handled and reported.

Distance Tolerance Horizontal and Vertical: Allows for user input of desired tolerance values for multiple measurements. Exceeded tolerances will be displayed on the process results report. With the Report Residuals option ON, the residual values of the measurements will be shown on the process results report.
The data to be averaged can be either the **Distance Measurements** or the **Coordinates**.

Process Settings>Check Point Settings: These options provide user controls for survey check points. With ***Report Check Points*** ON, any point coded as a check point in the raw data file, will be reported. When selected the ***Check Point Code*** and Distance Tolerance fields become active and allow forediting. The ***Check Point Code*** is a user specified code entered in during the survey that tells the program to check the coordinates of a particular point with the coordinates of another point. This code is configurable by the user. An example of a point description coded as a Check Point would be as such, "trav =8". This description tells the program that the description of the point is "trav" and to check the coordinates of the this point with that of point #8. The ***Distance Tolerance Horizontal*** and ***Vertical*** are user specified tolerances for the check point. If either of these tolerances is exceeded it will be reported on the process results report.

Process Settings>Store Point Records: These options control how any store point (PT) record is handled during processing of the raw data file. There are three options for storing Store Point (PT) records, ***Never***, ***Always***, and ***When CRDEmpty***. ***Never***prevents any Store Point (PT) Record Report in the raw file from being written to the crd file. With this option on no existing point in the crd file would be overwritten. ***Always*** will write to the coordinate file and will overwrite any existing point with the same number of the Store Point (PT) records. The ***When CRD Empty*** option will only write Store Point (PT) records to thecoordinate file when it is empty. ***Report Store Points*** displays all store points in the process results report. The ***Hold Store Points*** option will hold the coordinate values for the store point record when measurements are taken to the store points. This will prevent the coordinates of the point from changing if measurements to the point dictate a change in coordinate position.

Process Settings>Direct-Reverse Settings:

Direct-Reverse Vertical Angles*:* This option determines how to handle direct-reverse vertical anglemeasurements when processing. ***Balance Direct-Reverse*** will take the mean of the direct-reverse measurements and use this value when processing the file. ***Direct Only*** will only use the direct measurement to the point forprocessing.

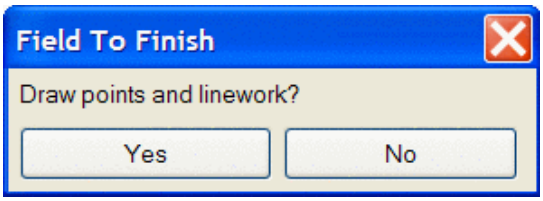
Foresight-Backsight Measurements: Balance Foresight-Backsight allows for averaging in the Foresight and backsight measurements when using direct-reverse sets. The Foresight Only option will average the foresight measurements only of a direct-reverse set.

Horizontal Angle Tolerance (Seconds): This is the tolerance that the angle measured by the direct measurements and the angle measured by the reverse measurements in a direct-reverse set must fall within.

Flip Angle Tolerance (Seconds): User specified value for the acceptable difference in measured horizontal angles determined from the direct (BD-FD) and reverse (BR-FR) observations.

Distance Tolerance: User specified tolerance for the difference in distance measurements to the same points. When this value is exceeded on a measurement, it will be displayed on the process results report.

Process Settings>Drawing Point and Linework: This option controls the drawing of points and linework using Field to Finish. It differs from the draw traverse and sideshot lines under the Tools Menu of the Raw Editor by using a field to finish code table (*.fld) to define how the points and linework are to be drawn and layerized. There are three settings for this option, Manual, Auto and Prompt. Manual means that the file will not be processed using the field to finish codes and no points or linework with be drawn upon existing the raw editor. The Auto option will use the current or last used field to finish file (*.fld) to draw the points and lines on the drawing screen when the raw editor is existed. The option of Prompt will give the option to draw the points and lines to the screen. With this setting specified, the following prompt will be displayed when existing the editor.



Tools Menu

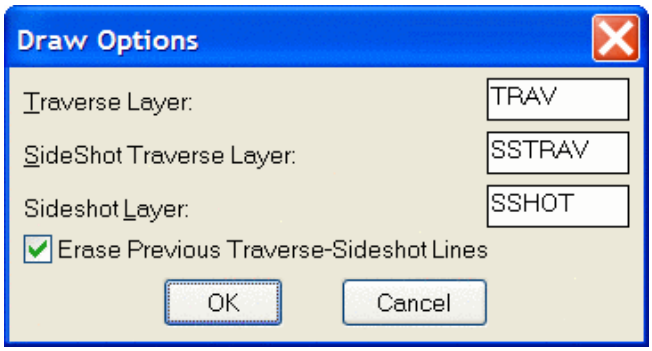
***Direct-Reverse Report*:** This routine creates a report of direct and reverse shots along with the resulting averaged shots. Any tolerance specified in the Process Settings>Direct-Reverse Settings section, that is exceeded will be displayed in this report. The residuals are the difference between the measurement and the final average.

Reduce Direct-Reverse: This routine processes the direct and reverse shots and simplifies the raw file by replacing the sets of direct and reverse shots with the resulting average traverse record.

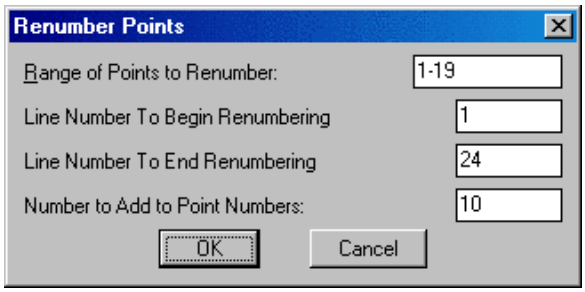
Update Raw from Points: This routine is used to update the raw data based upon the coordinates of the points contained in the point database. For example if the raw data has been processed using the compass rule adjustment method, the points in the crd file are now adjusted. However the raw data remains unchanged. If a record of the rw5 file reflecting the angles and distances between the points after an adjustment has been ran is desired, this routine can be run thus updating the raw data to reflect the adjusted angles and distances. Another application for this routine is that of building a rw5 file for future processing and adjustment. For example if a point file or text file has been received from another engineering firm or fellow surveyor and you would like to build a rw5 file for future reference and processing this this option can also be used to accomplish this. The rw5 file would be set up with the occupied points, foresight points and the desired angle type to use specified for the traverse. This would be all the manual entry of the data necessary. After creating the "shell" of the traverse then run the update raw from points routine and the raw data, as contained in the coordinate file, will be imported into the rw5 file thus filling out the horizontal angle, distance and vertical components specified.

Find Bad Angle: This routine prompts for another raw data (.RW5) file which is read and the data added to the end of the existing raw data (.RW5) file. For example, if you are editing the raw file from the first days work and have a separate raw file with a second days work, you can use this routine to add the second raw data to the first raw file.

Draw Traverse-Sideshot Lines: This routine draws lines for all the traverse and sideshot records. Sideshot Traverses are traverses that do not lead to the closing or ending point. There are different layers so that the lines can be drawn with different colors. This command does not process the raw file. Instead it reads the raw file and for each traverse and sideshot record, the program looks up the coordinates for the occupied and foresight points in the CRD file. So it may be necessary to run Process>No Adjust before running this routine. With the Erase Previous Traverse-Sideshot Lines toggled on, any previous linework drawn using this method will be erased from the drawing screen before drawing the lines again.



Renumber Points: This routine renumbers points in the raw file. This applies to all point numbers including: TR, SS, and PT records.



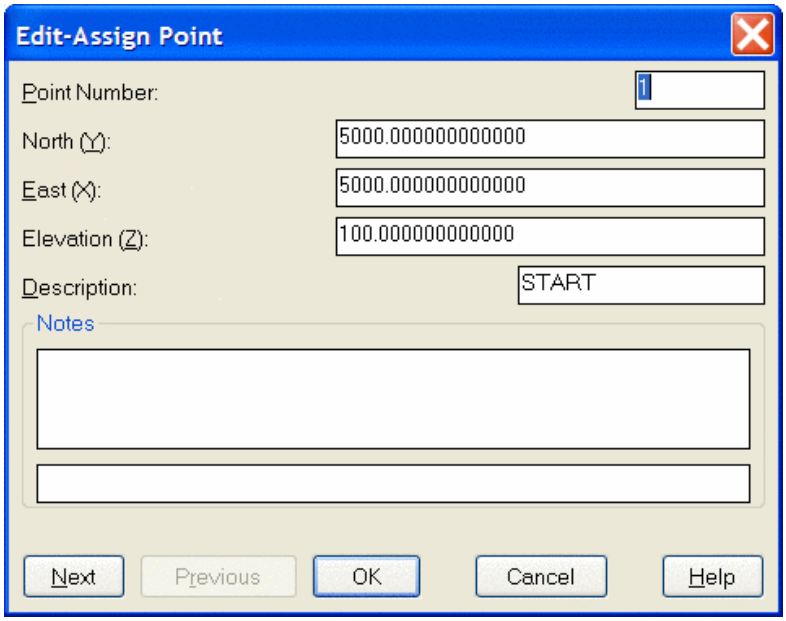
Range of Points to Renumber: Enter in the range of points to change, ie 1-4.

Line Number to Begin Renumbering: This corresponds to the line number located at the far left or the raw data editor. Enter the line number to begin the renumbering.

Line Number To End Renumbering: This also corresponds to the line number located at the far left on the raw data editor. Enter the line number to end the renumbering. If the range of numbers specified does not occur between the beginning line number and the ending line number, no changes will be made.

Numbers to Add to Point Numbers: Enter in the value to add. This number will be added to the existing point number to create the new point number. For example, if the number to add is 10 and the existing point numbers 1 and 6, the new renumber points will be 11 and 16.

Coordinate File: This option allows for editing and/or listing of the coordinate data in the active coordinate file. The active coordinate file will be displayed in the Header of the raw data editor. ***Edit Point*** will bring up the edit point dialog and allows editing of the points one at a time.



The ***List Point*** option will list the points in the active coordinate file in the standard report viewer format. ***Set Coordinate File***provides an option to set a new coordinate file to process to. This may be useful when processing the raw file by different adjustment methods for later review and comparison.

Point Groups: This option can be used to organize the survey data into point groups. There are three options for the creation of point groups, **Create All Point Group**, **Create Traverse Point Group** and **Create Sideshot Point Group**. The **Create All Point Group**option, creates a user specified group containing all of the points defined in the rw5 file. **Create Traverse Point Group** creates a user specified group containing only the points defined inthe traverse records (TR) of the rw5 file. The **Create Sideshot Point Group** creates a user specified group that contains only the points defined in the sideshot records (SS) of the rw5 file.

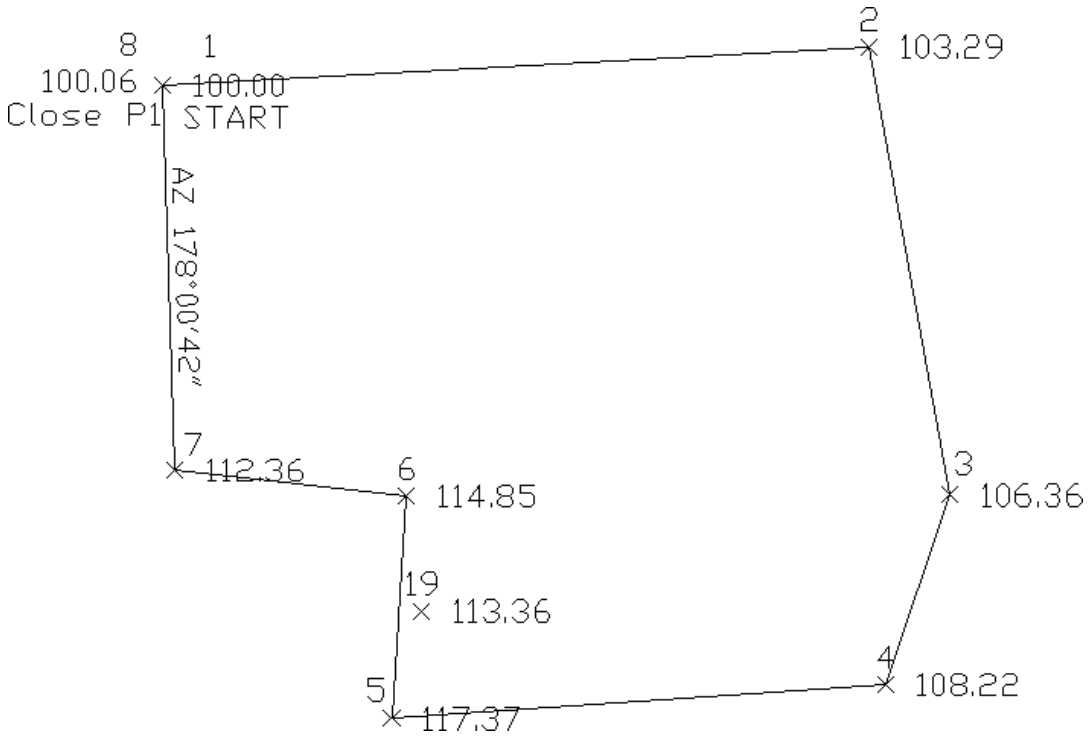
Format of the raw data (.RW5) file

Supported record header codes with their field headers:

BK » Backsight OP » Occupy Point Number
BP » Backsight Point Number (if 0 the next field's azimuth will be used for)
BS » Back Azimuth
BC » Back Circle DS » Description
LS » Line of Sight
HI » Height of Instrument
HR » Height of Rod/Target SP » Store Point PN » Point Number
N » North Coordinate

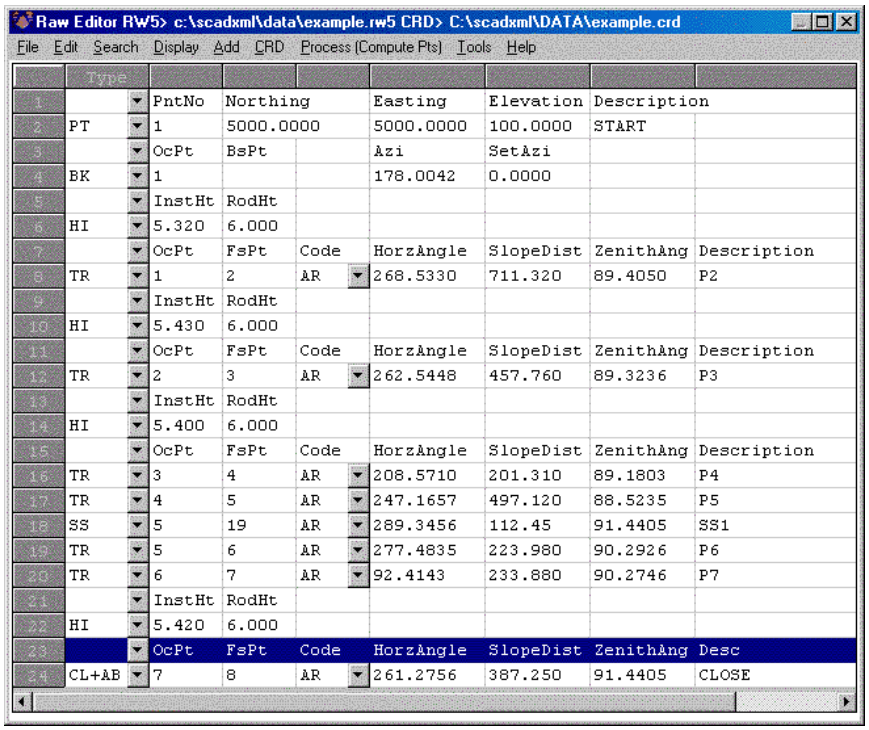
E > East Coordinate
EL » Elevation
- » Point Description/Note TR » Traverse
SS » Side Shot
CL » Closure Record
AB » Angle Balance Record OP » Occupy Point Number
FP » Foresight Point Number (one of the following 6)
AZ » Azimuth (angle code 5)
BR » Bearing (angle code 1 = NE, 2 = SE, 3 = SW, 4 = NW)
AR » Angle Right (angle code 7)
AL » Angle Left (angle code 6)
DR » Deflection Angle Right (angle code 9)
DL » Deflection Angle Left (angle code 8)
(one of the following 3) ZE » Zenith Angle (90 degrees level)
VA » Vertical Angle (0 degrees level)
CE » Change/Difference in Elevation from Instrument Point SD » Slope Distance (if ZE or VA above)
HD » Horizontal Distance (if CE above)
- » Point Description/Note

Traverse Examples



This first example is a closed traverse with an internal backsight of azimuth 178d0'42".

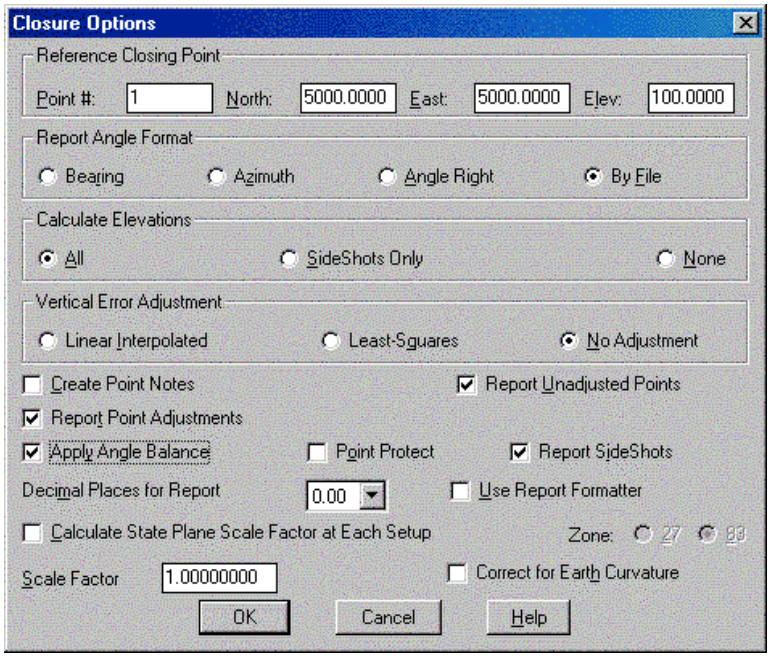
Use the functions under the Add menu to create and fill out the raw file as shown here.

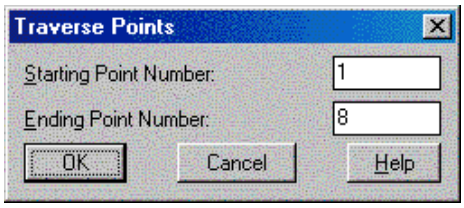


	Type							
1		PntNo	Northing		Easting	Elevation	Description	
2	PT	1	5000.0000		5000.0000	100.0000	START	
3		OcPt	BsPt		Azi	SetAzi		
4	BK	1			178.0042	0.0000		
5		InstHt	RodHt					
6	HI	5.320	6.000					
7		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
8	TR	1	2	AR	268.5330	711.320	89.4050	P2
9		InstHt	RodHt					
10	HI	5.430	6.000					
11		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
12	TR	2	3	AR	262.5448	457.760	89.3236	P3
13		InstHt	RodHt					
14	HI	5.400	6.000					
15		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
16	TR	3	4	AR	208.5710	201.310	89.1803	P4
17	TR	4	5	AR	247.1657	497.120	88.5235	P5
18	SS	5	19	AR	289.3456	112.45	91.4405	SS1
19	TR	5	6	AR	277.4835	223.980	90.2926	P6
20	TR	6	7	AR	92.4143	233.880	90.2746	P7
21		InstHt	RodHt					
22	HI	5.420	6.000					
23		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
24	CL+AB	7	8	AR	261.2756	387.250	91.4405	CLOSE

Notice that the record from point 7 to 8 is set as a CL+AB record. This tells the program that point 8 is the closing point and that the angle from 7 to 8 is the closing angle. For traverse adjustment, the closing reference point is 1 and the closure error is the difference between point 1 and point 8. For angle balance, the reference closing angle is 358d0'42" (178d0'42" + 180). The angle balance error is the difference between this reference angle and the angle from points 7 to 8.

Now let's process using Compass adjustment with Angle Balance. Choose Compass under the Process menu and fill out the dialogs as shown.



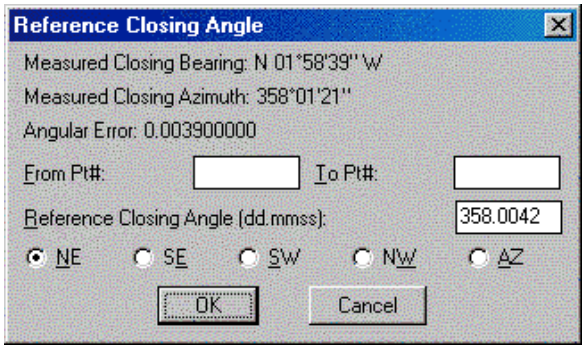


First half of process report:

```
Process Results 05/23/2002 10:06
Raw file> c:/scadxml/data/example.rw5


Scale Factor: 1.00000000
Correct for Earth Curvature: OFF
Starting Point 1: N 5000.00 E 5000.00 Z 100.00
BackSight Azimuth: 178°00'42''

Point Horizontal  Zenith   Slope   Inst  Rod   Northing   Easting   Elev
No.   Angle       Angle    Dist    HT    HT
Description

2     AR268.5330  89.4050  711.32  5.32  6.00  5038.43    5710.27   103.29
P2
3     AR262.5448  89.3236  457.76  5.43  6.00  4587.89    5791.20   106.36
P3
4     AR208.5710  89.1803  201.31  5.40  6.00  4397.30    5726.43   108.22
P4
5     AR247.1657  88.5235  497.12  5.40  6.00  4363.08    5230.59   117.37
P5
19    AR289.3456  91.4405  112.45  5.40  6.00  4471.32    5260.88   113.36
SS1
6     AR277.4835  90.2926  223.98  5.40  6.00  4586.54    5245.67   114.85
P6
7      AR92.4143  90.2746  233.88  5.40  6.00  4613.25    5013.33   112.36
P7
8     AR261.2756  91.4405  387.25  5.42  6.00  5000.09    4999.97   100.06
CLOSE

Closure Results (Before Angle Balance)

Starting Point 1: N 5000.00 E 5000.00 Z 100.00

Closing Reference Point 1: N 5000.00 E 5000.00 Z 100.00
Ending Point 8: N 5000.09 E 4999.97 Z 100.06
Azimuth Error : 341°38'22''
North Error   : 0.09061
East Error    : -0.03007
Vertical Error: 0.05953
Hz Dist Error : 0.09547
Sl Dist Error : 0.11251
Traverse Lines> 7
SideShots> 1
Horiz Dist Traversed: 2712.29
Slope Dist Traversed: 2712.62
Closure Precision: 1 in 28409
```

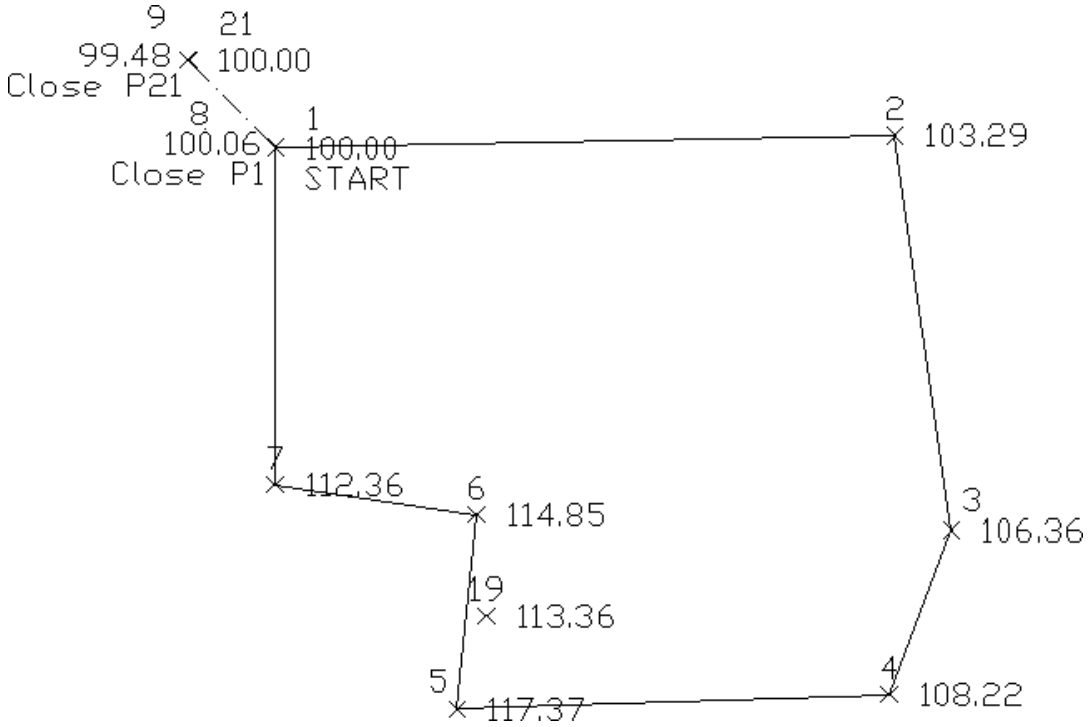
Remainder of process report:

```
Compass Closure
Adjusted Point Comparison

       Original           Adjusted
Point# Northing  Easting  Northing  Easting   Dist  Bearing
2      5038.445  5710.269 5038.440  5710.294  0.025 S 79°46'08'' E
3      4587.914  5791.222 4587.907  5791.263  0.042 S 79°46'08'' E
4      4397.319  5726.469 4397.310  5726.517  0.049 S 79°46'08'' E
5      4363.044  5230.628 4363.032  5230.693  0.067 S 79°46'08'' E
6      4586.509  5245.681 4586.496  5245.755  0.075 S 79°46'08'' E
7      4613.178  5013.335 4613.163  5013.416  0.083 S 79°46'08'' E
8      5000.017  4999.905 5000.000  5000.000  0.097 S 79°46'08'' E

Max adjustment: 0.097
Starting Point 1: N 5000.00 E 5000.00 Z 100.00
BackSight Azimuth: 178°00'42''

Point Horizontal Zenith  Slope  Inst Rod  Northing  Easting  Elev
No.   Angle      Angle   Dist   HT   HT
Description

2     AR268.5326 89.4050 711.34 5.32 6.00 5038.44   5710.29  103.29
P2
3     AR262.5434 89.3236 457.76 5.43 6.00 4587.91   5791.26  106.36
P3
4     AR208.5704 89.1803 201.30 5.40 6.00 4397.31   5726.52  108.22
P4
5     AR247.1657 88.5235 497.09 5.40 6.00 4363.03   5230.69  117.37
P5
19    AR289.3456 91.4405 112.47 5.40 6.00 4471.28   5260.97  113.36
SS1
6     AR277.4839 90.2926 223.99 5.40 6.00 4586.50   5245.75  114.85
P6
7      AR92.4130 90.2746 233.88 5.40 6.00 4613.16   5013.42  112.36
P7
8     AR261.2758 91.4405 387.27 5.42 6.00 5000.00   5000.00  100.06
CLOSE
```

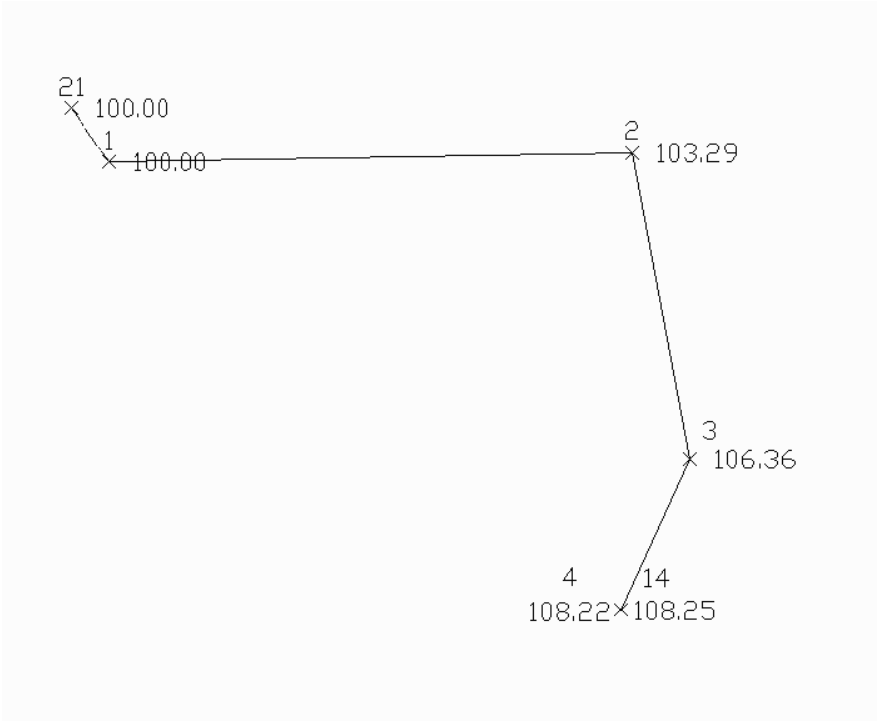


Shown above is the resulting process report. The angle balance had an error of 39 seconds which was divided among the 7 traverse sides. The Compass Closure shows how each traverse point was adjusted and then the resulting adjusted angles and distances.

Here is another layout of the last example that shows an external backsight setup. In this case there are two known points. Point 1 is the starting point and point 21 is the initial backsight. The setup could also use a backsight azimuth (ie north azimuth for example) instead of a backsight point number.



The closing record setup has changed from the last example. In this example, the shot from 7 to 8 is the closing shot with point 8 as the closing point. The closing reference point is still point 1. The angle balance shot is from 8 to 9 and the reference angle is from 1 to 21.



Example of an open traverse

The traverse starts from the known point 1 and ends at the known point 14. In this case there is no angle balance shot. The closing shot is from 3 to 4 with point 4 being the closing point. Point 14 is the closing reference point.

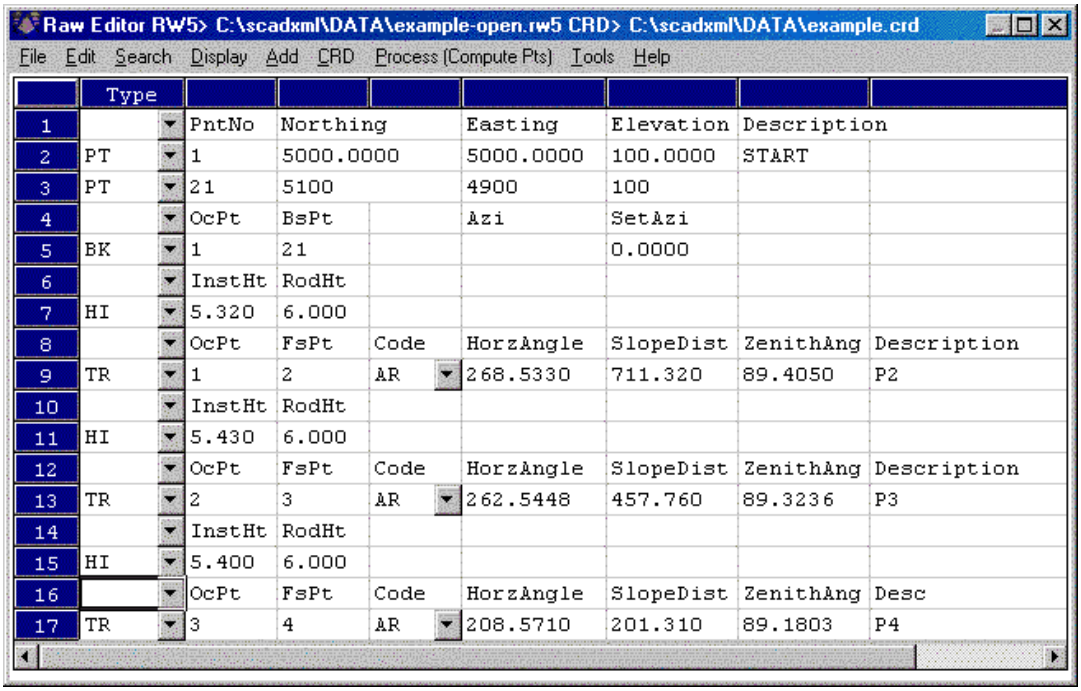
The closing record setup has changed from the last example. In this example, the shot from 7 to 8 is the closing shot with point 8 as the closing point. The closing reference point is still point 1. The angle balance shot is from 8 to 9 and the reference angle is from 1 to 21.

Here is an example of an open traverse.

Compass Report from Open Traverse example:

```
Process Results
Raw file> d:/scdev/data/tsurvey.rw5


Compass Closure
Adjusted Point Comparison


       Original         Adjusted
Point# Northing Easting Northing Easting Distance Bearing
2      5013.76  5711.18 5013.78  5711.13 0.047    N 63d21'19'' W
3      4560.69  5776.42 4560.72  5776.35 0.078    N 63d21'19'' W
4      4372.46  5705.08 4372.50  5705.00 0.091    N 63d21'19'' W


Point Horizontal Vertical Slope  Inst Rod Northing Easting Elev
No.   Angle      Angle    Dist   HT   HT
Description

2     AR133.5324 89.4050  711.27 5.32 6.00 5013.78 5711.13 103.29
3     AR262.5506 89.3236  457.74 5.43 6.00 4560.72 5776.35 106.36
4     AR208.5712 89.1803  201.30 5.40 6.00 4372.50 5705.00 108.22
```

The traverse starts from the known point 1 and ends at the known point 14. In this case there is no angle balance shot. The closing shot is from 3 to 4 with point 4 being the closing point. Point 14 is the closing reference point.



	Type							
1		PntNo	Northing		Easting	Elevation	Description	
2	PT	1	5000.0000		5000.0000	100.0000	START	
3	PT	21	5100		4900	100		
4		OcPt	BsPt		Azi	SetAzi		
5	BK	1	21			0.0000		
6		InstHt	RodHt					
7	HI	5.320	6.000					
8		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
9	TR	1	2	AR	268.5330	711.320	89.4050	P2
10		InstHt	RodHt					
11	HI	5.430	6.000					
12		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
13	TR	2	3	AR	262.5448	457.760	89.3236	P3
14		InstHt	RodHt					
15	HI	5.400	6.000					
16		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
17	TR	3	4	AR	208.5710	201.310	89.1803	P4

Portion of typical Sokkia/SDR raw data file:
00NMSDR20 V03-05 Jan-22-98 19:14 122211
10NMW970709A
13CPSea level crn: N
02TP00015000.000005000.0000085.63500005.22000000PK-FD
08KI00035000.000005192.9200081.7450000MN-SET
07TP0001000390.00000000.00000000
09F100010003193.10000092.40416660.00000000MN-SET
09F100010100193.00000091.31388880.00000000SN-REC

Portion of typical Wild/Leica raw data file:
410001+000000SB 42....+00000000 43....+00000000 44....+00000000 45....+00000000 110002+00000002
21.124+35959590 22.104+08748240 31...1+00000000 51..0.+0012+000 110003+00000003
21.124+00000000 22.104+08748240 31...1+00267075 51..0.+0012+000 110004+00000004
21.124+00420390 22.104+08702570 31...1+00168234 51..0.+0012+000 110005+00000005
21.124+26029130 22.104+09311370 31...1+00206133 51..0.+0012+000 410006+000000IP 42....+00000000
43....+00000000 44....+00000000 45....+00000000 110007+00000006 21.124+25827090 22.104+09504550
31...1+00106228 51..0.+0012+000 110008+00000007 21.124+27151500 22.104+09312240 31...1+00106066
51..0.+0012+000

Portion of typical SMI raw data file: CM Definitions: SS: Side Shot; TR: Traverse; OC: Occupied Coordinates;
PC: Point Coordinates; CM: Comment; OS: Occupied Station;
TS = time stamp; e = electronic; m = manual; CM TS TUE 04/09/91 09:41:25P
PC 1 5000.00000 5000.00000 0.00000
SS e HI:4.000 HR:5.000 PIPE/F
0 1 2 BAZ:0.00000 AR:0.00040 ZA:91.24330 SD:92.020
SS e HI:0.000 HR:0.000 BC/BR FRAME 1ST
0 1 3 BAZ:0.00000 AR:28.47220 ZA:91.20250 SD:65.240

Portion of typical PC COGO raw data file:
∗ NEW SET UP INST. AT 1 359 59 59 ON 4

L ANG 1000 4 1 77 18 52 4.44 * 1000 WALL# 283.22
L ANG 1001 4 1 55 44 28 9.8 * 1001 WALL# 283.28
L ANG 1002 4 1 38 37 8 15.89 * 1002 WALL# 283.48
L ANG 1008 4 1 27 18 34 123.82 * 1008 WALL# 287.75

Portion of typical Nikon raw data file:

MP,NOR,,5000.0000,5000.0000,100.0000,1
CO,Temp:111F Press:29.9inHg Prism:666 23-May-2000 10:30:36
ST,NOR,,1,,5.0000,0.0000,0.0000
SS,1,5.0000,131.0605,91.3744,88.4935,10:36:15,CL1
SS,2,5.0000,137.6770,90.2923,88.5236,10:36:50,CL1

Portion of typical MDL/Laser raw data file:

D052097F04P52I494P01P02
H32473V-0639R016202P03
H06687V-0706R014936P91
H03840V-0483R017380

Portion of typical Geodimeter raw data file:

50=HAWTHORN
54=19398
23=3222
2=1
37=1000.00
38=5000.00
39=700.000

Portion of typical Survis raw data file:

_OCCUPY_PNT_
621 616 5.140
148.36076
10255015.7245 3790987.2398 87.6695 ir
10255535.8009 3790669.8100 100.3900 ir
COMMENT
Thu Apr 08 08:14:14 1999
BACKSIGHT
0.00000 90.33400 609.4200 11.900 ir
SIDESHOT
1 0 0
18.47550 90.55000 17.4200 5.300 TP:gps1

Portion of typical Fieldbook raw data file:

NE 32 10696.4141 10043.5613 "SN-SET"
AZ 32 27 0
STN 32
BS 27
AD 27 0.00000 NULL "SN-SET"
AD 33 183.23250 183.660 "SN-SET"

Portion of typical SurvCOGO raw data file:

19100 , 0 , 19101 , 5 , 5.25 , 4.7 , 35.15 , 550 , 91.23 ,START
19101 , 19100 , 19102 , 5 , 5.15 , 4.7 , 35.15 , 120.23 , 88.34 ,
19102 , 19101 , 19103 , 5 , 5.2 , 4.7 , 125.1444 , 180.41 , 90 ,

19103 , 19102 , 19104 , 5 , 5.2 , 4.7 , 125.15 , 240.03 , 90 ,
19104 , 19103 , 19105 , 5 , 5.3 , 4.7 , 315.15 , 305.5 , 90 ,IRON PIN
19105 , 19104 , 19106 , 5 , 5.4 , 4.7 , 215.15 , 140.35 , 90 ,IRON PIN
19106 , 19105 , 19107 , 5 , 5.05 , 4.7 , 215.15 , 200 , 90 ,TACK IN FENCE
19107 , 19106 , 19108 , 5 , 5.2 , 4.7 , 300.23 , 400 , 90 ,

Keyboard Command: rawedit
Prerequisite: None

SurvNET

SurvNET Overview

The Network Least Squares Adjustment program (SurvNET) performs a mathematically rigorous least squares adjustment and statistical analysis of a network of raw traverse field data. SurvNET is located within the Edit-Process Raw Data File command under the Process menu.

The SurvNET program simultaneously adjusts a network of interconnected traverses with any amount of redundancy. The raw data can contain any combination of traverse (angle and distance), triangulation (angle only), and trilateration (distance only) measurements. It can also calculate resections, where any combination of distances and angles can be measured from an unknown point to known points (points located in the traverse). The raw data need not be in linear format, and individual traverses do not have to be defined using any special codes. All measurements will be used in the adjustment.

The SurvNET program adjusts both 3D and 2D traverses. This includes 3D traverses that contain some 2D data. If you have Vertical Adjustment turned ON in the project settings, elevations will be calculated and adjusted only if there is enough information in the raw data file to do so. Least squares adjustment is used for elevation adjustment as well as the horizontal adjustment. To compute elevations the instrument record must have a HI, and the foresight record must have a rod height, slope distance and vertical angle. A 0.0 (zero) HI or ROD HEIGHT is valid (only when the field is blank will it be considered a 2D measurement). A 3D traverse must also have adequate elevation control in order to process the elevations. Elevation control can be obtained from the Control File, Coordinate records in the raw data file, or Elevation records in the raw data file.

The SurvNET program can also automatically reduce field measurements to State Plane coordinates in either the NAD 83 or NAD 27 coordinate systems. A grid factor is computed for each individual line during the reduction. The elevation factor is computed for each individual line if the data is 3D. If the raw data has only 2D data, the user has the option of defining a project elevation to be used to compute the elevation factor.

A full statistical report containing the results of the least squares adjustment is reported. Coordinates will be written to the current point database.

Although the SurvNET program does not output the standard "Error of Closure" statement, it produces statistical information that allows a much more effective way to evaluate the strength of your traverses, and the precision of your measurements.

Raw Data Files

The SurvNET program processes Carlson raw data files (*.RW5). Measurement, coordinate, elevation and direction

(Brg/Az) records will be recognized. Scale factor records are not processed because the software calculates the state plane scale factors automatically.

Network Least Squares Settings

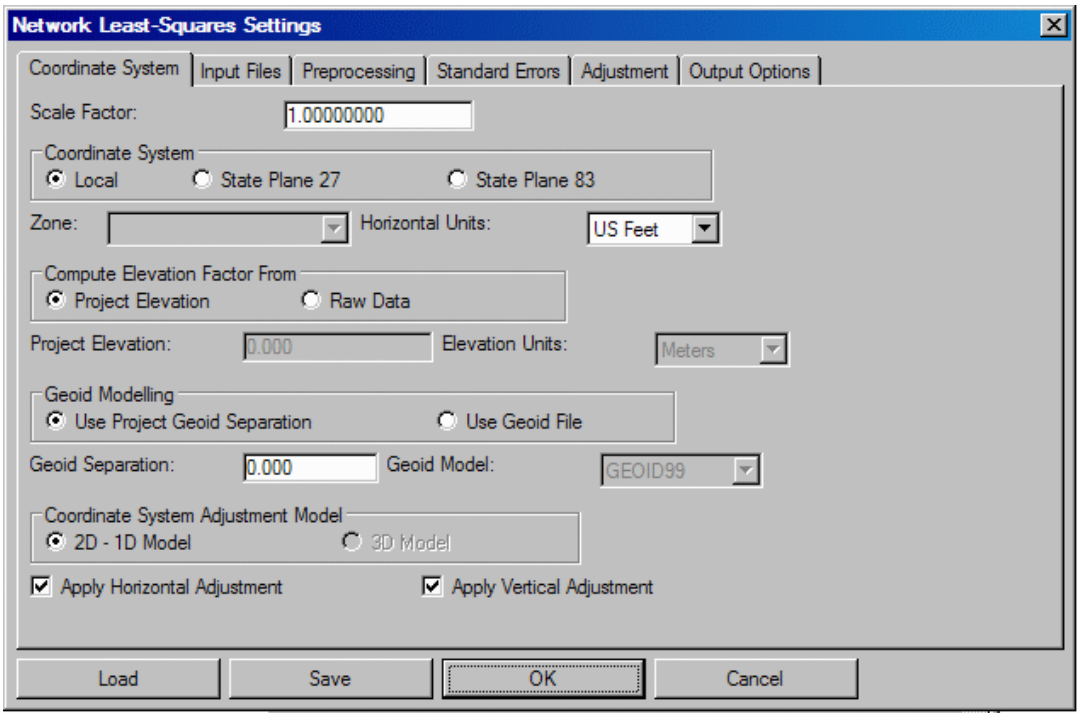
Function

The Network Least Squares Adjustment program (NLSA) performs a mathematically rigorous least squares adjustment and statistical analysis of a network of raw traverse field data. The NLSA program simultaneously adjusts a network of interconnected traverses with any amount of redundancy. The raw data can contain any combination of traverse (angle and distance), triangulation (angle only) and trilateration (distance only) measurements. It can also calculate resections, where any combination of distances and angles can be measured from an unknown point to known points (points located in the traverse). The raw data need not be in linear format, and individual traverses do not have to be defined using any special codes. All measurements will be used in the adjustment.

The NLSA program also adjusts both 3D and 2D traverses. This includes 3D traverses that contain some 2D data. If you have Vertical Adjustment turned ON in the project settings, elevations will be calculated and adjusted only if there is enough information in the raw data file to do so. Least squares adjustment is used for elevation adjustment as well as the horizontal adjustment. To compute elevations, the instrument record must have a HI, and the foresight record must have a rod height, slope distance and vertical angle. A 0.0 (zero) HI or ROD HEIGHT is valid (only when the field is blank will it be considered a 2D measurement). A 3D traverse must also have adequate elevation control in order to process the elevations. Elevation control can be obtained from the Control File, Coordinate records in the raw data file, or Elevation records in the raw data file. The NLSA program can also automatically reduce field measurements to State Plane coordinates in either the NAD 27 or NAD 83 coordinate systems. A grid factor is computed for each individual line during the reduction. The elevation factor is computed for each individual line if the data is 3D. If the raw data has only 2D data, the user has the option of defining a project elevation to be used to compute the elevation factor.

A full statistical report containing the results of the least squares adjustment is produced. Coordinates will be written to the current coordinate (.CRD) file. Although the NLSA program does not output the standard "Error of Closure" statement, it produces statistical information that allows a much more effective way to evaluate the strength of your traverses, and the precision of your measurements. See details of this statistical report later in this section.

Network Least Squares Settings dialog Choosing SurvNET from the pulldown menu displays the Network Least-Squares Settings dialog box.



Coordinate System

Scale Factor: Enter a value.

Coordinate System: Select Local (assumed coordinate system), SPC 1927 (State Plane NAD27) or SPC 1983 (State Plane NAD83).

Zone: If you choose SPC 1927 or SPC 1983, you can select the State and Zone you are in. The grid scale factor is computed for each measured line using the method described in section 4.2 of NPAA Manual NOS NGS 5, "State Plane Coordinate System of 1983", by James E. Stem.

Horizontal Units: Applies to the input/output of coordinate values (Meters, US Feet or International Feet).

Compute Elevation Factor From: When you select SPC 1927 or SPC 1983, in order to calculate the combined scale factor (so as to adjust distances to sea-level), you will be given the choice of either entering a Project Elevation, or using the elevations of the calculated coordinate points (Raw Data). If you are reducing a 2D network, select Project Elevation, since none of the calculated points will have elevations. For most survey projects it is sufficient to use an approximate elevation such as can be obtained from a Quad Sheet. For 3D networks, the elevation factor is computed for each individual line.

Geoid Modeling: You can choose either Use Project Geoid Separation or Use Geoid File.

Geoid Separation: This feature is dependent upon which Geoid Modeling option you decide to use.

Coordinate System Adjustment Model: Pick between 2D - 1D Model or 3D Model.

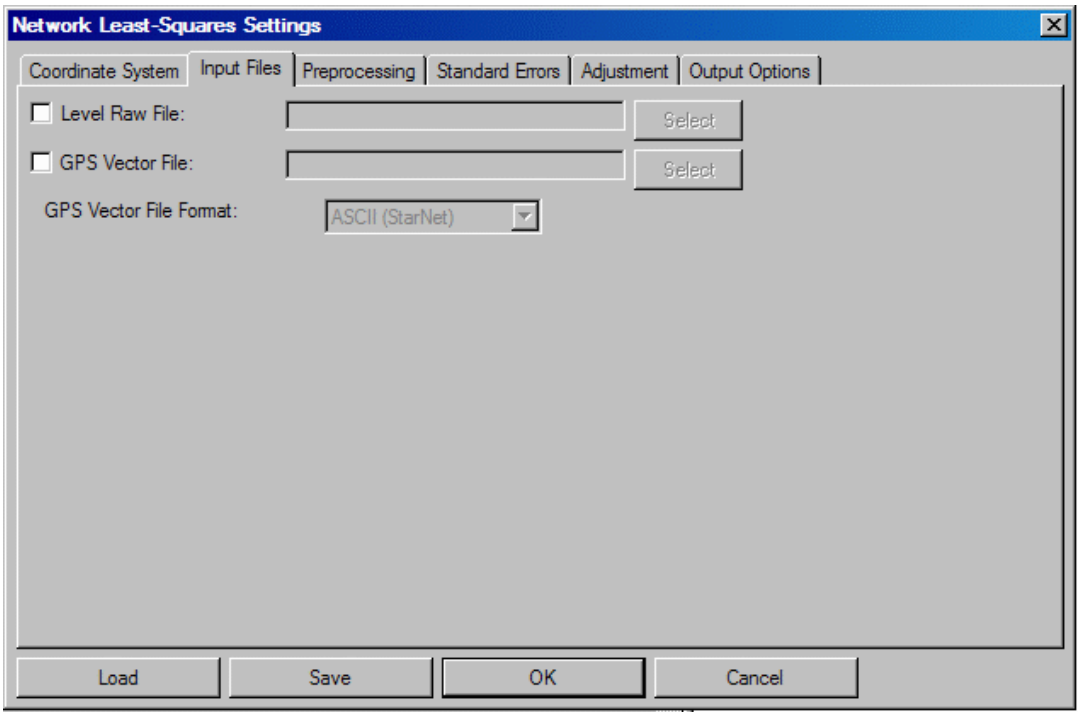
Apply Horizontal Adjustment: Check box for adjustment of North/East values.

Apply Vertical Adjustment: Check box for adjustment of elevations. You can adjust either horizontal and vertical data, horizontal data only, or vertical data only. If Vertical Adjustment is not checked, elevations will not be

calculated.

Load: Common option included in all tabbed dialogs described below. Click this button to load an existing .NLQ file.

Input Files

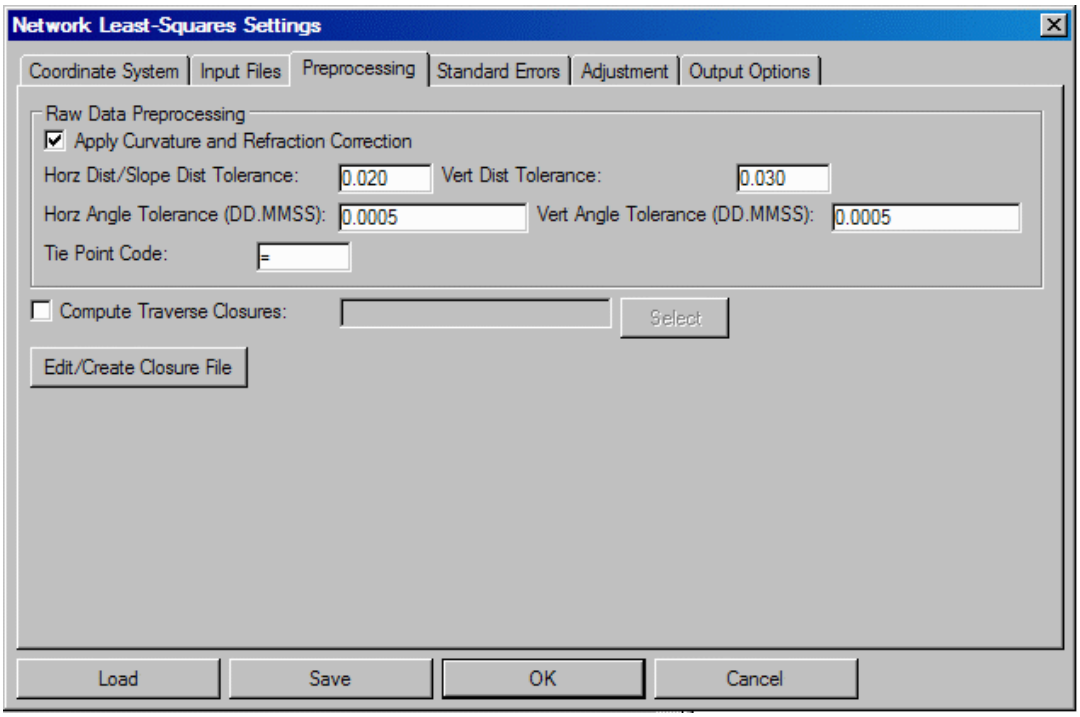


Level Raw File: Click to include existing .LEV file for input.

GPS Vector File: Click to include and existing GSPS vector file for input.

GPS Vector File Format: Select from ASCII (StarNET), Thales or Leica.

Preprocessing



When multiple angles or distances are measured to a point, a single average angle, horizontal distance component, and vertical difference component will be calculated for use in the least-squares adjustment. You may set the tolerances so that you are warned if any angle or distance exceeds these values. Tolerance warnings will be shown in the report after processing the data.

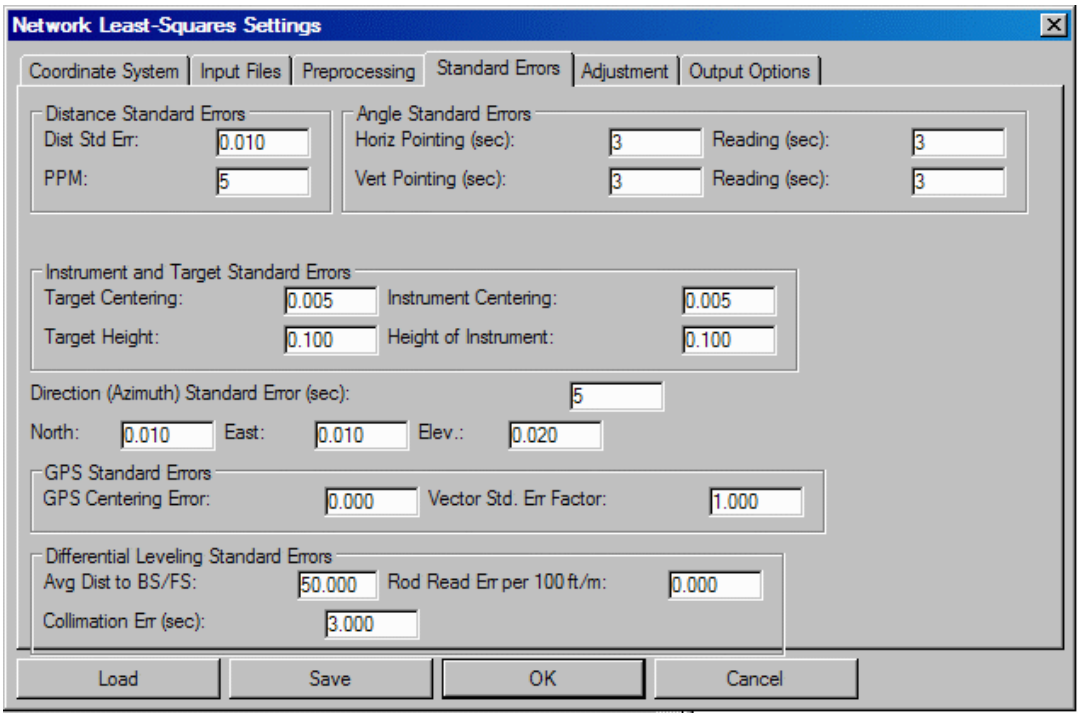
Horz. Dist/Slope Tolerance: Display a warning if the difference between highest and lowest horizontal distance component exceeds this value.

Horz. Angle Tolerance: Display a warning if the difference between the highest and lowest horizontal angle exceeds this value.

Tie Point Code: Enter code.

Edit/Create Closure File: With this feature, you can edit an existing or create a new .CLS closure file.

Standard Errors



Standard errors (SE) are basically realistic errors you would expect to obtain, based on the type equipment and field procedures used to take your measurements (e.g. if you are using a 5 second theodolite, you could expect the angles to be measured within +/- 5 seconds). The Distance, Angle Reading (Vertical and Horizontal) and PPM settings should be based on the equipment being used. Check the published specifications for your total station. Survey methods should also be taken into account when setting standard errors (e.g. you might set the Target Centering standard error higher when you are sighting a held prism pole than you would if you were sighting a prism set on a tripod). If the generated report shows that generally you have consistently high Standard Residuals for a particular measurement value (angles, distances, etc.), then there is the chance that you have selected standard errors that are better than your instrument and methods can obtain. (See explanation of report file).

Note: The settings from this dialog box will be used for the project default settings. These default standard errors can be overridden for specific measurements by placing SE records directly into the Raw Data File (see the above documentation on raw data files).

Distance Standard Error: Precision of distance measurements, obtain from EDM specs.

PPM: Parts per Million, obtain from EDM specs.

Horizontal Pointing (sec): Atmospheric conditions, optics, experience and care taken by instrument operator.

Horizontal Reading (sec): Precision of horizontal angle measurements, obtain from theodolite specs.

Vertical Pointing (sec): Atmospheric conditions, optics, experience and care taken by instrument operator.

Vertical Reading (sec): Precision of vertical angle measurements, obtain from theodolite specs.

Target Centering: Location of target (prism) relative to the point.

Instrument Centering: Location of instrument relative to the point.

Target Height: Accuracy of target height.

Instrument Height: Accuracy of instrument height.

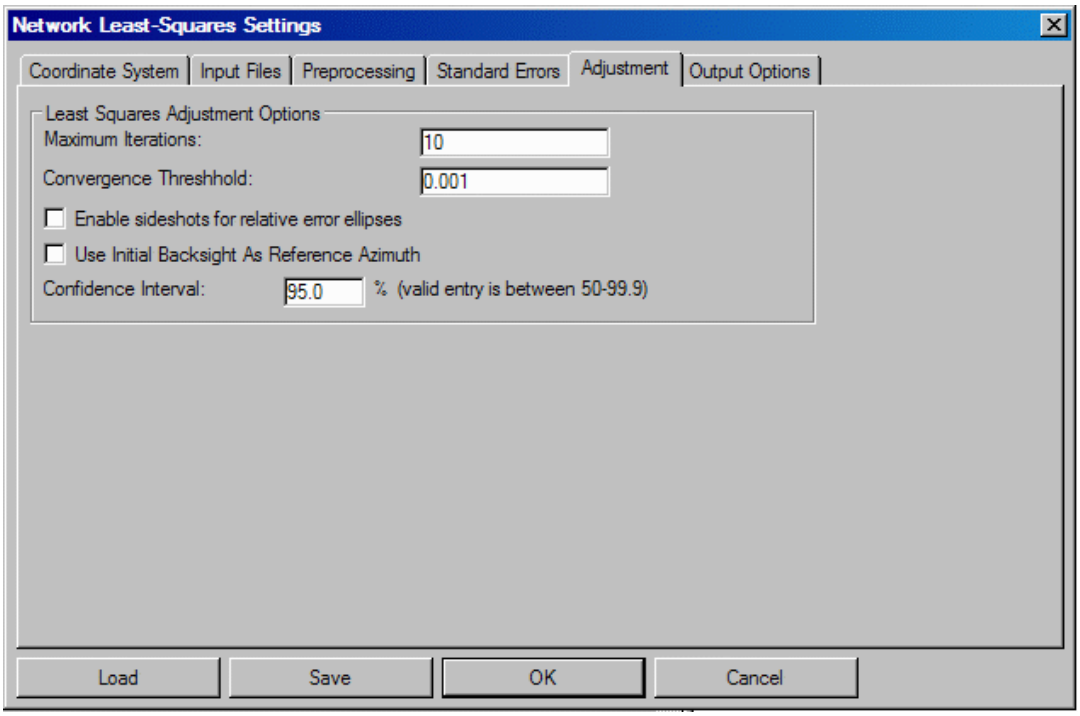
Direction (Azimuth) Standard Error (sec): Precision of bearing/azimuth records.

North Coordinate, East Coordinate: Precision of horizontal coordinate records.

GPS Standard Errors: A GPS Centering Error value and a Vector Std. Err Factor value may be entered.

Differential Leveling Standard Errors: Values for Average Distance to BS/FS, Rod Read Err per 100 ft/m and Collimation Err (sec) may be entered in these three fields.

Adjustment



Least Squares Adjustment Options: These two options are describe here.

Maximum Iterations: Number of iterations allowed for convergence. Select how many places you want to see after the decimal.

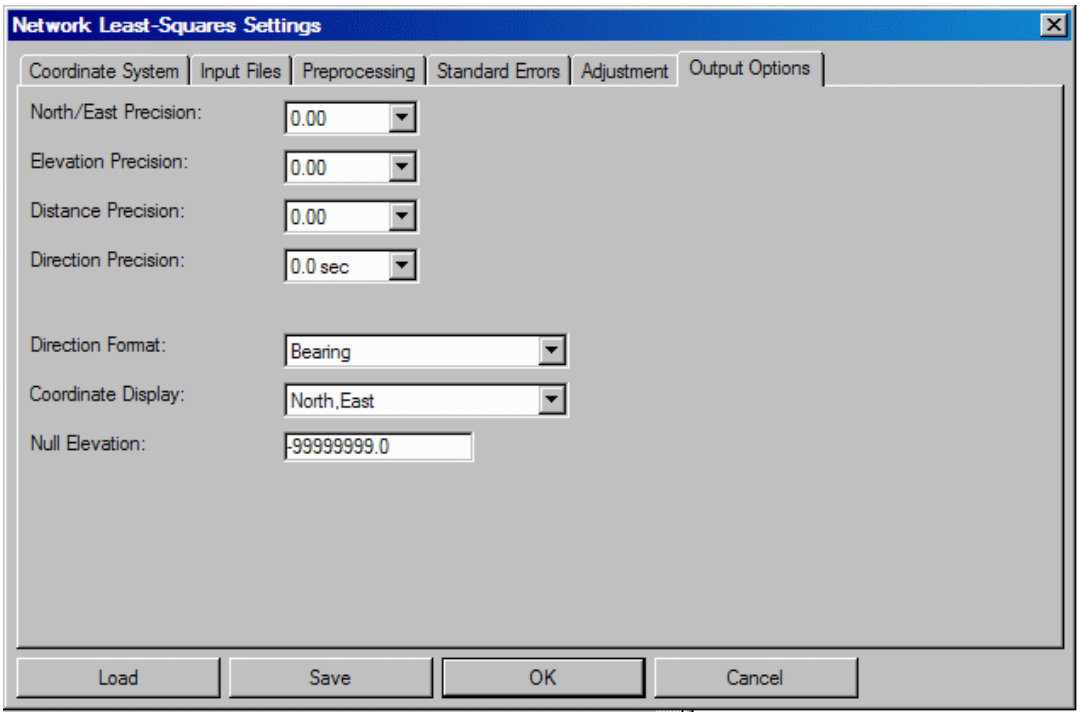
Convergence Threshold: Stop when the corrections to the adjustment are less than this value. Select how many places you want to see after the decimal.

Enable sideshots for relative error ellipses: Check box for sideshot relative error ellipses.

Use Initial Backsight As Reference Azimuth: Reported directions can be output in Bearing or Azimuth.

Coordinate Interval: Reported coordinates can be output in either North-East or East-North.

Output Options



These settings apply to the output of data to the report and coordinate files. If coordinate points already exist in the coordinate file, they will be overwritten and updated with the new coordinate values.

North/East Precision: Select how many places you want to see after the decimal.

Elevation Precision: Select how many places you want to see after the decimal.

Distance Precision: Select how many places you want to see after the decimal.

Direction Precision: Angular output of nearest second, tenth of second, or hundredth of second for directions (Azimuths or Bearings).

Direction Format: Reported directions can be output in Bearing or Azimuth.

Coordinate Display: Reported coordinates can be output in either North-East or East-North.

Null Elevation: Value to be reported for elevations that were not calculated.

Process Network

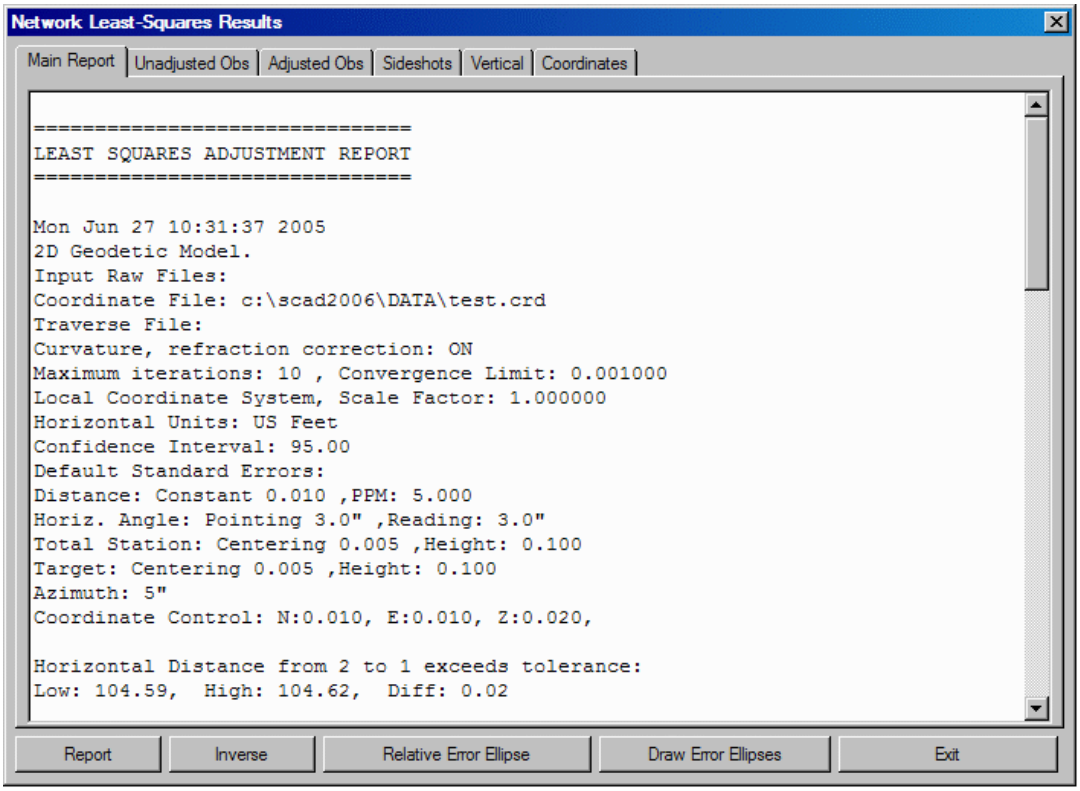
If there is a problem with the reduction, you will be shown error messages that will help you track down the problem. The data is preprocessed to calculate averaged angles and distances for sets of data. For a given setup, all multiple angles and distances to a point will be averaged prior to the adjustment. The standard error as set in the Project Settings dialog box is the standard error for a single measurement. Since the average of multiple measurements is more precise than a single measurement the standard error for the averaged measurement is computed using the standard deviation of the mean formula. During the preprocessing, approximate coordinate values for each point will also be calculated. This saves the user from having to come up with a list of approximate coordinate values prior to processing. Sideshots are separated from the raw data and processed after the adjustment. If the raw data processes properly, a report file will be displayed and the coordinate file will be populated with the adjusted coordinates.

Once you have clicked OK, you will see the full statistical report produced by this routine in its own dialog box. This displayed dialog is titled Network Least Squares Results. It, too, is categorized with the use of six tabs.

Network Least Squares Results dialog

Main Report

The main contain the Least Squares Adjustment Report, the Horizontal Adjustment Report and the Statistics. This last Statistics section displays some statistical measures of the adjustment including the number of iterations needed for the solution to converge, the degrees of freedom of the network, the reference variance, the standard error of unit weight, and the results of a Chi-square test. The degree of freedom is an indication of how many redundant measurements are in the survey. Degree of freedom is defined as the number of measurements in excess of the number of measurements necessary to solve the network. The standard error of unit weight relates to the overall adjustment and not an individual measurement. A value of one (1) indicates that the results of the adjustment are consistent with a priori standard errors. The reference variance is the standard error of unit weight squared. The chi-square test is a test of the "goodness" of fit of the adjustment. It is not an absolute test of the accuracy of the survey. The a priori standard errors, which are defined in the project settings dialog box or with the SE record in the raw data file, are used to determine the weights of the measurements. These standard errors can be thought of as an estimate of how accurately the measurements were made. The Chi-square test only tests whether the results of the adjusted measurements are consistent with the a priori standard errors. Note that if you change the project standard errors and then reprocess the survey, the results of the Chi-square test change.



Unadjusted Observations

This tabbed section lists the reduced and averaged measurements that contribute to the network. When multiple measurements are used, the standard error for the averaged measurement will be computed using the average of the mean formula. There is a list included of the control coordinates used in the network adjustment. These coordinates have been read from the raw data file. Note that the standard errors for the control points are displayed. This section shows the azimuths and azimuth standard errors used in the adjustment. Azimuths can only be defined as a direction record in the raw data file. This section also shows the distances and distance standard errors used in the adjustment.

These distances are horizontal distances derived from all slope distance and vertical angles for that line, including all foresight and backsight distances. The standard error settings used to calculate the final distance standard error include the distance standard error, the PPM standard error, the target centering standard error and the instrument centering standard errors. The techniques and formulas used to calculate the final distance standard error are found in section 6.12 of the textbook "Adjustment Computations, Statistics and Least Squares in Surveying and GIS", by Paul Wolf and Charles Ghilani. You also will see the angles and angle standard errors used in the adjustment. These angles are the averaged angle value for all the multiple angles collected. The standard error settings used to calculate the final angle standard error include: the pointing standard error, the reading standard error, the target centering standard error and the instrument centering standard errors. (For the techniques and formulas used to calculate the final angle standard error, please reference section 6.2 of: Wolf, P.R. and Ghilani, C.D., 1997, "Adjustment Computations: Statistics and Least Squares in Surveying and GIS", Interscience, Third Edition.)

Adjusted Observations

This sections lists the adjusted horizontal distance, horizontal angle, and azimuth measurements. In addition to the adjusted measurement, the residual, standard residual and the standard deviation of the adjusted measurement are displayed. The residual is defined as the difference between the unadjusted measurement and the adjusted measurement. The residual is one of the most useful and intuitive measures displayed in the report. Large residuals in relation to the standards of the survey are indications of problems with the data. The standard residual is the a priori standard error divided by the computed standard deviation of a measurement. A standard residual of one (1) indicates that the adjusted measurement is consistent with the standard errors defined for the measurement. One (or a few) measurements having high standard residuals, in relation to the rest of the standard residuals, may be an indication of an error in the survey. When all standard residuals are consistently large, an inconsistency in the a priori standard errors and the adjustment is likely. In other words, the standard errors defined for the project are too small, in relation to the survey methods used. The standard deviation of the measurement indicates a 68% probability that the adjusted measurement is within (plus or minus) the standard deviation of the measurement's true value.

This tabbed section displays the computed sideshots of the network. Sideshots are filtered out of the network adjustment as part of the preprocessing process. Least squares adjustment requires a lot of computer resources. Sideshots are filtered out to minimize the computer resources needed in a large network adjustment. The sideshots are computed from the final adjusted network points. The results of the sideshot computations are the same whether they are reduced as part of the least squares adjustment or from the final adjusted coordinates.

Vertical

This tabbed portion of the report displays the results of the vertical adjustment. The horizontal and the vertical adjustments are separate least squares adjustment processes. As long as there are redundant vertical measurements the vertical component of the network will be reduced and adjusted using least squares. The first part of the vertical adjustment results displays the fixed vertical benchmarks used in the vertical adjustment. These points are fixed and will not be adjusted vertically. Next, the points that will be adjusted as part of the vertical adjustment are listed. The third part of the vertical adjustment report displays the measurements used. The measurements consist of the vertical elevation difference between points in vertical adjustment. The lengths between these points are used to determine the weights in the vertical adjustment. Longer length lines are weighted less in the vertical adjustment than shorter length lines.

Coordinates

If the adjustment of the network converges, this tabbed section displays a list of the final adjusted coordinates and the computed standard X, Y standard error. The X, Y standard error signifies that there is a 68% probability that the adjusted X, Y is within plus or minus the standard error of the X, Y of its true value. This section displays the error ellipses for the adjusted coordinates. The error ellipse is a truer representation of the error of the point than the X, Y standard error. The error ellipses are calculated to a 95% confidence interval. The error ellipse axis is larger than the X, Y standard errors because the error ellipses in this report are calculated at a 95% probability level. The maximum error axis direction is along the axis of the semi-major axis. The direction of the minimum error axis direction is along the semi-minor axis and is perpendicular to the semi-major axis. If a point is located from a variety of stations,

you will see the error ellipse approach a circle, which is the strongest geometric shape.

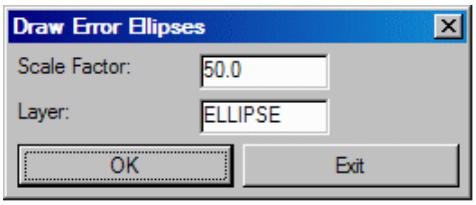
The following four buttons are located at the bottom of the Network Least Squares Results dialog box.

Report: This report information will be shown in a Standard Report Viewer so that you can analyze the data. Select the Printer icon if you want a hard copy. The first section of the report displays the primary settings used when the project was adjusted. The second section of the report displays warning and error messages generated during the preprocessing of the raw data. The primary messages displayed will be warnings when multiple angles, horizontal distances, and vertical differences exceed the tolerance settings as set in the project settings. The low and high measurement and the difference are displayed.

Inverse: The Inverse button is only active after a network has been processed successfully. Inverse can be used to obtain the bearing and distance between any two points in the network. Additionally, the standard deviation of the bearing and distance between the two points is displayed. This information can be used to determine the relative precision between any two points in the network. If you need to certify the Positional Tolerances of your monuments, per the ALTA Standards, use this function to determine these values (e.g. if you must certify that all monuments have a positional tolerance of no more than 0.07 feet, inverse between the monuments in as many combinations as you deem necessary, and make note of the standard deviations of the distances. If none of them are larger than 0.07 feet, you have met the standards).

Relative Error Ellipse: Reports the relative error ellipse from one point to another.

Draw Error Ellipses: Draws the error ellipse from one point to another.



Exit: Ends your session in the Network Least Squares Settings dialog and brings you back to the Raw Editor.

Vertial Adjustment Report

The following sections display the adjusted elevations, the computed standard deviations of the computed elevations, the final adjusted elevation difference measurements and their residuals. Finally, the computed sideshot elevations are displayed.

State Plane Reduction Report File

When reducing to a state plane coordinate system, there will be additional information displayed in the report file.

Note the heading of the report. It indicates that the project is being reduced into the Florida east zone of the 1983 State Plane Coordinate System. The heading shows that the computed elevation factor is based on a project elevation of 5 meters:

Tue Jul 16 21:25:34 2002

Input File: D:\lsdata\cgstar\CGSTAR.RW5

Curvature, refraction correction: ON

Maximum iterations: 10 , Convergence Limit: 0.001000

1983 State Plane Coordinates, zone:0901 Florida East

Elevation factor computed from project elevation,5.000000.

Elevation Units: Meters

Horizontal Units: Meters

The first distance listing in the Unadjusted Observation section of the report shows the unadjusted ground distances:

Distances: 14 Observations

From Sta.	To Sta.	Ground Dist.	StErr
1	5	290.45	0.0116
1	2	292.214	0.0116
2	6	52.388	0.0124
2	3	324.186	0.0113
3	4	275.603	0.0115
3	20	134.663	0.0147
20	21	116.073	0.0146
21	22	50.115	0.0144
4	5	309.647	0.0116
5	10	129.985	0.0126
10	11	126.010	0.0125
10	15	10.000	0.0142
11	12	129.426	0.0126
12	3	144.651	0.0126

There is a new section that displays the reduced unadjusted grid distances. The grid factor, elevation factor and combined factor, used to reduce the ground distance to a grid distance, are included in the listing:

Grid Distances: 14 Observations

From Sta.	To Sta.	Grid Dist.	Grid Factor	Z Factor	Combined Factor
1	5	290.458	1.00002753	0.99999922	1.00002674
1	2	292.221	1.00002801	0.99999922	1.00002723
2	3	324.195	1.00002802	0.99999922	1.00002723
3	4	275.611	1.00002752	0.99999922	1.00002674
3	20	134.666	1.00002773	0.99999922	1.00002694
20	21	116.076	1.00002759	0.99999922	1.0000268
4	5	309.655	1.00002725	0.99999922	1.00002646
5	10	129.989	1.00002734	0.99999922	1.00002656
10	11	126.014	1.00002755	0.99999922	1.00002677
11	12	129.429	1.00002775	0.99999922	1.00002697
12	3	144.655	1.00002782	0.99999922	1.00002703

In the Adjusted Coordinates section there is a new section that displays the latitude and longitude of the final adjusted points. The convergence angle, grid factor, elevation factor, and the combined factor are also displayed for each point:

Adjusted Geographic Coordinates

Sta.	Latitude	Longitude	Conv. Ang.	Grid Factor	Z Factor	Combined Factor
1	25-54'18.04854"N	80-09'50.01222"W	000-21'55"	1.0000278	0.99999922	1.00002701
5	25-54'22.19238"N	80-09'59.38867"W	000-21'51"	1.00002726	0.99999922	1.00002647
2	25-54'24.71981"N	80-09'42.54113"W	000-21'58"	1.00002823	0.99999922	1.00002744
3	25-54'32.95530"N	80-09'49.80362"W	000-21'55"	1.00002781	0.99999922	1.00002702
4	25-54'32.25098"N	80-09'59.67503"W	000-21'51"	1.00002724	0.99999922	1.00002645
20	25-54'36.61787"N	80-09'52.45127"W	000-21'54"	1.00002765	0.99999922	1.00002687
21	25-54'39.78404"N	80-09'54.71776"W	000-21'53"	1.00002752	0.99999922	1.00002674
10	25-54'25.52242"N	80-09'56.51499"W	000-21'52"	1.00002742	0.99999922	1.00002664
11	25-54'24.81748"N	80-09'52.05512"W	000-21'54"	1.00002768	0.99999922	1.00002689
12	25-54'28.26890"N	80-09'49.39720"W	000-21'55"	1.00002783	0.99999922	1.00002705

The remainder of the report is the same as the Local Coordinate System report that follows.

Sample Coordinate System Report

==========
LEAST SQUARES ADJUSTMENT REPORT
==========

Tue Jul 16 21:03:16 2002

Input File: D:\lsdata\cgstar\CGSTAR.CGR

Output File: D:\lsdata\cgstar\CGSTAR.RPT

Curvature, refraction correction: ON

Maximum iterations: 10 , Convergence Limit: 0.001000

Local Coordinate System, Scale Factor: 1.000000

Horizontal Units: Meters

Warning, Angle spread exceeds tolerance.
Inst. at 1, Backsight 5, Foresight 2
Low Angle: 109-19'10", High Angle: 109-19'17", Difference: 000-00'07"

Warning, Angle spread exceeds tolerance.
Inst. at 2, Backsight 1, Foresight 6
Low Angle: 190-32'02", High Angle: 190-32'10", Difference: 000-00'08"

Warning, Angle spread exceeds tolerance.
Inst. at 2, Backsight 1, Foresight 3
Low Angle: 096-03'48", High Angle: 096-03'56", Difference: 000-00'08"

Warning, Angle spread exceeds tolerance.
Inst. at 3, Backsight 2, Foresight 4
Low Angle: 124-03'50", High Angle: 124-03'56", Difference: 000-00'06"

Warning, Angle spread exceeds tolerance.
Inst. at 5, Backsight 4, Foresight 10
Low Angle: 039-26'35", High Angle: 039-26'45", Difference: 000-00'10"

Warning, Angle spread exceeds tolerance.
Inst. at 10, Backsight 5, Foresight 11
Low Angle: 241-56'23", High Angle: 241-56'35", Difference: 000-00'12"

Warning, Angle spread exceeds tolerance.
Inst. at 11, Backsight 10, Foresight 12
Low Angle: 114-56'20", High Angle: 114-56'34", Difference: 000-00'14"

Warning, Angle spread exceeds tolerance.
Inst. at 12, Backsight 11, Foresight 3
Low Angle: 140-39'18", High Angle: 140-39'31", Difference: 000-00'13"

Warning, Angle spread exceeds tolerance.
Inst. at 5, Backsight 4, Foresight 1
Low Angle: 117-30'35", High Angle: 117-30'50", Difference: 000-00'15"

Warning, Vertical distance between 1 and 5 exceeds tolerance.
Low Vert. Distance: 7.492, High Vert. Distance: 7.523, Difference: 0.031

Warning, Horizontal distance between 2 and 3 exceeds tolerance.
Low Distance: 324.154, High Distance: 324.195, Difference: 0.042

Warning, Vertical distance between 2 and 3 exceeds tolerance.
Low Vert. Distance: 6.612, High Vert. Distance: 8.357, Difference: 1.745

Warning, Vertical distance between 3 and 4 exceeds tolerance.
Low Vert. Distance: 11.459, High Vert. Distance: 11.516, Difference: 0.057

Warning, Vertical distance between 4 and 5 exceeds tolerance.
Low Vert. Distance: 4.340, High Vert. Distance: 4.375, Difference: 0.035

Warning, Horizontal distance between 12 and 3 exceeds tolerance.
Low Distance: 144.641, High Distance: 144.661, Difference: 0.020

HORIZONTAL ADJUSTMENT REPORT
==========

Unadjusted Observations
==========

Control Coordinates: 1 Observations

Sta.	N:	E:	StErr N:	StErr E:
1	10000	10000.000	0.001	0.001

Distances: 14 Observations

From Sta.	To Sta.	Dist.	StErr
1	5	290.45	0.0116
1	2	292.214	0.0116
2	6	52.388	0.0124
2	3	324.186	0.0113
3	4	275.603	0.0115
3	20	134.663	0.0147
20	21	116.073	0.0146
21	22	50.115	0.0144
4	5	309.647	0.0116
5	10	129.985	0.0126
10	11	126.01	0.0125
10	15	10	0.0142
11	12	129.426	0.0126
12	3	144.651	0.0126

Angles: 15 Observations

BS Sta.	Occ. Sta.	FS Sta.	Angle	StErr (Sec.)
5	1	2	109-19'13"	13
1	2	6	190-32'06"	41
1	2	3	096-03'52"	12.8
2	3	4	124-03'53"	13.1
2	3	20	185-23'56"	20.6
3	20	21	180-15'26"	22.5
20	21	22	183-26'45"	12.2
3	4	5	093-02'12"	13.2
4	5	10	039-26'40"	19.3
5	10	11	241-56'29"	8.6
5	10	15	056-23'10"	12.2
10	11	12	114-56'27"	8.6
11	12	3	140-39'24"	8.6
12	3	2	325-54'30"	8.6
4	5	1	117-30'42"	13

Azimuths: 1 Observations

Occ. Sta.	FS Sta.	Bearing	StErr (Sec.)
1	2	N 45-00'00"E	5

Adjusted Coordinates
==========

Adjusted Local Coordinates

Sta.	N:	E:	StErr N:	StErr E:
1	10000	10000	0.001	0.001
5	10125.859	9738.222	0.0153	0.0102
2	10206.625	10206.625	0.0089	0.0089
3	10458.769	10002.881	0.0111	0.0183
4	10435.346	9728.285	0.0183	0.0194
20	10571.01	9928.475	0.0191	0.0268
21	10668.042	9864.776	0.0274	0.0376
10	10228.844	9817.55	0.0152	0.0135
11	10207.941	9941.814	0.0143	0.0134
12	10314.625	10015.112	0.0143	0.014

Adjusted Coordinates Error Ellipses 95% CI

Sta.	Semi Major Axis	Semi Minor Axis	Max. Error Az.
1	0.004	0.004	N 45-00'00"E
5	0.067	0.043	N 10-51'15"E
2	0.045	0.031	N 45-00'00"E
3	0.081	0.046	N 77-38'20"E
4	0.104	0.050	N 47-34'08"E
20	0.119	0.078	N 72-08'02"E
21	0.174	0.102	N 64-12'51"E
10	0.075	0.046	N 37-10'13"E
11	0.068	0.050	N 38-56'28"E
12	0.064	0.058	N 38-41'29"E

Adjusted Observations
==========

Adjusted Distances

From Sta.	To Sta.	Distance	Residual	StdRes.	StdDev
1	5	290.4621	0.0119	1	0.0104
1	2	292.2123	-0.0012	0.1	0.0104
2	3	324.1736	-0.0126	1.1	0.0103
3	4	275.5934	-0.0101	0.9	0.0102
3	20	134.6627	0	0	0.0147
20	21	116.0727	0	0	0.0146
4	5	309.6469	0.0003	0	0.0102
5	10	129.9959	0.0107	0.9	0.0107
10	11	126.0102	0.0000	0	0.0108
11	12	129.437	0.011	0.9	0.0108
12	3	144.6625	0.0118	0.9	0.0113

Adjusted Angles

BS Sta.	Occ. Sta.	FS Sta.	Angle	Residual	StdRes	StdDev(Sec)
5	1	2	109-19'21"	7.4	0.6	9.5
1	2	3	096-03'36"	-15.5	1.2	8.5
2	3	4	124-03'52"	-1.5	0.1	9.1
2	3	20	185-23'56"	0	0	20.6
3	20	21	180-15'26"	0	0	22.5
3	4	5	093-02'11"	-0.1	0	8.9
4	5	10	039-26'44"	4.1	0.2	10.4
5	10	11	241-56'32"	2.5	0.3	8.2
10	11	12	114-56'33"	6.0	0.7	8.1
11	12	3	140-39'32"	7.5	0.9	7.8
12	3	2	325-54'36"	6.5	0.8	7.2
4	5	1	117-31'00"	17.2	1.3	9.3

Adjusted Azimuths

Occ. Sta.	FS Sta.	Bearing	Residual	StdRes	StdDev(Sec.)
1	2	N 45-00'00"E	0	0	5

Statistics
==========

Solution converged in 2 iterations
Degrees of freedom:6
Reference variance:1.83
Standard error unit Weight: +/-1.35
Passed the Chi-Square test at the 95% significance level
0.680 <= 10.955 <= 18.550

Sideshots
=========

From	To	Bearing	Dist.	N	E	StDev. N	StDev. E
2	6	N 55-32'06"E	52.388	10236.272	10249.817	0.0114	0.0136
21	22	N 29-50'17"W	50.115	10711.514	9839.841	0.0396	0.0383
10	15	N 86-00'27"W	10	10229.54	9807.574	0.0135	0.0196

LEAST SQUARES VERTICAL ADJUSTMENT REPORT

Tue Jul 16 21:03:16 2002
Input File: D:\lsdata\cgstar\CGSTAR.CGR
Output File: D:\lsdata\cgstar\CGSTAR.RPT
Curvature, refraction correction: ON

FIXED VERTICAL BENCHMARKS

Station Elevation
1 900.0000

POINTS TO BE ADJUSTED

Station
5,2,3,4,10,11,12

MEASUREMENT SUMMARY

From	To	Elev. Diff. (unadjusted)	Length (weights)
1	5	7.504	290.4502
1	2	7.5659	292.2135
2	3	6.9833	324.1861
3	4	-11.4907	275.6035
4	5	4.3557	309.6466
5	10	2.2647	129.9852
10	11	1.0938	126.0102
11	12	0.3836	129.4259
12	3	3.36	144.6507

ADJUSTED ELEVATIONS

Station	Adjusted Elev	Standard Dev.
1	900	0
5	907.4862	0.02438
2	907.5838	0.02443
3	914.5869	0.02832
4	903.1124	0.03091
10	909.7506	0.02836
11	910.8441	0.03016
12	911.2273	0.03026

ADJUSTED MEASUREMENT SUMMARY

From	To	Elev. Diff. (adjusted)	Residuals
1	5	7.4862	-0.0178
1	2	7.5838	0.0179
2	3	7.0031	0.0199
3	4	-11.4745	0.0162
4	5	4.3739	0.0182
5	10	2.2644	-0.0003
10	11	1.0935	-0.0003
11	12	0.3832	-0.0003
12	3	3.3596	-0.0004

Sideshots

Station	Elevation
20	901.918
21	911.404
22	910.293
15	909.751

Field to Finish 5

Field to Finish

Function

The Field to Finish command turns data collector field notes into a final AutoCAD drawing, by matching the descriptions of the field points with user-defined codes. The points are brought into the drawing with attributes defined by the code, including layer, symbol, size, line type, etc.

Two files are used in Field to Finish - a data file and a code file:

- The data file is the current Autodesk Land Desktop point database, consisting of point names, coordinates and text description fields. The description fields contain codes for the Field to Finish processing.
- The code file defines the layer, symbol, size and other actions to apply with each code.

Field to Finish can translate the field points into Autodesk Land Desktop points with symbol, layer, and size defined by the code. The Point Defaults command under the Points menu contains the settings for labeling the description, point number, and elevation, as well as locating the point at zero or at the real Z. The Draw-Locate Points command provides a simpler method for drawing points compared with Field to Finish.

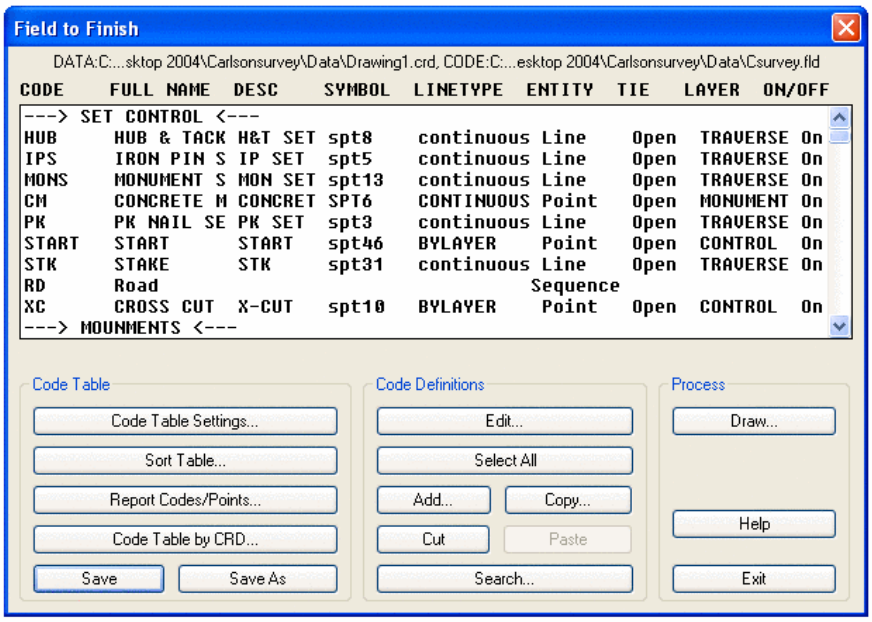
NOTE: Carlson Survey Desktop (CSD) also allows for conversion from a Carlson raw file (RW5) into a Autodesk Land Desktop raw file (FBK). The Edit-Process Raw file command in CSD can process an RW5 file. The purpose of the Fieldbook conversion is for processing the raw data through the Autodesk Land Desktop Fieldbook instead. This Fieldbook conversion is located in the Data Collection features as a button called Convert RW5 to Fieldbook and in the Edit- Process Raw Data command under File->Export->Fieldbook.

There are two different methods for connecting linework in Field to Finish. One method creates line work by connecting points with the same code. The line type is defined by the code, either as points only (no line work), lines, 2D polylines, or 3D polylines (breaklines). Distinct lines with the same code are defined by adding a group number to the end of the code name in the data file. With this method, all points with the description CODE1 will be one line, and points with CODE2 will be another line. Both CODE1 and CODE2 use the definition for CODE (e.g., the code EP could be a code for edge of pavement that is to be connected as 3D polylines. If there are two separate edge-of-pavement lines on the left and right sides of a road, all the points for the left side could have the description EP1 and the points on the right side could be EP2).

The second method is the PointCAD format. This method also connects points with the same code. The difference is that instead of using a number after the code for distinct lines, you use the same code with an additional code for starting and ending the line. (e.g., +0 is used to start a line and -0 to end. So the coding for a segment of edge of pavement could be EP+0, EP, EP, EP-0). Another special code that has been added to Field to Finish is +7, -7. This 7 code will use the line type definition of line, 2D polyline or 3D polyline defined by the Field to Finish code. (e.g. if EP is defined as a 3D polyline, then the coding EP+7, EP, EP, EP-7 will create a 3D polyline. Otherwise codes like +0, -0, which is defined as start and end line, will draw EP as a line).

- The advantage of the PointCAD method is that you do not have to keep track of line numbers. If you are surveying 50 curb lines, the first method would require you to use 50 distinct curb numbers.
- The advantage to the first method is that you do not have to use the start and end codes. Additionally, the Nearest Found connection option applies only to the first method.

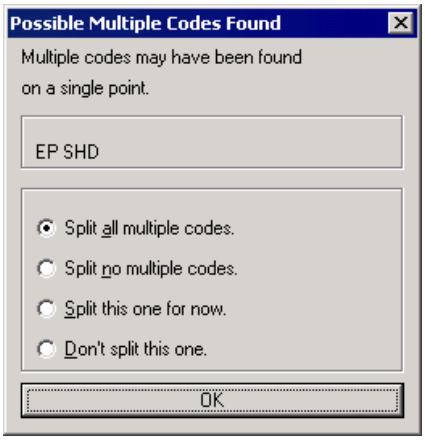
The main Field to Finish dialog box (shown below) allows you to load the data and code files, view and edit the code definitions, and then process the files.



CSD points in the drawing have point attributes, including a description. When Field to Finish draws the points, the point description from the data file is processed to match a code. The code then defines the description drawn with the point (e.g., consider a code of "UP" with a description of "POLE" and a data point with the description "UP". The data point description "UP" would be matched with the code "UP" and the point would end up being drawn with the description "POLE". A special character "/" (the divide key) can be used for an unprocessed description to append. Everything after the "/" is added directly to the point description and is not considered a code. In other words, a data point with the description "UP / 150" with the same code "UP" definition above would be drawn with the description "POLE 150").

Multiple codes are defined by including each code in the point description field separated by a space. A single data point can be used in different lines by assigning it multiple codes. For instance, a point might be part of both a curb line and a driveway line with a description of "CURB DRW". Field to Finish uses spaces as the delimiter for multiple codes.

You should avoid spaces in the descriptions except for where multiple codes are intended or after the "/" character (e.g., a code for a light post should not be "LGT POST" but instead might be "LGTPOST"). When Field to Finish detects spaces in the descriptions at start up, you will be asked whether or not to process the multiple codes.

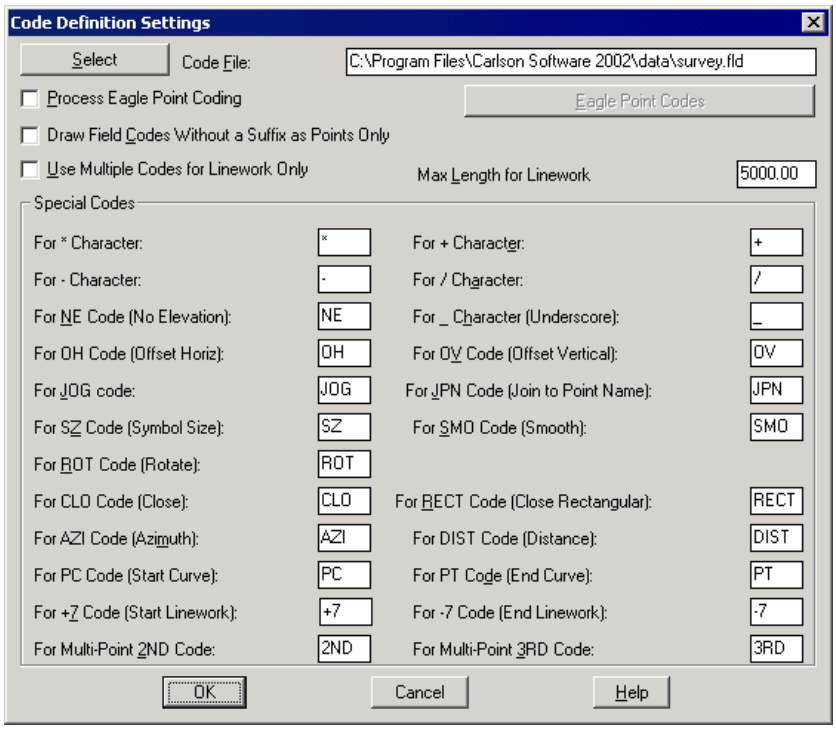


Using the Main Field to Finish Dialog

The main Field to Finish dialog is shown above

Code Table Settings

- **Code Table Settings**: Opens the Code Definition Settings dialog shown below.



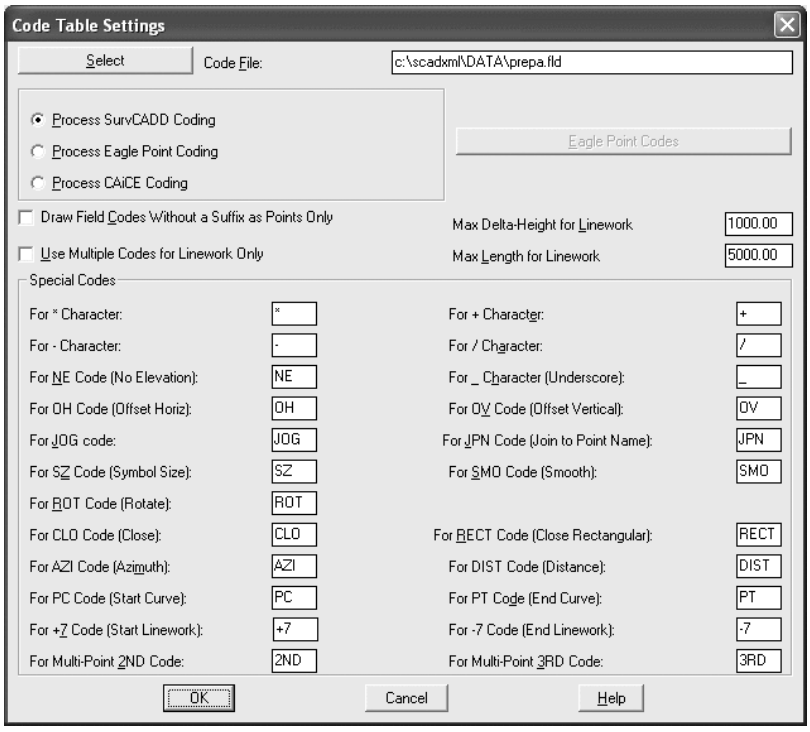
  - **Select**: Specifies a new code table. The name of the current table is shown in the field to the right of this button.
  - **Process Eagle Point Coding**: When selected, this option allows you to switch from interpreting coordinate files based on the Field to Finish method, to interpreting coordinate files using the Eagle Point Data Collection method.

Currently the supported designators include, Line, Curve, Close Line, Stop Line, Insert Description and Bearing Close. Also supported is the ability to recognize overwriting of descriptions, similar to Eagle Point, by using the space separator instead of the Insert Description designator. Examples of supported coding are as follows:

.TC	Places a node and or line per the field code library.
TC.	Places a node and or line per the field code library
.TC	Specifies a point on a curve.
TC-	Specifies a point on a curve.
..TC	Stops the line.
TC!	Stops the line.
.TC+	Closes the line back to the starting point.
TC+	Closes the line back to the starting point.
.TC#	Typically coded on the third corner of a rectangle, to close the figure with having to locate the fourth corner.
TC#	Typically coded on the third corner of a rectangle, to close the figure with having to locate the fourth corner.
WV.W1	Places a node as specified by the code WV in the field code library, and then begins a line as specified by code W in the field code library.
.TC.EP.FL	Results in three lines coming together.
TC1.TC2.TC3	Results in three lines coming together. All three lines are specified by the definition of the single code TC in the field code library.
TC.TC1	When used in conjunction with the Draw Field Codes Without a Suffix as Points Only toggle, TC will be recognized as the node, and TC1 will be recognized as the line, so that if the code TC in the field code library is defined as a polyline, line or 3D polyline, duplicate lines will not be unintentionally placed when this shot only pertains to a single element. Keep in mind that all line work must have a numeric suffix when using this toggle.
TREE * OAK	Result on screen would be: TREE OAK
TREE OAK *	Result on screen would be: OAK TREE
TREE OAK	Result on screen would be: OAK
TC1!.TC2-.VLT6#	Stops TC1, continues TC2 as a point on a curve and closes VLT6 as a rectangle using the Bearing Close code.

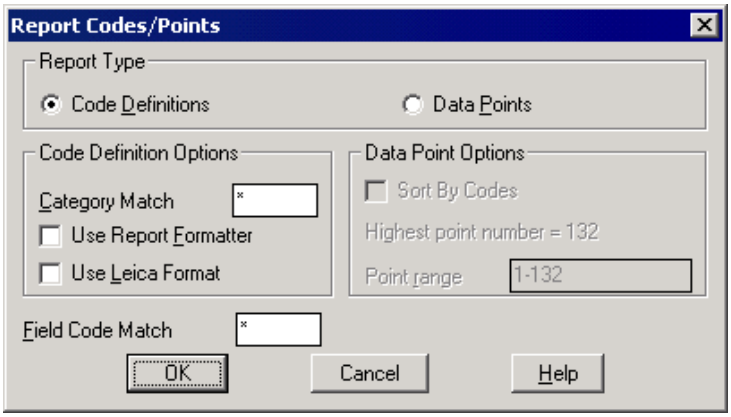
NOTE: The use of the Use Multiple Codes for Linework Only toggle is recommended when using Eagle Point Coding.

- **Use Multiple Codes for Linework Only**: When checked, and multiple codes are detected, only linework will be drawn for the secondary codes. Points are only created based on the primary code. If you want symbols for all multiple codes, uncheck this setting.
- **Max Length for Linework**: Specifies the maximum length that Field to Finish will draw any section of linework.
- **Max Elevation Difference for Linework:** With CSD, under the option Code Table Settings (shown below), you can limit the elevation difference within which linework will connect (i.e. if you were taking fence line shots on a ridgeline fence, then took a series of fence line shots in the valley, the ridge linework would stop and not connect to the valley linework if the elevation exceeded an entered amount). If you wish to disable this "elevation detection" for linework, keep the setting for the elevation high, as shown below in the upper right of the dialog.



– **Special Codes**: This section allows you to specify your own code for commands such as start curve, end curve, and offsets. See Special Codes below.

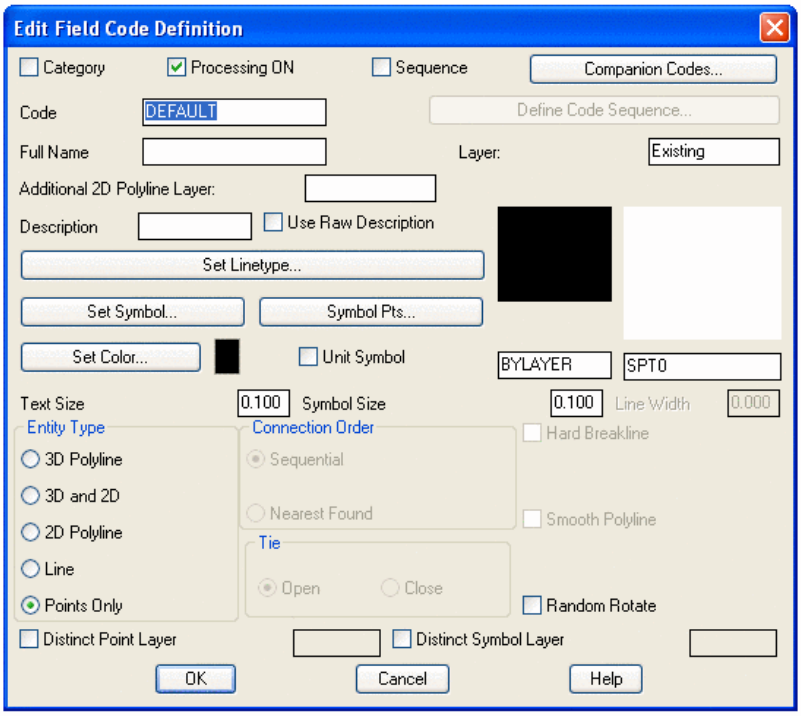
- **Sort Table**: Sorts the code table by either code name or layer.
- **Report Codes/Points:** Opens the dialog box shown below, and prints the code table or the data file to the screen, file, or printer. A useful option is to print the data file and choose Sort by Codes, grouping the data points by distinct codes.



- **Code Table by CRD**: Creates code table definitions based on the data file field descriptions. This is useful when creating a code table from scratch.

Code Definitions

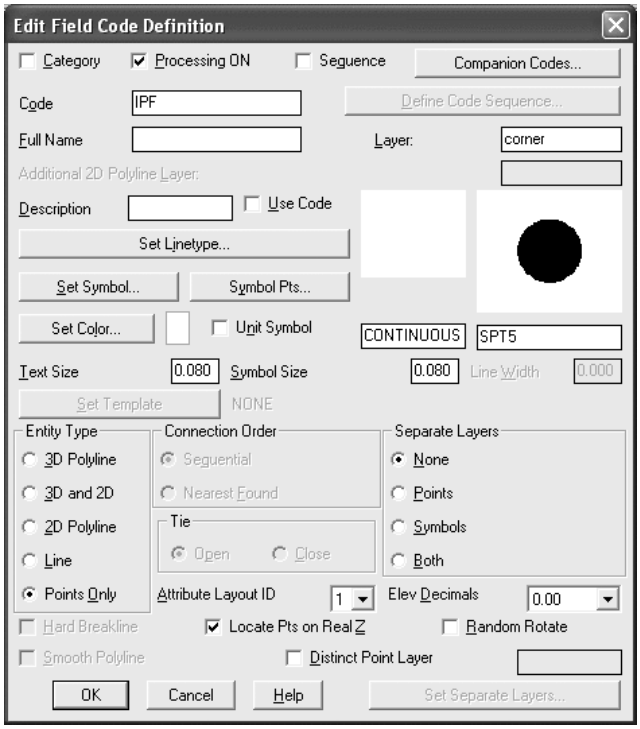
- **Edit** - This command opens the Edit Field Code Definition dialog box (shown below). The currently highlighted code will be edited.



- **Category**: This optional field that can to used to help organize your codes. A category is not used for processing and only is useful in viewing and printing.
- **Sequence**: Specifies a sequence type code. Sequences are described above in this section.
- **Define Code Sequence**: Sets the code names that make up the sequence.
- **Processing ON**: This toggle controls whether this code will be processed.
- **Code Name**: The key name that identities the code and is matched with the field data descriptions.
- **Layer**: The point and line work for the code will be created in this layer.
- **Full Name**: This is an optional field that describes the code for viewing.
- **Description**: This value is assigned to the point description field. An additional description can be added to a point by entering it after a forward slash in the data description field.
- **Use Code**: Turns off the Description field described above. Instead, the points will be drawn with their original unprocessed descriptions.
- **Linetype**: Line work can be drawn in any of the special linetypes, or with the linetype for the layer (BYLAYER). The spacing and size of the special line types is determined by the AutoCAD LTSCALE system variable and by the line type settings from the Annotate Defaults command. The special line type Hedge is drawn with a user specified width. The special line type Userdash is drawn with user specified distances for the length of the dash and the length of the gap between dashes. You will be prompted for this information when you select that line type. CSD also offers continuous linetypes to Field-to-Finish. When you select Linetype or Set Linetype in the Edit options, you can choose among the individual entity linetypes (first group of selections) and the true continuous linetypes (second part of the selections). The difference in these linetypes is illustrated by the Copy command. A fence line made up of individual entities, when copied by a single selection pick, will copy only the single entity picked (e.g. the polyline but not the X's). A continuous linetype will copy or offset as one entity, including the X's in the fence.
- **Symbol**: This is the point symbol for the code. To avoid drawing a symbol, use the Carlson Survey symbol named SPT0.
- **Color**: The line work will be drawn in this color. The default is BYLAYER.
- **Symbol Size**: This is a scaler value that is multiplied by the horizontal scale to obtain the actual size in AutoCAD. The horizontal scale can be set in Drawing Setup.

- **Text Size**: This is a scaler value that is multiplied by the horizontal scale to obtain the actual size.
- **Unit Symbol**: Draws the point symbol at unit (1:1) scale (e.g. this option could be used for a symbol that is already drawn to actual dimensions, such as a car symbol).
- **Set Template**: For 3D polyline codes, this option allows you to assign a template (.TPL) file to the code. The code points act as the centerline for the template, and the program will draw parallel 3D polylines for each break point in the template.
- **Entity Type**: Defines the line type to be created. Points-only does not create any line work. 3D Polyline can be used for breaklines.
- **Hard Breakline**: This will tag the 3D polylines created with this code as hard breaklines. In Triangulate & Contour, contours are not smoothed as they cross hard barriers.
- **Separate Layers**: Controls the layers of the point and symbol attributes. With None, the point layers are the standard layers, PNTNO, PNTELEV and PNTDESC, and the symbol layer is PNTMARK. With Points or Both, the point attribute layers begin with the layer for the code followed by the attribute type. In other words, a DWL code with the layer name DRIVEWAY would have the point attributes DRIVEWAYNO, DRIVEWAYELEV and DRIVEWAYDESC. With Symbols or Both, the symbol attribute layer begins with the layer for the code, followed by MARK.
- **Smooth Polyline**: This applies a modified bezier smoothing to the polyline. The smoothed polyline will pass through all the original points.
- **Connection Order**: The points of a distinct code can be connected in their point number order or by nearest found which makes the line by adding the next closest point.
- **Tie**: When checked, the linework drawn with this code will always close. For example if you have points 1, 2, 3, and 4 with the code BLDG (Tie is on for the code BLDG), then the linework will be drawn from point 1 to 2 to 3 to 4 and then back to point 1, closing the figure.
- **Precision**: Controls the display precision for the elevation label.
- **Attribute Layout ID**: Controls the location of the point number, elevation and description. These attribute layouts are defined in AutoCAD drawings that are stored in the CSD SUP directory with the file name of SRVPNO plus the ID number (i.e. SRVPNO1.DWG, SRVPNO2.DWG, etc.). If you want to change the attribute positions for a layout ID, open and edit the associated SRVPNO drawing. This allows you to assign a different point display Style (referred to as the attribute layout ID) with each particular code. This option is also available when multiple codes are selected. The option appears in the Multiple Set dialog. By selecting different attribute ID's, you can set the location of the point number, elevation and description with respect to the node of the point, change the rotation, or set the font and color of these attributes. New ID Layouts are made by loading the file for Srvpno1.dwg or Srvpno2.dwg, or any of the Srvpnox.dwg files found in the SUP subdirectory. The attributes and their colors can be edited and re-saved as a new Attribute Layout ID. To save as ID 6, for example, use SaveAs and save the file as Srvpno6.dwg.
- **Locate Pts on Real Z Axis**: Draw the points at the actual point elevation. Otherwise, the points are drawn at zero elevation (e.g. you could turn this option off for the FH, for fire hydrant code to drawn them at zero. The GND code could then have this option On, to draw the ground shots at their elevations).
- **Random Rotate**: Randomly rotates the symbol (e.g. this option could be used for tree symbols, in order to have the trees drawn in various orientations).
- **Line Width**: Controls the width for the linework. Only applies to 2D polylines.
- **Distinct Point Layer**: When this toggle is selected, the line work is created in the layer defined in the Layer field, and the points are created in the specified distinct point layer (e.g. DRIVEWAY for linework and DRIVEWAY_PNT for the points).
- **Entity Type (3D and 2D)**: Allows polylines to be drawn as both 3D and 2D. When selected, the Additional 2D Polyline Layer option, near the top of the standard Edit dialog, allows you to place the 2D polyline on a different layer than the 3D polyline. A curved polyline, coded with the PC or equivalent Start Curve code, would plot with a true arc for the 2D polyline and with a series of 3D interpolated vertices through the arc, in the case of the 3D polyline.

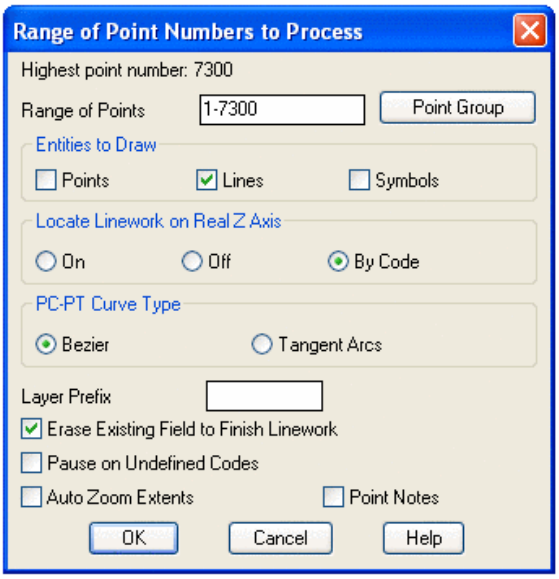
- **Add**: New code definition is inserted in the list in the position after the one currently selected. If none are selected for positioning, the new code is placed at the top. Only one code definition may be highlighted before running this command.
- **Copy:** Copy command requires that you first select and highlight a single code. It will capture all the settings in the standard Edit dialog, but leave the code name blank, requiring entry of a new code name. Copy might be used to add a new IPF (iron pin found) by borrowing from IP, changing nothing but the symbol, as shown below:



- **Cut**: Removes the highlighted code definitions from the list and puts them in a buffer for retrieval with Paste.
- **Paste:** Inserts code definitions placed in the buffer by the Cut command. These codes will be inserted after the row of the currently highlighted code, or at the top.
- **Search**: Allows you to search for a specific code in the list.
- **Save**: Saves the Field to Finish code list (.FLD) file.

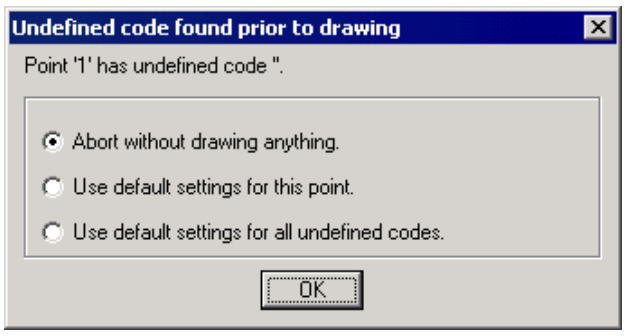
Process

- **Draw :** Leads to a dialog (shown below) that controls the range of points to process. With CSD, this dialog also controls whether only points, only lines, or lines and points are plotted. If you choose to plot lines only, this will be the default until changed.



- **Range of Points**: Specifies the range of points to draw.
- **Point Groups**: Point Groups are another way of defining a range of points to plot. Point Groups can be defined using the Point Group Manager under the Points pulldown menu, and include points sharing certain descriptions, elevation ranges, locations on the screen, etc.
- **Locate Points on Real Z Axis**: Choose between locating all the points at real Z elevation, all at zero elevation, or to use the real Z setting as defined in the individual codes.
- **Locate Linework on Real Z Axis**: Choose between locating all the linework at real Z elevation, all at zero elevation, or to use the real Z setting as defined in the individual codes.
- **PC-PT Curve Type**: Sets the method for drawing curves with more than 3 points. The Bezier option draws a smooth polyline through all the curve points. The Tangent Arcs method draws multiple arcs with arc end points at each of the curve points. These arcs are tangent to the preceding line segment.
- **Erase Existing Field to Finish Linework**: When checked, this option will erase from the drawing any old linework entities created by previous Field-To-Finish runs before drawing the new entities.

- **Layer Prefix**: Optional layer prefix added to all entities drawn with Field to Finish.
- **Pause on Undefined Codes**: When checked, Field to Finish will pause if it encounters a description that is not defined in the code table and show the dialog box below. A good way to check the data file for unmatched descriptions is to use the Print Table command and choose the Data Points and Distinct Code options. This command will print the different codes in the data file and identify any undefined codes.



- **Abort without drawing anything**: Lets you stop to correct the code table.
- **Use the default settings for this point**: This default is to draw a point in the MISC layer with no linework. To set your own default, define a code called SC_DFLT.
- **Use the default settings for all undefined codes**: Continue processing and use default code for all undefined codes.

- **Preview Only**: When checked, this option will temporarily draw the points and linework and allow you to review it with zoom and pan.
- **Auto Zoom Extents**: When checked, this will force a zoom extents after Field to Finish is done.

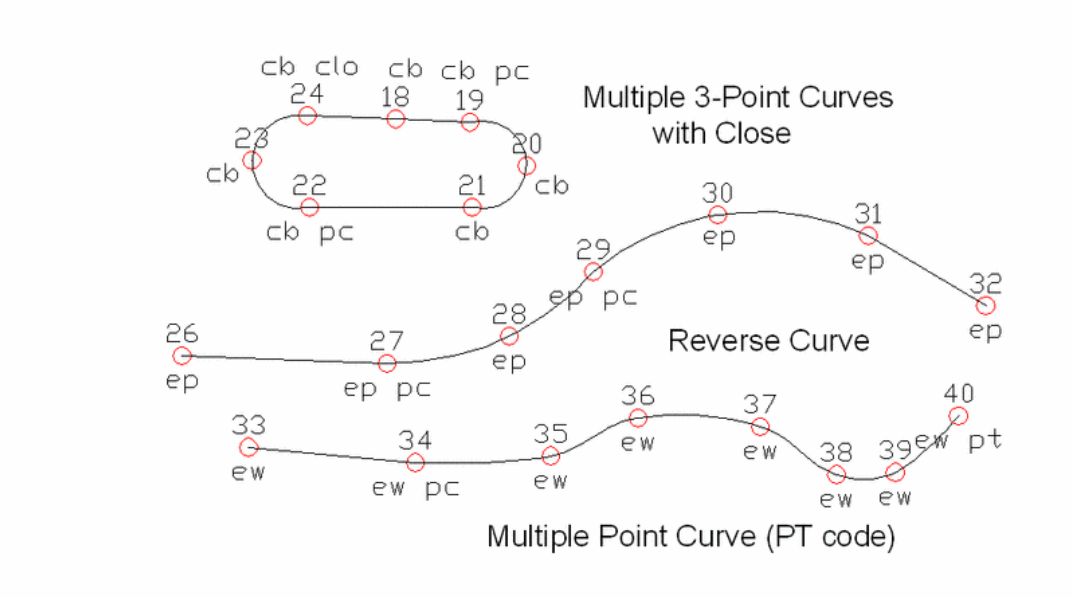
Special Codes

Field to Finish recognizes several special codes suffixes. A special code comes after the regular code. A space separates the codes. Here is a listing of the default special codes.

- **PC**: Begins a three point arc. The point with this special code is the first point on the arc. The next point with the code is considered a point on the arc, and third point with the code is the arc endpoint. Example (in point number, X, Y, Z, description format):
  - 10, 500, 500, 0, EP PC - start curve
  - 11, 525, 527, 0, EP- second point on curve
  - 12, 531, 533, 0, EP- end point of curve

NOTE: Point 12 (above) can be another PC, with descriptions EP PC, to create a reverse or compound curve (see the example graphic below).

- **PT:** A special code that can be used with PC to define a curve with more than three points. Starting at the point with the PC, the program will look for a PT. If the PT is found, all the points between the PC and PT are used for the curve, which is drawn as a smoothed polyline that passes through all points, and only curves the polyline between points. If no PT is found, then the regular three point arc is applied.

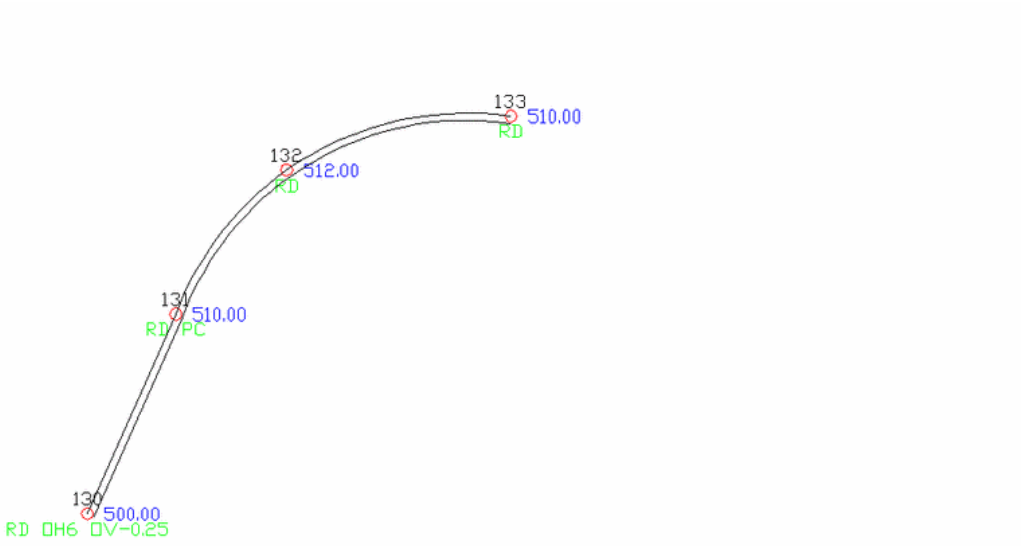


- **CLO:** Forces the lines drawn between a series of points with the same code to close back to the first point with the same code (e.g., shots 1-4 all have the BLD description with the exception of point 4. Its description is BLD CLO. This forces the linework drawn for the BLD code to close back to point 1, which is the first point with the description of BLD).
- **NE:** Represents no elevation. A point with this special code is located at zero elevation.
- **OH & OV:** The codes OH and OV stand for offset horizontal and offset vertical. These offset codes apply to 2D and 3D polylines. A single set of offset codes can be used to offset the polyline a set amount. Example:

  – 10, 500, 500, 100, EP OH2.5 OV-.5
  – 11, 525, 527, 101, EP
  – 12, 531, 533, 103, EP

  This creates a polyline connecting points 10,11 and 12 and an offset polyline with a 2.5 horizontal and -0.5 vertical offset. The direction of the horizontal offset is determined by the direction of the polyline. A positive horizontal offset goes right from the polyline direction and a negative goes left. The horizontal and vertical offset amounts start at the point with the offset codes until a new offset code is found, or the end of the polyline. Only one horizontal and vertical offset can be applied to 2D polylines. For 3D polylines, multiple offset codes can be used to make a variable offset. Example:
  – 10, 500, 500, 100, EP OH2.5 OV-.5
  – 11, 525, 527, 101, EP OH5.5 OV-.75
  – 12, 531, 533, 103, EP OH7.5

  This offsets the first point horizontal 2.5 and vertical -0.5, the second point horizontal 5.5 and vertical -0.75 and the third point horizontal 7.5 and vertical -0.75. A standard single horizontal and vertical offset on a 3D polyline is shown below:

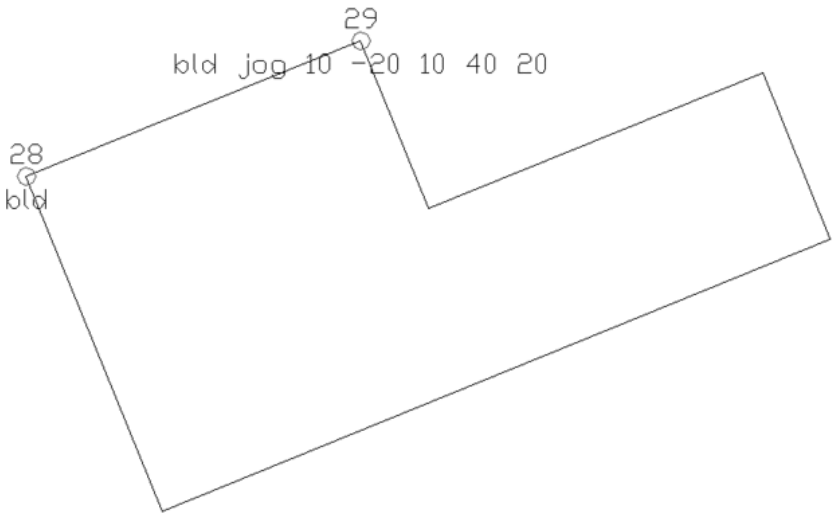


- **SZ:**Sets a different symbol size. The value of the new symbol size is specified after the SZ (e.g. SZ0.2). This value is a size scaler, multiplied by the current drawing scale to determine the actual drawn size (e.g., a drawing scale of 50 and a symbol size scaler of 0.2 would make the drawn symbol size 10).

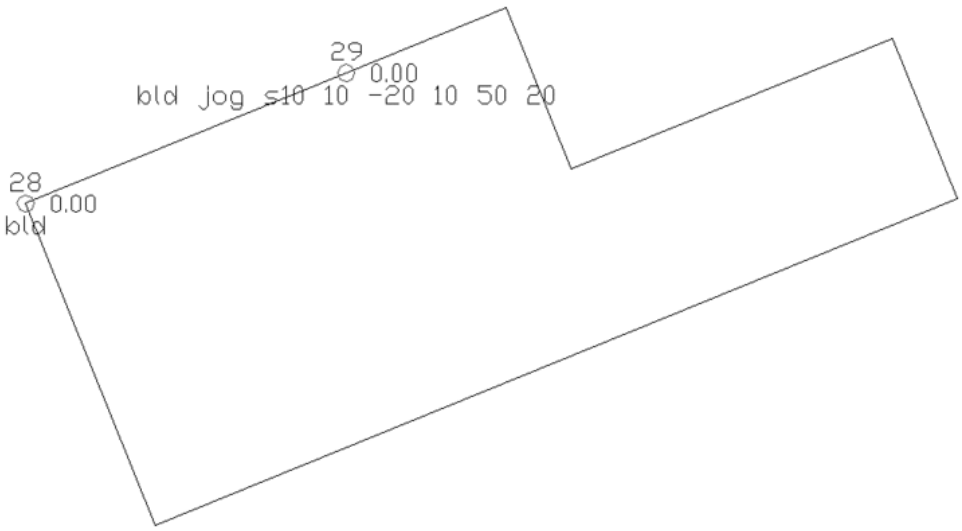
- **ROT:** Sets the rotation of the point symbol. If a point number follows the ROT code, then angle from the

current point to this point number is used for the rotation (e.g., ROT45 would rotate the symbol toward point number 45). If there is no point number after the ROT code, the rotation point is the next point number with the same code as the current point.

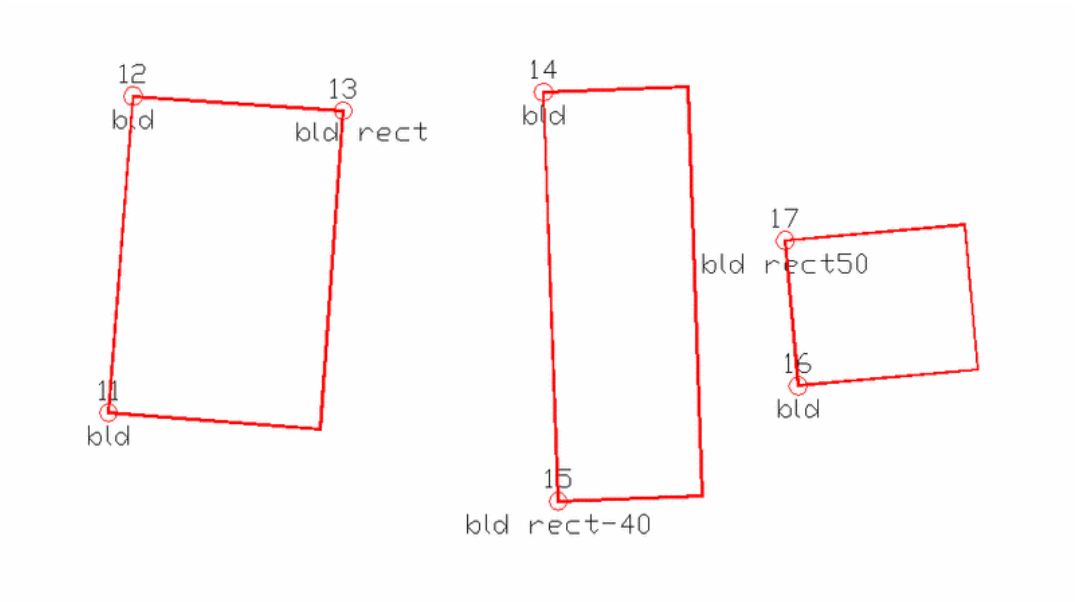
- **SMO:** This code is used to smooth the polyline.
- **SCA**: This code is used to control multi-point symbols described later in this section.
- **AZI & DIST:** The AZI and DIST codes are used together to locate an offset point. The AZI sets the offset azimuth and DIST sets the distance. The values should directly follow the code (e.g., AZI25 DIST4.2 would draw the point offset 4.2 at an azimuth of 25 degrees).
- **JOG Special Code:** Allows for additional points to be inserted into the line work at perpendicular offsets. Only offsets should follow the JOG code. Positive numbers indicate a jog to the right and negative numbers indicate a jog to the left. Alternatively, "R#" and "L#" can be used where # is the distance to either the right or the left (e.g.,"BLDG JOG R5 L12.2 L5 L12.2" [also "BLDG JOG 5 -12.2 -5 -12.2"] draws a closed rectangle on the right hand side of an existing line). The offsets are always done in the X-Y plane. If the current line is vertical, an offset to the right is along the positive X-axis. Just as "cb pc" shown above uses the "pc" special code to launch into a 3-point arc, by default, the jog special code, following any normal user-defined code, enables the entry of left and right "jogs" or segments of a polyline. This is useful for drawing buildings based on tape measurements, as opposed to trying to physically survey each building corner by total station or GPS. The key is to take 2 measurements on a building, which establishes a "line" or vector. Assuming you used bld for building, the second bld would be followed by the reserved word "jog", which in turn would be followed by the left and right measurements in the form of bld jog 10 -20 10 40 20. The "-" or negative sign indicates a left-hand jog. All jogs are at right angles to the previous segment. With CSD, the JOG option no longer creates duplicate points for each jog segment. The additional segments are drawn with no associated point numbers, minimizing point file size.



- **Straight JOG within JOG command:** It is possible to add a straight jog instead of the conventional right and left jogs. This is done by using the S# option (i.e. S10, for 10 units), which must follow the JOG expression. You cannot use S10 as a reserved, "understood" command unless it follows JOG. Use this straight jog option when there is a need to extend the vector of the first two building points surveyed. If you cannot obtain a shot at the true, second building corner, take two shots where you can obtain them, measure the additional distance to the true corner, and record it as a straight jog. Here is a graphic example:



- **JPN:** The JPN (Join to Point Name) special code joins to the point named immediately after the code (e.g., JPN205 draws a line from the current point to the point 205).
- **RECT:** Causes a rectangle to be formed on a 2D or 3D polyline using one of two different methods. If a number follows RECT (e.g., RECT10), a rectangle will be drawn 10 units to the right of the last two points ending on the point with the RECT code. Use a negative offset to place the rectangle on the left side (e.g., RECT-2.5). If no number follows RECT, the polyline will be closed by shooting right angles from the first point of the polyline and the current point, and creating a new point where those two lines cross.



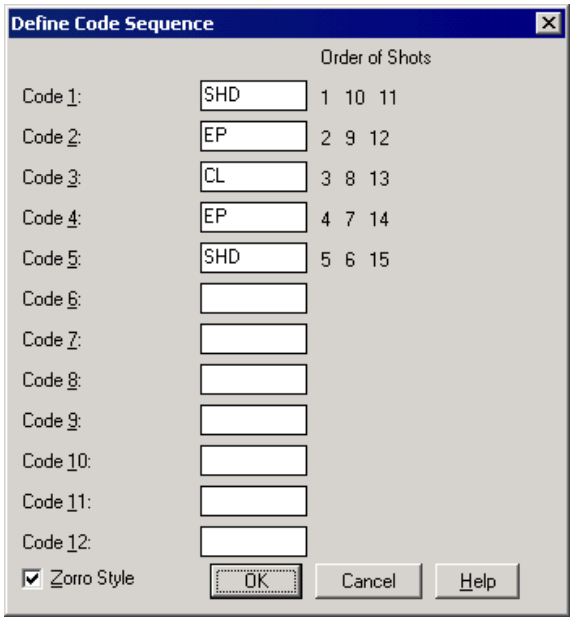
NOTE: *You may substitute your own code for any of these special codes in the Code Definition Settings dialog shown.* Field to Finish will layer the points and linework according to these code definitions. If the layers are not already defined, Field to Finish will create the necessary layers and assign different colors.

Sequences

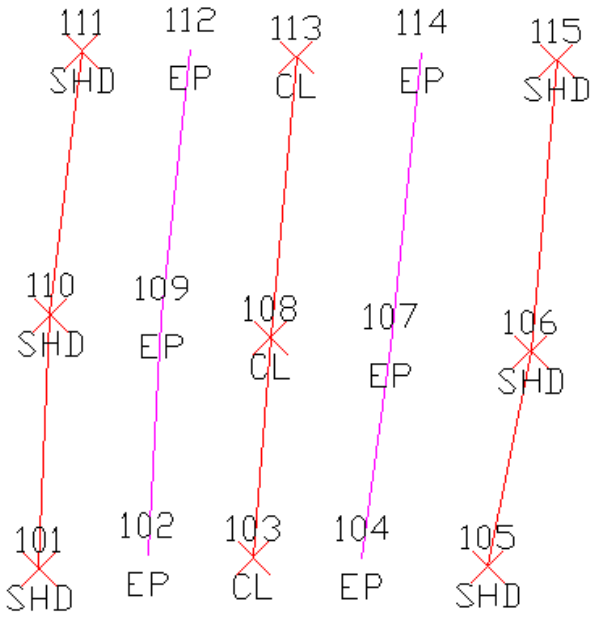
Sequences are a way to simplify field entry of a sequence of codes. For example, a road cross-section might

be entered as SHD1 EP1 CL EP2 SHD2. Instead of entering these descriptions individually, one sequence definition can store these descriptions in order. Then, just the sequence code (such as RD) is used in the field. The cross-section can be shot in left right then left right order, right left then right left order, or alternating left right then right left order (the alternating method is known as Zorro style). However, shots must always start from a right or left edge.

1. To set up a sequence, choose the Sequence toggle in the Edit Code dialog.
2. Select the Define Code Sequence button. This brings up a dialog for entering the sequence codes in order.
3. Sequence codes should be defined as normal codes somewhere else in the Field to Finish code table (e.g. SHD as a 3D polyline).



The illustration below demonstrates usage of a sequence code.



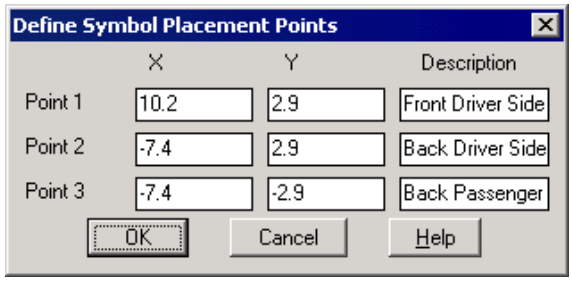
In the field, this template code is used for all the cross-section shots (i.e. RD for all the points). Later, Field to Finish will substitute this template code with the sequence codes (i.e. substitute RD with SHD).

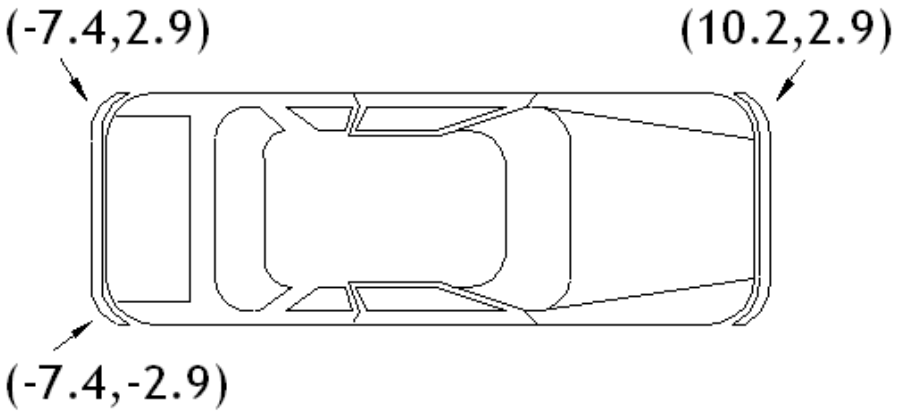
Symbol Points

For each code definition, the symbol insertion points can be defined with up to three points. To define the symbol insertion points, choose the Symbol Pts button in the Edit Code Definition dialog box.

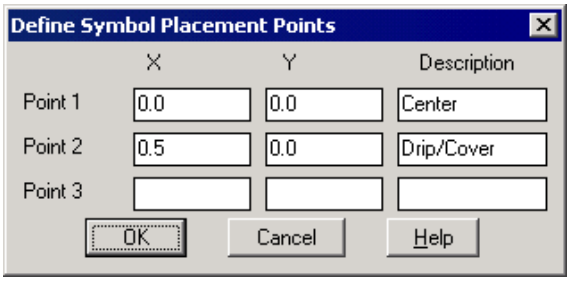
- To activate symbol points, use the command 2ND 3RD after the description (e.g. CAR 2ND 3RD). Then, for a two point rotation and scale, follow with a second point and description. For a three point rotation and scaling (allowing distortion of the dimensions - scaling in two directions), follow with a thrid point with description. The shortened form CAR 2ND will initiate the symbol point logic in the case of a two point rotation and scale. CAR ROT will rotate and scale a two point symbol definition.

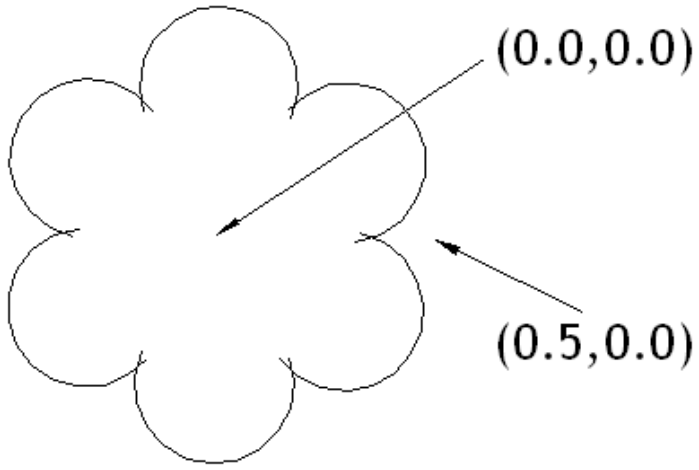
- By default, the symbol insertion is defined by one point at the symbol center (0,0). A one point insertion definition can be used to insert a symbol offset from the center.
- With a two insertion point definition, the program will rotate and scale the symbol (i.e. two insertion points can be used to insert a tree symbol to size the tree, where the first point is for the tree center and the second is for the drip line).
- With a three insertion point definition, the program will rotate and scale the symbol in both X and Y (i.e. three points can be used to insert a car symbol with the first point being the front driver side, the second point as the back driver side (to rotate and scale the length) and the third as the back passenger side (to scale the width).
- Besides the insertion point coordinates, you can define a description for each point used for the drawn point description, for prompting in the Insert Multi-Point Symbol command. See a three point symbol example below:





The coordinates for the insertion point definitions are for the symbol at unit size. To figure these coordinates, you will need to open the symbol drawing (.DWG) file. By default, the symbols are located in the CSD SUP directory (e.g., to make an insertion point for the tree drip line, open the tree symbol drawing and find the coordinate at the edge of the tree symbol (in this case 0.5,0.0)). Shown below is a two point symbol example:

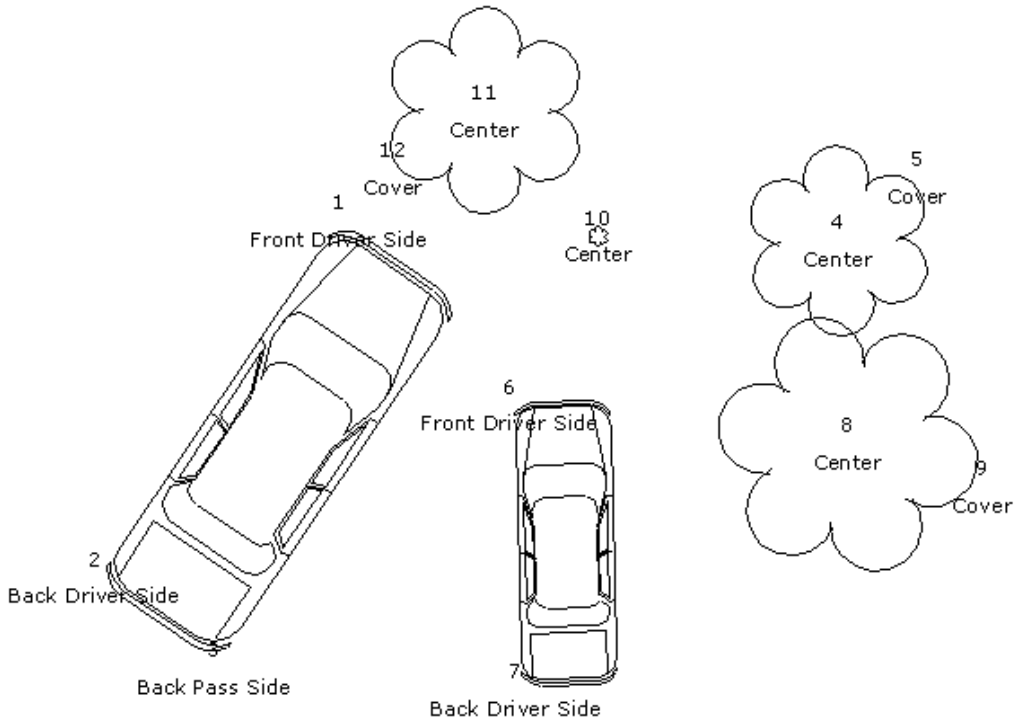




Not all of the symbol insertion points need to be used when drawing the points. If a code definition has three insertion points, it is possible to use only one or two. There are special codes to associate multiple points to the same symbol.

- The first code point is used as the first symbol insertion point.
- The 2ND code is used to specify the second symbol insertion point. A point number can follow the 2ND to identify a specific point. Without the point number, the program will use the next point with the current code. So a car would be drawn by a single point with description (e.g. from point 45, Car 2ND46). 46 in this example scales the car from point 45 to 46, according to the first two reference coordinates specified in the Symbol Points dialog.

- The 3RD code is used to specify the third symbol insertion point. Just as with the 2ND code, a point number after the 3RD is optional. The 2ND and 3RD codes should be assigned to the first point (e.g., consider a code "CAR" with a three point symbol insertion definition. If the first point has a description of "CAR 2ND 3RD", then point one will be used as the first symbol insertion point, and the next two points with the CAR description will be used as the second and third symbol insertion points).



PointNo.	Northing(Y)	Easting(X)	Elev(Z)	Description
1	5110.7	4931.8	0.0	CAR ROT SCA
2	5019.6	4870.4	0.0	CAR
3	4991.6	4911.9	0.0	CAR
4	5120.4	5147.5	0.0	TREE ROT
5	5133.8	5167.8	0.0	TREE
6	5040.8	5019.3	0.0	CAR ROT
7	4968.9	5021.2	0.0	CAR
8	5035.0	5151.4	0.0	TREE ROT
9	5029.1	5184.5	0.0	TREE
10	5122.3	5046.5	0.0	TREE
11	5175.1	4998.8	0.0	TREE ROT
12	5161.7	4976.1	0.0	TREE

Prerequisite: A data file of points with descriptions.
Keyboard Command: fld2fin

COGO Commands 6

Inverse

Function

This command reports the bearing/azimuth and horizontal distance between two points. The command prompts for a series of points. Use the appropriate object snap mode to select the points from the screen or use the point numbers to reference coordinates stored in the current coordinate database. The results are then displayed.

Prompts

Calculate Bearing & Distance from starting point?

Traverse/Sideshot/Options/Arc/Point number or pick point: 2072

Use point number 2072, as an example.

PtNo. Northing(y) Easting(x) Elev (z) Description

2072 4028.83 8229.35 394.49 B

Traverse/Sideshot/Options/Arc/Point number or pick point: 2070

Use point number 2070.

PtNo. Northing(y) Easting(x) Elev (z) Description

2070 4037.31 8253.02 394.61 B

Bearing: N 70d17'36" E Horizontal Distance: 25.1385978

- **Traverse and Sideshot**: The Inverse command can be used in conjunction with the Traverse and Sideshot commands. The last two points you specify become the Backsight and the Occupied point for the Traverse and Sideshot commands. You can go directly from the Inverse command to the Traverse and Side shots command. Enter T to go directly to the Traverse command. Enter SS or S to go directly to the Side shots command. Even a single S will transmit to Sideshot. Hot keys are not case sensitive.
- **Options:** Several input options for Inverse are set by entering O for Options.
- **Sideshot Inverse:** Sideshot inverse holds the current occupied point and calculates the bearing/distance to each entered point. When the Pairs option is set, Inverse reports the bearing/distance between pairs of points instead of every entered point(e.g., if points 1,2,11,12 were entered, the bearing/distance would be reported for 1,2 and 11,12 but not 2,11). The Auto Increment option uses the next point number when you press Enter. To exit the command with Auto Increment active, enter End.
- **Angle:** Several angle output options are set at the second prompt in Options. The angle can be reported as either Bearing, Azimuth, Gon, or Angle Right. You can also set an option to report with decimal seconds at the next prompt.
- **Arc**: You can inverse around an arc by inversing to the PC, and then entering A, for the Arc option. The command will ask for the radius point, the curve direction left or right, and the PT point. The curve data is then reported. There is an unequal PC-Radius and PT-Radius distance check. The tolerance for this check is set in the Area Label Defaults command under the Area menu.

Prerequisite: None

Keyboard Command: inverse

Occupy Point

Function

This command sets the occupied point and backsight angle for COGO commands such as Traverse.

Prompts

1. Set Occupied Point
2. Pick point or point number. When setting the occupied point, you can pick a point on the screen, enter coordinates at the command line, or type in a point number that will be read from the current coordinate file.
3. Set backsight method [Azimuth/Bearing/None/<Point>]? Four options are available for determining the backsight direction: Azimuth, Bearing, None, and Point:
   - **Azimuth and Bearing**: Enter the backsight angle in the selected format.
   - **None**: Sets the backsight to an azimuth of 0 (north).
   - **Point**: Pick a point on the screen, input coordinates, or type a point number that will be read from the current coordinate file.
   - You can also set the occupied point by using the Inverse command. If you Inverse from point 3 to point 1, you set point 1 as the occupied point and point 3 as the backsight. For more information, refer the Inverse command section of this manual.

Prerequisite: None

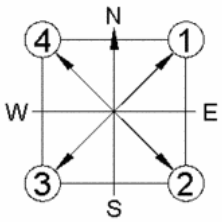
Keyboard Command: occpoint

Traverse

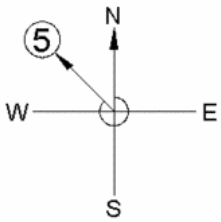
Function

This command allows you to enter any combination of turned angles, azimuths, or bearings, to define a traverse or figure.

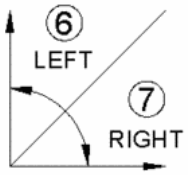
- Traverse prompts for an Angle-Bearing Code that defines the angle or bearing type. Codes 1 through 4 define the bearing quadrants: 1 being North-East, 2 South-East, 3 South-West, and 4 North-West. Code 5 is a north based azimuth, 6 is an angle turned to the left, 7 is an angle turned to the right, 8 is a deflection angle left, and 9 is a deflection angle right. This command always occupies the last point it calculated and backsights the point before that.



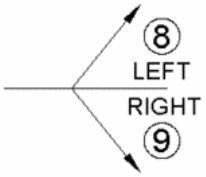
Codes used for BEARINGS



Codes used for AZIMUTHS



Codes used for Angles LEFT & RIGHT



Codes used for Deflection Angles LEFT & RIGHT

- For both the Angle-Bearing Code and the Distance prompt, you can enter point-defined responses(e.g. two points separated by an asterisk, as in 2*3 for the bearing (or distance) defined by 2 to 3). You can also add math expressions. For angles, 2*3+90 would deflect 90 degrees right from 2 to 3. For distance, 2*3/2 would mean half the distance of 2 to 3. You do not need to enter N before entering a number-defined distance.
- The Traverse command also draws lines between located points (if the Line On/Off option in the COGO menu is set on) and plots the points calculated and stores them in the current coordinate file if point numbering is on. The point settings are defined in the Point Defaults command under the Points menu. If Point Protect is turned on, the Traverse command checks whether the point numbers are already stored in the file. Point Protect is set in the Coordinate File Utilities command under the Points menu.
- Some Angle-Bearing code input options for the Traverse command are set by entering O for Options. The Angle Right option prompts for the angle right and skips the angle-bearing code prompt. The Azimuth option prompts for the azimuth and skips the angle-bearing code prompt.

Prompts

1. Occupy Point? Pick point or point number. You will be prompted for the occupied point only the first time you use the command. You can use the Inverse or Occupy Point commands to set the occupied and backsight points.
2. Exit/Options/Line/Side Shot/Inverse/<Angle-Bearing Code <7>: **Press Enter.** Pressing Enter uses the default angle right code.
3. Backsight Point? Pick point or point number.
4. Enter Angle (dd.mmss) <90.0000>: **88.1324**. You can also enter L or R to define an angle 90 degrees Left or Right.
5. Number inverse/<Distance>: **100**
6. Vertical Angle Type (0-3) <2>: **Press Enter**. You see this prompt only if Vertical Angle Prompt in Point Defaults is set to None.
7. Enter Zenith Angle (dd.mmss) <90.0000>: **Press Enter**. Hz Distance > 100.00
8. Enter Point Description <>: **ip**
9. Exit/Options/Line/Side Shot/Inverse/<Angle-Bearing Code <7>>: **14*9-45.2045**. Uses the bearing defined by point numbers 14 & 9 and subtracts the angle 45 degrees, 20 minutes, and 45 seconds. You can use a + or - in this type of entry.
10. Number inverse/<Distance>: **N**. You can enter 14*9/2 here, as well
11. Point number inverse (e.g. 10*20): **14*9/2**. Causes the command to recall the distance from point number 14 to 9 and divide it by 2.
12. Enter Zenith Angle (dd.mmss) <90.0000>: **Press Enter**
13. Enter Point Descriptions <ip>: **Press Enter**
14. Exit/Options/Line/Side Shot/Inverse/<Angle-Bearing Code <7>>: **L**. Select Line or Polyline that defines Bearing: **select line that defines bearing**
15. Number inverse/<Distance>: **100**
16. Enter Zenith Angle (dd.mmss) <90.00>: **Press Enter**. Hz Distance >100.00
17. Enter Point Description <ip>: **Press Enter**
18. Exit/Options/Line/Side Shot/Inverse/<Angle-Bearing Code <7>>: **E**

Input to end the command. Enter S or SS to execute the Side Shots command or I to execute the Inverse command.

Prerequisite: None

Keyboard Command: traverse

Side Shots

Function

This command allows you to input any combination of turned angles, azimuths, or bearings while remaining on an occupied point. A point is "occupied" by inversing to it, traversing to it, or by using the commands Occupy Point, Draw-Locate Point, or Enter-Assign Point described in this manual.

- The command prompts for an Angle-Bearing Code that defines the angle or bearing type. Codes 1 through 4 define the bearing quadrants: 1 being North-East, 2 South-East, 3 South-West, and 4 North-West. Code 5 is a north based azimuth, 6 is an angle turned to the left, 7 is an angled turned to the right, 8 is a deflection angle left, and 9 is a deflection angle right.
- The Side Shot command plots the points calculated and stores them in the current coordinate file if point numbering is on. If Point Protect is turned on, Side Shots checks if the point numbers are already stored in the file. All points calculated radiate from the occupied point. Use the Traverse, Inverse, or Occupied Point commands to define the occupied and backsight points.

Prompts

1. Exit/Options/Line/Traverse/Inverse/<Angle-Bearing Code <7>: **6**. Code 6 for angle turned to left.
2. Enter Angle (dd.mmss) <45.5413>: **22.3524** (Angle of 22 degrees, 35 minutes, 24 seconds).
3. Number inverse/<Distance>: **120.91**
4. Enter Vertical Angle (dd.mmss) <90.0000>: **88.2548**. This prompt comes up only if you have Vertical angle prompting set to 1 or 2.
5. Instrument Height <5.0>: **5.12**
6. Rod-Target Height <5.0>: **5.12** Prompts 5 and 6 come up only if you have Instrument and Rod height prompting turned on in Point Defaults.
7. Enter Point Elevation <1033.31>: **Press Enter**. You can accept the elevation calculated by this command.
8. Enter point description: **Topo Shot**
9. Exit/Options/Line/Traverse/Inverse/<Angle-Bearing Code <6>>: **E**

Prerequisite: None

Keyboard Command: sideshot

Enter-Assign Point

Function

This command creates a point at the coordinates you specify. The point is both stored in the current coordinate file and drawn on the screen.

- The command prompts for northing and easting. Whether the program prompts for point number, elevation, and description depends on the settings in the Configure Carlson Survey Desktop command. The point symbol and layer are also set in Configure CSD.

Prompts

1. Enter North(y): **5000**
2. Enter East(x): **5000**
3. Enter Point Elevation <>: **100**
4. Enter Point Description <>: **START**. (5000.0 5000.0 100.00)
5. Enter North(y): **Press Enter** to end

Prerequisite: None

Keyboard Command: eapoint

Raw File On/Off

Function

This command toggles raw file creation. When this option is active, commands such as Traverse create entries in the current raw file (.RW5). If Raw File is turned on, the Raw File On/Off menu option will have a check mark character next to it.

Prerequisite: ∗.RW5 file

Keyboard Command: OPENRAW

Line On/Off

Function

This command toggles line plotting on and off for the Traverse command. If line drawing is turned on, the Line On/Off menu option will have a check mark character next to it.

Prerequisite: None

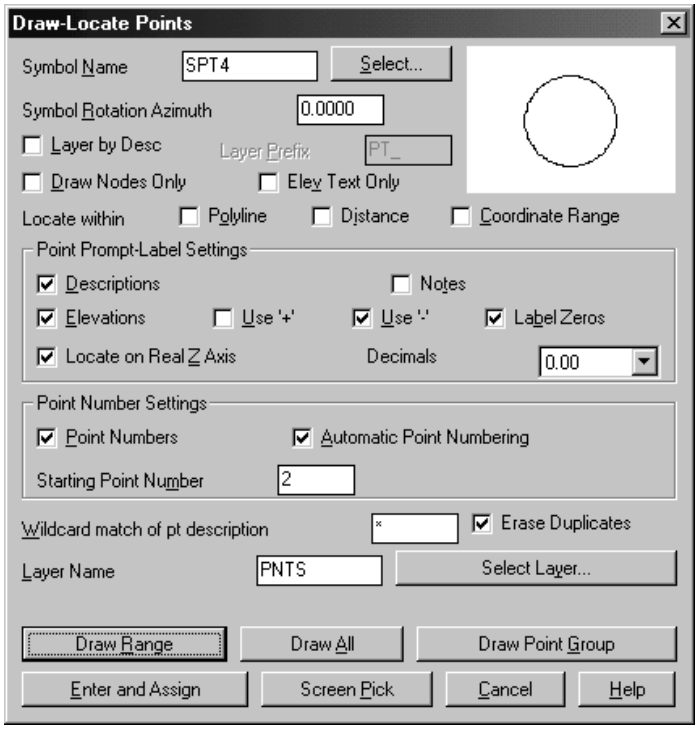
Keyboard Command: LINEONOFF

Point Commands 7

Draw Locate Points

Function

The Draw-Locate Point dialog (shown below) allows you to insert both new and existing points into the drawing. Create new points by selecting points on the screen, or by entering northing and easting coordinates. Place existing points by entering point numbers that reference the current project point database.



Using the Main Draw-Locate Points Dialog

Selecting Point Symbol

In the Draw-Locate Point dialog, you must select the point symbol and select placement options, if necessary.

- **Symbol Name**: The name of the symbol file is displayed here. Choose a different symbol by clicking Select. The selected point symbol is displayed on the right.
- **Symbol Rotation Azimuth**: The rotation angle used for the point symbols, used in a counterclockwise direction relative to the current twist screen.
- **Layer by Desc**: Inserts the points in the layer named by the point description. Using Layer by Desc organizes the points by description and allows for layer management. You can use the Isolate Layers command to show only points on a certain layer. If you include an invalid layer character in the description, the layer name stops at the bad character (e.g. a point description of UP / 105 would use layer UP). The Layer Prefix is added to the beginning of the layer name (e.g. a Layer Prefix of PT_ and a point with the description EP would use the layer PT_EP). Layer Prefix is optional. It allows all the point layers to be grouped.
- **Draw Nodes Only**: Inserts only a point entity (the node), and not the point block and symbol. This option is most useful when you have a lot of points to insert, because inserting only the nodes alone is faster than inserting nodes with the point block and symbol. Commands such as Triangulate & Contour and Make 3D Grid File can use these points, and do not need the point block and symbol.

- **Elevation Text Only**: Draws text of the point elevation without the point block, symbol, or node. The decimal place of elevation text is placed at the northing and easting point location.
- **Locate within Polyline**: Inserts only the points that are inside a closed polyline. The command prompts you to select a closed polyline. All the points in the current coordinate file are checked. Any points that are located within the closed polyline are drawn.
- **Locate within Distance**: Inserts only the points that are within a specified distance from a reference point. The command prompts you for the reference point and the search distance. All the points in the current coordinate file are checked. Any points that are located within the search distance of the reference point are drawn.
- **Locate within Coordinate Range**: Inserts only the points that are within the specified range of northing, easting, and elevation. The command prompts you for the minimum and maximum northing, easting, and elevations. These values default to the actual minimum and maximum in the coordinate file. Then the command prompts you for the point number range of points to check. The points that fall in both the point number range and the coordinate range are drawn.

Prompt-Label Settings

Under Point Prompt-Label Settings, you determine attributes for which you will be prompted.

- **Descriptions**: Determines whether or not you are prompted for descriptions for each point, when creating new points. When placing both new and existing points, Descriptions determines whether this attribute is labeled with the point inserts.
- **Notes**: Works with the note file (.not) associated with the current coordinate file. The note file contains unlimited point descriptions, in addition to the fixed 32 character point descriptions in the coordinate file. When you create points with Notes on, the command will prompt you for point notes to be stored with the point. When you draw existing points with Notes on, any notes associate with these points are drawn as text entities, below the point description.
- **Elevations**: Determines whether or not you are prompted for elevations for each point when creating new points. When you are placing both new and existing points, Elevations determine whether this attribute is labeled with the point inserts.
- **Use '+'**: Labels the positive elevations with a leading '+' (e.g. "+159.43").
- **Use '-'**: Labels the negative elevations with a leading '-'.
- **Locate on Real Z Axis**: Determines if the points are placed at their elevations, or at zero elevation.
- **Label Zeros**: When the Elevations option is on, Label Zeros identifies points with zero elevation. When Elevations is not on, only points with nonzero elevation are labeled.

Point Number Settings

Under Point Number Settings, you determine how points will numbered.

- **Point Numbers**: Determines whether the complete point block is drawn, or just the symbol and node. When you create new points with Point Numbers off, no points are stored in the current coordinate file, only the point symbol and node are drawn. When you draw existing points with Point Numbers off, the point attribute block is not drawn, only the point symbol and node are drawn.
- **Automatic Point Numbering**: Uses the Starting Point Number for the first new point. The next point number is automatically incremented. Before storing the point, the command checks whether the point number is used. If the point number is used and point protect is on (set in the Coordinate File Utilities command), then the

command will prompt for another point number or to overwrite the point. With Automatic Point Numbering off, the command will prompt for the point numbers.

Determining Point Display and Layering

- **Wild card match of point description**: You can display only points with specific descriptions. This can be thought of as a filter. In other words, entering IP (for Iron Pin) would display only points that are labeled with the description IP. The default is the asterisk (*), which will display all points regardless of description.
- **Layer Name**: Allows you to designate a layer for the points to be displayed. You can enter a new name, or choose an existing layer by clicking Select Layer.
  - Any CSD point consists of a block insert with attributes, a point symbol, and a point entity.
  - The point entity is used for picking the point by OSNAP Node in other commands.
  - The block insert includes a point number, elevation, and description. These attributes are in the PNTMARK, PNTNO, PNTELEV, and PNTDESC layers. The points are also in an overall layer as specified in this dialog box.
  - This layer setup allows you to freeze a group of points by the main layer name or freeze point attributes for all the points in the drawing (e.g. freezing layer "PNTS" would freeze all the points in this layer. Freezing layer "PNTELEV" would freeze the point elevation attribute for all the points).
- **Draw Range**: Draws existing points from the current coordinate file. The Draw Range button will prompt for the point numbers to draw.
- **Draw All**: Draws all the points in the coordinate file, then zooms the extent of the display to show the points.
- **Enter & Assign**: This command can be used to create new points using the point northing and easting.
- **Screen Pick Point**: Allows you to create points by picking the point coordinate on the screen (e.g. set the Object Snap to EndPoint and pick the end point of a building polyline to create a point at the building corner).

Prompts

To create a new point.

1. In the Draw-Locate Point dialog box, choose Screen Pick.
2. Pick point to create.
3. Select/<Enter Point Elevation <0.00>: Enter elevation or Press S and enter to select text to set elevation.
4. Enter/<Select text of elevation>: Select text entity that defines elevation of point.

These prompts appear only if elevation prompting is turned on.

5. Enter point description: HUB

This prompt only appears if description prompting is turned on.

To locate a point in the coordinate file (point number 3 in this example).

In the Draw-Locate Point dialog box, choose Draw Range.

- Point numbers to draw: 3

PtNo. North(y) East(x) Elev(z) Description

3 4154.28 4147.35 0.00

- Point numbers to draw: 1-2

Locates a range of points. From 1 to 2.

PtNo. North(y) East(x) Elev(z) Description

1 4252.76 4158.32 0.00 RADPT

2 4258.11 4059.38 0.00

- Point numbers to draw: Press Enter.

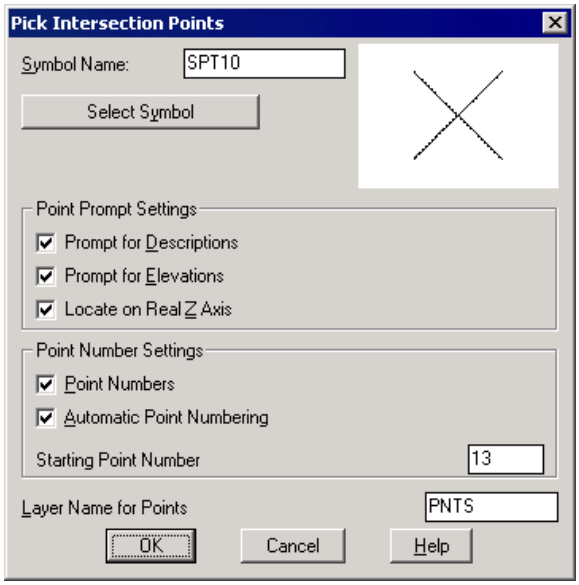
This ends the command.

Keyboard Command: LPOINT

Pick Intersection Points

Function

This command creates points at line or polyline intersections. The object snap is automatically set to intersection, or alternatively, Apparent Intersection. This command is similar to the Draw-Locate Points command, with an additional check to see if an intersection exists at the picked point. If there is no intersection or interior polyline vertex at the point, no point is created.



Prompts

In the Pick Intersections dialog box, you must set parameters for the point.

- **Symbol Name**: This field displays the symbol name.

- **Select Symbol**: This allows you to select a new symbol type. The symbol is displayed to the right.

Point Prompt Settings

- **Prompt for Descriptions**: You are prompted for point description.
- **Prompt for Elevations**: You are prompted for elevation.
- **Locate on Real Z Axis**: The point uses the elevation of the intersected lines.

Point Number Settings

- **Point Numbers**: Assigns point numbers to the created points.
- **Automatic Point Numbering**: Numbers the new points automatically. You will be prompted for point numbers if the option is not checked.
- **Starting Point Number**: Sets the starting point number for automatic point numbering.
- **Layer Name for Points**: Allows you to assign a layer for the points.

1. APParent intersection on <Yes>/No: **Press Enter**
2. [app on] Pick Intersection Point: **pick an intersection**

NOTE*:* Apparent Intersection object snap lets you select theoretical intersections (e.g. twolines that cross in plan view but that are at different elevations). For more information on object snaps, see the Object Snap command in the Settings section of this manual.

Prerequisite: None

Keyboard Command: PICKINT

Bearing-Bearing Intersect

Function

This command creates a point at the intersection of two lines. You can define a line by picking two points, selecting a line, or typing in a bearing. After the lines are defined, a point symbol is located at the point of intersection.

Prompts

1. Click Enter to use preview point or select 1st Base point.

Pick point or point number: **1**

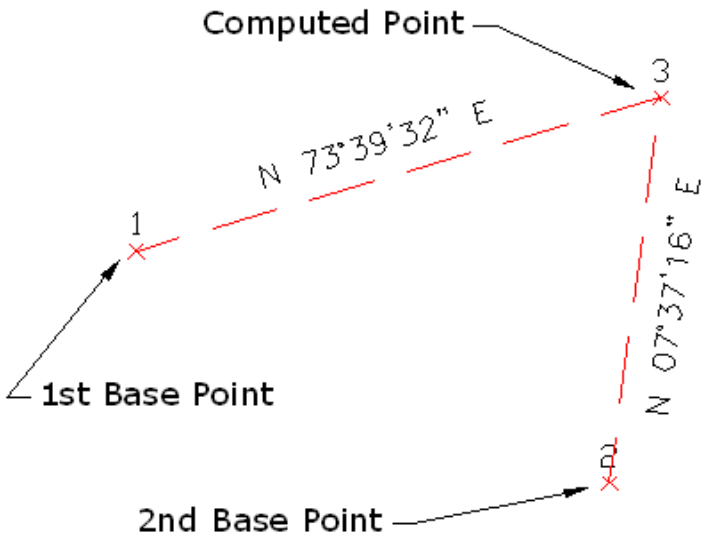
PtNo. Northing Easting Elev(Z) Description
1 4070.77 8432.52 0.00

2. Define 1st angle by (Line/Points/Right/Azimuth/Bearing)<Bearing>: **press Enter**
3. Bearing (Qdd.mmss): **173.3932**
4. 2nd Base point?

Pick point or point number: **2**

PtNo. Northing Easting Elev(Z) Description
2 4049.28 8476.29 0.00

5. Define 2nd angle by (Line/Points/Right/Azimuth/Bearing)<Bearing>: **press enter**
6. Bearing (Qdd.mmss): 107.3716



Prerequisite: Execute Drawing Setup to set Defaults.

Keyboard Command: bbint

Bearing-Distance Intersect

Function

This command creates a point using a bearing and a distance.

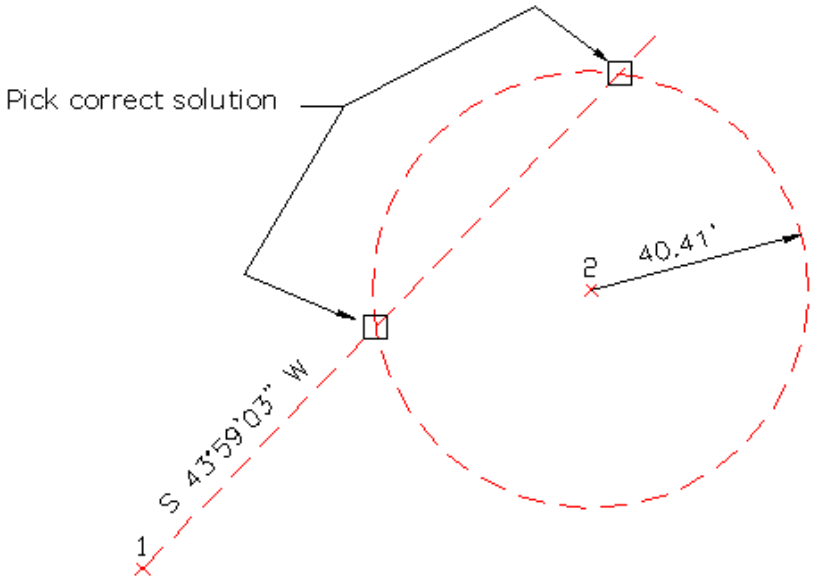
Prompts

1. [Enter] to use preview point or select known Bearing base point ? Pick point or point number. The command prompts you for a base point from which the known bearing intersects.
2. Define bearing by (Line/Points/Bearing <Line>: **Press Enter**. Define the bearing by one of three methods: picking two points, selecting a line with the same bearing, or typing in the bearing in the form of Qdd.mmss (similar to the Locate by Bearing command).
3. Select Line or Polyline that defines Bearing: **select line**
4. Known distance base point. Pick point or point number: **pick a point.**
5. You are prompted for a base point from which the known distance radiates.
6. Pick or Type Distance: **40.41** A circle is drawn radiating from the selected base point, and a line defined by the bearing is extended to intersect the circle.
6. [int on] Pick Intersection point ([Enter] to cancel): **pick point**
7. Pick the correct point for the solution desired and a point symbol is located at the selected intersection. The command then erases the temporary circle and line.

NOTE: Except where noted, most commands leave the selection of the appropriate object snap mode up to you. If a command turns on an object snap, the prompt line of a command notates the object snap by enclosing it in brackets (i.e. if the midpoint object snap is on, [mid on] appears in the point prompt line). Each predefined point symbol has a point entity at the center of the symbol. Use the NODE object snap to snap lines or other drawing entities to point symbols.

8. Enter Point Number <55>: **Press Enter**. This prompt appears only if Automatic Point Numbering is toggled off in the Point Defaults command on the Points menu.

9. Enter Point Symbol Number <4>: **Press Enter**. Symbol number four is located at the computed coordinate and labeled point number 55. This prompt appears only if Prompt for Symbol Numbers is toggled ON in the Point Defaults command on the Points menu.



Prerequisite: Run Drawing Setup to set defaults.

Keyboard Command: bdint

Distance-Distance Intersect

Function

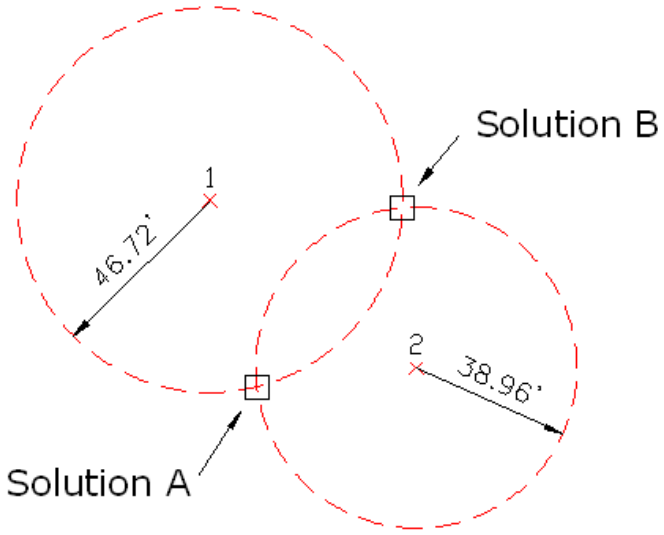
This command creates a point at the distance-distance intersection from two base points.

- The command prompts for two distances and two base points. The two possible intersections, labeled A and B, are shown on the screen.

- Select near the desired intersection, or type in the letter A or B. The A intersection is the first possible intersection, clockwise from the first point.

Prompts

1. Select 1st base point. Pick point or point number: **1**
2. Points/<1st distance>: **46.72**
3. Select 2nd base point. Pick point or point number: **2**
4. Points/<2nd distance>: **38.96**
5. Pick near solution or Enter [A] or [B]: **pick a point**



Prerequisite: None

Keyboard Command: ddint

Resection

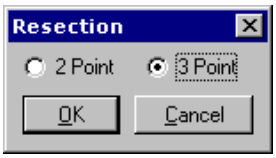
Function

This command calculates point coordinates, given the angle and distance from two or three reference points. X, Y, and Z coordinates can all be calculated.

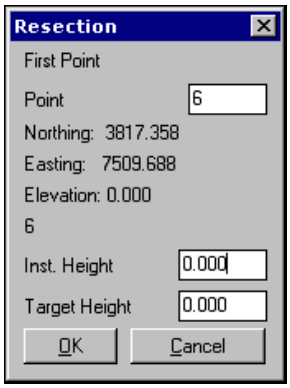
- The Resection command calculates the coordinate by averaging the distance-distance and angle-angle solutions. Since there is redundant data, the final calculated coordinate differs slightly from the individual measurements (e.g. in a 3-point resection there are two different distance-distance solutions: one between the first-second point, and one between the second-third points).
- Resection reports the difference between the final coordinate and the individual solutions as residuals, indicating whether the data is good. High residuals suggest a problem with the input data.

Prompts

1. In the first Resection dialog box, select either two or three reference points.



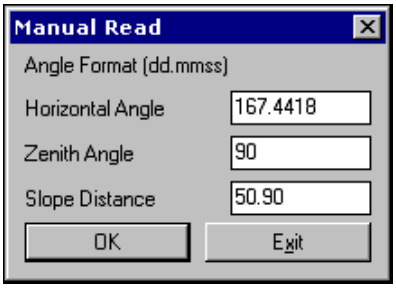
2. In the second Resection dialog box, assign the reference point.



- **Point**: You must enter the point number of your reference point. These reference points need to be stored in the current coordinate file before you run this command.
- **Inst. Height**: You must enter the instrument height.
- **Target Height**: You must enter the target height.

If you need only the 2D solution, then enter the instrument and target heights as 0.0.

3. In the Manual Read dialog box, specify parameters for the calculation.



- **Horizontal Angle**: You must enter a horizontal angle from the resection to the reference points. The horizontal angle is the horizontal azimuth, or angle right, from the unknown point to the reference point.
- **Zenith Angle**: You must enter a zenith angle. For a 2D solution, set the zenith angle to 90 degrees.
- **Slope Distance**: You must enter a slope distance from the reference points to the resection.

4. You are prompted for additional reference points and parameters.

5. In the results dialog box that displays the final coordinates and residuals, you can choose to store the coordinates in the current coordinate file with a specified point number.

Prerequisite: 2 or 3 reference points

Keyboard Command: CRESECTION

Point on Arc

Function

This command creates a Point on an Arc.

Prompts

1. Define arc by, Points/<select arc or polyline>: **pick arc or polyline arc segment**. Pick a point on the arc somewhere near its midpoint. The preview arrow points to the 1st endpoint, the occupied point.

2. Precede distance with minus sign if distance from 2nd endpoint. Distance along arc from 1st point: **100**
3. You must enter a distance. If the distance is from the 1st endpoint (PC, the one highlighted by the screen preview arrow) use a positive value. If the distance is from the 2nd endpoint (PT), use a negative value.
4. The command then plots a point at the computed distance.

Prerequisite: Execute Drawing Setup command to set defaults.

Keyboard Command: PTARC

Divide Between Points

Function

This command divides the distance between two points, and inserts a point symbol at the specified distance. Divide Between Points can also interpolate elevation. To interpolate the elevations, the points picked must be at their real Z axis elevation.

Prompts

1. Interpolate elevations <N>: **press enter**. If you want to have the elevations calculated at the points, then respond with Y for yes.
2. Point to divide-interpolate from? Pick point or point number: **pick a point**

PtNo. North(y) East(x) Elev(z) Description
1 4252.76 4158.32 0.00

3. Point to divide-interpolate to ? Pick point or point number: **pick a point**
4. Number of Segments-Divisions: **3**

The command then locates 2 points.

Prerequisite: Locate two points to divide. If you want to interpolate elevation they should have a real Z axis elevation.

Keyboard Command: DIVLIN

Divide Along Entity

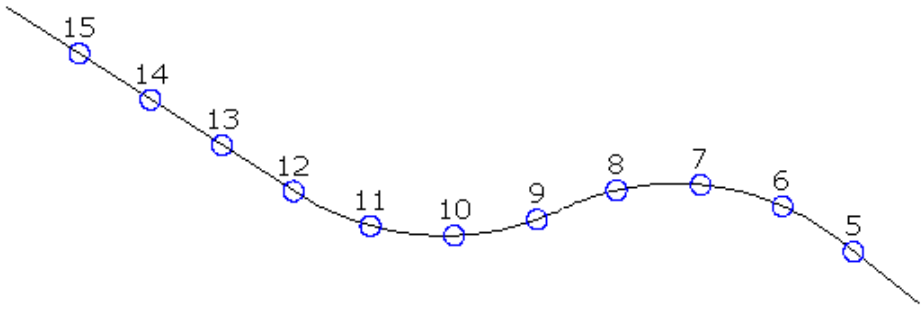
Function

This command divides an entity such as a line, polyline, or arc. You select the entity and specify the desired number of segments. Divide Along Entity then locates the computed points along that entity.

Prompts

1. Interpolate Elevations <N>: **Press Enter**. If you want to have the elevations calculated at the points, then respond with Y for yes.
2. Select Entity to Divide: **pick an entity**
3. Number of Segments/Divisions: **12**

The command then locates 11 points.



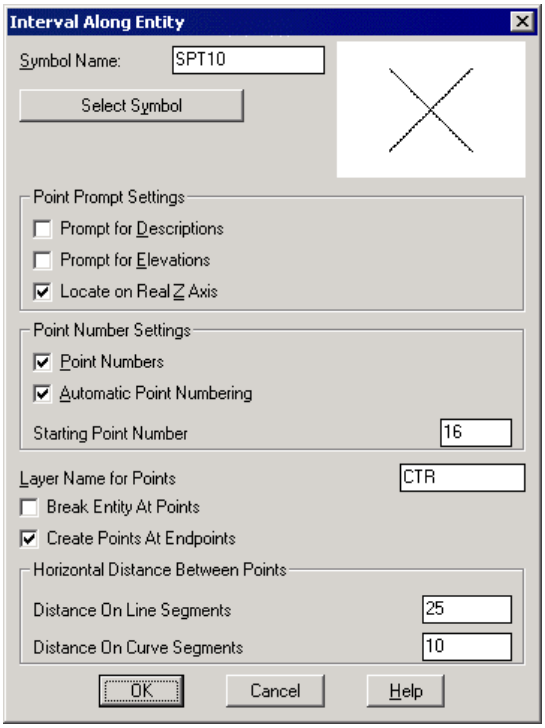
Prerequisite: If you want to interpolate elevations, you must locate two points that have real Z axis elevations.

Keyboard Command: DIVENT

Interval Along Entity

Function

This command creates points at a specified distance along a line, arc, or polyline. The points are stored in the current coordinate file and drawn on the screen. Use this command to locate lot corner points along a frontage line. The point symbol, point layer, and point prompting options are set in the dialog box (shown below).



Prompts

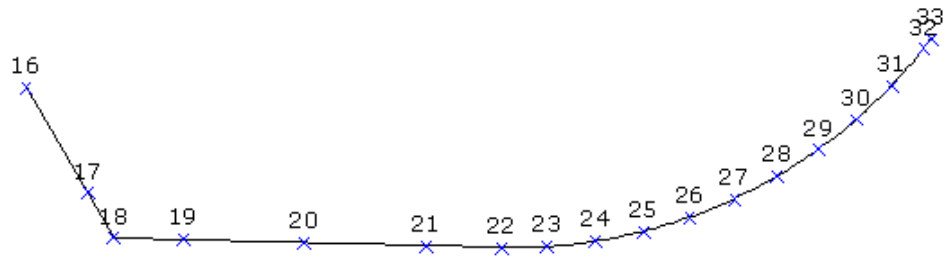
1. In the Interval Along Entity dialog box, you must set parameters for the point.
   - **Symbol Name**: Displays the symbol name.
   - **Select Symbol**: Allows you to select a new symbol type. The symbol is displayed to the right.

2. Under Point Prompt Settings, determine the point attributes and elevation.
   - **Prompt for Descriptions**: You are prompted for point description.
   - **Prompt for Elevations**: You are prompted for elevation.
   - **Locate on Real Z Axis**: Uses the elevation of the selected entity.

3. Under Point Number Settings, determine how the created points are numbered.
   - **Point Numbers**: Assigns point numbers to the created points.
   - **Automatic Point Numbering**: Numbers the new points automatically. You will be prompted for point numbers if the option is not checked.
   - **Starting Point Number**: Sets the starting point number for automatic point numbering.

4. Other Settings
   - **Layer Name for Points**: Allows you to assign a layer for the points.
   - **Break Entity at points**: If checked, selected entity will be broken at each point.
   - **Create Points at Endpoints**: Creates a point at each endpoint

5. Horizontal Distance Between Points
   - **Distance on line segments**: Specifies the horizontal distance between each point on line segments.
   - **Distance on Curves segments**: Specifies the horizontal distance between each point on curve segments.



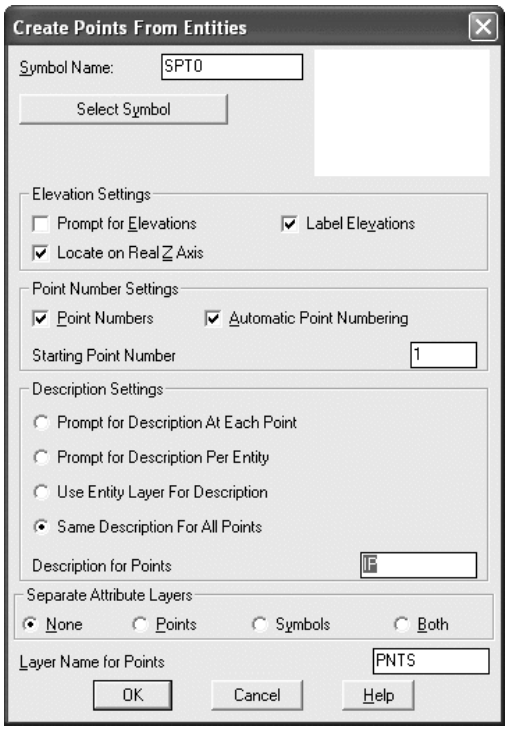
Prerequisite: None

Keyboard Command: PTINT

Create Points from Entities

Function

This command creates CSD points at the endpoints of selected entities. For arcs and polylines with arc segments, points are created at the radius points of the arcs. The points are stored in the current coordinate file and drawn on the screen. The Create Points from Entities dialog box is shown here:



Prompts

1. In the Create Entities to Points dialog box, set parameters for the points created.

   - **Symbol Name**: Displays the symbol name.
   - **Select Symbol**: Allows you to select a new symbol type. The symbol is displayed to the right.

2. Under Elevation Settings, determine the point attributes and elevation.
   - **Prompt for Elevations**: You are prompted for elevation.
   - **Locate on Real Z Axis**: The point acquires the elevation of the selected entities.
   - **Label Elevations**: Specifies whether or not to label the elevations.

3. Point Number Settings determines how the intersect points are numbered.
   - **Point Numbers**: This option assigns point numbers to the created points.
   - **Automatic Point Numbering**: Numbers the new points automatically. You will be prompted for point numbers if the option is not checked.
   - **Starting Point Number**: Sets the starting point number for automatic point numbering.

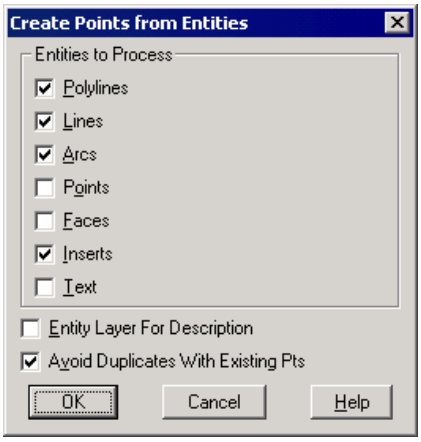
4. Description Settings provides the option to assign descriptions to all points, or to assign the same description to all points associated with a single entity, or to prompt each time for the point description
5. Separate Attribute Layers determines layers for the point attributes
   - **None**: The point symbol, point number, elevation, and description will use the layer names PNTMARK, PNTNO, PNTELEV, and PNTDESC.
   - **Points**: Layer names are determined based on the current point layer, instead of the default attribute layer names. The layer names for these attributes begin with the current point layer, followed by the attribute name (e.g. if the point layer is UTIL the attribute layers will be UTILMARK, UTILNO, UTILELEV, and UTILDESC).

- **Symbols**: Only the point symbol itself will take on the name of the current layer (e.g. UTILMARK is created, but all other attribute layers would be PNTNO, PNTELEV, and PNTDESC).
- **Both**: The block reference layer will be unique (UTIL) but point attributes will PNTNO, PNTELEV, etc.

.

6. Under Layer Name for Points, you must specify the layer name for the points

After choosing the correct settings, select OK. The Create Points from Entities dialog box will appear.



- **Entities to Process:** Select the types of entities you wish to process.
- **Entity Layer for Description**: Allows you to use the layer name of the entity as the description for the created point.
- **Avoid Duplicates with Existing Points**: Allows you to prevent creation of a point, if a point with the same coordinates already exists in the current coordinate file.

7. Select arcs, faces, points, text, lines and polylines. Select objects: **select entities**

Prerequisite: Entities (Points, lines, polylines, etc.) on which to locate points.

Keyboard Command: AUTOPNTS

Building_Offset_Extensions

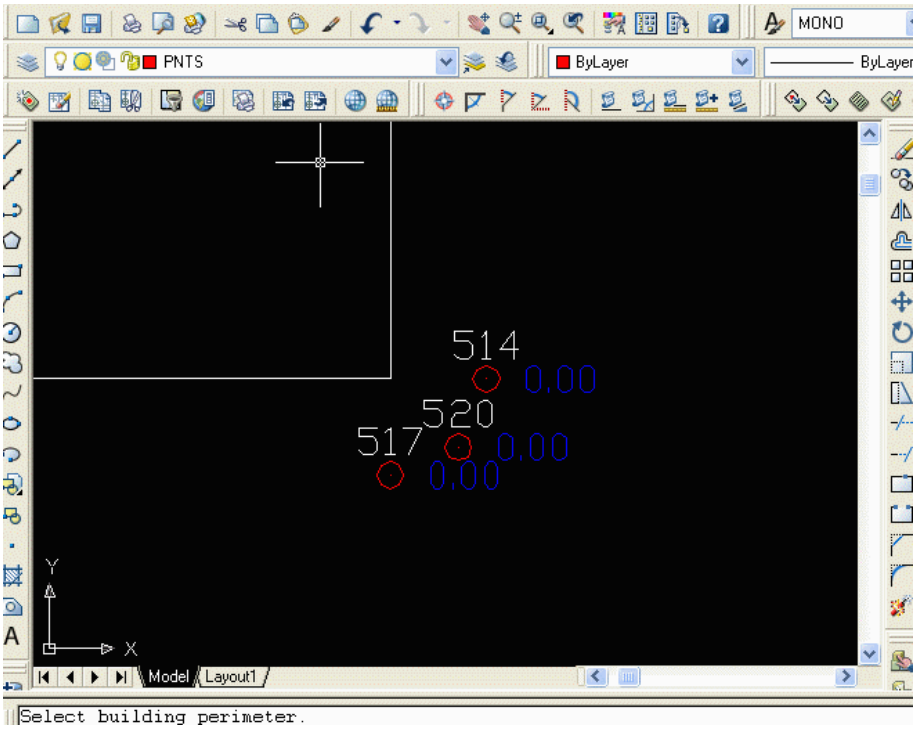
Function

This command is used to calculate building corner offsets that are extensions of the building faces. The below example was for 10' offset points to be generated starting at point number 510. Starting point number: This is the point number that the offsets are supposed to start. Select the building object by screen picking, and then press enter. Enter offset amount: This is the distance that the offsets are extended past the end of the building face line.

Prompts

Starting point number <373>: 510
Select building perimeter.
Select objects: 1 found

Select objects:
Enter offset amount <10.00>:



Keyboard Command: bldg_pnts
Prerequisite: An object that represents a building

Erase Points

Function

This command erases Autodesk Land Desktop points from the drawing. The points to erase can be selected from the screen or specified by point number. Erasing a Autodesk Land Desktop point will erase the point symbol and point entity. Optionally, the points may be erased from the coordinate file. As long as the points are not deleted from the coordinate file, they can be redrawn with the Draw-Locate Points command.

Prompts

1. Select points from screen or by point number (Screen/<Number>)? Enter
2. Point numbers to erase: 5
3. Delete points from coordinate file (Yes/<No>)? Y

Erased 1 point from file.

Erased 1 point from drawing.

Prerequisite: Points to erase.

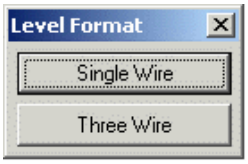
Keyboard Command: DELPT

Edit-Process Level Data 8

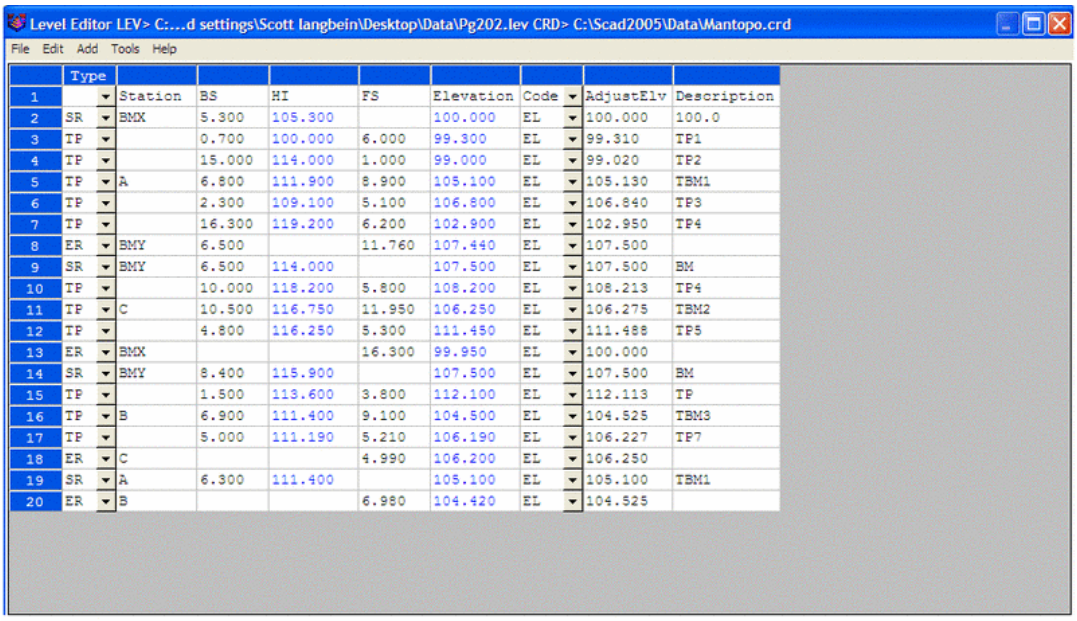
Edit-Process Level Data

Function

This command is for entering level data. It has a spreadsheet editor for entering this information, and the level calculations are updated as the data is entered. There is also a processing and reporting feature. This routine runs the *.lev file editor and *.lev file report functions. If you are creating a new .LEV file, you must choose either single-wire or three-wire for your level format data entry preference.

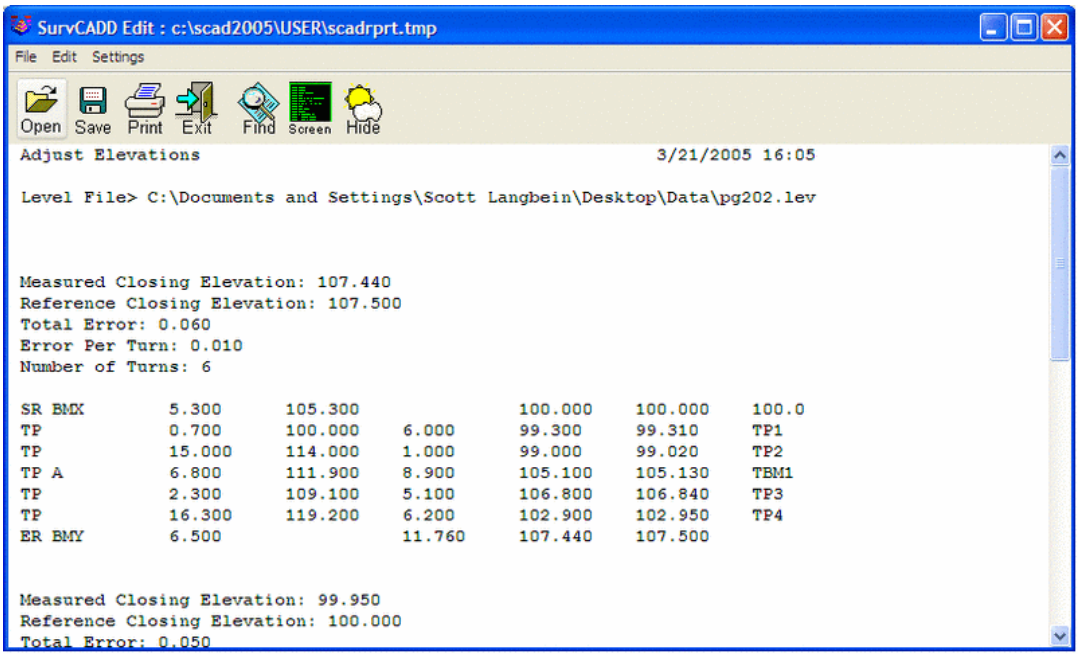


Format choice box



	Type		Station	BS	HI	FS	Elevation	Code	AdjustElv	Description
1										
2	SR		BMX	5.300	105.300		100.000	EL	100.000	100.0
3	TP			0.700	100.000	6.000	99.300	EL	99.310	TP1
4	TP			15.000	114.000	1.000	99.000	EL	99.020	TP2
5	TP		A	6.800	111.900	8.900	105.100	EL	105.130	TBM1
6	TP			2.300	109.100	5.100	106.800	EL	106.840	TP3
7	TP			16.300	119.200	6.200	102.900	EL	102.950	TP4
8	ER		BMY	6.500		11.760	107.440	EL	107.500	
9	SR		BMY	6.500	114.000		107.500	EL	107.500	BM
10	TP			10.000	118.200	5.800	108.200	EL	108.213	TP4
11	TP		C	10.500	116.750	11.950	106.250	EL	106.275	TBM2
12	TP			4.800	116.250	5.300	111.450	EL	111.488	TP5
13	ER		BMX			16.300	99.950	EL	100.000	
14	SR		BMY	8.400	115.900		107.500	EL	107.500	BM
15	TP			1.500	113.600	3.800	112.100	EL	112.113	TP
16	TP		B	6.900	111.400	9.100	104.500	EL	104.525	TBM3
17	TP			5.000	111.190	5.210	106.190	EL	106.227	TP7
18	ER		C			4.990	106.200	EL	106.250	
19	SR		A	6.300	111.400		105.100	EL	105.100	TBM1
20	ER		B			6.980	104.420	EL	104.525	

Level File Editor dialog



Level File Report example

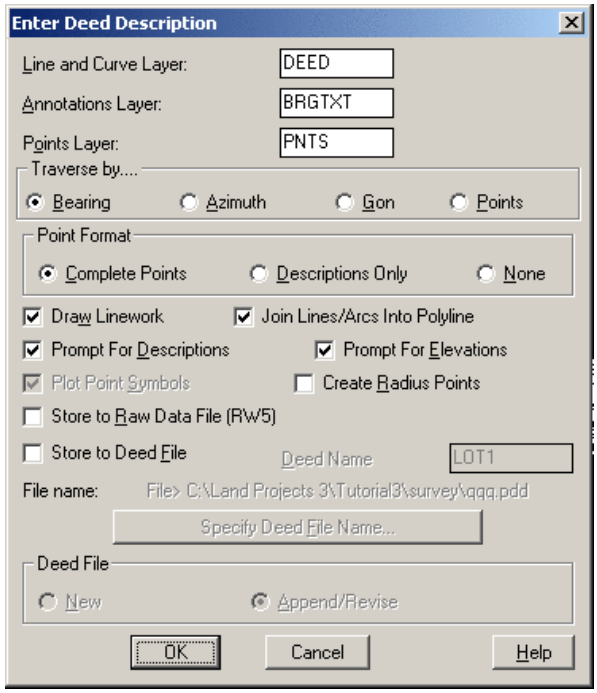
Keyboard Command: diglevel
Prerequisite: .LEV (level) file to process

Deed Commands 9

Enter Deed Description

Function

The Enter Deed Description command lets you enter line and curve data, which is drawn and optionally annotated as entered. At the end, the closure and area of the figure is reported. The command starts with the dialog box shown here.



- **Line and Curve Layer**: Specify the layer name for lines and arcs.
- **Annotations Layer**: Specify the layer name for the annotation text
- **Points Layer**: Specify the layer name for the points
- **Traverse by**: Select between entering bearings, azimuth, gons or point numbers. The points option recalls points from the current project point database.
- **Point Format**: Choose between creating CSD points in the project point database at each point in the figure, drawing descriptions only, or having no point labels.
- **Draw Linework**: Specify whether or not to draw linework, if this is disabled then all annotation options are disabled also.
- **Prompt for Descriptions**: Specify whether or not the program should prompt you for point descriptions. If this is not checked, then point descriptions are blank.
- **Prompt for Elevations**: Specify whether or not the program should prompt you for point elevations. If this is not checked, then point elevations are set to zero.
- **Plot Point Symbols**: If the Point Format is set to Descriptions Only or None, this option is available. It will place point symbols without creating points in the project point database.
- **Create Radius Points**: When checked, radius points will be created for arcs. Radius points are given the description RADPT.

- **Store to Raw Data (.RW5) File**: When checked, data entered will also be written to a raw data (.RW5) file that can be opened using the Edit Process Raw Data File command. This file can be used to perform coordinate adjustments. The compass rule, crandall rule, transit rule, angle balance adjustment and least square adjustment commands are all available. See Edit Process Raw Data File for more information.
- **Store to Deed File**: When checked, data entered will be written to a deed (.PDD) file. This file can be processed later to correct errors, create deed reports or to redraw the deed. To use this option, set the deed file name by picking the Specify File Name button. Also set the Deed Name field.
- **Deed Name**: Specify the beginning deed name. This option is only available when Store to Deed File is selected.
- **Specify Deed File Name**: Before specifying the deed (.PDD) file name, choose New or Append/Revise from the Deed File Parameters below. Only available when Store to Deed File is checked on.

Prompts

1. Pick point or point Number: **1**

PtNo. North(y) East(x) Elev(z) Description
1 8000.00 12000.00 0.00

In this example, the coordinate for point number one has already been stored in the project point database with the Draw-Locate Points command.

2. Exit/Curve/<Bearing (Qdd.mmss)>: **145.3035**
3. Varas/Poles/Chains/<Distance>: **210.5**
4. Enter Point Elevation <>: **396.25**
5. Enter Point Description <>: **ip**
6. Enter P to input a distance in Pole format or C for Chains format.
7. Exit/Curve/<Bearing (Qdd.mmss)>: **C**. Enter C to traverse through a curve.
8. Radius: **1103.5**
9. Curve direction (Left/<Right>)? **Press Enter for right**
10. Non-tangent/Reverse-tangent/Bearing/Chord/Delta angle/Tangent/<Arc length>: **N**. In this example, the curve is a non-tangent curve, so enter N. If the curve is tangent to the previous leg, then enter the arc length. Enter C for a chord length, D to enter the delta angle, or T to enter the tangent distance.
11. Chord Bearing (Qdd.mmss): **245.2341**
12. Length of Chord: **201.22**
13. Undo/Exit/Curve/<Bearing (Qdd.mmss)>: **345.3218**
14. Varas/Poles/Chains/<Distance>: **209.28**
15. Undo/Exit/Curve/<Bearing (Qdd.mmss)>: **445.2348**
16. Varas/Poles/Chains/<Distance>: **200.54**
17. Undo/Exit/Curve/<Bearing (Qdd.mmss)>: **E**. Enter E to end the prompting and calculate the closure error.

Closure error distance> 1.35251089 Error Bearing> N 70d41'35" E

Closure Precision> 1 in 607.63 Total Distance Traversed> 821.82

Prerequisite: None

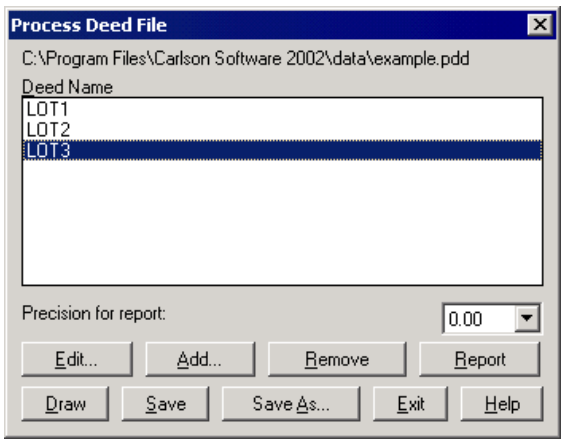
Keyboard Command: PDD

Process Deed File

Function

The Process Deed File command contains several functions for deed files (.PDD).

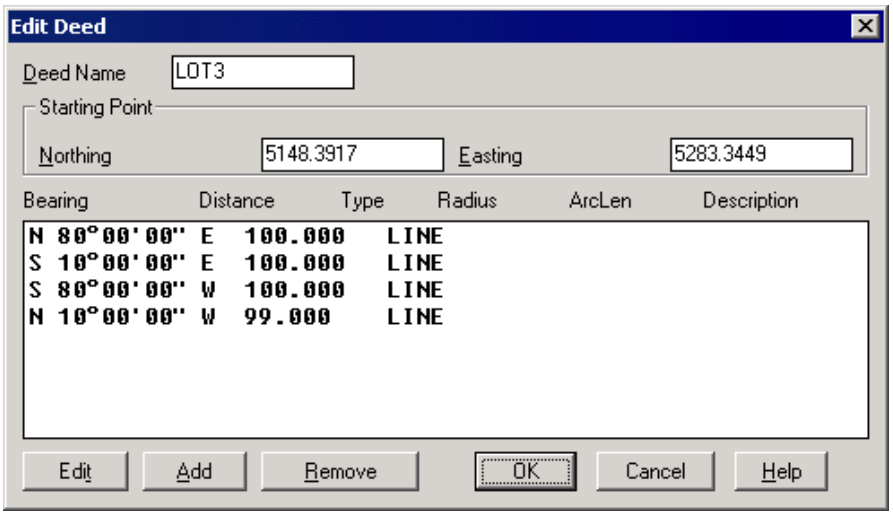
- A deed file consists of one or more deed descriptions. Each deed description includes a deed name, starting coordinate, and line and curve data.



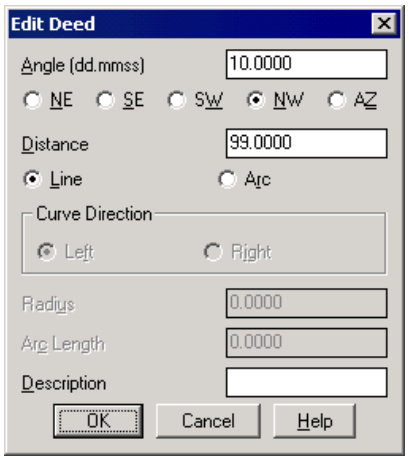
- **Generate a Deed Report**: Highlight the deed name in the Process Deed File dialog box, and select the Report button. This displays the report in the standard report viewer, which you can use to print or save the report. The report includes the closure error distance and bearing.

- **Draw Deed Linework**: Highlight the deed name and pick the Draw button. The draw function draws only the lines and curves of the deed.

- **Edit a Deed**: Highlight the deed name and select the Edit button. This brings up a dialog box (shown below) to edit the deed name and the starting coordinate. To edit any of the line or curve data, highlight the data row and select the edit button.



Selecting the Edit button displays a second Edit Deed dialog box (shown below). Here, you can edit the angle and distance of a line segment or edit the curve parameters of an arc.



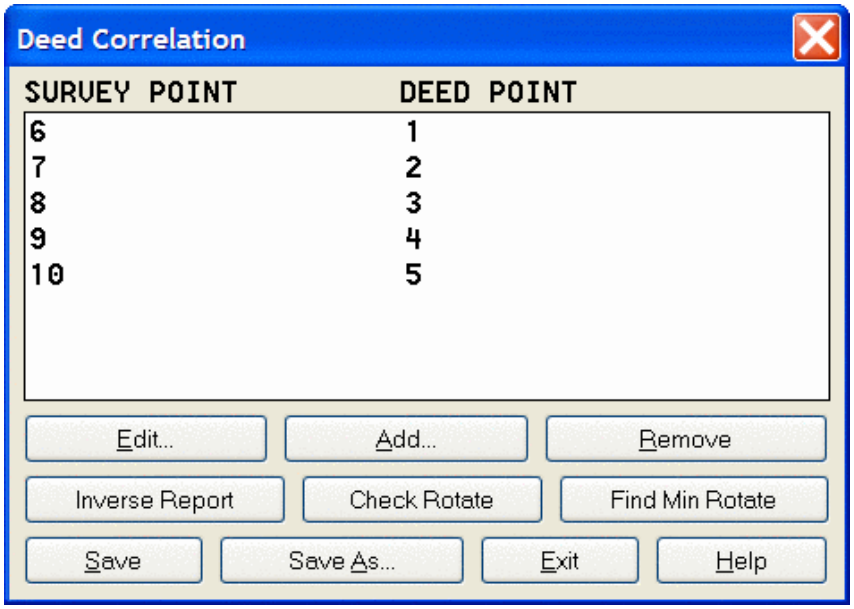
Prerequisite: None

Keyboard Command: DEED

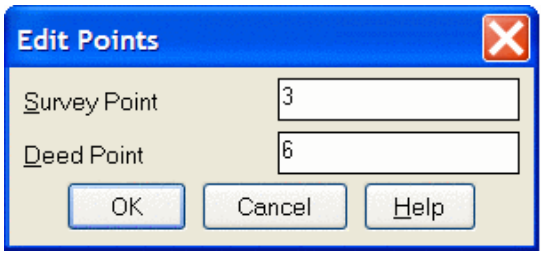
Deed Correlation

Function

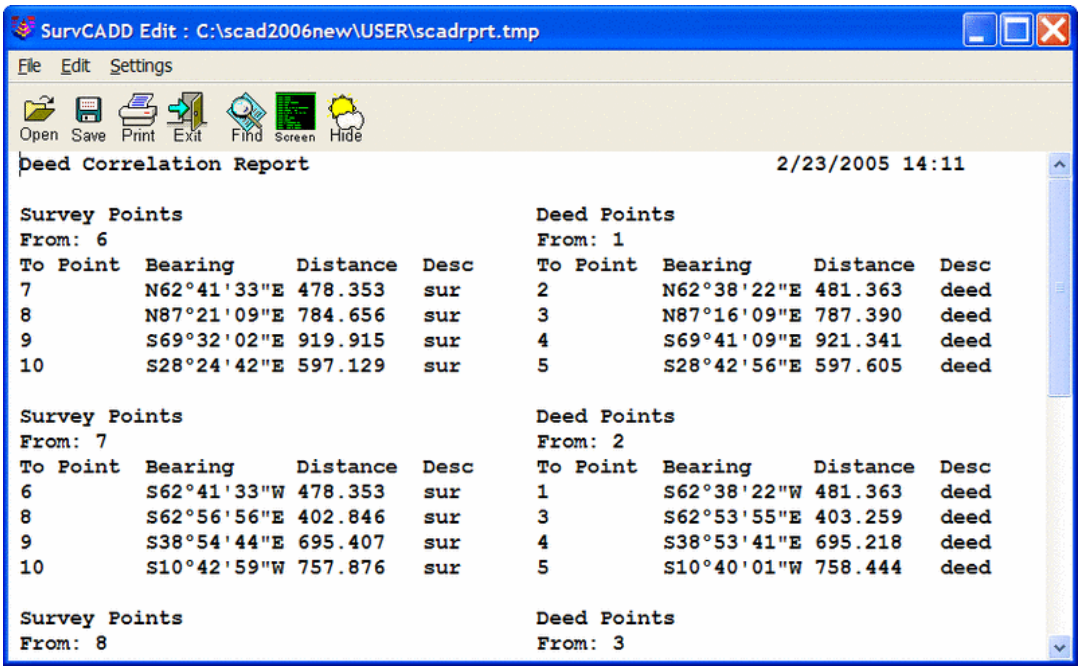
This command takes a set of field and design/deed points and creates an inverse report, such as radial stakeout, for each pair of points. It includes a routine to find the best point to hold and the best point to rotate to. This command provides tools for the correlation of surveyed points with that of deed input points. Different points can be specified as hold points, or rotation points, and provide a report showing the bearing and distance of all sides of the traverse/deed, based upon the hold and rotation points. This allows for the review of different scenarios based upon hold and rotation points. Perhaps two points in the field are in good shape, and seem to meet all the descriptions thereof. You decide to hold these two points as good, but you would like to see what holding these points will do to each side/call of the tract/description. This is what this routine is designed to do. In addition to allowing user specified trials of different hold and rotation points, the routine also provides a Find Mininum Rotatation option that will report which points specified as the hold and rotation points will result in the minimum rotation of all sides of the tract/description. All points must be contained in the same coordinate file, and the points to be used in the correlation must be specified as either Survey points or Deed points.

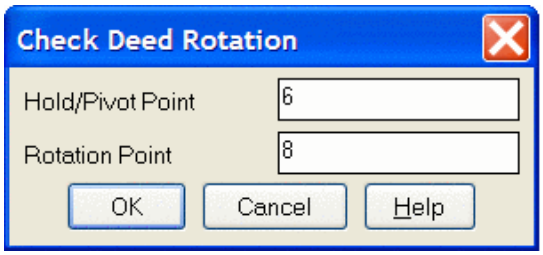


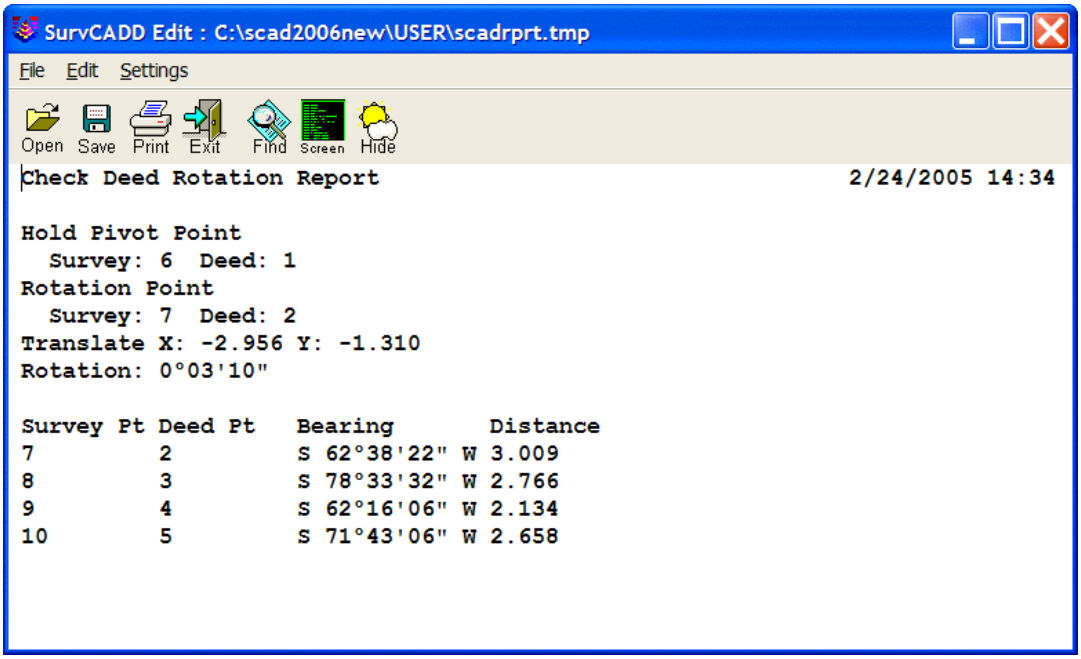
Edit: This button allows for editing of the highlighted/selected Survey and Deed point. Once selected the dialog above is displayed allowing for changes to be made.
Add: Click this button to specify the points as either Survey or Deed points. Then fill out the Edit Points dialog as desired.
Remove: This button will remove the highlighted/selected Survey and Deed points from the correlation setup. This does not delete the points from the coordinate file.
Inverse Report: This generates a report showing the inverse data from each point, both survey and deed, to every other point specified in the correlation set up. For example if there were four points in the survey points (1-4) then the report would show inverse data from 1 to 2, 3,4; from 2 to 1,3,4; from 3 to 1,2,4 and from 4 to 1,2,3. This would be the same for the corresponding deed points.
Check Rotate: This option that allows for user specified hold and rotation points, and then reports the inverse data of each side of the tract/description. The hold point and rotation point must be points from the specified survey point group.
Find Min Rotate: Determines the hold and rotation points that would result in the minimum rotation to each side of the tract/description. When selected the Minimum Deed Rotation Report is displayed.
Save: Preforms a quick save if the file has previously been saved.
Save As: This option prompts for a user specified file name and allows for a user specified location to save the file. The file extension for the deed correlation file is dcf. When executing the program you have the option of using an existing file or creating a new file for the deed correlation.
Exit: This button end the routine.
Help: This button displays the help topics relating to the Deed Correlation routine.

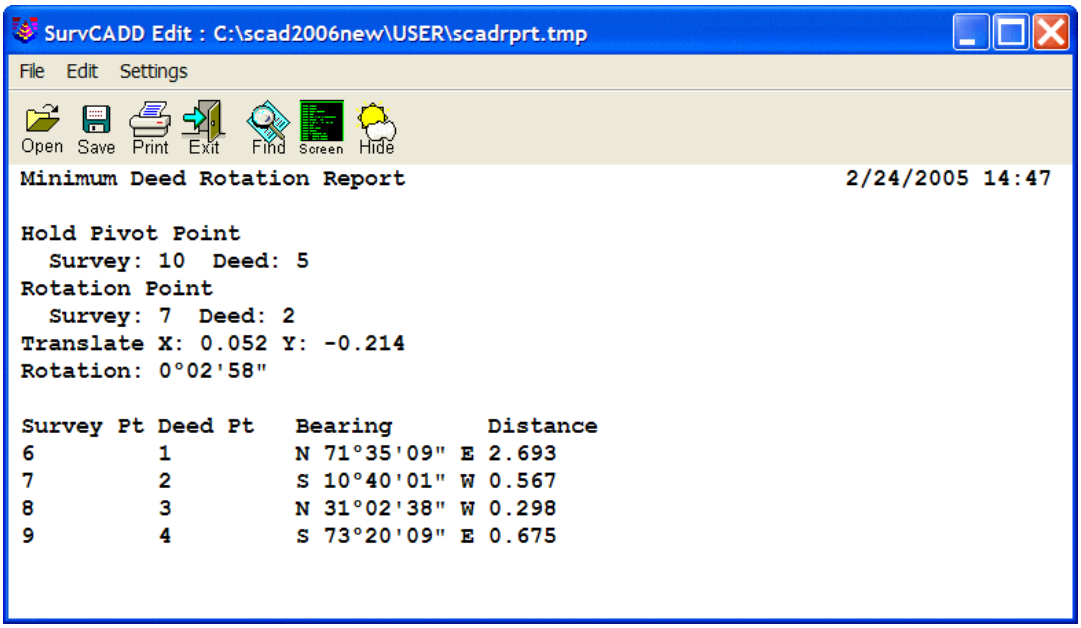


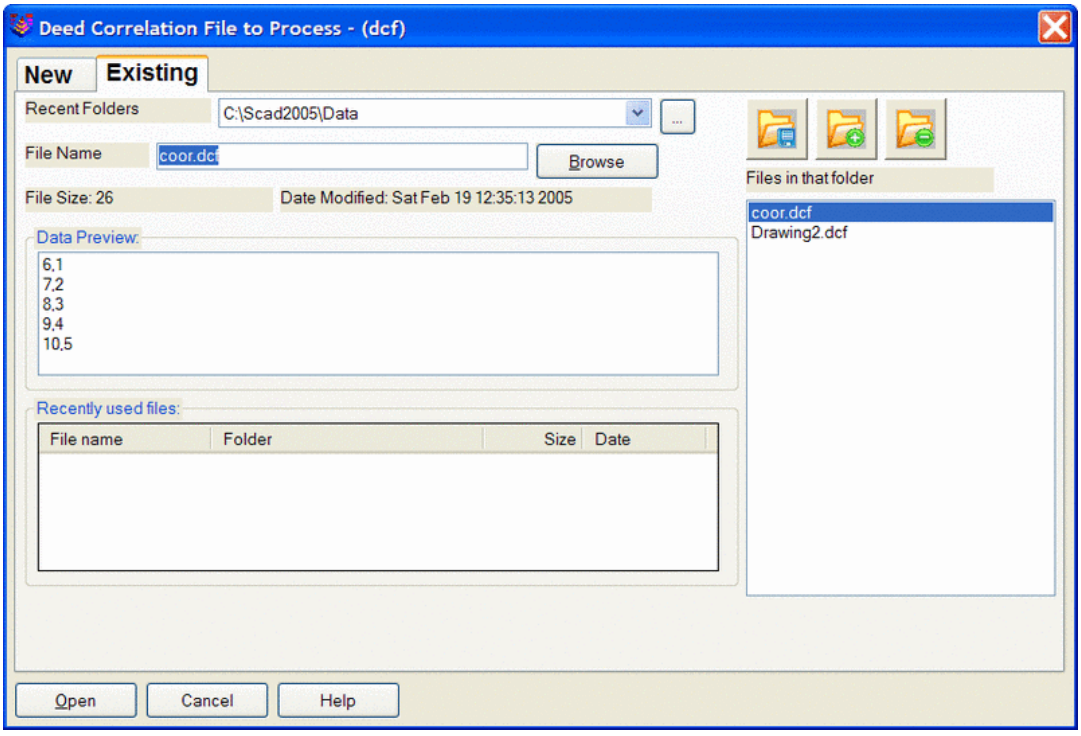
After specifying the hold and rotation points, the deed correlation report will display again, showing the bearing and distace of each side of the tract/description.


SurvCADD Edit : C:\scad2006new\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Deed Correlation Report 2/23/2005 14:11
Survey Points From: 6
To Point Bearing Distance Desc
7 N62°41'33"E 478.353 sur
8 N87°21'09"E 784.656 sur
9 S69°32'02"E 919.915 sur
10 S28°24'42"E 597.129 sur
Deed Points From: 1
To Point Bearing Distance Desc
2 N62°38'22"E 481.363 deed
3 N87°16'09"E 787.390 deed
4 S69°41'09"E 921.341 deed
5 S28°42'56"E 597.605 deed
Survey Points From: 7
To Point Bearing Distance Desc
6 S62°41'33"W 478.353 sur
8 S62°56'56"E 402.846 sur
9 S38°54'44"E 695.407 sur
10 S10°42'59"W 757.876 sur
Deed Points From: 2
To Point Bearing Distance Desc
1 S62°38'22"W 481.363 deed
3 S62°53'55"E 403.259 deed
4 S38°53'41"E 695.218 deed
5 S10°40'01"W 758.444 deed
Survey Points From: 8
Deed Points From: 3


Check Deed Rotation
Hold/Pivot Point 6
Rotation Point 8
OK Cancel Help


SurvCADD Edit : C:\scad2006new\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Check Deed Rotation Report 2/24/2005 14:34
Hold Pivot Point
Survey: 6 Deed: 1
Rotation Point
Survey: 7 Deed: 2
Translate X: -2.956 Y: -1.310
Rotation: 0°03'10"
Survey Pt Deed Pt Bearing Distance
7 2 S 62°38'22" W 3.009
8 3 S 78°33'32" W 2.766
9 4 S 62°16'06" W 2.134
10 5 S 71°43'06" W 2.658





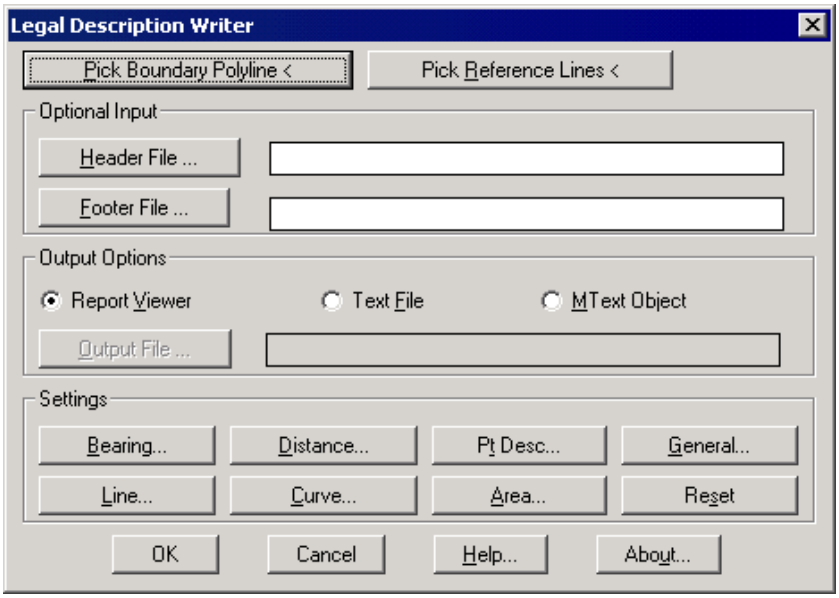
Keyboard Command: deed_align
Prerequisite: Coordinates

Legal Description

Function

The Legal Description Writer allows you to create a detailed legal description from a polyline. This description

consists of calculated calls, point descriptions from CSD points, and numerous terms you can define. You can easily change the values associated with these terms and store the new values as defaults. The initial dialog box is shown below.



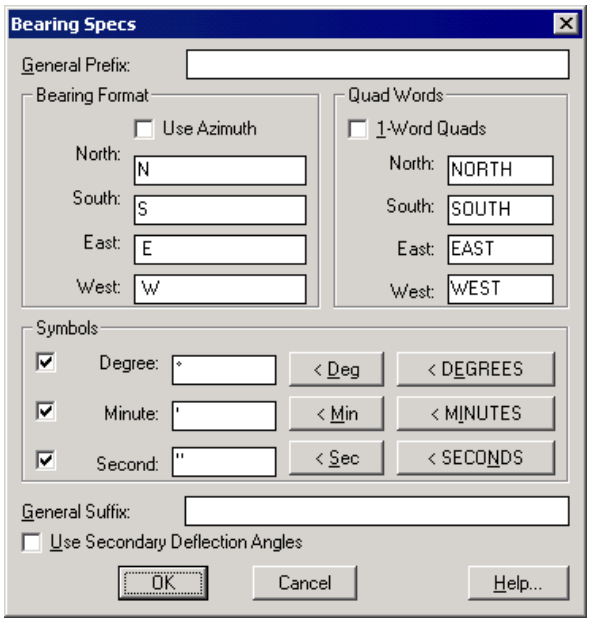
- **Pick Boundary Polyline**: Designates the polyline boundary to use. The boundary should be a closed polyline drawn in the direction of advance.
- **Pick Reference Lines**: Selects lines that tie into the polyline boundary for the legal description. These should be line entities with one endpoint exactly the same as the beginning point of the boundary polyline. If a CSD point exists at the end of the line away from the boundary, the command picks up its description. If not, you are prompted for the description. You can choose any number of reference lines.

- **Header File**: Designates the optional header text file. If a valid file name is entered, it will be written into the top of the output file.
- **Footer File**: Used for the optional footer text file, this is written into the bottom of the output file.
- **Report Viewer**: The output is sent to the standard report viewer.
- **Text File**: The output is sent to an external text file, as designated in the output file section of this manual.
- **Mtext Object**: This creates an Mtext object in the current drawing. You will be prompted for a starting point (which is the upper left corner), as well as a second point that determines the width and angle. By default, Ortho is turned on for the second point. Press the F8 key to toggle Ortho off.
- **Output File**: Used to designate the output text file. This file can then be brought into your word processor and edited. Note that the appearance of the output file can be affected by the status of the Use Paragraph Format toggle.

Settings Group

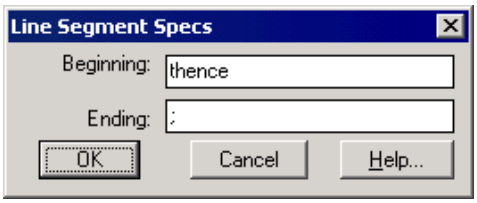
Buttons in the Settings group initiate additional options that are explained in detail in the following sections.

1. **Bearing**: This option is used to establish the appearance of the bearings that are drawn with the description.

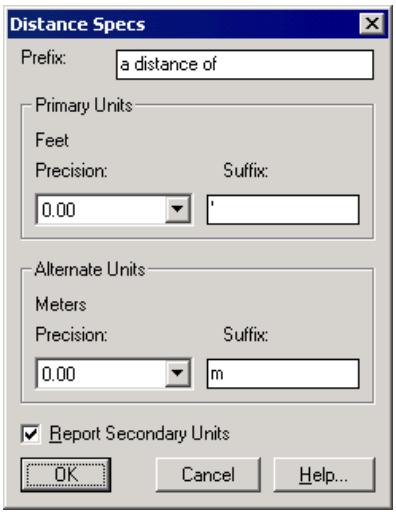


- **Bearing Format**: Designates the character or word used in each bearing direction. Standard values are the letters N, S, E, or W. One possible option is the entire words NORTH, SOUTH, EAST, and WEST. *Keep in mind that spaces must be included*. If you don't enter a space after N/S, and before E/W,a space will not be formatted into the bearing.
- **Words Quads**: For bearings that are due NORTH, the default is to generate N 00 00' 00 E. If the 1-Word Quads toggle is turned on, the program will substitute the single word (which you can change) for the direction, usually NORTH, or DUE NORTH.
- **Symbols**: Designates the precision for bearings, as well as the symbols used. Turn on/off the toggles for degrees, minutes, and seconds to control the precision (e.g. if you wish to round to the nearest minute, simply clear the toggle from the second field). For each field (degrees, minutes, seconds), you can supply the character or word to be used. You can quickly fill in these fields with the two buttons to the right of each field.

2. **Line**: Establish the terms used when the course of a call is a line segment. Supply the beginning and ending terms for these line calls.

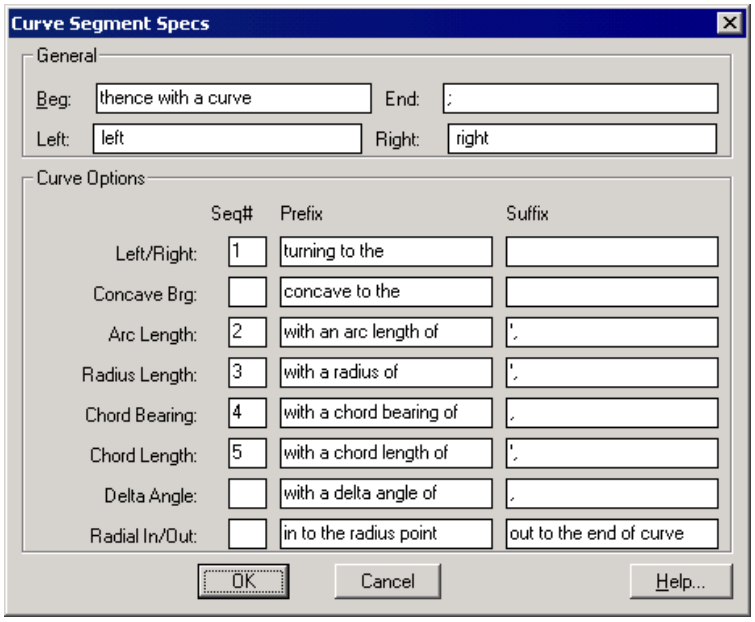


3. **Distance**: This dialog box is used to establish the terms and precision used when creating a distance for the course of a call. The precision and suffix apply to curves as well. Choose the desired distance precision from the window, and supply the beginning and ending terms for the line calls.

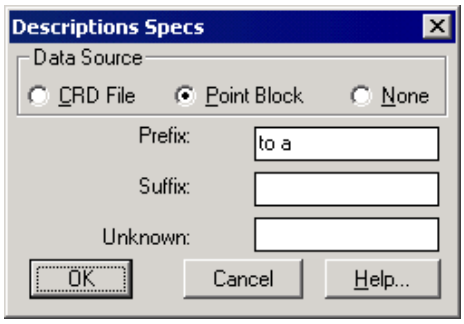


If you would like to report dual distances, such as feet/metric, turn ON the toggle in the lower left corner of the dialog box. The primary units are set in the Settings menu, Drawing Setup (e.g. if you have English as your default unit, the alternate will be metric, etc.).

4. **Curve**: Establish the terms and options used when creating the course of a curve. Basic options include beginning and ending terms and the words for left and right (if chosen). In the large table of curve options, select the items you wish to report in the order you want them to appear, by placing a number in the sequence field indicating the desired order. Make sure you do not enter duplicate numbers.

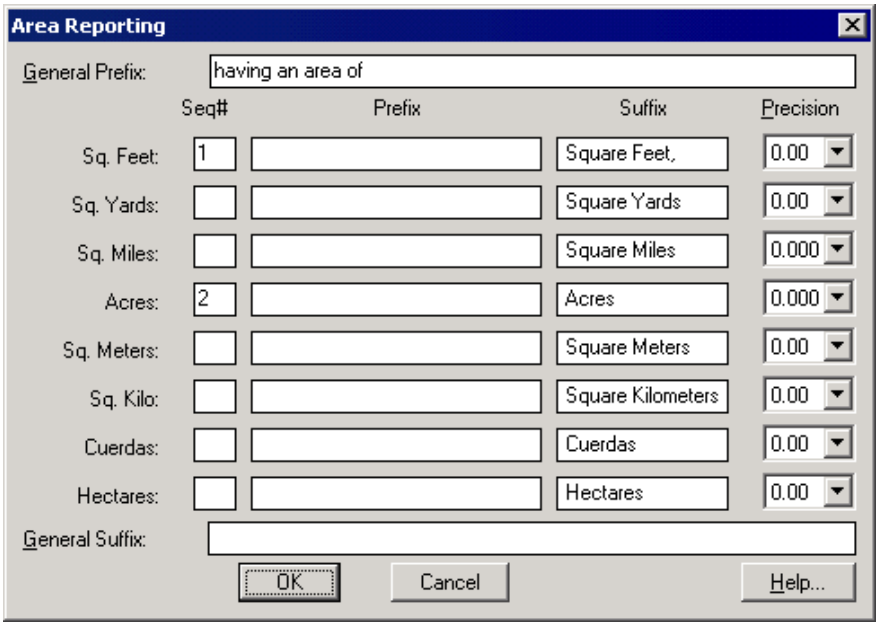


5**. Pt Description**: In the process of following the polyline definition for a boundary, the Legal Description Writer can look for descriptions of the points at the endpoints of the polyline. These can be extracted by setting the data source to the corresponding point from the coordinate file, meaning the points do not have to be plotted on the screen. A second option is Point Block. With Point Block, the command reads the information from the drawing, instead of a coordinate file.

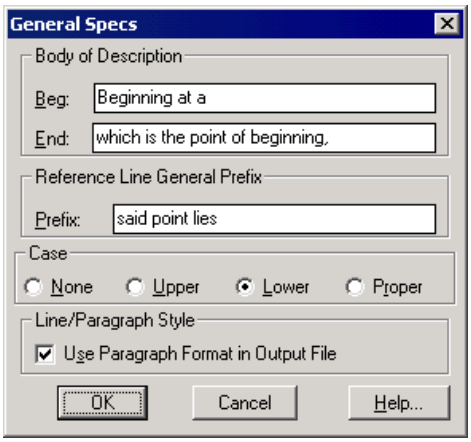


- **Data Source**: Choose the source for the point data; either the current point database, point blocks from in the drawing, or none.
- **Prefix**: General term applied before the actual description.
- **Suffix**: General term applied after the actual description.
- **Unknown**: The text designated here will be placed in the description if the program does not find a valid description at that coordinate location. The words Unknown Point may be used.

6. **Area Reporting**: The Legal Description Writer can output several types of areas. Basic options include beginning and ending terms. In the large table of area options, choose the items you wish to report, in the order you want them to appear, by placing a number in the sequence field indicating the desired order. Make sure you do not enter duplicate numbers. You can edit the prefix/suffix for each, and control decimal precision of each field output.



7. **General**: This option controls general specifications, which can affect the entire description. Each item is explained in detail below.



- **Body of Description**: Enter the beginning and ending terms for the description.
- **Reference Line General Prefix**: Specify the prefix string when a reference line is selected.
- **Case**: Choose the button corresponding to the string case conversion desired. If you want no changes to be made, choose none. Choosing upper, lower, or proper case conversion will affect the case of all text throughout the description, except bearing letters.
- **Line/Paragraph Style**: If this toggle is on, the program will output the description without carriage returns after each line. This approach makes a nice paragraph style when brought into a word processor with word wrap. If the toggle is cleared, the program will place carriage returns at the end of each call.

8. **Reset**: This option resets the entire dialog box back to the original settings from the installation.

Minimum Procedure Outline:

- Initiate Legal Description from the Tools menu.
- Choose the Pick Boundary Polyline button and select desired polyline.
- Choose OK, and the boundary description will appear in the Report Viewer.

Standard Procedure Outline:

- Initiate Legal Description from the Tools menu.
- Choose the Pick Boundary Polyline button and select desired polyline.
- Designate the Header, Footer, and Output file names.
- Choose the appropriate button for the output you desire.
- Choose OK to generate the boundary description.

Prerequisite: closed polyline boundary

Keyboard Command: LEGAL

Station-Offset Commands 10

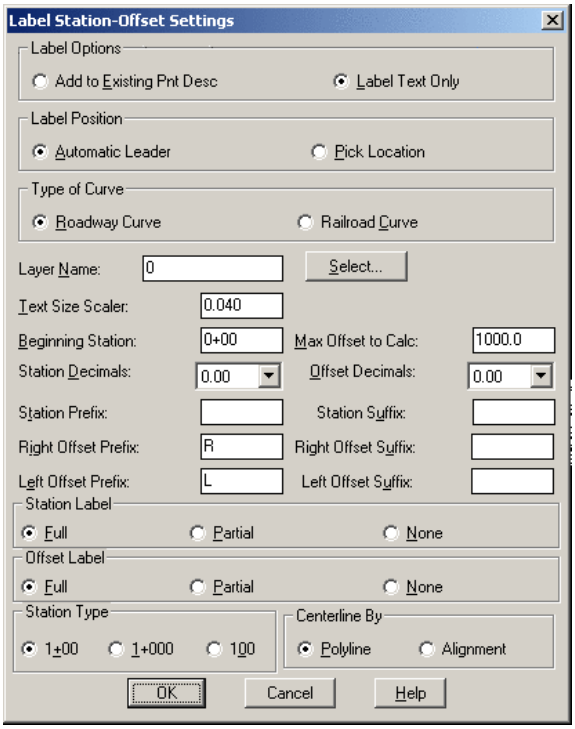
Label Station Offset

Function

This command labels the station and offset of a point, relative to a centerline.

- A polyline that represents the centerline or a centerline file (.CL) is required before running this command.
- The points to label can be picked on screen or specified by point number.
- As the cross hairs are moved, the station and offset of the current position are displayed in real time in the corner of the drawing window.

The options for this command are set in the dialog box shown below:



1. **Label Options:** the two selections described below update the point descriptions and control the label format.

   - **Add to Existing Pnt Desc**: If you have points and want to add the station-offset to the point descriptions, use Add to Existing Point Description. The Point Description option turns the station and offset ON.
   - **Label Text Only**: Labels the offsets that are onscreen as text only. Label Text draws a leader to the point with the station text above the line, and the offset below.

2. **Label Position**: Sets the location. The polyline should be drawn in the order of increasing stations. If the polyline goes the wrong way, use the Reverse Polyline command as described in this manual.

   - **Automatic**: Labeling is automatic.
   - **Pick Location**: Select the location for each label.

3. **Type of Curve**: Sets the type of curve.

   - **Roadway**: Stationing uses the actual arc length of the curve.
   - **Railroad**: Stationing applies a slight adjustment to the arc length based on 100 foot chord segments.

4. **Other settings in Label Station-Offset Settings:** Used for precision and text additions.

- **Layer Name**: Enter in a layer name for the text. The Select button brings up a list of layers to choose from.
- **Beginning Station**: Enter in the beginning station to start the labeling for Automatic.
- **Max Offset to Calc**: Enter in the maximum offset distance to label. Points with offsets greater than the Maximum Offset to Calc are not labeled.
- **Station Decimals**: Determines the precision of the station for labels.
- **Offset Decimals**: Determines the precision of the offset labels.
- **Station Prefix**: Assigns a prefix to station labels.
- **Station Suffix**: Assigns a suffix to station labels.
- **Right Offset Prefix**: Assigns a prefix to right offset labels.
- **Right Offset Suffix**: Assigns a suffix to right offset labels.
- **Left Offset Prefix**: Assigns a prefix to left offset labels.
- **Left Offset Suffix**: Assigns a suffix to left offset labels.

5. **Station Label**: the label can be abbreviated.

- **Full**: Labels the full station.
- **Partial**: Labels a partial station (e.g. at station 5+89, the label would be +89, the characters after the + sign).
- **None**: No station is labeled, only the offset.

6. **Offset Label:** abbreviates the label.

- **Full**: Labels the full offset value.
- **Partial**: Labels a partial offset (e.g. at offset R 34.8, the label is 34.8). The Offset Label Partial will drop the L for left or R for right from the label.
- **None**: No offset is labeled, only the station.

7. **Station type:** Assigns the label format.

- **1+00**: Stationing is drawn in the format 1+00.
- **1+000**: Stationing is drawn in the format 1+000.
- **100**: Stationing is drawn in the format 100.

8. **Centerline By**: Chooses the entity. The centerline labeled is either from a polyline or a horizontal alignment.

Prompts

1. The Polyline should have been drawn in direction of increasing stations.
2. Select Polyline Centerline: pick the polyline centerline
3. Pick point or point number (Enter to End): **pick a point**. Station > 2+10.91 Offset> 57.36 Right
4. Select point number to add station description to: **pick point number**. This prompt will not appear if the L option, Label Text Only, was selected.
5. Pick point or point number (Enter to End): **Press Enter**

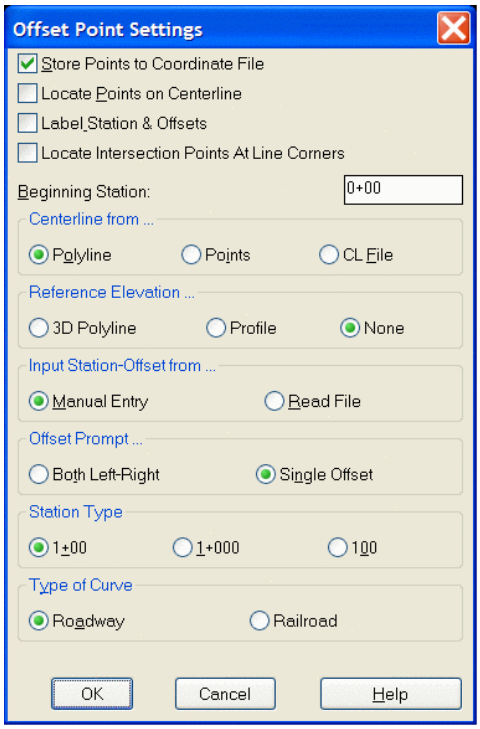
Prerequisite: A polyline centerline

Keyboard Command: offsta

Offset Point Entry

Function

This command creates points along a centerline at specified stations and left and right offsets. The centerline can be defined by a polyline, centerline (.CL) file or two points.



The **Store Points to Coordinate File** option will store any points the the current coordinate (.CRD) file. This includes centerline points and offset points.

When **Locate Points on Centerline** is checked, the program will locate points along the centerline, otherwise just the offset points will be created.

When **Label Stations & Offsets** is checked, the program will label the station-offset as the point description attribute.

When **Locate Intersection Points At Line Corners** is checked, the program will locate points along the centerline at the intersection points of selected lines with that of the centerline. This routine is to be used along with Locate Points on Centerline. This is a good option to use when the exact station of where the offset points are to be created is not known but is referenced by an existing line on the drawing.

Use **Centerline from** to specify whether to define the centerline by picking a polyline in the drawing, selecting a centerline (.CL) file, or using 2 points.

Use **Reference Elevation** to assign elevations to the points created when locating points on the centerline of offset points. When using a 3D Polyline for the elevation reference, points will be created at the station entered and the offsets specified with the elevation of the same station along the 3D polyline. The Profile option will do the same as the 3D Polyline option only it will use a profile file for the elevation reference. You will be prompted for the profile to use for the elevation reference. None simply creates 2d point data on elevation zero. The Reference Elevation option is good for creating points along the centerline for final grade elevation points. *Profile to 3D polyline* can be used to transfer the profile data to the polyline before calculating the final grade points.

The Manual Entry option in **Input Station-Offset from** will prompt for the station and offset distances. The Read File option will read the stations and offsets from a text file. The text file format is comma delimited with point number, station, offset and elevation. The station should be just the station number without the '+' (i.e. 250 instead of 2+50). The elevation is optional. The Read File option is a quick routine to convert a station-offset data file into coordinates.

When **Offset Prompt** is set to Both Left-Right, the program will prompt for left and right offsets. If you respond

to an offset prompt with zero (0), no offset point is created. The Single Offset option will prompt for one offset per station. Enter a right offset with a positive value and a left offset as a negative value.

Use **Station Type** to specify the stationing format to use.

Use **Type of Curve** to specify whether the curves are for a roadway or railroad.

Prompts

Offset Point Settings Dialog
Polyline should have been drawn in direction of increasing stations.
Select Polyline near endpoint which defines first station.
[nea on] Select Polyline to Station-Measure: *select a polyline*
(5309.0 4845.0) Station: 0.00
(5526.0 4917.0) Station: 228.63
Distance from beginning station along centerline (Enter to end): *110*
Starting Segment Station: 0.0 Ending Segment Station: 228.633
Working Line segment...(5413.4 4879.64 0.0)
Left offset distance <10.0>: *15*
Right offset distance <15.0>: *20*
Distance from beginning station along centerline (Enter to end): *press Enter*

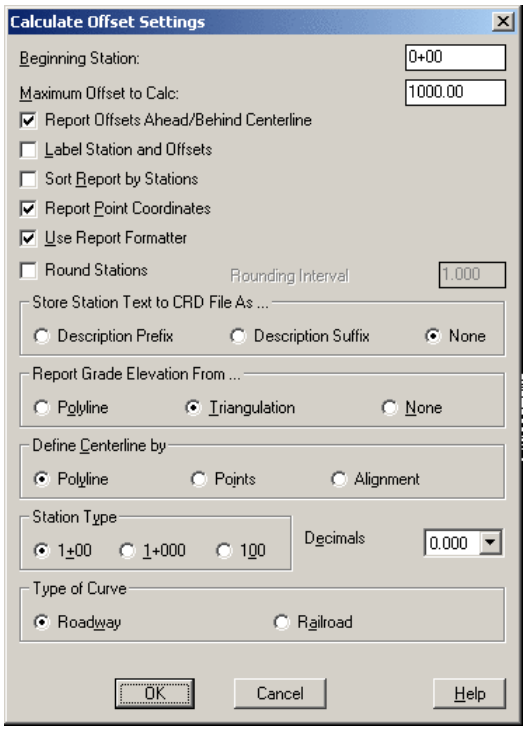
Keyboard Command: offpts
Prerequisite: A centerline (.CL) file, polyline, or two points

Calculate Offsets

Function

This command calculates the station and offsets of point coordinates from a centerline.

- The points used to calculate the offsets can be stored in the current project point database or picked on the screen.
- When picking points, the station and offset of the current position of the cross hairs is displayed in the lower screen menu.
- The centerline can be defined by either a polyline, by two point numbers, or by centerline (.CL) file.



1. **Calculate Offset Settings**

   - **Beginning Station**: Specify the starting station of the centerline. When using a centerline (.CL) file, this field is not available.
   - **Maximum Offset to Calc.**: Specify the maximum distance the program should look when calculating an offset.
   - **Store Station Text to CRD File**: Stores the station and offset values in the point descriptions in a coordinate file.
   - **Display Offsets Ahead/Behind Centerline**: Shows offsets for points or picked points located before the beginning station and after the ending station of the centerline.
   - **Label Station and Offsets**: Draws station-offset labels.
   - **Sort Report by Stations**: Reports the station-offsets in station order, no matter what order the points were calculated.
   - **Report Point Coordinates**: Includes the point northing and easting in the report.
   - **Use Report Formatter**: Customizes the layout of the report fields outputs the data to Microsoft Excel or Access.
   - **Round Stations**: Rounds the selected stations to the interval specified in the Rounding Interval field.
   - **Rounding Interval**: Specify the amount of rounding to use when rounding stations. Available only if Round Stations is checked.
   - **Report Grade Elevation From**: Calculates an elevation for each point from a 3D polyline, grid (.GRD) file, or triangulation (.FLT) file. To use this option, the Report Formatter option must be toggled ON. The grade elevation is reported and compared with the point elevation to report the cut/fill.
   - **Polyline**: The grade elevation is calculated by finding the elevation at the point on the 3D polyline that is the nearest perpendicular position from the offset point. The 3D polyline that is used for elevations does not need to be the same polyline used as the centerline for the station-offset calculations.
   - **Triangulation**: Prompts you to specify a triangulation surface.
   - **None**: No grade elevations are calculated.

2. **Define Centerline by**: Defines the type of the centerline to use.

- **Polyline**: Select this option to pick a polyline in the drawing.
- **Points**: Select this option to use points representing the centerline.
- **Alignment**: Select this option to use a horizontal alignment.

3. **Station Type**: Assigns the label format.
   - **1+00**: Stationing is drawn in the format 1+00.
   - **1+000**: Stationing is drawn in the format 1+000.
   - **100**: Stationing is drawn in the format 100.

4. **Decimals**: This is the number of decimals used in the stationing and labeling.

5. **Type of Curve:** Sets the type of curve.
   - **Roadway**: Stationing uses the actual arc length of the curve.
   - **Railroad**: Stationing applies a slight adjustment to the arc length based on 100 foot chord segments.

Prompts

1. The polyline should have been drawn in direction of increasing stations.
2. Select the polyline near the endpoint that defines the first station.
3. Select Polyline Centerline: select polyline centerline
4. (5309.0 4845.0) Station: 0.00
5. (5526.0 4917.0) Station: 228.63

PtNo. North(y) East(x) Elev(z) Description
140 4889.13 5410.25 0.00 1+10.00L10.00
Station on Line> 1+10.00 Offset> 10.00 Left

PtNo. North(y) East(x) Elev(z) Description
141 4870.15 5416.55 0.00 1+10.00R10.00
Station on Line> 1+10.00 Offset> 10.00 Right

+ before station denotes point is ahead of line segment, - denotes beyond.

6. Pick point or point numbers (Enter to End): 22-28

Station	Offset	Description	Elev	Pt#	North	East
4+95.89 L	15.48	Catch Basin	0.00	22	4811	4454
5+78.43 L	58.18	Power Pole	0	23	4839	4548
6+77.26 L	57.28	Power Pole	0	24	4868	4656
9+01.55 R	16.81	Catch Basin	0	25	4745	4887
10+50.51 L	25.39	Traffic Sign	0	27	4872	5043
4+03.48 R	22.15	Light Pole	0	28	4657	4454

7. Pick point or point numbers (Enter to End): **Press Enter**

Menu Location: Tools

Prerequisite: A polyline that represents the centerline or a centerline file (.cl).

Keyboard Command: CALCOFF

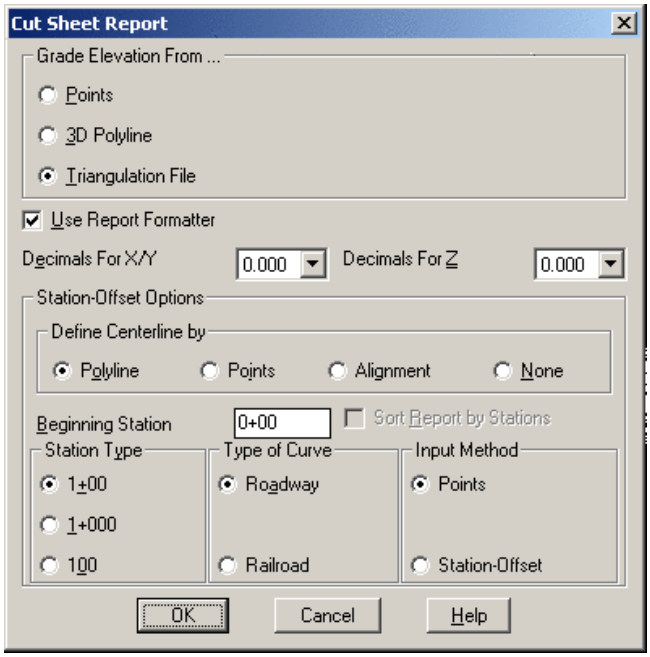
Cut Sheet 11

Cut Sheet

Function

This command creates a report of the elevation difference between points, and a design elevation which can be defined by a triangulation surface, 3D polyline or design points. The station and offset of the points can also be reported if a centerline is specified.

- The Report Formatter option can be used to customize the report layout and to output the report data to Microsoft Excel or Microsoft Access.



1. **Grade Elevation From**:

   – **Points**:Reports the horizontal distance and cut/fill between two points. The points to compare can be in the same coordinate file, or separate files. For the same coordinate file option, two ranges of point numbers are compared. For the separate file option, the point numbers are used to match points between the files.
   – **3D Polyline**: When using a 3D polyline for the grade elevation, the command calculates the elevation along the polyline at the position perpendicular from the point.
   – **Triangulation File**: For triangulation of surface files, the design elevation is determined by the surface file at the point.

2. **Use Report Formatter**: Used to customize the report layout, and to output the report data to Microsoft Excel or Access.
3. **Decimals:** Controls the decimal precision used.
4. **Grade to Process:** Uses the top surface or various subgrades.
5. **Define Centerline by**: Contain the station settings.
   – **Polyline**: Selects a polyline in the drawing.

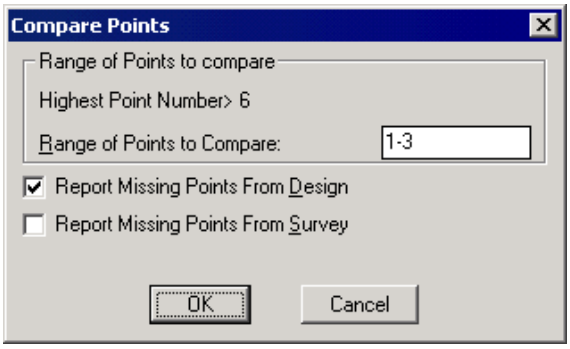
– **Points**: Uses points representing the centerline.
– **Alignment**: Uses a project alignment.
– **None**: Centerline is not used.

6. **Beginning Station**: Used when defining a centerline by points or by selecting a polyline. Enter the beginning station.
7. **Sort Report by Stations:** Allows you to sorts the output report by station number.
8. **Station Type**: The label format is assigned.
   – **1+00**: Stationing is drawn in the format 1+00.
   – **1+000**: Stationing is drawn in the format 1+000.
   – **100**: Stationing is drawn in the format 100.

9. Under the Type of Curve, you set the type of curve.
   – **Roadway**: Stationing uses the actual arc length of the curve.
   – **Railroad**: Stationing applies a slight adjustment to the arc length based on 100 foot chord segments.

Prompts

- When using a 3D polyline for the grade elevation, the program calculates the elevation along the polyline at the position perpendicular from the point.
- For grid and triangulation surface files, the design elevation is determined by the surface file at the point.
- With section files, the grade elevation is interpolated from the offset-elevation data in the section file based on the station-offset of the point along the centerline.
- The Points option reports the horizontal distance and cut/fill between two points. The points to compare can be in the current project point database or separate point database files.
- For the same point database option, two ranges of point numbers are compared.
- For the separate file option, the point numbers are used to match points between the files. If point numbers are missing in the comparison (e.g.. points 1 to 3 in the current coordinate file are being compared to points 1 and 3 in the design coordinate file), there is an option for reporting the missing points in the Compare Points dialog (shown below).



This generates the following report.

Cut Sheet 11/29/2002 02:25

Survey Coordinate File> c:\CarlsonOEM\exist\data\points.mdb

Design Coordinate File> C:\CarlsonOEM\design\data\points.mdb

Survey Design

Pt# Elevation Elevation Delta-X Delta-Y Cut/Fill Description

---

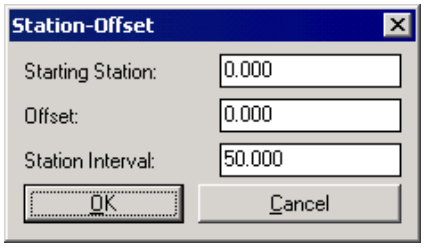
1 3511.400 3519.340 0.000 0.000 F7.940 fill

2 Missing From CRD File 2

3 3499.000 3502.110 0.000 0.000 F3.110 fill

- If the Station-Offset method is selected as an Input Method, only the final grade elevations are produced in the report. This is useful for writing final grades on the stakes prior to taking field shots.

- You are first prompted for the desired offset and starting station (as shown in the Station Offset dialog below), and then obtain a report of final grades only.



Cut Sheet 11/29/2002 02:55

PT# Station Offset ElevationGrade Cut/Fill Desc

PP 0.000 R0.000 3663.288

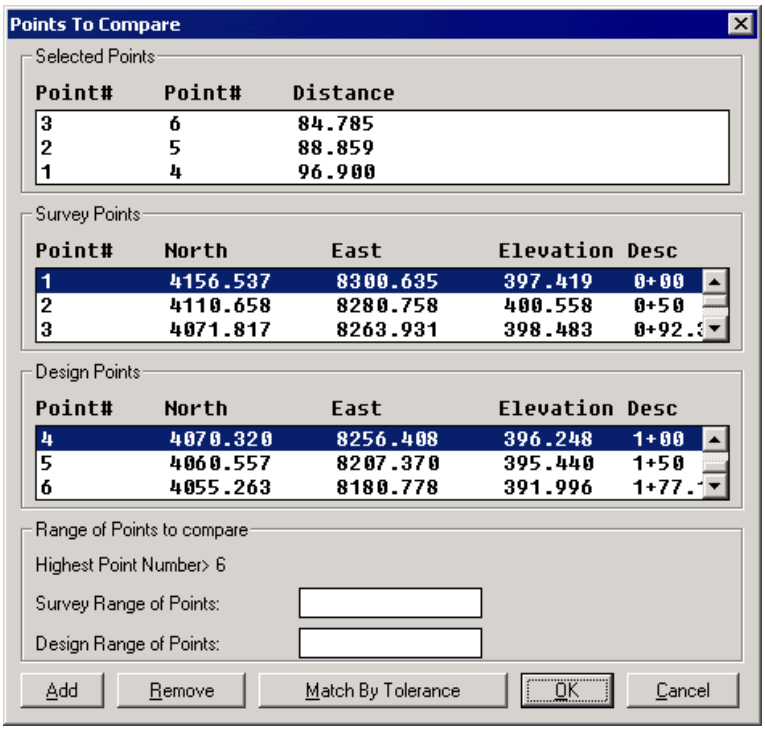
PP 0+50.0 R0.000 3662.031

PP 1+00.0 R0.000 3660.800

PP 1+50.0 R0.000 3633.005

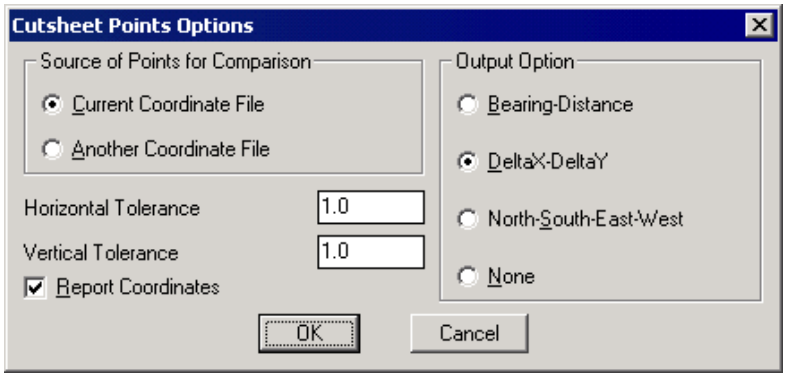
PP 2+00.00 R0.000 3652.743

- When comparing points in the same file, the Points to Compare dialog appears (shown below), which includes the option to assign multiple design points to the same survey point.



1**. Points to Compare**: Establishes in the upper window all the point pairings that you wish to compare for the cut sheet. This is done 3 ways:

- Entering the survey point and design point in the lower dialog boxes (e.g.. 3 and 13 as shown above) and clicking add.
- Selecting the points from Survey Points and Design Points sections and clicking add.
- Matching points that are within a distance tolerance from each other, using Match by Tolerance. This last option can be a huge time-saver, particularly when there is a lack of familiarity with the pairings to analyze. When comparing points, there is an option to flag points in the report that exceed the specified distance tolerance, as shown here.



Prerequisite: None

Keyboard Command: CUTRPRT

Layout Commands 12

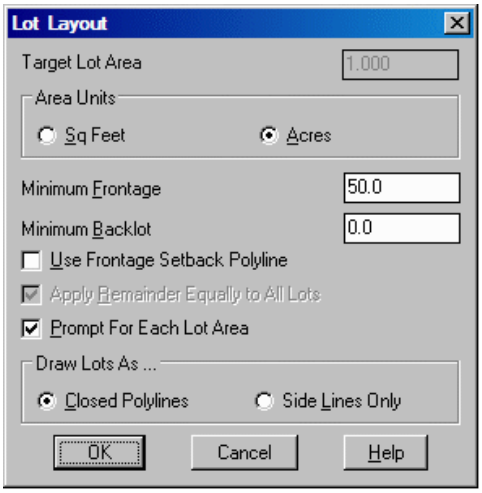
Lot Layout

Function

This command draws lots based on a front and back polyline. Starting from the front polyline, the program calculates two lot side lines perpendicular from the front polyline that intersect the back polyline and create the specified lot size. Lots are created along the front polyline in the order that the front polyline is drawn. If the front polyline needs to be reversed, use the *Reverse Polyline* command. The direction of the back polyline does not matter. The lots can be drawn as closed polylines or just the lot sides can be drawn. There is also an option to automatically create all the possible lots at the specified area between the front and back polylines or to prompt for each 0.4 acre lot.

In prompt mode, the program reports the remaining area between the front and back polylines and then asks for the lot size. The lot size can be specified either by area or frontage along the front polyline.

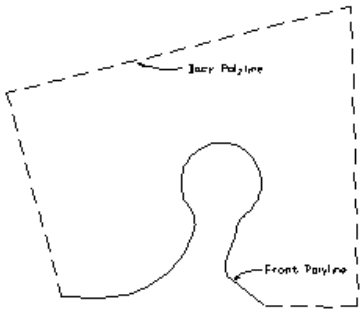
The lots are sized to meet the specified area and also meet the minimum frontage and backlot distances. The program starts by checking the lot area at the minimum distances. If this area is greater than the target, then the lot is drawn at the minimum distance and the resulting lot area will be greater than the target area. Otherwise the program will increase the frontage until the lot reaches the exact target area. The Use Frontage Setback Polyline option allows you to use another polyline besides the actual frontage polyline for the minimum frontage indicator. Typically, this Frontage Setback Polyline would be offset a set amount from the actual frontage polyline.



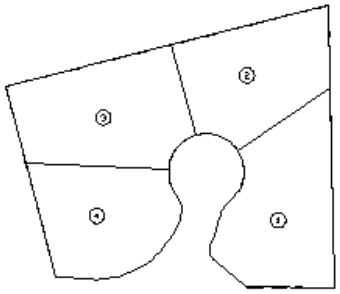
Prompts

Lot Layout dialog
Select front polyline: *pick a polyline*
Select back polyline: *pick a polyline*
With prompt for each lot active:
Area remaining: 160326.88 S.F, 3.6806 Acres
Quit/Frontage/Enter lot area (Acres) <1.2269>: *1*
Area remaining: 116766.88 S.F, 2.6806 Acres
Quit/Frontage/Enter lot ara (Acres) <1.0000>: *F*
Enter Frontage <50.00>: *75*
Lot Area: 37807.50 S.F., 0.8679 Acres
Area remaining: 78959.38 S.F, 1.8127 Acres
Quit/Area/Enter frontage <50.00>: *A*
Quit/Frontage/Enter lot area (Acres) <1.0000>: *press Enter*

Area remaining: 35399.38 S.F, 0.8127 Acres
Quit/Frontage/Enter lot ara (Acres) <1.0000>: *Q*



Polylines for Lot Layout
The Front Polyline goes from right to left



Resulting lots numbered using Sequential Numbers

Keyboard Command: lotlay
Prerequisite: A frontage polyline and a backlot polyline.

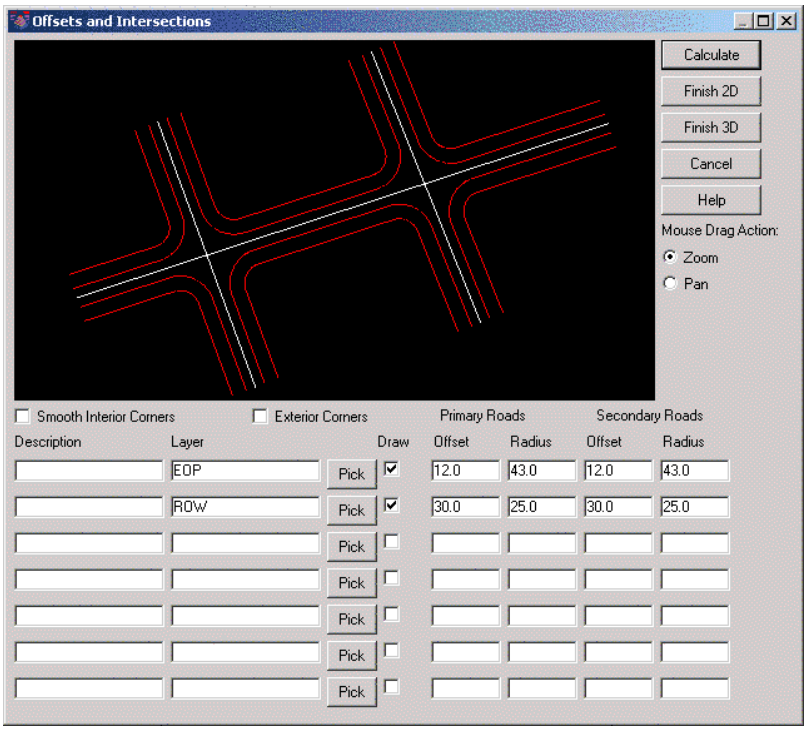
Offsets & Intersections

Function

This command takes a set of centerline polylines and calculates the series of offset polylines using the user defined offset and fillet radius values. The function recognizes primary and secondary roadways which allows for different offsets and fillet radii to be specified for each. Up to seven sets of offsets and radii can be defined for different features such as edge of pavement, right-of-way, sidewalk, etc.. Each set also has a layer name and description. The Pick button lets you set the layer name by picking an entity with that layer in the drawing. The description is for your own information and is not used by the program.

Multiple centerline polylines can be processed together which allows for the creation of an entire set of roadway offset polylines in one step. Intersections are calculated based on the centerlines selected and the fillet radii are applied at the intersections. The Smooth Interior and Exterior Corner options will fillet bends in the offset polylines. Otherwise turns without an arc in the original centerline will become straight corners in the offset polylines. The results of the calculations for the given parameters may be previewed in the dialog. Zoom and pan are available by clicking and dragging mouse on the preview image (zoom or pan mode is selected by a toggle). Once the satisfactory offsets are calculated, they are inserted into the drawing by clicking on Finish2D button. The Finish 3D button opens the *Elevate 2D Polylines* command.

If it is preferable to handle intersections manually, you may run the command multiple times on non-intersecting centerlines. Another alternative is to use the *Offset* command and the *Fillet* command.



Prompts

Select all PRIMARY road polylines.
Select objects: *select polylines*
Select objects: *Enter*
Select all SECONDARY road polylines.
Select objects: *select polylines*
Select objects: *Enter*
Calculating offsets for layer EOP...
Calculating offsets for layer ROW...

Keyboard Command: wayint
Prerequisite: Centerline polylines

Cul-de-sacs

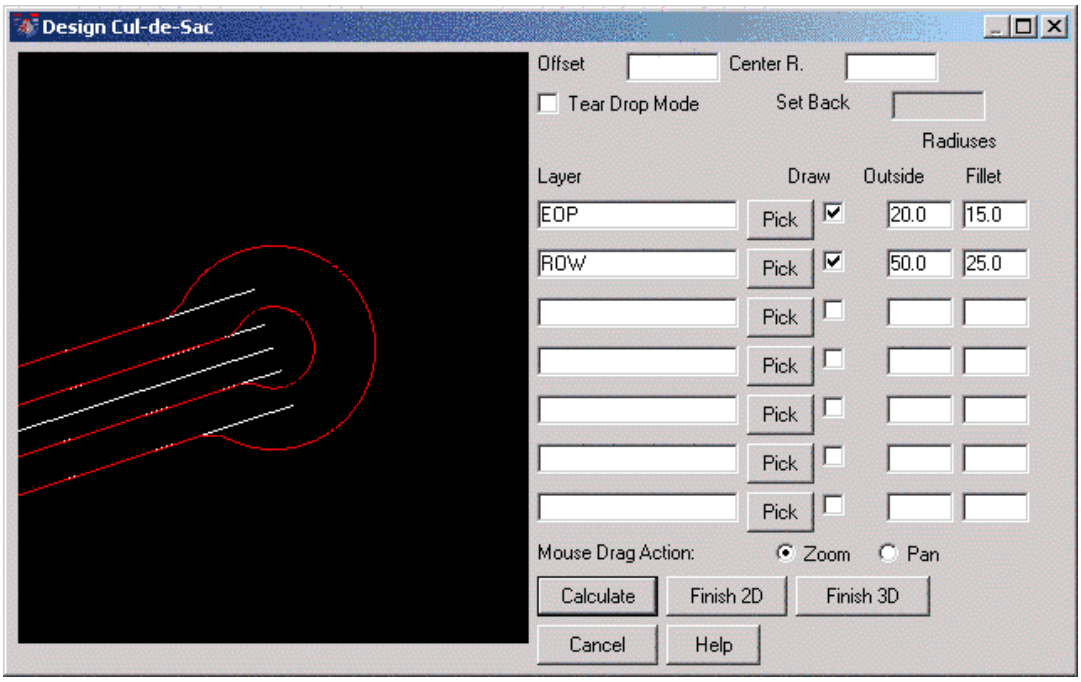
Function

This command uses a polyline centerline and the offset polylines to create a cul-de-sac. These offset polylines can be generated by the *Offsets & Intersections* command, or with the standard *Offset* command. The layer names of the offset polylines must match the layer names set in the dialog.

To run this command, pick a set of polylines and point on roadway centerline where the cul-de-sac center is. For cul-de-sacs with an offset center, pick a projection of that center onto the centerline and specify an offset distance (positive value is offset to the right, negative - to the left). Like the *Offsets and Intersections* command, a preview

is shown of the cul-de-sac being designed. Any of the cul-de-sac parameters may be modified and reviewed before the cul-de-sac is applied and the drawing is modified with the Finish 2D button.

Bend cul-de-sacs are created by selecting offset entities on one side of the centerline.



Prompts

Select all offset polylines to end with cul-de-sac.
Select objects: *make selections*

Keyboard Command: stdcul
Prerequisite: A set of offset polylines and roadway centerlines.

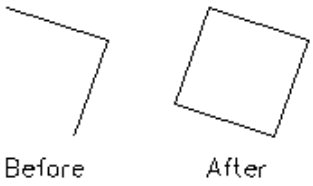
4 Sided Building

Function

Often only two sides of a building are surveyed in the field. This routine completes the building by drawing the other two sides. 4 Sided Building creates a parallelogram given two connecting lines or given a polyline with two segments. With two lines, there is an option to make the parallelogram as a polyline or as four lines.

Prompts

Options/<Pick a line or polyline>: *pick a line*
Pick another side (Enter for none): *pick a line*
Convert the lines into a polyline [<Yes>/No]? *press Enter*
Options/<Pick a line or polyline>: *press Enter* Entering O for options lets you choose whether or not to be prompted to set the new polyline width.

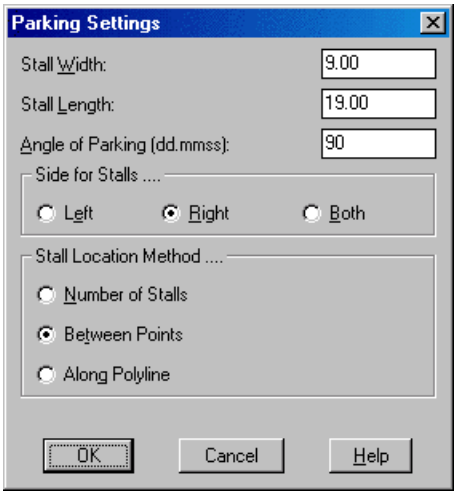


Keyboard Command: 4sided
Prerequisite: A polyline with two segments or two adjoining lines

Parking

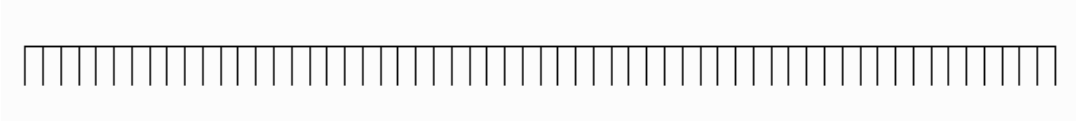
Function

This command draws a series of parking stalls or equilateral lot lines. The command prompts for stall width, stall parking angle, side for stalls and stall depth. Stalls can be located by the number of stalls in a direction, as many as fit between two points, or along a polyline.



Prompts

Parking Settings dialog *make selections*
Starting point? *pick a point*
Pick point or point number
Ending point? Pick point or point number *pick a point*
Created 58 stalls.



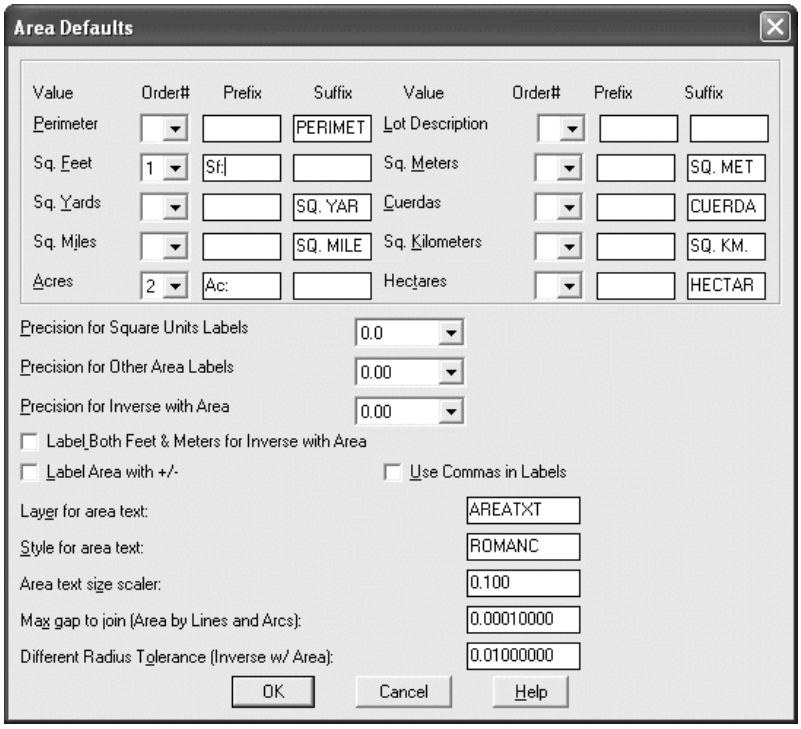
Keyboard Command: parking
Prerequisite: Locate a starting point and an ending or direction point

Area Commands 13

Area Label Defaults

Function

The Area Defaults dialog box (shown below) allows you to set the way areas will be labeled.



1. You must assign a sequence number to each type of label in order to control the order in which the labels are drawn. If a sequence number is left blank, the corresponding area label value is not used.
2. For each value, you can set the label suffix name. You can also specify the precision of the labels.
3. You must determine label style and layer.
   - **Label Both Feet & Meters for Inverse with Area**: When this option is turned ON, both feet and meters will be shown in the Inverse with Area report.
   - **Label Area with +/-**: Displays + or - in the area labels.
   - **Use Commas in Labels**: Allows you to use commas in the area labels.
   - **Layer for area text**: Assigns a layer for the area text.
   - **Style for area text**: Sets a text style.
   - **Area text size scaler**: Sets the text size to appropriate scale.
   - **Max gap to join (Area by Lines and Arcs)**: Use this option during Area by Lines & Arcs command. When connecting lines and arcs that define the perimeter, this command will join endpoints if the distance between the two points is less than the specified gap. Otherwise, the program will report an error and will not report an area.
   - **Different Radius Tolerance**: Checks the difference between the PC-Radius and PT-Radius on curves. If the difference between these distances is greater than this tolerance, an accurate area calculation cannot occur, and the command displays a warning.

Prerequisite: None

Keyboard Command: DEFAREA

Inverse with Area

Function

This command generates a report of the bearing and horizontal distance between a series of points. The report also includes the northing, easting, and station of each point, and calculates the area of the closed figure defined by the points. Curve data can also be entered and reported.

- Inverse with Area creates a polyline of the figure which can be erased or kept in the drawing. The points can be either picked on the screen or entered by point number.

- You can also enter a range of point numbers (e.g. 1-9). The closure precision is calculated by dividing the total distance inversed by the closure error. The distance between the starting and ending points is the closure error.

- To report the distances in both feet and meters, select the Label Both Feet & Meters for Inverse with Area option in the Area Label Defaults dialog box. The area can be labeled in the drawing using the settings from the Area Label Defaults command.

Prompts

1. Station/<Pick starting point or number>: **select a point**
2. Pick point or point numbers (R-Radius Pt,U-Undo,Enter to end): **select a point**
3. Pick point or point numbers (R-Radius Pt,U-Undo,Enter to end): **R** for radius
4. Radius point number or pick point: **select a point**
5. Curve direction (Left/<Right>)? **Press Enter**
6. Pick End of Arc or point number (U-Undo,Enter to end): **select a point**
7. Pick point or point numbers (R-Radius Pt,U-Undo,Enter to end): **select a point**
8. Pick point or point numbers (R-Radius Pt,U-Undo,Enter to end): **Press Enter**. A complete report is generated.
9. Pick area label centering point: **select a point**
10. Erase Polyline Yes/No <Yes>: **Press Enter**. This option allows you to keep the polyline you have created on the screen.

Prerequisite: None

Keyboard Command: invarea

Area by Lines and Arcs

Function

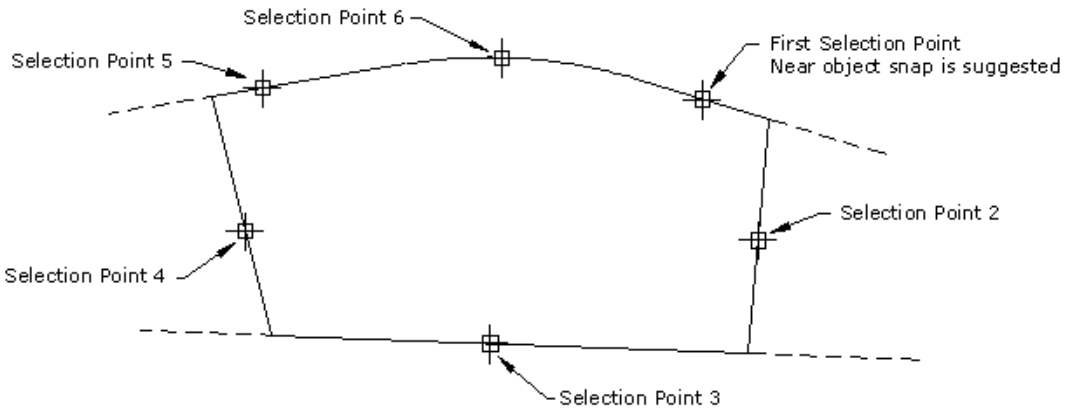
This command allows you to calculate the area of a perimeter or lot defined by lines, arcs, or polylines. The default settings for joining the perimeter and labeling the area are defined in Area Defaults.

- One of the settings is the maximum gap size to join. If a gap is greater than this gap tolerance, the area is not reported, and the program displays a temporary X symbol at the gap.

Prompts

1. Select lines and arcs or polylines of perimeter for area calculation.
2. Select Objects: select lines and arcs or polylines. The lines and arcs are then joined together and the area is

calculated.
3. Enter/pick Label center point: **pick point**. The area is then plotted at the point selected.



Prerequisite: Lines, arcs, or polylines on screen.

Keyboard Command: JOINAREA

Area by Interior Point

Function

This command calculates and labels the area of the perimeter surrounding a selected interior point.

- The AutoCAD Boundary command is used to find the perimeter. Generally this command will only work on closed or overlapping objects. Use Area by Lines & Arcs for other applications.

Prompts

1. Pick point inside area perimeter: Select a point.
2. Pick area label centering point: Select a point. The area is then plotted at the point selected.

Keyboard Command: ptarea

Prerequisite: Set Area Label Defaults.

File Name: \lsp\ptarea.lsp

Area by Closed Polylines

Function

This command will calculate and report the area of multiple polylines. A typical report is shown below:

Keyboard Command: plarea

Prerequisite: Set Area Label Defaults.

File Name: \lsp\ptarea.lsp

Polyline Area 05/19/2002 13:56

Polyline Area: 9392.8 sq meters

Polyline Perimeter: 572.17 meters

Polyline Area: 27808.4 sq meters

Polyline Perimeter: 847.85 meters

Total Area: 37201.2 meters

Total Perimeter: 1420.02 meters

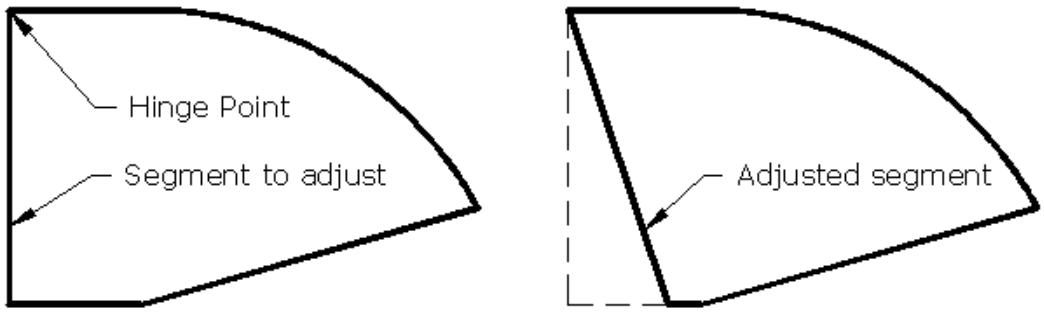
Hinged Area

Function

This command allows you to determine the dimensions of a figure, when the area is fixed and three or more sides are known. You define the figure by selecting a closed polyline, or by picking the known points and curves. The command then prompts you for the area to be solved (in square units or acres).

Prompts

1. Define area by points or closed polyline (Points/<Linework>)? **Press Enter**.
2. Select polyline segment to adjust: Select the segment.
3. Select hinge point[endp]: Select the hinge point.
4. Keep existing polyline (Yes/<No>)? **Press Enter.**
5. Acres/Enter target area (s.f.): **A**. Enter A to specify the desired area in acres.
6. Enter target area (acres): **14**



Prerequisite: A closed perimeter polyline.

Keyboard Command: HAREA

Sliding Side Area

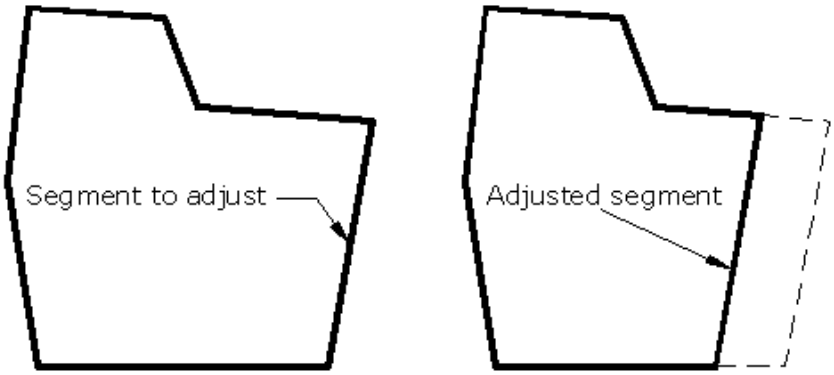
Function

This command adjusts one side of a polyline to meet a specified area.

- The existing area can be defined by a closed polyline, or by picking each point in the perimeter.
- The desired area can be entered in either square feet or acres.
- The area to adjust must be represented by a closed polyline.
- The program moves the selected segment of the polyline in or out.
- The original direction of the segment is maintained.

Prompts

1. Define area by points or closed polyline (Points/<Linework>)? **Press Enter**
2. Select polyline segment to adjust: **pick a line segment of polyline**
3. Keep existing polyline (Yes/<No>)? **Press Enter**
4. Acres/Enter target area (s.f.): **A**
5. Enter target area (acres): **0.45**



Prerequisite: A closed perimeter polyline

Keyboard Command: SSAREA

Area Radial from Curve

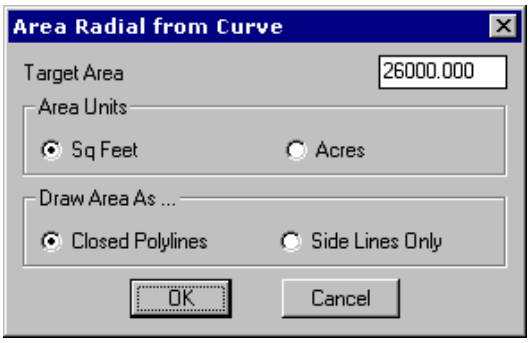
Function

This command allows you to draw lines radial from a curve to reach a predetermined area.

Prompts

1. Define area by points or closed polyline [Points/<Linework>]? Press Enter
2. You define the existing area by selecting polylines or by picking each point in the perimeter.
   - For the point method, the last entity you select when defining the figure should be the curve from which you are radiating.
   - For the polyline method, select front and back polylines.

3. In the Area Radial from Curve dialog box (shown below), you must set parameters for the area calculation.



- **Target Area**: Assign a target area for the calculation.
- **Area Units**: Choose between square feet or acres.
- **Draw Area As**: Choose whether the resulting areas will be displayed as closed polylines, or as areas with only side lines drawn.

4. Select curve to radiate from: pick the curve
5. Select back polyline: pick the polyline
   - The computed lines are drawn perpendicular from the front polyline and intersect the back polyline.
   - This computed line is moved to find the target area.
   - Both ends of the front and back polylines are connected to close the area.

Prerequisite: An existing area defined by points or polylines.

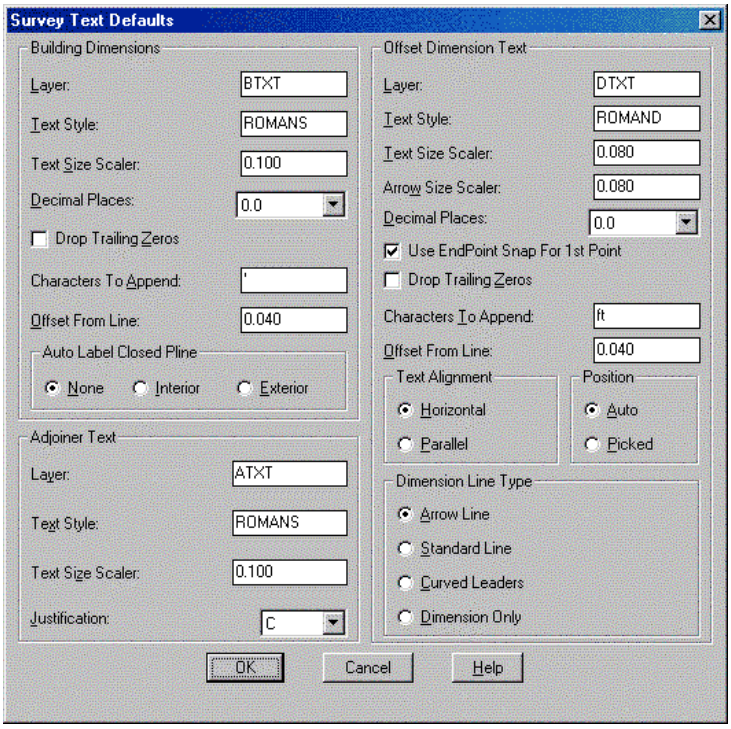
Keyboard Command: AREARC

Survey Text Commands 14

Survey Text Defaults

Function

This command sets the defaults for the Offset Dimensions, Building Dimensions and Adjoiner Text commands.



Building Dimensions allows you to set text specifications for building dimensions.
Layer: Allows you to set the layer for the building text.
Text Style: Allows you to set the text style for the building text.
Text Size Scaler: This value multiplied by the horizontal scale determines the actual text size.
Decimal Places: Allows you to set the display precision for the building dimensions.
Drop Trailing Zeros: Allows you to truncate trailing zeros from dimensions.
Characters To Append: Allows you to set characters to add to reported dimensions.
Offset From Line: Allows you to set the offset distance from the line to the dimension text. **Auto Label Closed Pline** allows you to choose between automatically labeling the Interior or Exterior or closed polylines. You may also choose none.

Offset Dimension Text allows you to set text specifications for offset dimensions.

Layer: This option allows you to set the layer for the offset text.
Text Style: This option allows you to set the text style for the offset text.
Text Size Scaler: This value multiplied by the horizontal scale determines the actual text size.
Arrow Size Scaler: This option allows you to set the arrow scaler to determine arrowhead size.
Decimal Places: This option allows you to set the precision for the offset dimensions.
Drop Trailing Zeros: This option allows you to truncate trailing zeros from dimensions.
Label as Feet and Inches: This option allows you to use feet and inches.
Characters To Append: This options allows you to set characters to add to reported dimensions.
Offset From Line: This option allows you to set the offset distance from the line to the dimension text.

Text Alignment allows you to align text either parallel to the line or horizontally in the drawing.

Position allows you to determine if you are to pick the location of the text, or if the text is automatically positioned in the drawing.

Adjoiner Text allows you to set text specifications for adjoiner text.

Layer: Allows you to set the layer for the adjoiner text.
Text Style: Allows you to set the text style for the adjoiner text.
Text Size Scaler: Allows you to set the text scaler to determine text size.
Justification: Allows you to set the text justification. See the AutoCAD Reference Manual for details on each justification choice.

Dimension Line Type allows you to determine the line style to use for dimensions.

Single Arrow Line: Draws a line with an arrowhead from the dimension text to the figure.
Dual Arrows Line: Draws dual arrowhead.
Standard Line: Draws a line with no arrowhead from the dimension text to the figure.
Curved Leaders: Draws a curved line with an arrowhead from the dimension text to the figure.
Dimension Only: Draws the dimension text with no line.

Keyboard Command: svtextdf
Prerequisite: None

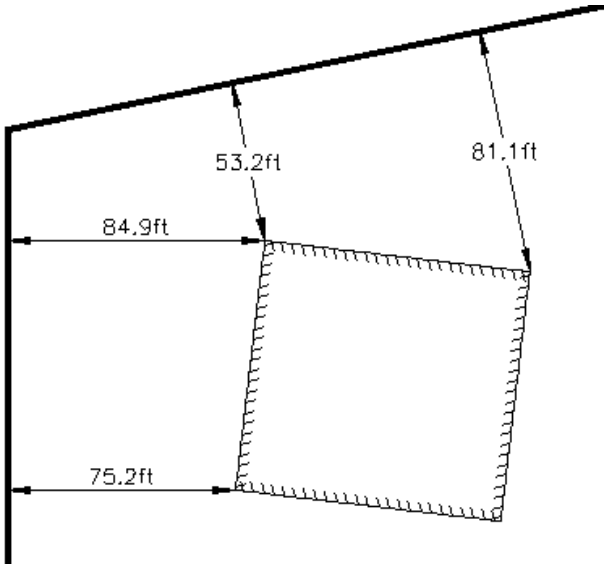
Offset Dimensions

Function

This command labels the perpendicular distance between a point and a line or polyline. The point can be a building corner or other object. The endpoint snap is on by default for picking this point although you may choose another snap mode manually. There is also an option for arrow only on end of line. The text layer, size, style and the dimensioning method are set in the *Survey Text Defaults* command.

Prompts

[end on] Pick Bldg/Object Corner: *pick a point*
Pick Line To Offset From: *pick a line or polyline*



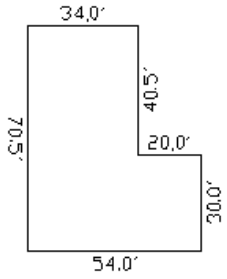
Offset Dimensions showing perpendicular distance from points to property line

Keyboard Command: dimentxt
Prerequisite: Line or polyline

Building Dimensions

Function

This command labels the length of line and polyline segments. The label is located in the middle of the line or polyline segment. The options for Building Dimensions are set in the *Survey Text Defaults* command. One option labels all the segments of a closed polyline with one pick of the polyline. Otherwise the procedure is to pick a line or polyline segment and then choose an alignment. Depending where the alignment point is picked, the label is drawn either perpendicular or parallel, above or below the line.



Prompts

Pick Line or Polyline: *pick line or polyline segment to label*
Pick alignment: *pick point as shown*

Keyboard Command: bldgtext
Prerequisite: Line or polyline

Adjoiner Text

Function

This command draws text that is aligned with the selected line or polyline segment. The layer, style, size and justification for the text is set in the *Survey Text Defaults* command. To align text that is already drawn, use the *Rotate Text* command found in the Edit menu.

Prompts

Pick Line or Polyline: *pick a line or polyline for alignment*
Starting point: *pick a point to start the text*
Text: *MAIN STREET*

Adjoiner Text aligns text with a line or polyline

Keyboard Command: adjntext
Prerequisite: Line or polyline

Create Point Table

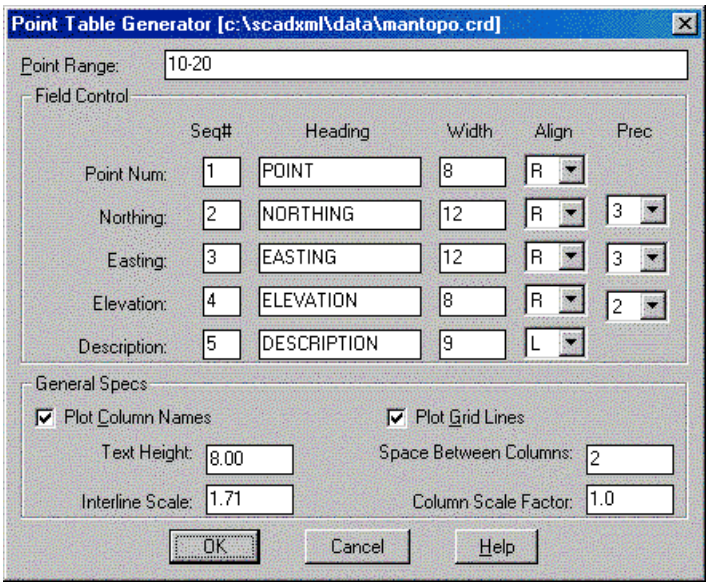
Function

This command draws a table of the coordinate data of the points from the current coordinate (.CRD) file or from the screen. The command displays the dialog shown below for setting the point table options. At the top of the dialog, enter the range of point numbers to label. You can also specify the order and format of the table columns. To not include a data type, set the Sequence number to blank.

Prompts

Point Table Dialog
Building Data List ... Done.

Table Upper Left Corner: *pick a point*
Generating Table... Done.



POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
10	4837.185	4938.546	9.57	17
11	4814.573	4926.339	10.09	17
12	4768.075	4942.627	9.71	17
13	4720 630	4943 015	10.39	17
14	4672 472	4943 661	11.02	17
15	4640.627	4935.524	11.57	17
16	4608.962	4915.995	11.93	17
17	4577.455	4880.778	12.95	tp
18	4504.613	4821.334	13.78	17
19	4436 627	4755 157	15.09	17
20	4370 285	4693 938	16.34	17

Typical Point Table

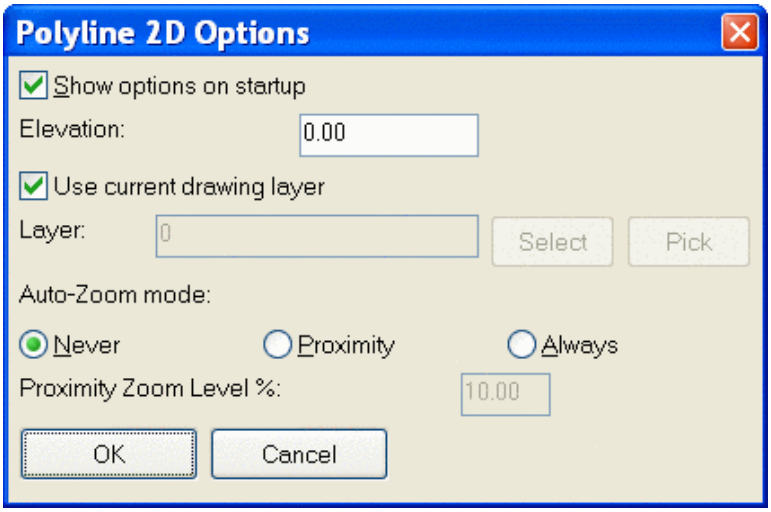
Keyboard Command: pointtbl
Prerequisite: Coordinates

Polyline Commands 15

2D Polyline

Function

In addition to the regular AutoCAD Draw Polyline command (PL), there is the Carlson command that has several options.



The **Show Options on Startup** dialog will appear every time the command is run, unless this is turned off. If it is off, then the last settings will apply. To get the box back, choose O for Options.

The **Elevation** of the polyline can be set here. The default is 0.

If **Use Current Drawing Layer** is on, the layer of the new polyline will be the current layer.

If the current layer is not used, the **Layer** option allows you to **Select** from a list or **Pick** from the screen.

There are 3 options under **Auto-Zoom Mode**. Never will not zoom to the last point picked. Proximity will zoom to the percent proximity set below. Always will always zoom center on every point.

If the Proximity Auto-Zoom mode is checked, the percent of the proximity is set in the **Proximity Zoom Level%** box.

Prompts

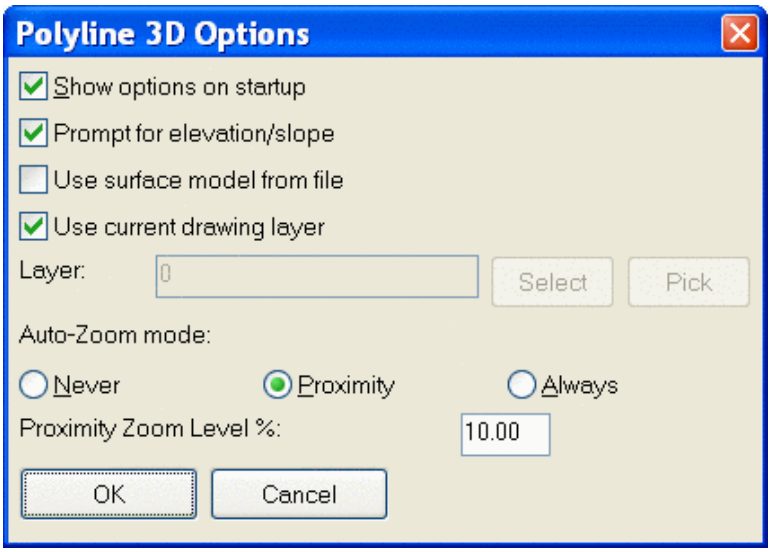
[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick a point*
Segment length: 0.00, Total length: 0.00
[Arc/Direction/Close/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Segment length: 3.83, Total length: 3.83
[Arc/Direction/Close/Extend/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Segment length: 2.94, Total length: 6.77 *press Enter to end*

Keyboard Command: 2DP
Prerequisite: None

3D Polyline

Function

In addition to the regular AutoCAD Draw 3D Polyline command, there is the Carlson command that has several options.



The **Show Options on Startup** dialog will appear every time the command is run, unless this is turned off. If it is off, then the last settings will apply. To get the box back, choose O for Options.

Prompt for Elevation/Slope controls whether the elevation of each picked point will be entered in, or hit S for slope to draw a slope line.

Use Surface Model from File will use a grid or triangulation file as a surface model. Wherever the points are picked on the surface, the elevation of the surface will be assigned to the polyline.

If **Use Current Drawing Layer** is on, the layer of the new polyline will be the current layer.

If the current layer is not used, the **Layer** option allows you to **Select** from a list or **Pick** from the screen.

There are 3 options under **Auto-Zoom Mode.** Never will not zoom to the last point picked. Proximity will zoom to the percent proximity set below. Always will always zoom center on every point.

If the Proximity Auto-Zoom mode is checked, the percent of the proximity is set in the **Proximity Zoom Level%** box.

Prompts

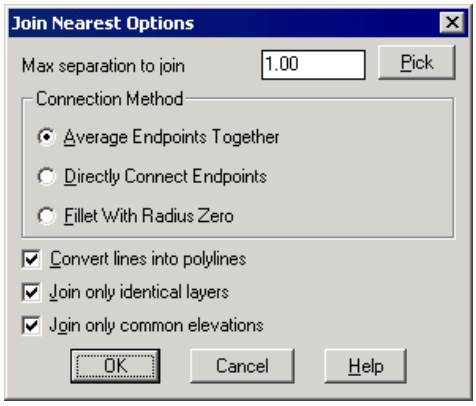
[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick a point*
Elevation <0.00>: *435*
Z: 435.00, Hz dist: 0.00, Slope dist: 0.00, Slope: 0.0% Ratio: 0.0:1
[Arc/Direction/Close/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Slope/Ratio/Interpolate/Degree/<Elevation> <0.00>: *444*
Z: 444.00, Hz dist: 3.67, Slope dist: 9.72, Slope: 245.3% Ratio: 0.4:1
[Arc/Direction/Close/Extend/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Slope/Ratio/Interpolate/Degree/<Elevation> <0.00>: *399*
Z: 399.00, Hz dist: 3.16, Slope dist: 45.11, Slope: -1425.2% Ratio: -0.1:1
[Arc/Direction/Close/Extend/Follow/Undo/<Pick point or point numbers>]: *press Enter to end*

Keyboard Command: 2DP
Prerequisite: None

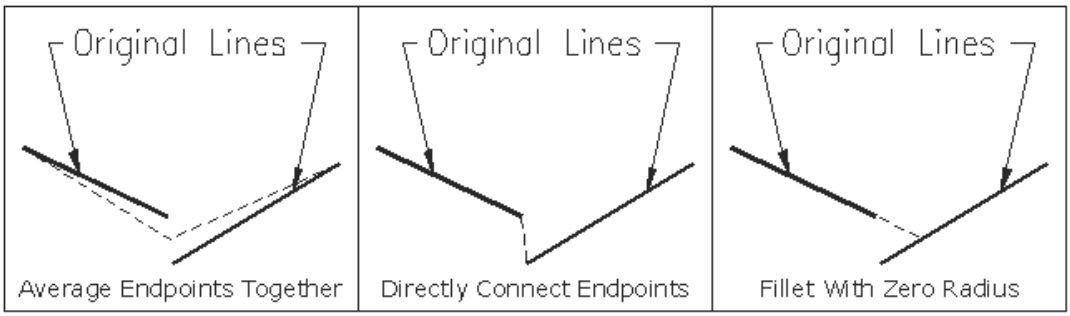
Join Nearest

Function

This command joins lines or polylines together, and allows you to join lines that do not exactly meet. You specify the maximum distance to join, along with other options, in the dialog box shown below. You can join several entities at once.



1. Specify the maximum separation distance parameter. Entities beyond this distance will not join.
2. Under Connection Method, determine how entities are connected.
   - **Average Endpoints Together**: Averages the endpoints of the two entities when joined.
   - **Directly Connect Endpoints**: Directly connects the endpoints of the two entities with a polyline.
   - **Fillet With Radius Zero**: Performs a tight fillet on the two entities.
3. In the Join Nearest Options dialog box, choose to join only lines with common elevations or layers.
   - **Convert lines into polylines**: Automatically converts any lines in the selection set into polylines.
   - **Join only identical layers**: Joins entities on the same layer.
   - **Join only common elevations**: Joins entities with identical elevations.



Prerequisite: Lines or Polylines to be joined.

Keyboard Command: NEARJOIN

Extend by Distance

Function

This command extends a line (or polyline), or creates a new line (or polyline) from an existing one, using a specified distance. The new segment is drawn from the current position, in the direction indicated by the "current position arrowhead."

- Start by selecting an existing line or polyline. Initially, the current position arrowhead will set itself on the closest vertex where the line (or polyline) was selected.

- Extending from the endpoint of a polyline will add a new point to that polyline, while extending from any other point will create a new polyline.

There are two modes of operation: draw mode (D) and move mode (M).

- In draw mode, extending will draw line or polyline segments.

- In move mode, the current position arrowhead can be moved without drawing segments. The orientation of the current position arrowhead can be changed with the Right, Left, and Angle commands.

Here is a list of the Extend by Distance options:

Key	Name	Action
D	Draw mode	Actions draw or extend the line or polyline
M	Move mode	Actions only move the pointer
#	Number	Distance to draw or extend
R	Right rotate	Rotates clockwise 90 degrees
L	Left rotate	Rotates counterclockwise 90 degrees
E	Extend to edge	Extends to intersection with a selected line or polyline
T#	Total distance	Sets current segment to specified distance
A#	Angle change	Rotates pointer by specified number of degrees
A	Align	Rotates pointer to align with segment
B	Bearing	Sets pointer direction by bearing in format: Qdd.mmss with Q-quadrant, d-degrees, m-minutes, s-seconds (e.g. 130.1005 is NE 30 degrees, 10 minutes, and 5 seconds)
S	Switch	Reverses pointer direction
N	Next	Moves pointer to next point
P	Previous	Moves pointer to previous point
U	Undo	Undo the last Extend by Distance command
C	Close	Closes the polyline
O	Open	Opens the polyline
Help	Help	Displays this list

Prompts

1. Select line or pline to extend: **select line or polyline**. Pick the polyline near the place to extend.
2. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **T50**. The line is extended to a total length of 50 units.
3. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **R**. The pointer is turned to the right.
4. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **75**. A polyline is drawn to 75 units.
5. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **B145.0000**. The pointer is turned toward NE at a bearing of 45 degrees.
6. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **50**. A polyline is drawn to 50 units.
7. Enter or pick distance to draw (A,B,C,E,L,M,N,O,P,R,S,T,U,Help): **Press Enter**. Press Enter to end the command.

Prerequisite: An existing line or polyline with at least one segment from which to start.

Keyboard Command: EXTENDER

Boundary Polyline

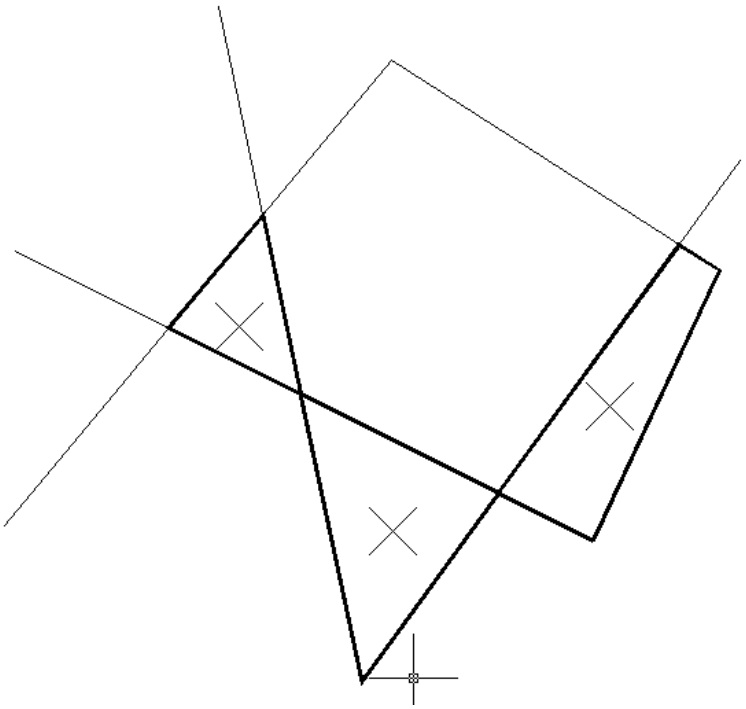
Function

This is a streamlined analog of the AutoCAD command *Boundary.* The Carlson version is faster and works in many cases where *Boundary* fails. *Boundary Polyline* supports a snap tolerance, which means that you may specify a maximum gap to close when creating a closed polyline.

To create closed polylines from any existing linework, simply select all entities you would like to use and specify desired snap tolerance. Then click inside openings you would like to trace and the routine will generate corresponding closed polylines. The duplicate polylines are detected and not created, so that clicking more than once in the same area does not change anything. These new polylines are always created in the current layer. Layers of the original linework do not matter.

Prompts

Select polylines: *pick an entities to be used*
Enter snap tolerance or press Enter for none:
Pick an internal point: *pick the points to enclose*



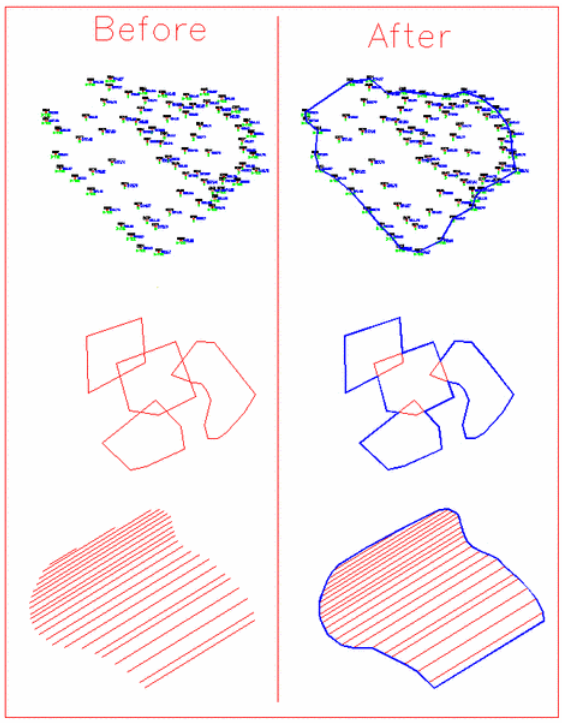
These three polylines are created from original linework by clicking at shown locations

Keyboard Command: boundpl
Prerequisite: Entities

Shrink-Wrap Entities

Function

This command creates a closed polyline which encloses a given set of entities. The resulting polyline is created in the current layer. The program works on either point entities or polylines. For points, the program creates a closed polyline through the points around the perimeter of the area defined by the points. For polylines, the shrink-wrap polyline follows the outside border of the selected polylines. The polylines that are processed have to be connected to be shrink-wrapped. The snap tolerance is the maximum gap that will be joined to make the closed polyline. For open polylines, as in the bottom figure, the Gap method works better, as it jumps across the gaps and connects the end points.



Prompts

Shrink-wrap across gaps or bounded linework only [<Gap>/Bound]? *G*
Shrink-wrap layer <FINAL>:
Select points and linework to shrink-wrap.
Select objects: *select entities to process*
Reading points... 46
Inserted 46 points.
Inserted 23 breakline segments
Perimeter reduction level 0-3 (0-None, 3-Most) <2>: *2*
Reduce Perimeter Pass: 1 Removed: 5
Reduce Perimeter Pass: 2 Removed: 3
Reduce Perimeter Pass: 3 Removed: 4
Reduce Perimeter Pass: 4 Removed: 2
Reduce Perimeter Pass: 5 Removed: 1
Reduce Perimeter Pass: 6 Removed: 0
Create 2D or 3D Polyline [<2D>/3D]? *2D*

Keyboard Command: swplines
Prerequisite: Entities

Erase by Closed Polyline

Function

This tool is used to cleanup drawing geometry at the extents of a polyline boundary. It provides options to erase adjacent geometry as well as trim geometry crossing the fence of the polyline.

First select the boundary polyline, only one can be selected. Designate the desired options in the following dialog.

The top section allows you to toggle which object types should be affected by the operation. Note that some objects such as text and inserts cannot be trimmed.

In the middle of the dialog is a toggle that determines whether to prompt for objects to process. If you want to isolate the drawings contents to that of the selected polyline, turn this toggle on. Note that all geometry in the drawing is effected, even that outside of the current viewport. Many users will prefer to turn this toggle off so they will be prompted to manipulate the geometry.

The bottom row allows you to choose whether to erase all the entities on the inside or outside of the polyline.

Keyboard Command: erasepline
Prerequisite: Entities and a closed polyline

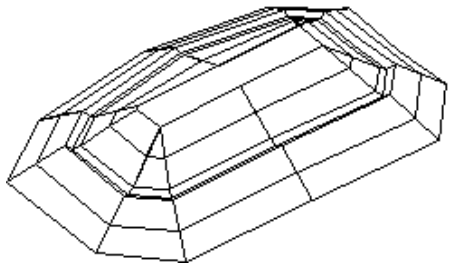
Offset 3D Polyline

Function

This command allows you to offset a 3D polyline entity in both the horizontal and vertical directions.

- There are three offset methods.
  - The Interval method applies one horizontal and one vertical offset to all the vertices of the polyline.
  - The Constant method uses a horizontal offset and sets the elevation of the polyline to one constant elevation.
  - The Variable method allows you to specify each horizontal and vertical offset individually, either by polyline segment or for each point.

The vertical offset can be specified by actual vertical distance, percent slope, or slope ratio.



Prompts

1. Enter the offset method (<Interval>/Constant/Variable): **Press Enter**
2. Vertical/<Horizontal offset amount>: **15**
3. Percent/Ratio/Vertical offset amount <0>: **10**
4. Select a polyline to offset (Enter for none): **select a 3D polyline**
5. Select side to offset: **pick point**

Select a point on the graphics screen in the direction of the desired offset.

Prerequisite: 3D polylines

Keyboard Command: OFFSET3D

Fillet 3D Polyline

Function

This command fillets two segments of a 3D polyline with the given radius. AutoCAD's *FILLET* command does not support 3D Polyline entities. Since 3D polylines cannot have arcs, this command draws the fillet arc as a series of short chords. The elevations along the curve are interpolated from the 3D polyline.

Prompts

Enter fillet radius <10.00>: *press Enter*
Select first polyline segment: *pick a segment of a polyline*
Select second polyline segment: *pick an adjoining segment of the same polyline*
Select first polyline segment (Enter to End): *pressEnter*

Keyboard Command: fillet3d
Prerequisite: 3D polyline

Entities to Polylines

Function

This command converts selected lines, arcs, circles, 3Dfaces, and solids into individual polylines. Use Join Nearest to convert adjoining lines and arcs into continuous polylines.

Prompts

1. Select lines, arcs, circles, 3Dfaces and solids to convert.
2. Select objects: **pick entities**

Prerequisite: Lines, arcs or other entities to convert.

Keyboard Command: TOPLINE

Text Explode To Polylines

Function

This command converts the selected text into polylines.

Prompts

Select text to be EXPLODED.
Select objects: *select the text*
1 text object(s) have been exploded to lines.
The line objects have been placed on layer 0.
Reading the selection set ...
Joining ...
Converting ...

Keyboard Command: textexp
Prerequisite: Text

Draw Polyline Blips

Function

This command will draw temporary markers, "blips", at each polyline vertex. This allows you to identify the actual location of each vertex.

- The Blips are temporary. Any change to the viewport (pan, zoom, regen) will make the blips disappear. In later versions of AutoCAD, you can also click on the polyline to activate the grips which will remain visible during and after viewport changes. See illustration under Densify Polyline Vertices in this manual.

Prompts

1. Select polylines to draw blips.
2. Select objects: select polyline(s).

Prerequisite: A polyline.

Keyboard Command: plblip

File Name: \lsp\poly3d.arx

Reverse Polyline

Function

This command reverses the order of the line and/or arc segments of a polyline.

- Reverse Polyline can be used in conjunction with commands such as Station Polyline/Centerline and Profile from Surface Entities, since the polyline must be plotted in the direction of increasing stations.
- If it is more convenient to draft a polyline in one direction you may do so and then use the Reverse Polyline command to change its order.
- This command can also be used to reverse a 3D Polyline Breakline or a 3D Pad Template. Temporary arrows are drawn along the polyline to graphically show the new polyline direction.

Prompts

1. Select the Polyline to Reverse: **pick point on polyline**

Prerequisite: A polyline

Keyboard Command: REVPLINE

Reduce Polyline Vertices

Function

This command removes points from a polyline without significantly changing the polyline. The offset cutoff is the maximum distance that the polyline can move when you remove a point (e.g. in a polyline with three points in a straight line, the middle point can be removed without changing the polyline).

Prompts

1. Enter the offset cutoff <0.1>: **.5**
2. Select polylines to reduce.
3. Select objects: **pick polylines**

Prerequisite: A polyline

Keyboard Command: REDUCE

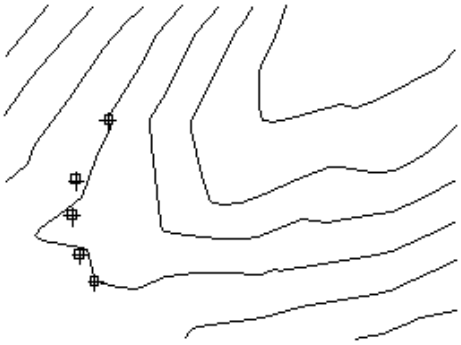
Edit Polyline Section

Function

This command revises a segment of a polyline. Begin by picking a point on the polyline where you want to start editing. Then pick new points for the polyline. When finished picking new points, press Enter and then pick a point on the polyline to connect with the new points. The polyline segment between the start and end points is then replaced with the new points.

Prompts

Select polyline to edit: *pick the polyline at the place to start editing*
Pick intermediate point (Enter to End): *pick a point*
Pick intermediate point ('U' to Undo, Enter to End): *pick a point*
Pick intermediate point ('U' to Undo, Enter to End): *press Enter*
Pick reconnection point on polyline: *pick the polyline at the place to join*



Edit this contour by picking new points

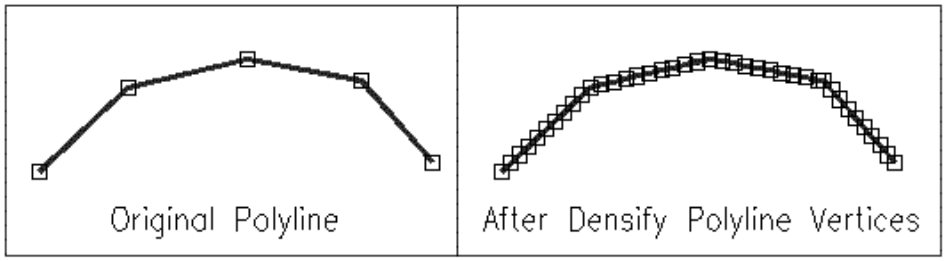
Contour with segment replaced with new points

Keyboard Command: editpl2
Prerequisite: Polylines

Densify Polyline Vertices

Function

This command adds vertices to the selected polylines at the specified interval. These points are interpolated between existing points in the polyline. This command is the opposite of Reduce Polyline Vertices.



Prompts

1. Select polylines to densify.
2. Select objects: select polylines
3. Point interval <10.0>**:** Press Enter.
4. Testing Entity> 1
5. Added 17 points to 1 polyline.

Prerequisite: A polyline.

Keyboard Command: densepl

File Name: \lsp\poly3d.arx

Set Polyline Origin

Function

This command sets the starting vertex of a closed polyline. Select the polyline, then pick near the point you want to set as the starting point.

Prompts

1. Select Polyline: **pick a polyline**
2. Pick Near New Origin Point: **pick a point on the polyline** to be the starting point

Prerequisite: A closed polyline

Keyboard Command: PLCHGORG

Remove Polyline Arcs

Function

This command allows you to replace arc segments in polylines with chords. Removing arcs is a prerequisite to some commands that don't handle arcs, such as Break by Closed Polyline and Make 3D Grid file. This command can add many vertices to the polyline.

Prompts

1. Select polylines to remove arcs from.
2. Select objects: **pick polylines**
3. Offset cutoff <0.5>: **Press Enter**

This specifies the maximum distance that any point on the arc will be allowed to shift.

Prerequisite: A polyline

Keyboard Command: RMARC

Remove Polyline Segment

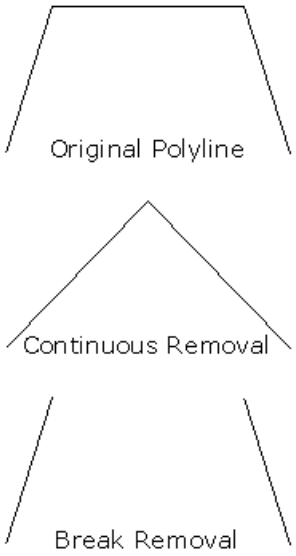
Function

This command allows you to remove a specified segment from a polyline.

- A polyline segment is the section between two vertices of the polyline.
- There are two options for removing the segment.
  - When you specify the Continuous option, the two vertices of the removed segments are averaged together to keep the polyline continuous.
  - When you specify the Break option, the segment is left missing in the polyline, resulting in two separate polylines.

Prompts

1. Break polyline at removal or keep continuous [<Break>/Continuous]? **C**
2. Select polyline segment to remove: **pick point on polyline segment**



Prerequisite: A polyline

Keyboard Command: REMOVEPL

Remove Polyline Vertex

Function

This command allows you to remove the selected vertex from a polyline.

Prompts

1. Select polyline vertex to remove: **pick point on polyline**
2. Select the vertex to remove

Prerequisite: A polyline

Keyboard Command: RMVERTEX

Polyline Report

Function

This command generates a report of bearing-distance and curve data for all the points along the selected polyline. The closure is reported between the starting and ending points of the polyline. The polyline area is also reported.

Prompts

1. Starting station <0.0>: **Press Enter**
2. Decimal places <3>: **2**
3. Select polyline to report: **pick a polyline**
4. Standard Report Viewer displays the report for the selected polyline.
5. Select polyline to report (Enter to End): **Press Enter**

Polyline Report 11/29/2002 04:09

NORTHING EASTING STATION BEARING DISTANCE
4094.21 8149.92 325.00

S 76°57'30" E 50.35

4082.85 8198.97 375.35

RADIUS: 46.96 LENGTH: 68.52 CHORD: 62.60 DELTA: 83°36'22"

CHORD BRG: N 63°11'04" E PC-R: N 14°59'15" E PT-R: N 68°37'07" W

RADIUS POINT: 4128.21,8211.11

4111.09 8254.84 443.87

N 21°22'53" E 40.93

4149.21 8269.76 484.80

Closure Error Distance> 131.85 Error Bearing> S 65°20'58" W

Closure Precision> 1 in 1.2 Total Distance> 159.80

Polyline Area: 3396.5 sq ft, 0.08 acres

Prerequisite: A polyline

Keyboard Command: PLREPORT

Polyline Info

Function

This command reports the length and elevation of the selected line or polyline.

Prompts

1. Pick Polyline or Line: **pick a polyline**

Polyline length: 145.43 Elevation: 100.0

Prerequisite: None

Keyboard Command: POLYLEN

Polyline to RW5 File

Function

This command generates a raw data (.RW5) file for the selected polyline.

- This file can be opened using Edit Process Raw Data File, which allows you to process the raw data (.RW5) file to generate coordinate points, calculate closure and perform coordinate adjustments by the compass, crandall, transit and least squares adjustment features.

Prompts

1. .RW5 File to Write (Standard Windows File Selection Dialog): Choose file location and name.
2. Select Polyline To Process: Select Polyline.

Keyboard Command: pl2RW5

Prerequisite: a polyline

File Name: \lsp\cogoutil.arx

Symbols Commands 16

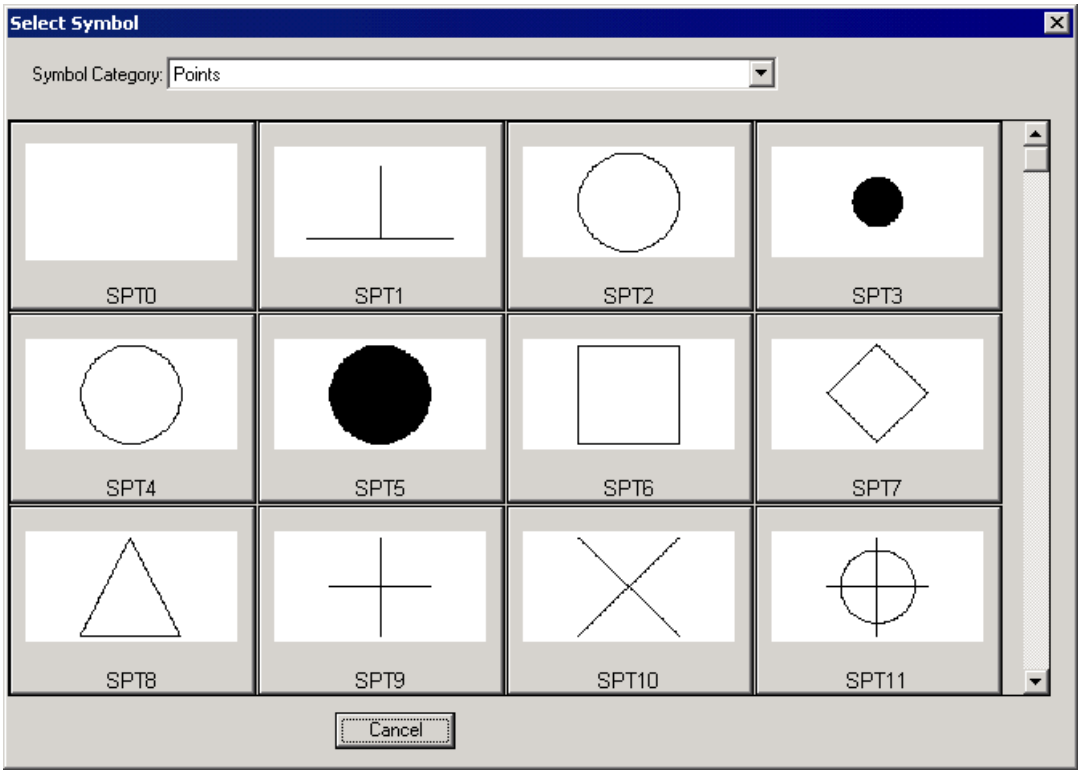
Insert Symbols

Function

This command inserts symbols from the symbol library into the drawing. The symbol library may be edited using the Edit Symbol Library command. The locations of symbols can be specified by selecting points, specifying point numbers in the current point database file, or by entering the northing and easting.

- If you specify a point number that already has a symbol on it, you will be prompted whether or not to replace the existing symbol.
- Selecting the Enter coords option allows you to insert the symbol by entering a northing and easting.
- Using the Select Entities option, symbols can also be placed on arcs, points, lines or polylines.
- Under the Options command, you can turn prompting for rotation on or off. With rotation off, the symbol will be inserted horizontal to the current twist screen.

Choose a symbol from the Select Symbol dialog (shown below) by clicking on it. Select a different category by choosing the Symbol Category drop down list. Within each category, use the scroll bar to view all of the symbols.



Prompts

1. Layer name for symbols <PNTS>: **Press Enter**
2. Symbol Size <2.0>: **Press Enter**
3. Options/Select entities/Enter coords/<Point numbers or pick point>: **pick point**
4. Options/Select entities/Enter coords/<Point numbers or pick point>: **5-10**. Inserts symbols at points 5-10 from the current coordinate file.

5. Options/Select entities/Enter coords/<Point numbers or pick point>: **S**. Enter S, for Select entities.
6. Entities to Process, Choose the types of entities to place symbols on. Select arcs, points, line or polylines.
7. Select objects: pick a polyline
8. Rotation Angle <0.0>: **Press Enter**
9. Options/Select entities/Enter coords/<Point numbers or pick point>: **Press Enter**

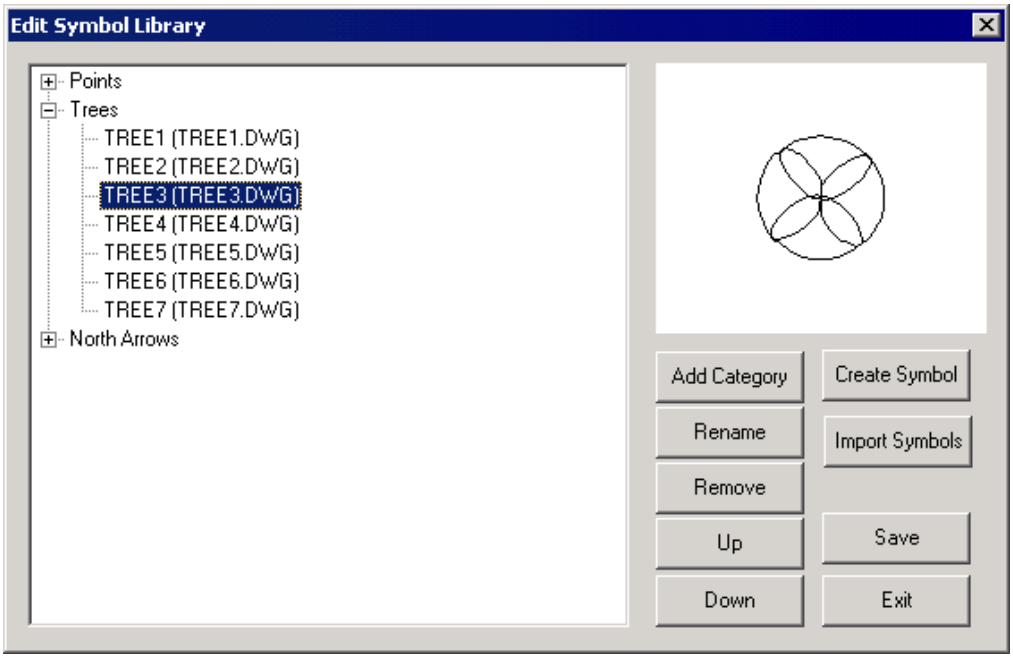
Prerequisite: None

Keyboard Command: PTSYM

Edit Symbol Library

Function

This command allows you to customize the symbol library. The symbols are sorted alphabetically within each category, while categories remain in the placed order. This allows the most frequently accessed categories to remain on top.



- **Add Category**: Categories are a way to group symbols by type for convenient symbol selection. A new category is added by selecting this button. An edit field then appears in the tree view on the left and waits for you to enter the category name. Press the Enter key to finish the input.
- **Rename**: Select the category or symbol that you want to rename and press this button. By default, the symbol description is the same as file name.
- **Remove**: Select the category or symbol that you want to remove and press this button
- **Up**: If a symbol is selected, this moves the symbol up into the next category. If a category is selected, this moves the category up in the list.
- **Down**: If a symbol is selected, this moves the symbol down into the next category. If a category is selected, this moves the category down in the list.

- **Create Symbol**: Allows you to select drawing entities to create a new symbol. The symbol should be drawn at unit size (scale 1:1) because CSD will scale the symbol by the current drawing scale automatically when the symbol is used.
- **Import Symbols**: Allows you to select existing drawing (.DWG) files to populate the selected category. If the files you select are not in the CSD SUP directory, the program will offer an option of copying them there.
- **Save**: Saves the symbol library list.
- **Exit**: Exit the dialog. If there are unsaved changes, you will be prompted to save.

NOTE: The symbol library is stored in an ASCII file named symbols.dta in the Carlson Survey \USER directory.

Prerequisite: Field to Finish file with codes defined with Multi-Point Symbols.

Keyboard Command: EDITPTSYM

Twist Screen Commands 17

Twist Screen Standard

Function

This command will twist the screen orientation to where something other than the north direction is toward the top of the screen/drawing. It does not do a coordinate rotation, the drawing coordinates remain unchanged. Use commands on the ∗Points∗ menu such as *Rotate Points* and *Translate Points* if you want to do a coordinate rotation or translation.

Prompts

This routine prompts for the twist angle then adjusts the screen and cross-hairs to that angle. This is a modification of AutoCAD's *DVIEW* command. The twist angle is always measured counterclockwise with 0 degrees being to the east/right.

Keyboard Command: twist1
Prerequisite: None

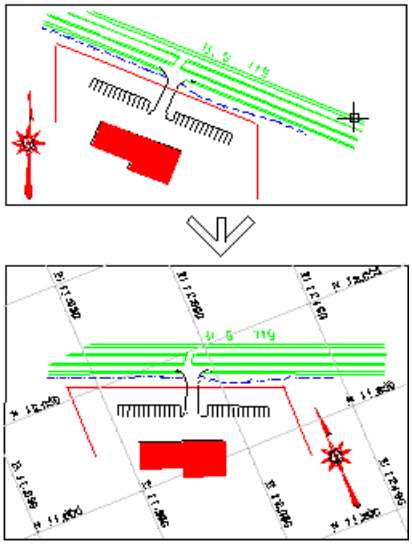
Twist Screen Line, Polyline or Text

Function

This is a variation of the previous command that allows you to select a line, polyline, or text in your drawing that you want to be aligned parallel to the east-west direction of the graphics screen. Think of the entity you select as a pointer or arrow that will point in the east direction of the screen after you select it. Select the line, polyline, or text closest to the end point which you want to be the horizontal or east direction of the screen.

Prompts

Pick a line, polyline or text to make horizontal: *pick a line or polyline*



Keyboard Command: twist2
Prerequisite: None

Twist Screen Surveyor

Function

This is another variation of twisting the screen that allows you to input an angle/azimuth that you want to be aligned parallel to the east-west direction of the graphics screen.

Prompts

Angle to set to horizontal: *0* This would align due north with respect to real world coordinates to the east or horizontal direction of the graphics screen.

Prerequisite: None
Keyboard Command: twist3

Restore Due North

Function

This command twists the screen to make due north vertical.

Keyboard Command: twist4
Prerequisite: None

Conversion Commands 18

Convert Points

Function

This group of commands converts point formats.

1. **Import Point File**: These commands read point data from other formats into the Autodesk Land Desktop point database for the current project.

   – The supported import formats are C&G, Carlson (SurvCADD/Carlson Survey), Geodimeter, Leica and TDS.

2. **Export Point File**: These commands write point from the current Autodesk Land Desktop project into other point file formats.

   – The supported export formats are C&G, Carlson (SurvCADD/Carlson Survey), Geodimeter, Leica and TDS.

3. **Convert Point Objects:** These commands convert the drawing point entities between Autodesk Land Desktop AECC_POINT entities and Carlson (SurvCADD/Carlson Survey/CSD) point blocks.

Import Softdesk Centerline

Function

These commands convert centerlines from the current Land Desktop project into Carlson, Leica and Sokkia format files. The commands first prompt to select an LDD centerline from a list of centerlines defined in the current project. Then the program prompts for the file name of the new format to create.

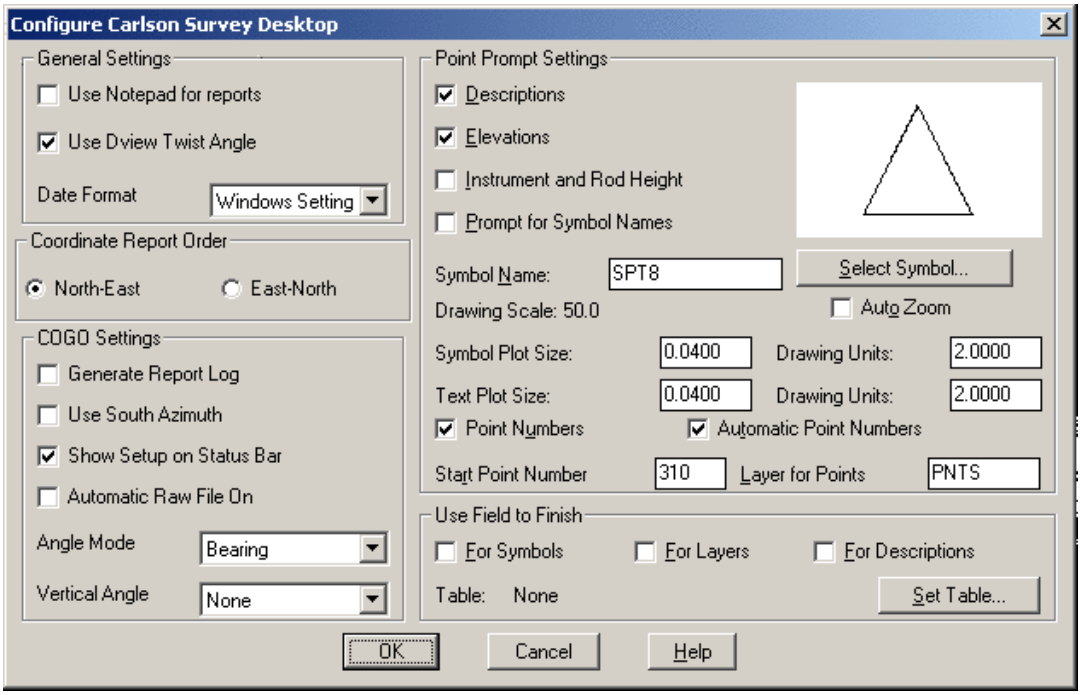
Keyboard Command: ldd2cl, wildcl1, cl2sdr
Prerequisite: alignments in the current project

Configure Carlson Survey 19 Desktop

Configure Carlson Survey Desktop

Function

This command allows you to set the default settings that are used each time you start a new drawing or load an existing drawing. These settings are also used in the current project. These settings are stored in∗.ini files in the CSD directory.



1. **General Settings:**

   - **Use Notepad for Reports**: When this toggle is turned ON, any report generated will appear in Windows Notepad instead of the Carlson Report Viewer.
   - **Use Dview Twist Angle**: Keeps text horizontal to a twist screen view.
   - **Date Format**: Controls the display of dates in CSD reports with this drop down menu. The default is 'Windows Setting' which allows you to control it with Windows Control Panel. Several other common formats are available.
   - **Coordinate Report Order:** Choose whether coordinates are reported in northing-easting or easting-northing order.

2. **COGO Settings:**
   - **Generate Report Log**: Allows output from several commands to be accumulated in a report buffer. Any report that is displayed in the standard report viewer is also added to the report log. When activated, the report log resides in the lower left corner of the desktop as a minimized title bar, displaying the number of lines in the report buffer. To view the report log, maximize the icon on this title bar. You can edit the report log, save it to a file, or print it. To quickly turn the report log on and off, you can type REPORT at the command prompt, which toggles the report log on/off.

- **Use South Azimuth**: Allows you to use a south azimuth for calculations.
- **Show Setup Points on Status Bar:** When selected, the current occupied and backsight point numbers are visible in the program status bar.
- **Automatic Raw File On**: When selected, a .RW5 file is automatically created during any of the following commands: Locate Point, Traverse, Sideshot, and Inverse.

3. **Angle Mode:** Determines how angles are entered and displayed.
   - **Bearing**: Sets reporting to bearing mode for any of the Inquiry commands.
   - **Azimuth**: Sets reporting to north based azimuth mode for any of the Inquiry commands.
   - **Gon**: Sets reporting to gon mode for any of the Inquiry commands.
   - **Other**: Allows you to set a custom angle mode by using the Units Control command (described later in this chapter).

4. **Vertical Angle:** Selects an option to determine how the vertical angle is calculated. The Vertical Angle Prompt applies to creating points with commands such as Traverse.
   - **None**: The vertical angle will not be used to calculate point elevations.
   - **0 Degrees Level**: The vertical angle is used to calculate elevation and horizontal distance.
   - **90 Degrees Level**: The zenith angle is used to calculate elevation and horizontal distance.
   - **Elevation Difference**: Use the elevation difference to calculate the elevation.

5. **Point Prompt Settings:**
   - **Descriptions**: Determines whether you are prompted for a point description when creating points, and whether the point descriptions are labeled in the point block.
   - **Elevations**: Sets prompting and labeling for point elevations.
   - **Instrument & Rod Height**: Turns on prompting for instrument and rod heights when creating points.
   - **Symbol Name**: Shows file name of the point symbol you have selected.
   - **Select Symbol**: Allows for a graphical selection of the default point symbol. Your selection then appears to the right of the button.
   - **Starting Point Number**: Allows you to specify the number assigned to the first point.
   - **Layer for Points**: Specify the layer for points.
   - **Auto Zoom**: The screen view will zoom center to the new point when it is drawn. This is useful for keeping the display centered to the current working area.
   - **Use Field to Finish Table**: Allows you to use the code definitions from Field to Finish for the point symbols and/or layers when creating new points with commands such as Traverse (e.g. when creating a point with description "EP" with both For Symbols and For Layers toggled ON, the command will look up EP in the Field to Finish table and will use the symbol and layer defined in this code table, instead of the symbol and layer set in Point Defaults).
   - **Set Table**: Select the Field to Finish (.FLD) code table file for layer and symbols definitions for the above options.

Prerequisites: None

Keyboard Command: CONFIG_SCAD

Help 20

About Carlson Survey Desktop

Function

Displays the Carlson Survey Desktop version number, serial number, license information, and copyright information. You can run the registration wizard by clicking the Change Registration button on this dialog.

Prerequisite: None

Keyboard Command: ABOUT_SCAD

OnLine Help

Function

This command opens the Carlson Survey Desktop on-line Help File.

Prerequisite: None

Keyboard Command: [F1] or HELP

Technical Support

Discussion Groups

Carlson Software operates user discussion groups. The NNTP address is news://news.carlsonsw.com.

Visit our website at http://www.carlsonsw.com for complete details on how to connect to these discussion groups.

Electronic Mail

The technical support email address is support@carlsonsw.com

Internet

The following internet resources are available:

Knowledge base: http://update.carlsonsw.com/kbase_main.php

Program updates and patches: http://update.carlsonsw.com

Technical support documents: http://www.carlsonsw.com

Phone or Facsimile

Phone: 606-564-5028

Fax: 606-564-6422

Fax for registrations only: 606-564-9525

Please submit your company name, product version, and serial number with all support inquiries.

Index