Reference Manual

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NAVIGATION

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For further information concerning this limited warranty, please call or write:
Thales Navigation, Inc., 471 El Camino Real, Santa Clara, California 95050, Phone: +1 408-615-5100, Fax: +1 408-615-5200 or
Thales Navigation SA – ZAC La Fleuriaye – BP 433 – 44474 Carquefou Cedex – France
Phone: +33 (0)2 28 09 38 00, Fax: +33 (0)2 28 09 39 39.

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All Thales Navigation global positioning system (GPS) receivers are navigation aids, and are not intended to replace other methods of navigation. Purchaser is advised to perform careful position charting and use good judgment. READ THE USER GUIDE CAREFULLY BEFORE USING THE PRODUCT.

1. THALES NAVIGATION WARRANTY

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In the event of a defect, Thales Navigation will, at its option, repair or replace the hardware product with no charge to the purchaser for parts or labor. The repaired or replaced product will be warranted for 90 days from the date of return shipment, or for the balance of the original warranty, whichever is longer. Thales Navigation warrants that software products or software included in hardware products will be free from defects in the media for a period of 30 days from the date of shipment and will substantially conform to the then-current user documentation provided with the software (including updates thereto). Thales Navigation's sole obligation shall be the correction or replacement of the media or the software so that it will substantially conform to the then- current user documentation. Thales Navigation does not warrant the software will meet purchaser’s requirements or that its operation will be uninterrupted, error-free or virus-free. Purchaser assumes the entire risk of using the software.

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3. PURCHASER'S DUTIES
To obtain service, contact and return the product with a copy of the original sales receipt to the dealer from whom you purchased the product.

Thales Navigation reserves the right to refuse to provide service free-of-charge if the sales receipt is not provided or if the information contained in it is incomplete or illegible or if the serial number is altered or removed. Thales Navigation will not be responsible for any losses or damage to the product incurred while the product is in transit or is being shipped for repair. Insurance is recommended. Thales Navigation suggests using a trackable shipping method such as UPS or FedEx when returning a product for service.

4. LIMITATION OF IMPLIED WARRANTIES
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The following are excluded from the warranty coverage:

(1) periodic maintenance and repair or replacement of parts due to normal wear and tear;

(2) batteries;

(3) finishes;

(4) installations or defects resulting from installation;

(5) any damage caused by (i) shipping, misuse, abuse, negligence, tampering, or improper use; (ii) disasters such as fire, flood, wind, and lightning; (iii) unauthorized attachments or modification;
(6) service performed or attempted by anyone other than an authorized Thales Navigations Service Center;

(7) any product, components or parts not manufactured by Thales Navigation,

(8) that the receiver will be free from any claim for infringement of any patent, trademark, copyright or other proprietary right, including trade secrets

(9) any damage due to accident, resulting from inaccurate satellite transmissions. Inaccurate transmissions can occur due to changes in the position, health or geometry of a satellite or modifications to the receiver that may be required due to any change in the GPS. (**Note**: Thales Navigation GPS receivers use GPS or GPS+GLONASS to obtain position, velocity and time information. GPS is operated by the U.S. Government and GLONASS is the Global Navigation Satellite System of the Russian Federation, which are solely responsible for the accuracy and maintenance of their systems. Certain conditions can cause inaccuracies which could require modifications to the receiver. Examples of such conditions include but are not limited to changes in the GPS or GLONASS transmission.).

Opening, dismantling or repairing of this product by anyone other than an authorized Thales Navigation Service Center will void this warranty.

6. EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES

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7. COMPLETE AGREEMENT

This written warranty is the complete, final and exclusive agreement between Thales Navigation and the purchaser with respect to the quality of performance of the goods and any and all warranties and representations. THIS WARRANTY SETS FORTH ALL OF THALES NAVIGATION'S RESPONSIBILITIES REGARDING THIS PRODUCT.

THIS WARRANTY GIVES YOU SPECIFIC RIGHTS. YOU MAY HAVE OTHER RIGHTS WHICH VARY FROM LOCALITY TO LOCALITY (including Directive 1999/44/EC in the EC Member States) AND CERTAIN LIMITATIONS CONTAINED IN THIS WARRANTY MAY NOT APPLY TO YOU.

8. CHOICE OF LAW.

This limited warranty is governed by the laws of France, without reference to its conflict of law provisions or the U.N. Convention on Contracts for the International Sale of Goods, and shall benefit Thales Navigation, its successors and assigns.

THIS WARRANTY DOES NOT AFFECT THE CUSTOMER'S STATUTORY RIGHTS UNDER APPLICABLE LAWS IN FORCE IN THEIR LOCALITY, NOR THE CUSTOMER'S RIGHTS AGAINST THE DEALER ARISING FROM THEIR

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For further information concerning this limited warranty, please call or write:

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1

Installation

This chapter describes the system requirements and installation instructions for Thales FAST Survey.

Using the Thales FAST Survey manual

This manual is designed as a reference guide. It contains a complete description of all commands in the FAST Survey product. The chapters are organized by program menus and are arranged in the order that the menus appear in FAST Survey. Some commands are only applicable to either GPS or total stations use and may not appear in your menu.

System Requirements

Software

- Windows CE® version 3.0 or later. Handheld PC.
- Microsoft ActiveSync 3.7 and later.

RAM and Hard Disk Space Requirements

- 64 MB of RAM (recommended)
- 10 MB of hard disk space (minimum)

Hardware (Required)

- StrongARM, XScale or compatible processor (hardware must be supported by Microsoft for the operating system being used)

Hardware (Optional)

- Serial cable for uploading and downloading data.

MicroSoft ActiveSync

Microsoft® ActiveSync® provides support for synchronizing data between a Windows-based desktop computer and Microsoft® Windows® CE based portable devices. Microsoft ActiveSync 3.7.1 supports Microsoft Windows 98 (including Second Edition), Windows NT Workstation 4.0 SP 6, Microsoft Windows ME, Windows 2000 Professional Edition, and Windows XP.Before you can install Thales FAST Survey, your desktop PC must have Microsoft ActiveSync installed and running. If you do not have ActiveSync installed, insert the Thales FAST Survey CD-ROM and choose “Install ActiveSync”. You may also choose to download the latest version from Microsoft. After the ActiveSync installation starts, follow the prompts. If you need more assistance to install ActiveSync, visit Microsoft’s web site for the latest install details.

You should have a serial cable that was included with your mobile device. Attach this cable from your desktop PC to the mobile device.

Auto Connection

If the default settings are correct, ActiveSync should automatically connect to the mobile device. You may see a dialog on the mobile device that asks you if you want to connect, press Yes.

Manual Connection

If nothing happens when you connect the cable, check to see if you have the following icon in your system tray . If you see this icon, right click on it and choose “Connection Settings”. You should see the following dialog.

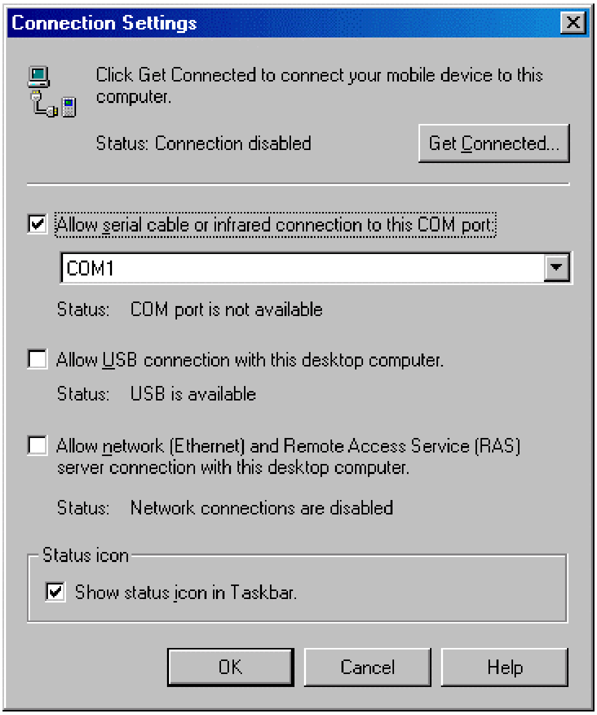


Figure 1-1

Click the first toggle at the top that says "Allow Serial cable or infrared connection to this COM port". Then choose the correct COM port below (usually this will be COM1). Now you should see a dialog on the mobile device that says "Connect to desktop?" Choose Yes.

If you see this icon in the system tray , you are connected. When you do get connected, you should see the following dialog:

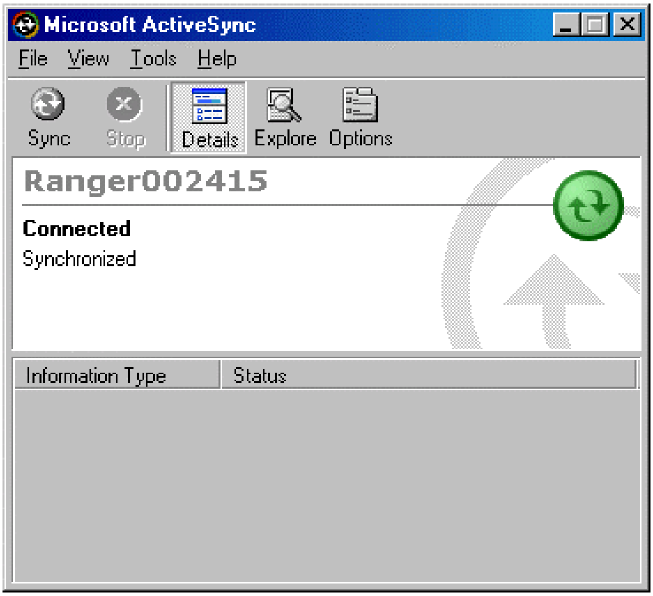


Figure 1-2

If you do not see an ActiveSync icon in your system tray, choose the Windows Start button, then choose Programs, then choose Microsoft ActiveSync. Make sure the cable is connected and press Next on the screen that appears below:

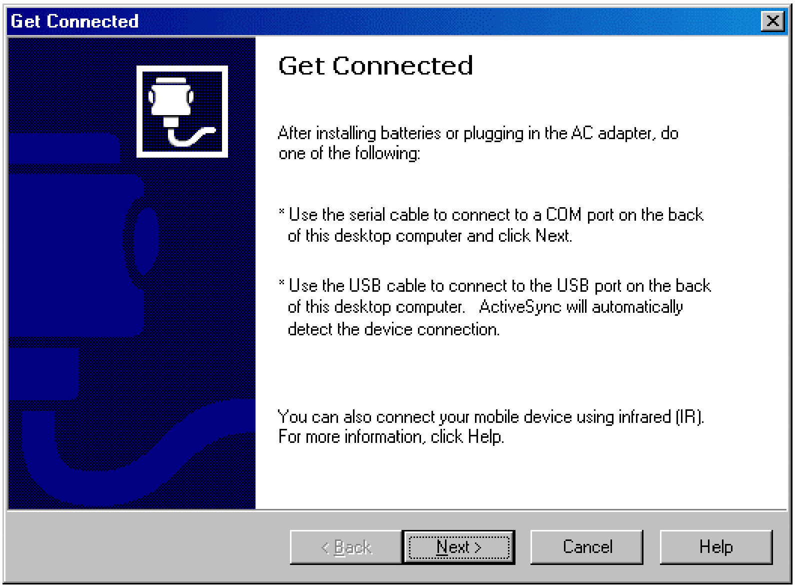


Figure 1-3

After you press Next the following screen will appear and the connection should happen:

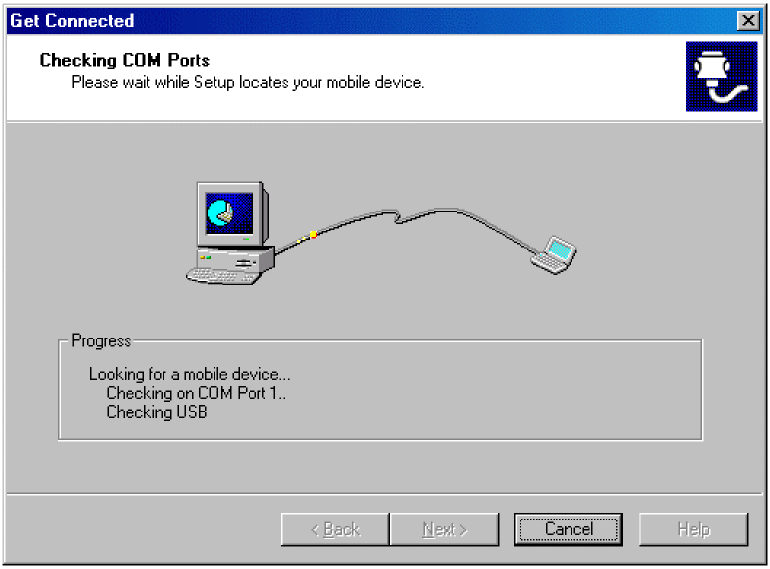


Figure 1-4

Troubleshooting

If you cannot get connected, make sure that no other program is "using" the COM port. Programs to check for include any Fax/Modem software and other data transfer software. If you see anything you think may be "using" the COM port, shut it down and retry the connection with ActiveSync.

Enabling Com Port Communication for ActiveSync on Allegro, Panasonic Toughbook 01 and other CE devices

In order for ActiveSync to communicate, it may be necessary to direct the CE device to utilize the Com port as a default. Some may come set default to USB. Go to Start (on Allegro, blue key and Start button), then Settings, then Control Panel, then Communications icon, then PC Connection. Set to Com1 at a high baud rate, such as 57,600 baud. This will download programs and files at a high rate of speed. On the Allegro, use PC Link to connect to PC with ActiveSync. On the Panasonic Toughbook, do Start, Run, and in the Open window, type in "autosync –go" (autosync then spacebar then "minus" go). Then do Start, Settings, Control Panel, Communications, do PC Connection, Change Connection to Serial Port @ 115K. Make sure “Enable direct connections to the desktop computer” is checked.

Note: When using FAST Survey’s Data Transfer option, you will need to disable Serial Port Connection (click off Allow Serial Cable). This is done with Connection Settings in ActiveSync. Click back on to use ActiveSync.

Installing FAST Survey

Before you install Thales FAST Survey, close all running applications on the mobile device.

1. Connect the mobile device to the desktop PC and ensure that the ActiveSync connection is made.
2. Insert the CD into the CD-ROM drive on the desktop PC.

   If Autorun is enabled, the startup program begins. The startup program lets you choose the version of FAST Survey to install.

   To start the installation process without using Autorun, choose Run from the Windows Start Menu. Enter the CD-ROM drive letter, and setup. For example, enter d:\setup (where d is your CD-ROM drive letter).
3. On the desktop PC, the following introduction dialog will appear. Press Next.

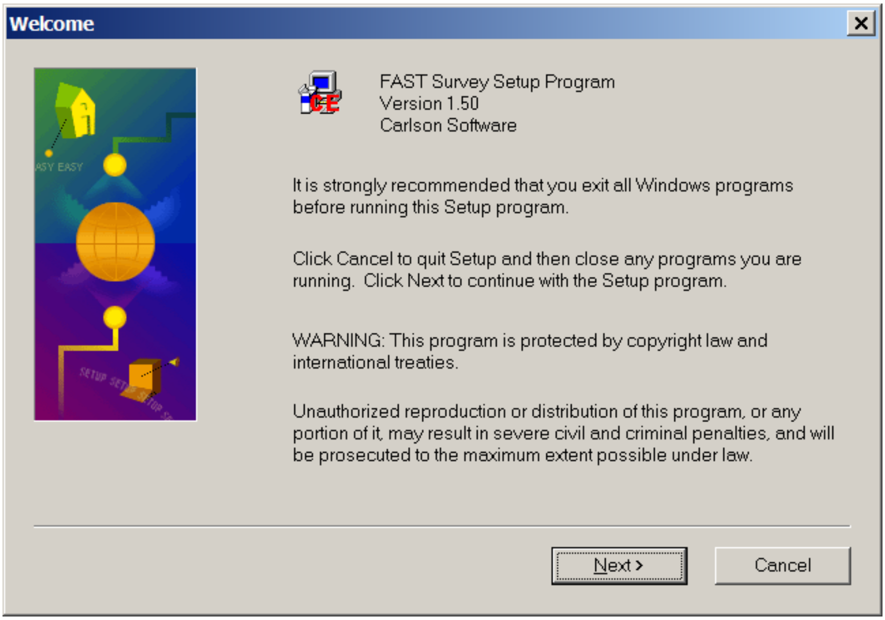


Figure 1-5

4 On the next dialog, you must read and accept the Thales FAST Survey End User License Agreement. If you agree with the EULA, press Yes. If you do not agree with the EULA, press No and the installation program will quit.

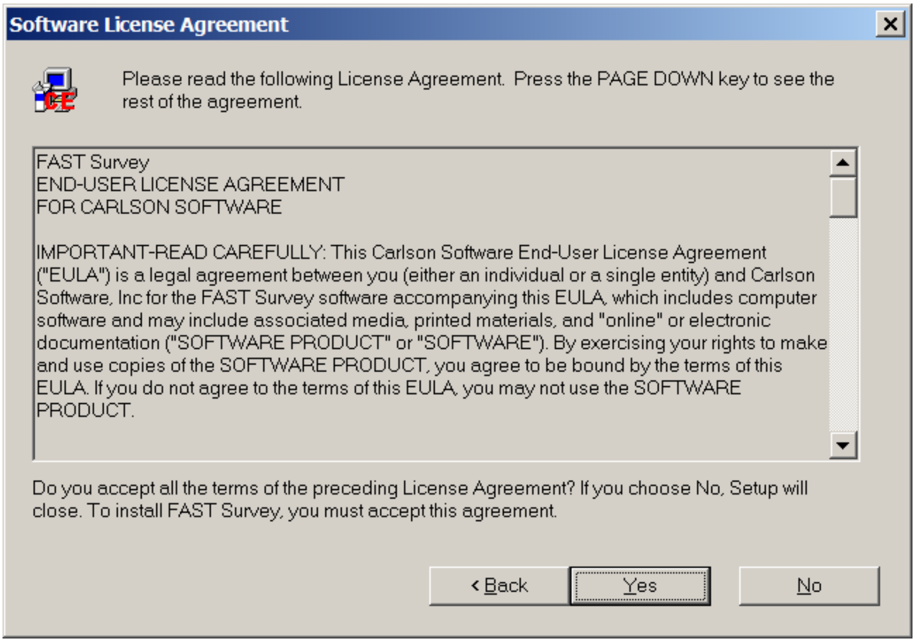


Figure 1-6

5 On the next dialog, type in your name and your company name and then press Next.

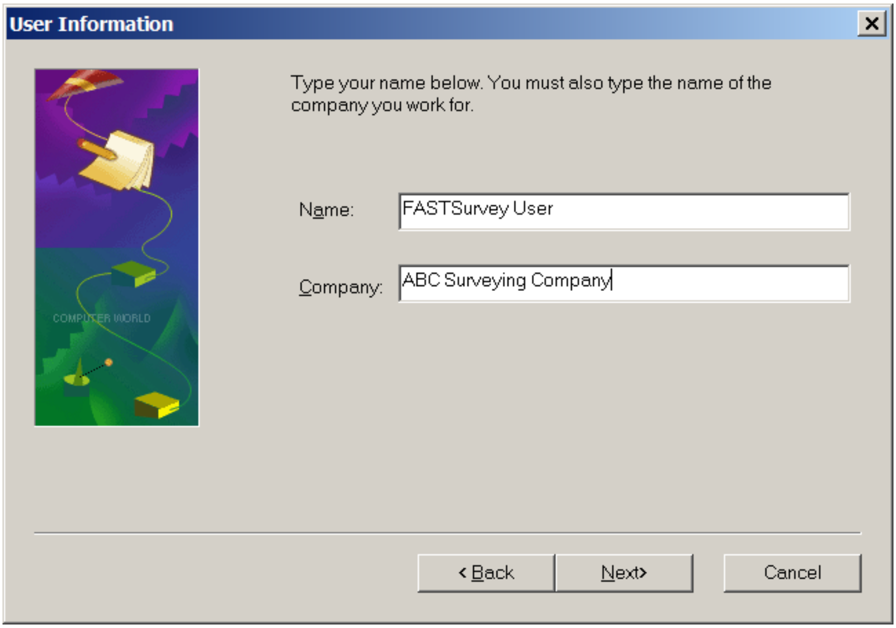


Figure 1-7

6 The next dialog asks you to confirm the installation directory. Press Yes.

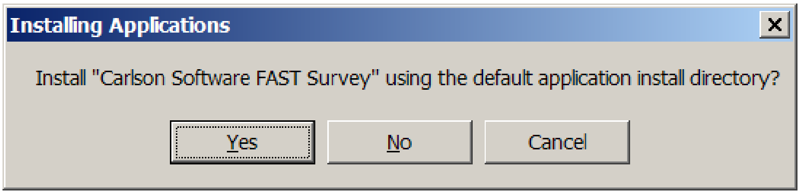


Figure 1-8

7 At this point, the necessary files will be copied to the mobile device. The dialog shown below shows you the progress.

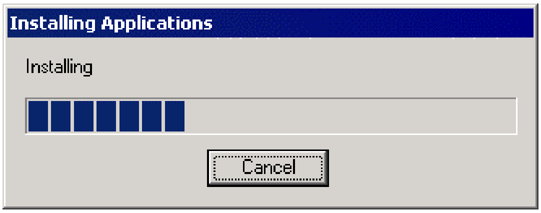


Figure 1-9

8 After this has completed, Figure 1-10 will appear on the mobile device showing the installation progress and Figure 1-11 will appear on the desktop. The installation is complete.

Figure 1-10

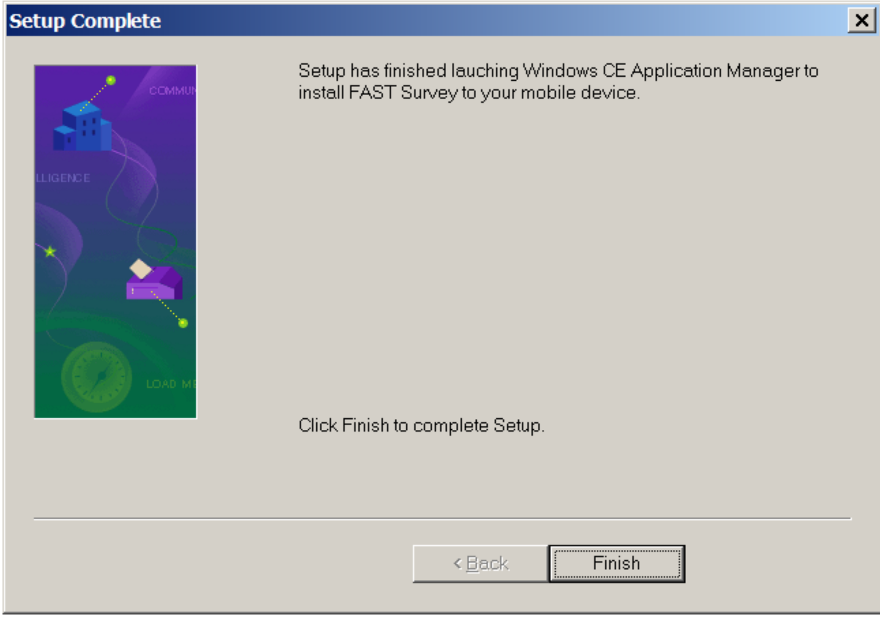


Figure 1-11

Authorizing FAST Survey

The first time you start FAST Survey, you are prompted to register your license of the software. If you do not register, FAST Survey will remain in demo mode, limiting each job file to a maximum of 30 points.

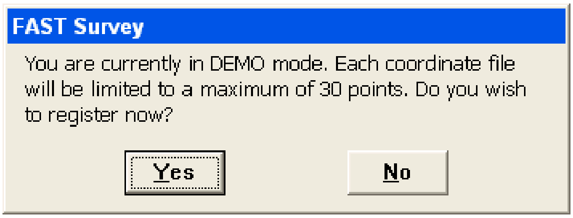


Figure 1-12

Choose Yes to start the registration process or No to register later.

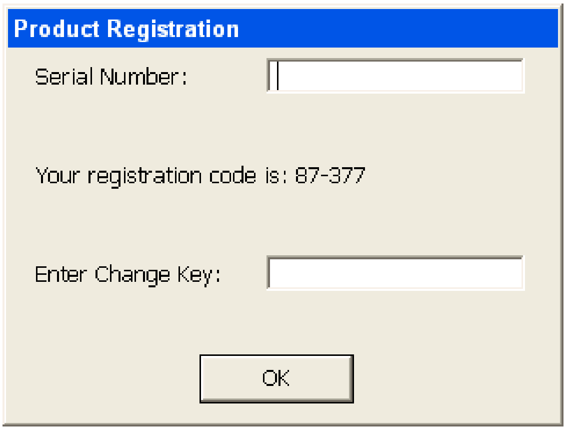


Figure 1-13

If you choose Yes, the dialog shown above will appear. You may obtain the Change Key required (above) and complete your registration by contacting Thales Navigation at the locations listed at the front of the manual.

You will be required to give your company name, phone number, email address, FAST Survey serial number, and the registration code supplied by the Product Registration dialog box (shown above). After you submit this information, your change key will be provided by Thales Navigation. Keep this for your permanent records. After you receive your change key, enter it and press OK.

After Registering FAST Survey

After you register FAST Survey, you need to perform a RAM Backup. If you do not do this, then your authorization code will be lost the next time the computer reboots. To perform a RAM backup, choose the Start button, then Programs, then Utilities, then Backup RAM. See the illustration below.

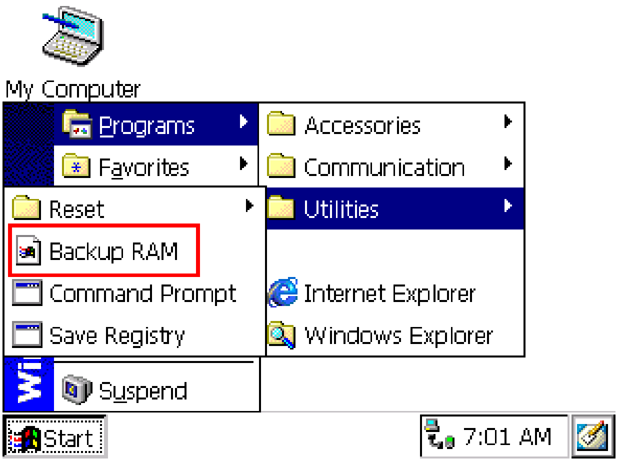


Figure 1-14

If you cannot find this on your Start menu, then open the Control Panel, and choose RAM Backup.

Hardware Notes

If FAST Survey quits responding, you can reset the hardware by following the applicable procedures described below.

- **Ranger**: Tap the Start button, then choose Programs, Utilities, Reset, Soft Reset. You can also press and hold the power button down for approximately 5 seconds.
- **Juniper Allegro**: You press and hold the On\Off button down for approximately 5 seconds.
- **Other hardware**: See the hardware documentation.

Color Screens

FAST Survey 1.21 or greater enables viewing of color. Any red, green, blue or other colored entities in DXF files will retain the color when viewed within FAST Survey. Points will appear with black point numbers, green descriptions and blue elevations. Dialogs and prompting will utilize color throughout FAST Survey.

Thales Tech Support for FAST Survey

Contact information for tech support for FAST Survey is provided below:

Customer Service, Technical Support, Repair:
If you need assistance with your Thales Navigation, Ashtech or DSNP products, please send an email to the address below, or via telephone:

North, Central and South America (NCSA) plus International
Monday thru Friday, 7:00 A.M. to 5:00 P.M. (PST, GMT -8 hours/PDT, GMT -7 hours)
Tel: 800 229 2400 (U.S.)
Tel: 408 615 3981 (International)
Fax: 408 615 5200
Email: professionalsupport@thalesnavigation.com

2

File Menu

This chapter provides information on using the commands from the File menu.

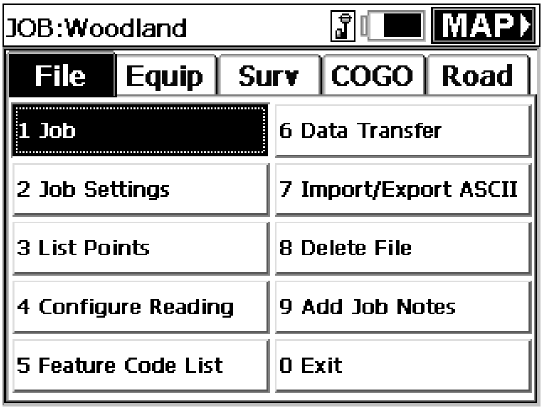


Figure 2-1

Job

Function

This command allows you to select an existing coordinate file for your job or to create a new coordinate file. The standard file selection dialog box appears for choosing a coordinate file (see Figure 2-1).

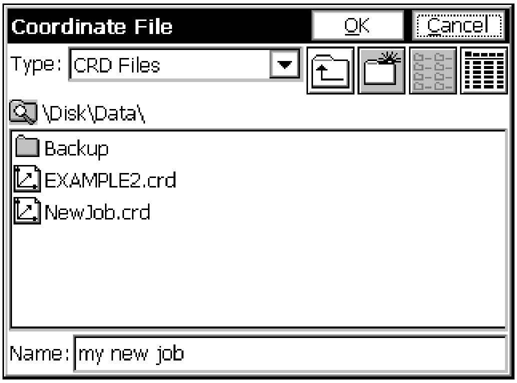


Figure 2-2

All data points you collect are stored in the coordinate (.crd) file you select. To select an existing coordinate file, pick it on the screen (you may have to scroll over to see it). Your file name selection should appear in the Name field at the bottom of the dialog box. Accept your selection by choosing OK. Double clicking on the file name in the list will also enter your selection. To create a new coordinate (.crd) file for a new job, enter a new file name in the Name field at the bottom of the dialog box and press OK or Enter.

Note: If you choose a coordinate file that already exists, it will load this instead of overwriting it with a new file. This means that you cannot overwrite an existing coordinate file from within FAST Survey. The file extension .crd will automatically be appended to the file name. Buttons for moving up the directory structure, creating a new folder, listing file names, and listing file details appear in the upper right corner of the dialog box.

Job Settings

Function

This command allows you to set configuration options for data collection. These options remain set from job to job. Some options may only apply to GPS or to Total Station use. If an option is not applicable, it is greyed out. The Job Settings routine contains 5 tabs (sets of options), as shown in Figure 2-3.

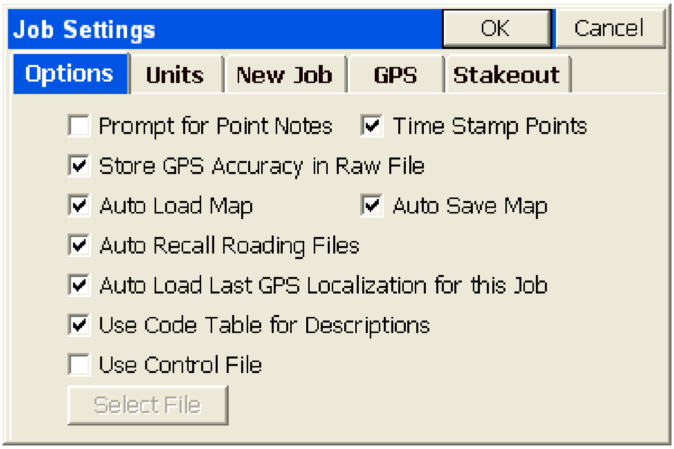


Figure 2-3

Options Tab

- **Prompt for Point Notes**: Point Notes are additional descriptions that can be stored with a point. A regular point consists of a point number, northing, easting, elevation and a 32 character description. Point Notes are a way to add an unlimited number of lines of text to a point number. With this toggle turned ON, you will be prompted for notes after collecting a point. The notes are stored in a file that has the name of the coordinate file with a .NOT extension. For example, a job called TOPO.CRD would have a note file called TOPO.NOT.
- **Time Stamp Points**: When clicked on, this will store a Date and Time note in the raw file. Raw files in FAST Survey have a ".RW5" extension and are nearly identical to the TDS ".RW5" format. If point 11 is surveyed with the time stamp on, and point 12 is surveyed with the time stamp off, the data might appear as shown in Figure 2-4, using the command Review File within Cogo, Process Raw File:

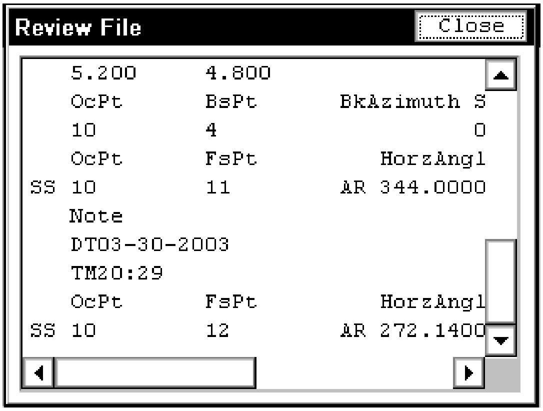


Figure 2-4

- **Store GPS Accuracy in Notes**: This option is available when configured to any GPS equipment. When storing a point, it will store the horizontal and vertical RMS (also referred to as CEP/SEP) values in the note field for the point. This offers a good check on the quality of the shot.
- **Auto Load Map and Auto Save Map**: Maps like the one shown in Figure 2- can be viewed in the Map view within FAST Survey. These maps can be created by using the command IDXF which brings in a DXF drawing file. AutoCad DXF formats 12 through 2000 are fully compatible and will import. Microstation DXF files and DXF files from other CAD programs will also import. Linework (referred to as polylines) can be produced within the MAP view by using the PL (polyline) command, or such commands as Offset (O2 and O3). In addition, use of Feature Codes, where linework is associated with field codes such as EP for edge-of-pavement, will lead to the drawing of polylines in the Map view. These maps can then be auto-saved whenever you exit a coordinate file, and auto-loaded whenever you load a particularly coordinate file. The maps are saved in DXF format. It makes the most sense to click on both Auto Load Map and Auto Save Map if you want to auto-recall your latest map. If Auto Load Map is on and Auto Save Map is turned off, you will recall the map that was saved previously—when Auto Save Map was on. If you want to start your map from a clean slate (from the point plot only—which always appears in map view), you can turn off Auto Load Map and re-enter the program. Then add polylines, use IDXF to import maps

(polylines), then click on Auto Save Map and Auto Load Map and you will store and recall only the new linework.

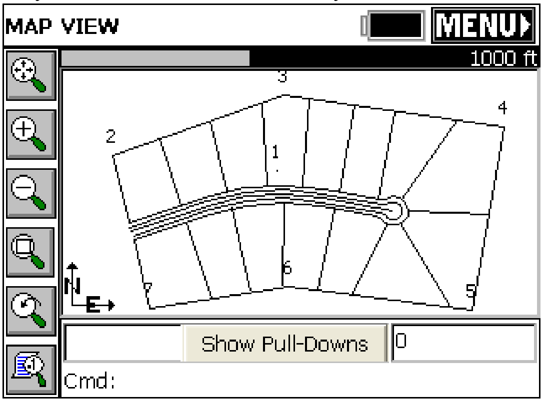


Figure 2-5

Note: the above graphic display is non-default. In the Map screen, the normal display includes pulldown menus. These can be turned off, however, using the Tools pulldown and selecting Preferences, which leads to the screen shown below. The pulldown menu mode is recommended, since it contains the same graphic space, and also responds identically to keyed-in commands (such as PL for polyline).

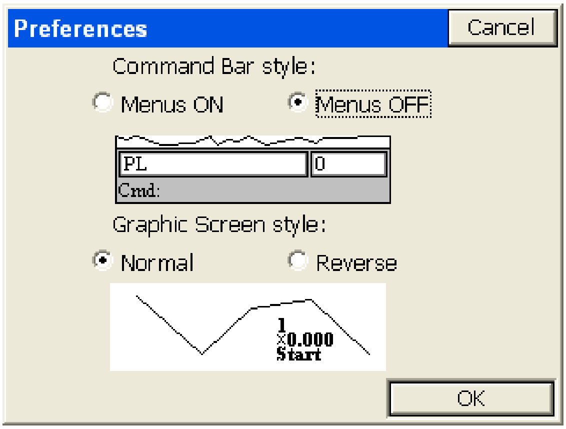


Figure 2-6

- **Auto Recall Roading Files**: This command applies to Offset Stakeout in the non-roading version of FAST Survey, and additionally to Template Stakeout and Slope Staking in the roading version of FAST Survey. Clicked on, this option would recall the last roading files (centerlines, profiles, templates, superelevation files, etc.) used in road stakeout. The Auto Recall Roading Files also applies to the commands Input-Edit Centerline and Input-Edit Profile.
- **Auto Load Last GPS Localization for this Job**: If you are working on the same job with GPS equipment for several days, it is advisable to click this option on. It allows you to set up the base in the same location, change only the base antenna height in Configure Base (if applicable), then continue to work. With this option clicked off, you would have to go to Localization within the Equip menu and Load the stored localization (.dat) file. Even with the option turned on, you can always move to a new job and create or load another localization file.
- **Use Code Table for Descriptions**: The codes in the feature code list will appear as selectable options when storing points when this is clicked on, and Configure Reading is set to Hgt/Desc Prompt on Save. If the code table includes FL, EP, IP and LP for example, these appear within the Store Point routine as shown in Figure 2-7.

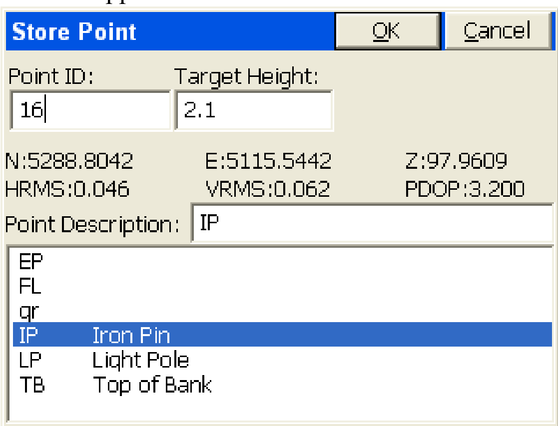


Figure 2-7

- **Use Control File**: Control files apply to the setup and backsight in Store Points and to stakeout. The control file is useful for referencing points that don't exist in your current, working file. If you start a job that has 10 control points in an existing file, you may not want to enter those points in your new file—just use them as needed. The Control File allows this. If you designate file 000901.crd as your control file, for example, you can work in the file subdiv.crd and reference the control file, as needed.

Application in Store Points: If your control file has points 1 through 6, and your current file uses point numbers starting at 1000, then if you setup on 1 and backsight 4, it will first look in your current file, and failing to find point 1, will use point 1 from the control file. Similarly, because it doesn't find point 4 in your current file (subdiv.crd), it will use point 4 from the control file. If you foresight points 1001, 1002 and 1003, then move up to 1003 as your setup and backsight point 1, it will use point 1003 from the current file, even if there is a 1003 in the control file. It will use point 1 from the control file, since it doesn't exist in the current file. It will always look in the current file first, and use that point. You can "force" a setup or backsight point to come from the control file rather than the current file, by using the "From List" icon to the right of "Occupy Point" and "Backsight Point", then select Control File.

Application in Stakeout: Control files work similarly in stakeout. If you stakeout point 5, and 5 is not found in the current file, it will look for point 5 in the control file. But with Stakeout, you can go to Job Settings, Stakeout options, and set the program to give priority to the control file when duplicate points exist. If that is turned on, then if point 5 is found in both files and you stakeout point 5, you will stakeout point 5 from the control file. And you can select "From List", choose Control File, and "force" the requested point to be from the control file rather than the current file.

Note: Be careful when turning on "Control File Points have Priority for Stakeout"! This can lead to surprises during stakeout, where you may be convinced it is giving wrong distance and direction instructions to the selected point, only because it is using the point you entered from the control file, not the current file. This has been a source of tech support, even though the feature can be useful when applied correctly.

- **Select File**: You need to select a file for the control file. That file appears, and will remain as the default control file even when the control file option is clicked off (in which case it is grayed out). When selected the control file appears as shown in Figure 2-8.

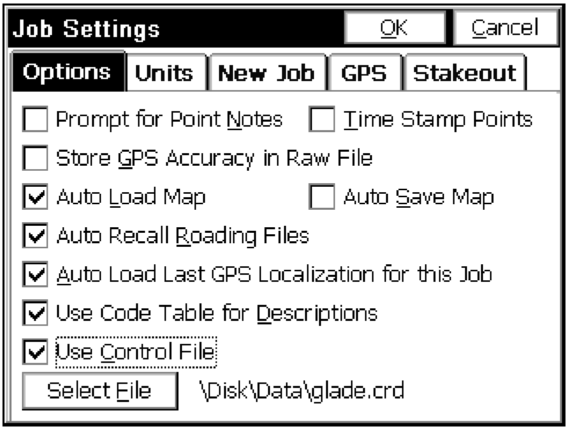


Figure 2-8

Units Tab

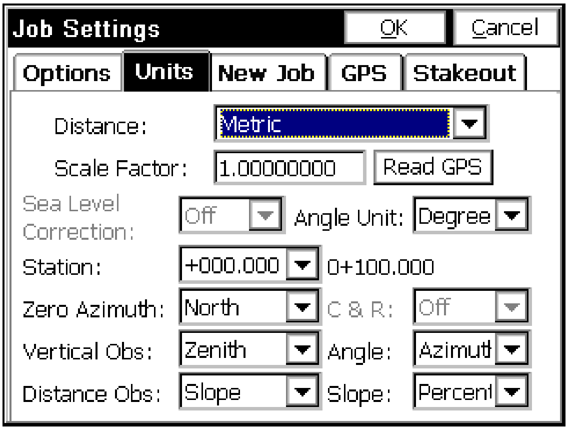


Figure 2-9

- **Distance**: Select the units that you want to use. Choices include US Feet, International Feet, and Metric.
- **Scale Factor**: For most applications, the Scale Factor should be set to 1.0. Read GPS will compute the combined grid/elevation factor for where the reading is taken. All distance measurements, taken by a total station will be multiplied by the scale factor. All GPS coordinates will also be multiplied by the scale factor whenever a 1-point alignment is involved. To match grid coordinates or the

coordinates of any standard transformation (e.g. UTM), the scale factor should be set to 1.0. When configured to total stations, Read GPS becomes Calculate. The Calculate option will calculate the combined grid/elevation factor from any entered coordinate—based on your current state plane zone setting. This can allow you to go "ground to grid," to typically reduce the distance measured by total station to the sea level grid distance of GPS. If set to a GPS configuration, you can take a reading using Read GPS. After converting the LAT/LONG from the GPS to the state plane coordinates and computing the grid and elevation factors, the Scale Factor is applied as the final adjustment to the coordinates. This adjustment is used on the X,Y and not the Z. In GPS, the Scale Factor is applied by dividing the distance between the coordinate and a base point by the 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 Align Local Coordinates. If there are no points specified in Align Local Coordinates, then 0,0 is used as base point. The Scale Factor can be entered directly or calculated using the grid factor and elevation for the current position. When using the current position, the program will read the LAT/LONG from the GPS receiver. The scale factor is then calculated as: (State Plane Grid Factor - (Elevation/Earth Radius)). A scale factor can be used to make grid-to-ground conversions between identical points, to adjust the lesser sea level distances of GPS to the ground (greater) distances measured by total stations whenever you are above sea level. The grid to ground scale factor is greater at higher elevations. In summary, when configured to GPS, the scale factor (typically >1) can be used to go "grid to ground" and when configured to total stations, the scale factor (typically <1) can be used to go "ground to grid." It can also be used for any other scaling purpose desired.

- **Sea Level Correction**: This is either Off or On. It applies only to total station work. If turned On, the distances that are measured will be reduced the higher the elevation of the survey. This is, in effect, a ground to grid conversion. When using a total station and surveying between state plane coordinates (coordinates based on a sea level grid), distances at elevation must be reduced. This will occur automatically when sea level correction is turned on. Distance effects are negligible under 1000 feet (300 meters) but do become geometrically larger over greater distances.

- **Curvature and Refraction**: This option applies only to total station configurations and will be unavailable when your instrument is configured to any GPS option. When selected, options are On or Off. This factor causes an adjustment in distance measurement, particularly over very long distances. Effects are negligible except over long distances. It is recommended that this factor be set On, except in those very rare cases where the instrument factors in curvature and refraction.
- **Angle Unit**: This offers the option of degrees (360 circle, 60 minutes to a degree and 60 seconds to a minute) or gons, often referred to as grads (the 400 circle and fully decimal). An angle of 397.9809 gons is equivalent to 358 degrees, 10 minutes and 58 seconds. (Note: you can verify this in Cogo, Calculator, Conversion tab). The Angle Unit configuration impacts commands such as Inverse, Traverse, Sideshot, Input-Edit Centerline and other commands where a direction is displayed or entered.
- **Station**: This option impacts the display of centerline stationing, sometimes referred to as "chainage". In the U.S., for example, roads designed in feet are "stationed" by every 100 feet, so that a road at linear position 14280.5 is given a station of 142+80.50. Metric roads in the U.S. are often stationed by kilometers, where the same road position has a station of 14+280.500. You can configure the placement of the "+" as desired, independent of your configuration for metric vs feet units. You can also configure for a purely decimal display of stationing/chainage, as in 14280.500. This display form shows up in such commands as Input-Edit Centerline, within the Start Station dialog box. However, you should enter stationing in purely numeric form, without the "+" convention. Only the display is impacted by this option.
- **Zero Azimuth**: Allows you to specify the direction for zero azimuth, North or South.
- **Vertical Obs**: Allows you to set the default prompting to Zenith (0 degrees up, 90 degrees level), Vertical Angle (90 degrees up, 0 degrees level) or Elevation Difference (up is positive in absolute units, down is negative).
- **Angle**: Options are Bearing or Azimuth. This applies to numerous commands, such as prompting and displays in Sideshot Traverse (the backsight as azimuth or bearing), Intersections and Inverse.
- **Distance Obs**: Options are Slope or Horizontal. This applies to the values displayed from total station readings.

- **Slope**: Whenever slopes are reported or prompted, the user has the option to specify the default in Percent, Degrees or Ratio. Some commands such as 3D Inverse will, however, automatically report both slope and ratio and are unaffected.

New Job Tab

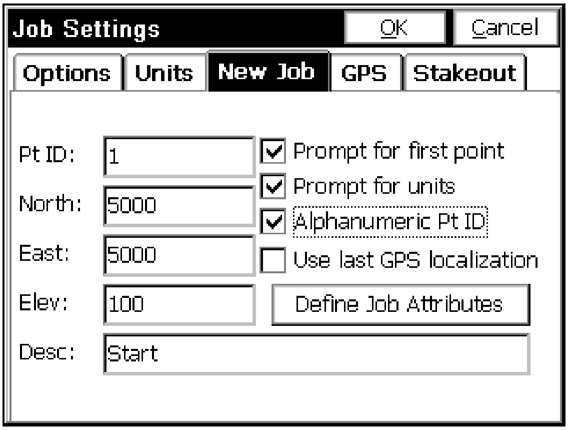


Figure 2-10

- **Prompt for first point**: This option specifies whether or not FAST Survey will prompt you to specify a starting point when starting a new job. You may specify a default staring point in this dialog also. Applies for total station use only.
- **Prompt for units**: This option specifies whether or not FAST Survey will prompt you to set the units when you start a new job.
- **Alphanumeric Pt ID**: When this option is turned ON, FAST Survey will allow alphanumeric point numbers such as 2A or T1105. When this option is turned OFF, FAST Survey will only allow numeric point number entry. Note: this only affects new jobs, not existing ones. Purely numeric files operate faster when there are thousands of points in the file.
- **Use last GPS localization:** If this feature is checked on, each new job will use the previous job's localization file and project scale. If this feature is checked off, each new job will start out with no localization and a project scale of 1.0. The default value is off.
- **Define Job Attributes:** This lets you set up prompting, for each new job, for job-related attributes like Client, Jurisdiction and other notes. These will prompt when each new job is started, and the

attributes and entries will appear in the raw file (.rw5) file. Select Add to enter new attributes:

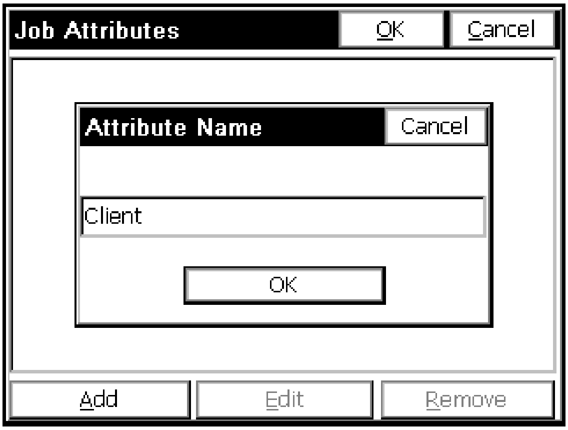


Figure 2-11

GPS Tab

Predefined Coordinate Systems

You may select from a list of recently used projections. Find this list in File/Job Settings/GPS. See Figure 2-12.

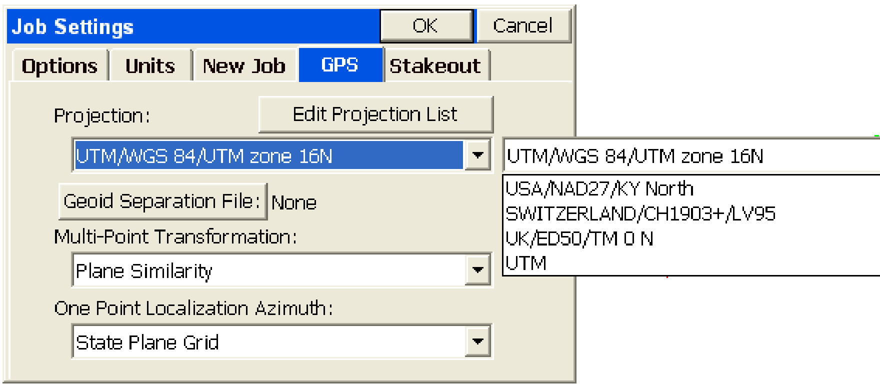


Figure 2-12

- **Projection**: If you click the arrow to the right of the current projection, you can select from a list of projections that you have selected recently. But to select a projection that you haven't used before, choose Edit Projection List.

- **Edit Projection List**: Click this button to choose a new projection or define a new projection. It brings you to this screen:

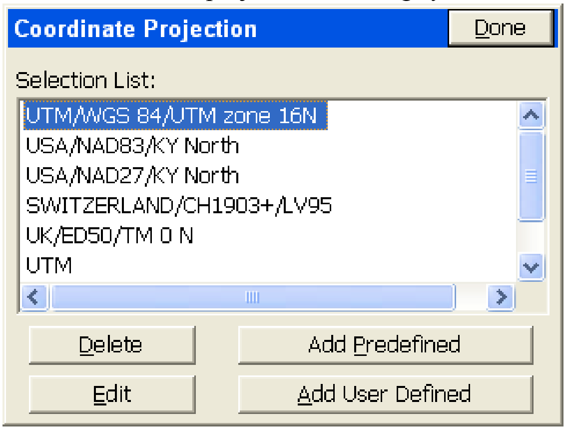


Figure 2-13

If you click Add Predefined, you can set the country/projection to use at the top of the dialog, then choose the "zone" within the projection. For example, in the United States, State Plane 83 is a common projection, with various grids available covering all states. If Austria is selected, options for that country appear. See below:

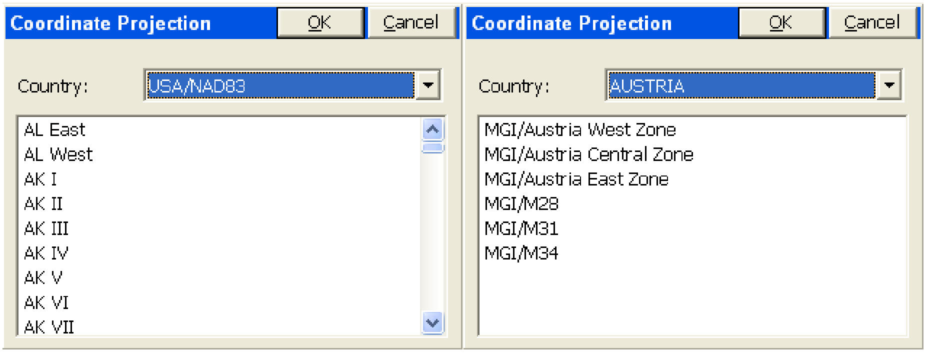


Figure 2-14

- **NAD 27:** When selecting this coordinate system, you will also need to specify a state plane zone. FAST Survey will use data files to perform a NADCON datum shift from WGS84 to NAD27 coordinates. By default, only data files for the continental U.S. are loaded to the data collector. If you are working outside this region, please load the appropriate files from your CD to the SurvStar\NADConv directory. NAD27 uses the Clarke 1866 ellipsoid.

- **NAD 83:** When selecting this coordinate system, you will also need to specify a state plane zone. NAD 83 uses the GRS80 ellipsoid.
- **UTM:** The ellipsoid used in the Universal Transverse Mercator calculation is determined by the Datum selection. The zone is determined by the lat/lon values read in from the receiver. Whenever FAST Survey does a reverse calculation (from UTM to WGS84) you will be prompted to enter a zone number.
- **3TM (Canada):** This system is also referred to as “MTM”. It is a 3 degree zone width Transverse Mercator calculation. You may select between the Clarke 1866 ellipsoid and the WGS84 ellipsoid.
- **New Zealand:** You may select between “NZGD2000” and “NZGD49”. Both use the Transverse Mercator calculation. NZGD2000 uses the GRS80 ellipsoid. NZGD49 uses the International 1924 ellipsoid. You may specify a Meridional Circuit with either datum. To select the circuit, press the “Define” button. You will see a pull-down list with all Meridional Circuits as well as the option to pick “None”.
- **RGF 93 (France):** This system requires that you have the file named “Predef1.csl” in the SurvStar directory on the data collector. If this file is not found, please re-install FAST Survey.
- **NTF (France):** This system requires that you have the file named “Predef1.csl” in the SurvStar directory on the data collector. If this file is not found, please re-install FAST Survey. NTF is an approximation of the NTF-GR3DF97A grid transformation.
- **NTF-GR3DF97A:** This system is a grid transformation that requires the files “Predef1.csl” and “gr3df97a.bin” to be in the SurvStar directory on the data collector. The “Predef1.csl” file is part of the default installation. You will need to use Data Transfer to copy the “gr3df97a.bin” file from your CD to your data collector.
- **OSTN02 (UK):** This system is a grid transformation that requires the files “Predef1.csl”, “ostn02_x.bin” and “ostn02_y.bin”. The “Predef1.csl” file is part of the default installation. You will need to use Data Transfer to copy the “ostn02_x.bin” and “ostn02_y.bin” files from your CD to your data collector.
- **RD2000:** This is the RD NAP transformation for the Netherlands. This system is a grid transformation that requires the file “Predef1.csl”, “X2C.grd” and “Y2C.grd”. The “Predef1.csl” file is part of the default installation. You will need to use Data Transfer

to copy the “X2C.grd” and “Y2C.grd” files from your CD to your data collector.

- **Denmark 34:** Used for all cadastral mapping and for most technical mapping carried out in Denmark. System 34 is a two dimensional - horizontal - coordinate system. System 34 is based on the National Geodetic Reference Network and is divided into two different zones, one covering Jutland and Fuen, and the other covering Sealand. The island of Bornholm has its own coordinate system called System 45.

User Defined Coordinate Systems

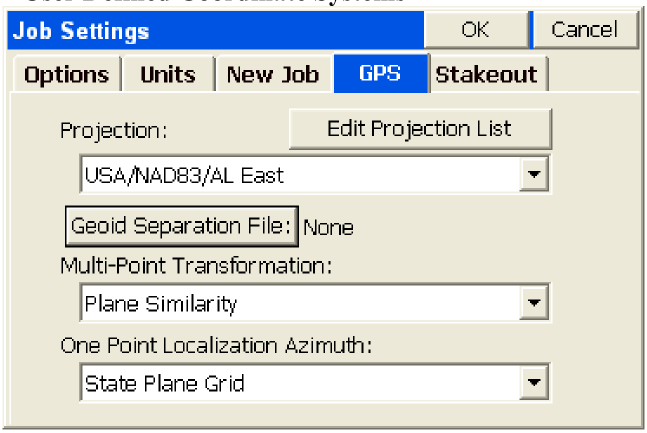


Figure 2-15

To define a new coordinate system, go to File/Job Settings/GPS and select “Edit Projection List.” Then click on the "Add User Define" button. Enter a name for your system (e.g. PRVI for Puerto Rico/Virgin Islands), then select a projection (in the example below, Lambert_Conformal_Conic_2SP) and enter the appropriate parameters. See Figure 2-16. Note that all latitude and longitude values are in decimal degrees and False Northing and False Easting are always presented in meters. All entries involving degree must be in decimal degrees based on a 360 circle.

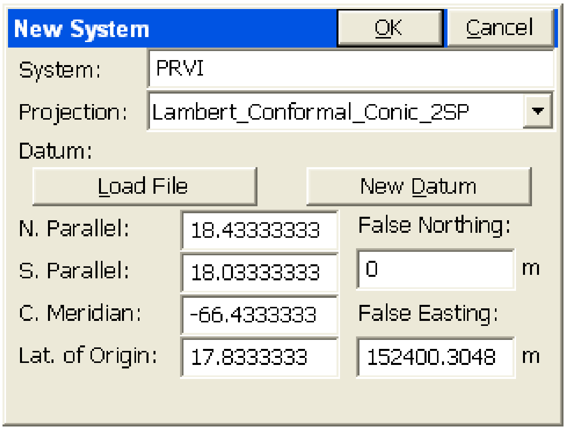


Figure 2-16

Some projections such as Switzerland CH1903 involve a datum shift in addition to the above. Define a datum shift by selecting "New Datum", as shown in Figure 2-16. This brings up the dialog shown in Figure 2-17. You may select a predefined Ellipsoid or set your own parameters by typing in a new ellipsoid name and entering values for a and 1/f. The values for dX, dY, dZ, rot X, rot Y, rot Z and scale are "to WGS84". Rotation values are in seconds on the 360 circle. If the values you have are "from WGS84", simply reverse the sign of each value (positive becomes negative and vice versa). In this example, we can choose the Ellipsoid GRS80 and leave the other items in the dialog unchanged.

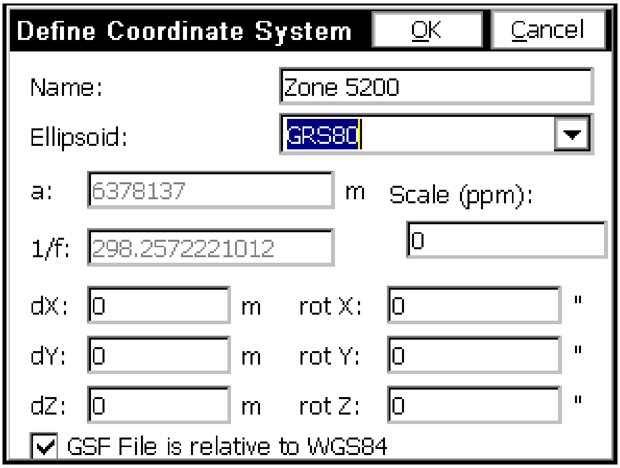


Figure 2-17

You will need to save the system to a file, as shown in Figure 2-18. You may save the system to a "sys" file or a "csl" file. Sys files contain only one system definition. Csl files contain multiple system definitions. Both files are ASCII text files using OpenGIS WKT (Well Known Text) format.

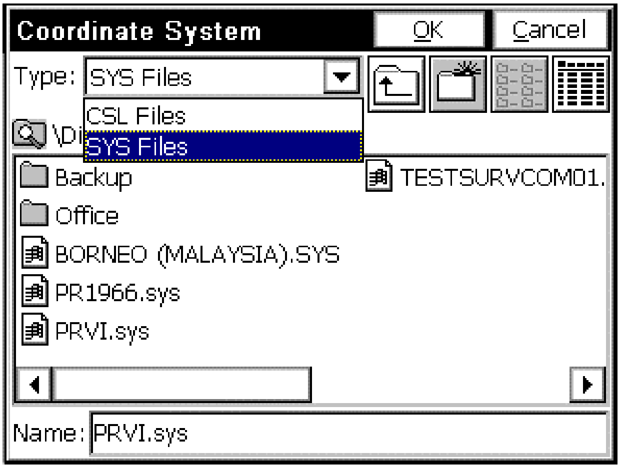


Figure 2-18

To load a user defined coordinate system from a file, go to File, Job Settings, GPS and click on the "Edit Projection List". Select "Add

User Defined" and select Load File as shown in Figure 2-19. Then click on the "Define" button. Select "Load from File" as shown in Figure 2-19. Change the File Type to "sys" or "csl" depending on the type of file you are loading. A "sys" file will be associated with each job. You can load the projection last used on a survey job by loading its "sys" file. Select your file and say OK. If you have selected a csl file, you will be asked to choose from a list of system definitions found in the file. For the "csl" type, you may verify that the details of your system have been loaded correctly by pressing "Edit/View Details" and "Edit/View Datum".

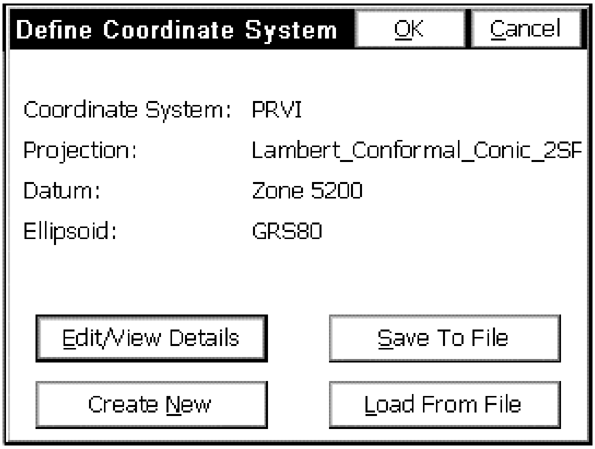


Figure 2-19

- **Transformation**: The transformation in the Align Local Coordinates command can either be by plane similarity or rigid body methods. Both methods use a best-fit least squares transformation. 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. Plane Similarity is the default for multi-point localizations and is recommended for most applications.
- **One Point Localization Azimuth**: This option applies to the rotation when using one point in Align Local Coordinates. 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. Though referred to as “state plane,” this applies to grid systems worldwide, and is the default setting.

Stakeout Tab

This option will appear different depending on whether you are configured for total station use or GPS. If you are configured for a total station, the Stakeout tab will appear as shown in Figure 2-20 below.

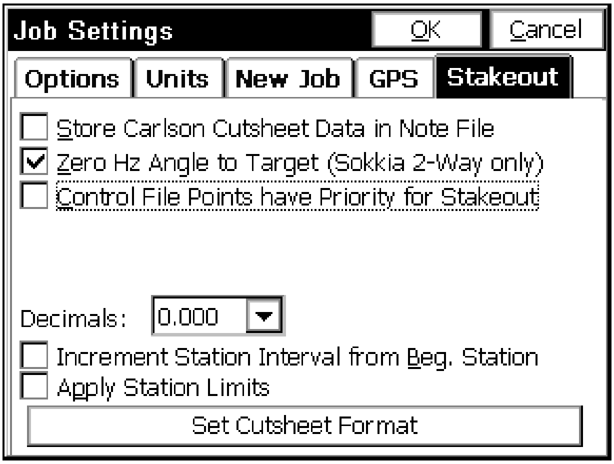


Figure 2-20

If you are configured for GPS, the Stakeout tab will appear as shown in Figure 2-21 below.

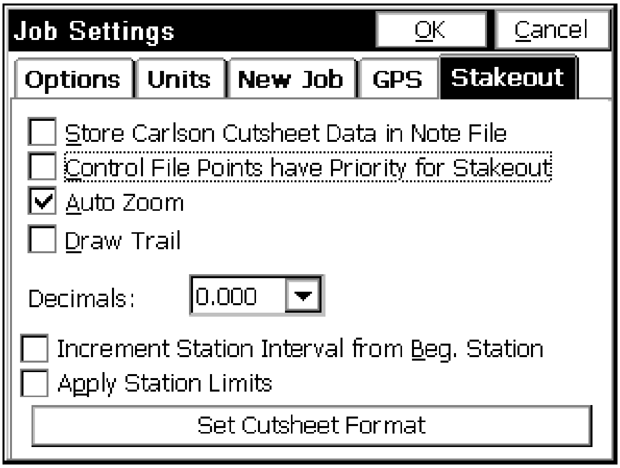


Figure 2-21

- **Store Carlson Cutsheet Data in Note File**: This option specifies whether or not to store the stakeout data in the note file (.NOT) for the current job. At the end of staking out a point, there is an option to store the staked coordinates in the current job. This stakeout note file option allows you to store more stakeout data in addition to the staked coordinates. This additional data includes the target coordinates and horizontal and vertical difference between the staked and target points. Keep in mind that you can store an ASCII cutsheet file using the button at the bottom of the dialog, so storing into the note file is redundant if a formal cutsheet file is stored. The one advantage of the note file is that notes are viewable in association with points using Carlson Software office products such as Carlson SurvCadd, Carlson Survey, or Carlson Survey Desktop.
- **Zero Hz Angle to Target**: This option specifies whether or not FAST Survey will set the horizontal angle of the total station to zero in the direction towards the stakeout point. When stakeout is completed, the horizontal angle is set back to the original value. This option only applies to Sokkia total stations or to total stations such as Nikon which have a "Sokkia emulation" mode.
- **Control File Points have Priority for Stakeout**: This option, which applies to both total stations and GPS, will choose the point in the control file for stakeout, when the point requested exists in both the current file and the control file.

Note: Use this option with care. You may not realize that this option is set, and will discover that directions to your expected stakeout point of 10 are really based on a point 10 from another file altogether – the control file.

- **Auto Zoom**: This option specifies whether or not FAST Survey will zoom the drawing display in or out so that both your current position and stakeout target are visible on the screen. This option only applies to GPS.
- **Draw Trail**: This option specifies whether or not FAST Survey displays a line in the stakeout screen showing where you have been as you move towards the stakeout point. This option only applies to GPS.
- **Decimals**: Use this to control the decimal precision reported during stakeout routines.
- **Increment Station Interval from Beg. Station**: For centerlines that start on an "odd" station such as 1020 (10+20 in U.S. stationing format), this option would conduct stakeout by interval measured from station 1020. So a 50 interval stakeout, instead of being 1050, 1100, 1150 would be 1020, 1070, 1120, etc.
- **Apply Station Limits:** When selected, the program will not automatically advance beyond the natural start and end of a given centerline.

Set Cutsheet Format leads to the following 3 options:

- **Set Pt Cutsheet Format**: This button opens a Settings dialog where you can customize the Point Cutsheet report format as well as view and edit the current point cutsheet file. This applies to the command Stake Points.
- **Set Cl Cutsheet Format**: This button opens a Settings dialog where you can customize the Centerline Cutsheet report format and view and edit the current centerline cutsheet file. This applies to commands within Stake Line/Arc and includes station and offset options in the stored file, as well as cut/fill.
- **Set Slope Staking Report Format**: This button opens a Settings dialog where you can customize the Slope Staking report format as well as view and edit the current slope staking report file. This applies only to the command Slope Staking available with Roading.

These last three options allow you to customize the respective output report. To change an item label, highlight the item, change the Header

Label field, then tap Update Item. You can select an item in the list and turn it ON or OFF. You can also control the order of the report items by using the Move Down and Move Up buttons. The options in this dialog are shown below.

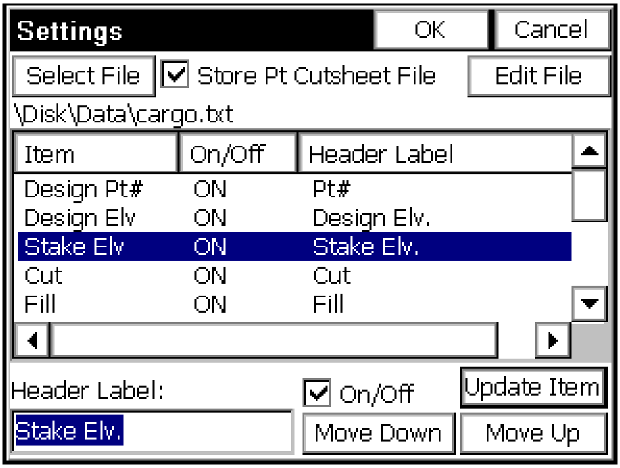


__Figure 2-22__

- **Select File**: Tap this button to select the output file. This file name is shown below this button.
- **Store Pt Cutsheet File**: Check this toggle to store the report to the selected file. Uncheck this toggle to disable the report.
- **Edit File**: Click to Edit and review the cutsheet file. Here is a point cutsheet file. Notice that the vertical bars of the "spreadsheet" can be moved left and right condensing the display, to see more of the header lines. Just pick them in the title line and move them. Shown below is a Point Cutsheet, as viewed in the Edit File option.

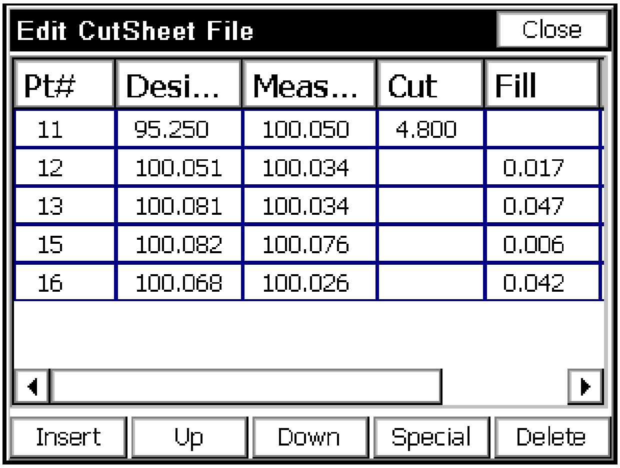


Figure 2-23

List Points

Function

This command will list all of the points in the current coordinate (.crd) file. You can also edit any point in the list.

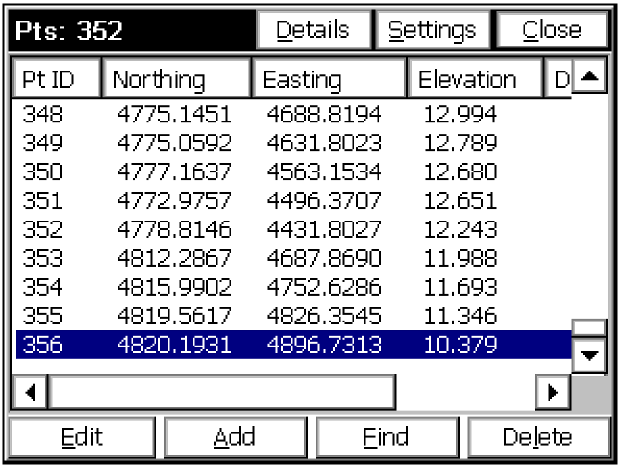


Figure 2-24

Figure 2-24 shows the List Points dialog. The point list includes Point ID, Northing, Easting, Elevation, and Description. The title bar of the dialog box displays the total points in the file. Click on Details to see more information, such as the highest point ID in the file and the used and unused point IDs.

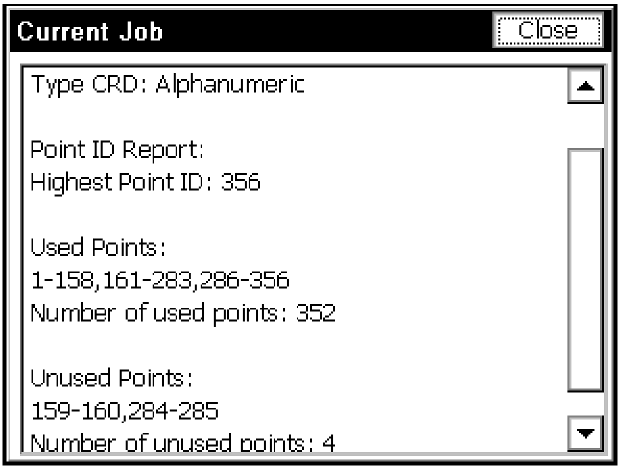


Figure 2-25

Tap the Settings button to customize the List Points display.

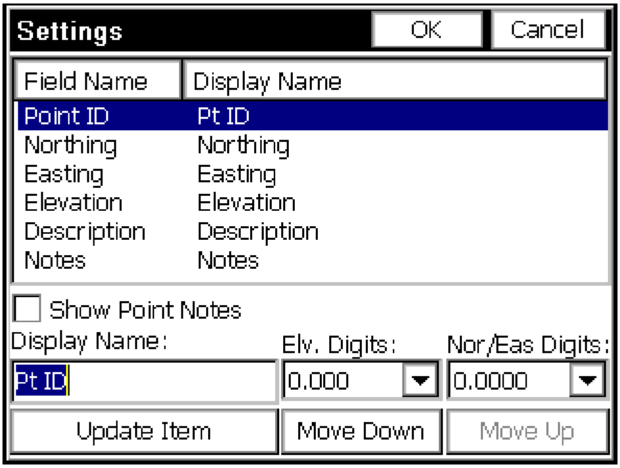


Figure 2-26

Figure 2-26 shows the Options dialog for List Points. To rearrange the order of the fields shown in Figure 2-24, highlight a field and use the Move Down and Move Up buttons. To rename a field, highlight it, enter a new name in the Display Name field and then tap Update Item. This would allow customization, where Northing, Easting could become X, Y as renamed, and "re-ordered" header lines. The decimal precision for each field can also be set in the Options dialog. Notes can be placed in any order of the list, but can also be turned off, as shown above. Press OK to return to the main List Points dialog.

To edit a point in the list, double tap on it or highlight the point and tap the Edit button. The dialog shown in Figure 2-27 appears.

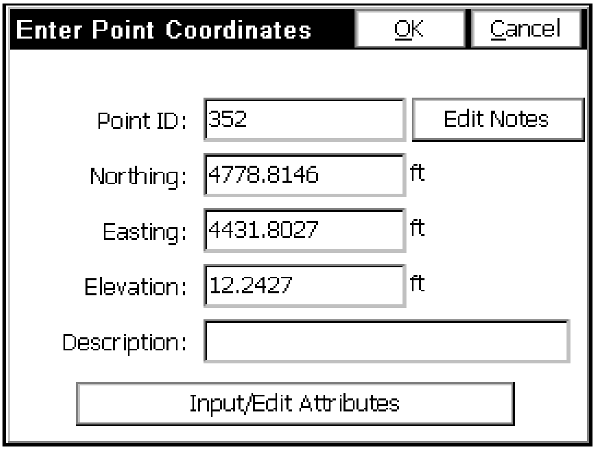


Figure 2-27

You may edit any aspect of the point. To edit, move the cursor into the field of the aspect to modify and enter the new value. Choose OK to enter the edited point into the coordinate file, or choose Cancel to negate your modifications. The Input/Edit Attributes button refers to GIS data attributes associated with a point. These GIS attributes will export in the form of shape files (Tools pulldown in the Map screen). Few surveyors currently need the GIS attributing features of FAST Survey, but these features help link FAST Survey to the ESRI world, just as the DXF output of linework links to the CAD world.

To add a point, press the Add button. The dialog shown in Figure 2-27 appears except all of the fields are blank. You must enter the point number, northing and easting.

To delete a point, highlight a point number and tap the Delete button. You will be asked to confirm this choice before the point is actually deleted.

To find a point number, tap the Find button. The dialog shown in Figure 2-28 appears. You can search for a point by Point ID or description, but not both at the same time.

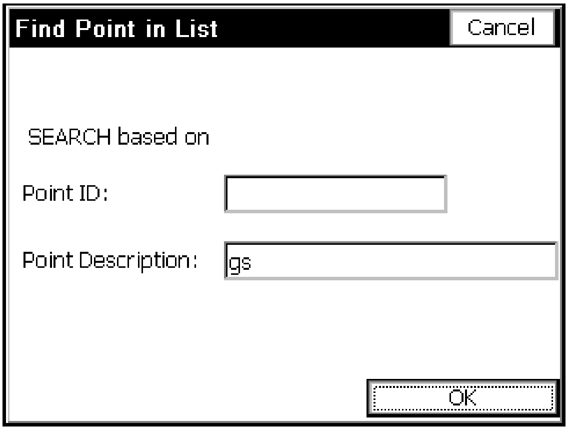


Figure 2-28

When a control file is specified, List Points offers the option to select the control file and to list the control file points also. This feature, shown here in Figure 2-29, enables the “From List” option found throughout FAST Survey to access Control Points. The vertical bars in the “header” lines separating Pt ID, Northing, Easting, etc. can be moved to “condense” the display, as desired. The new positions, however, are not stored.

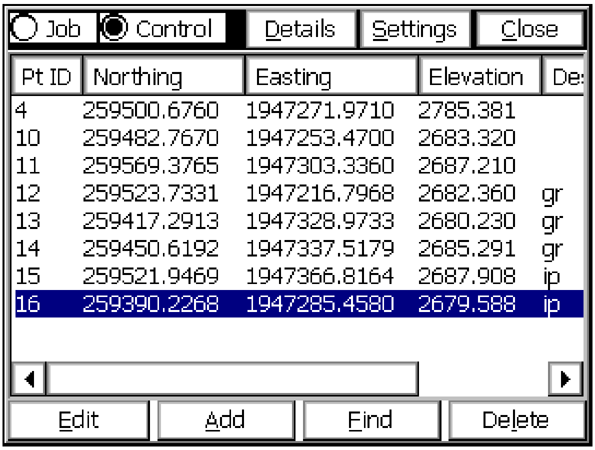


Figure 2-29

The number of points and highest point number in the file will now appear in the “Details” option.

Configure Reading

Function

This function allows you to select settings and preferences that apply to observations taken in the field. These parameters are used in many operations, such as Store Points (GPS) or Sideshot/Traverse. Configure Reading is also accessible from within Sideshot/Traverse and other routines by pressing the C icon.

Total Station Configure Reading Dialog – see Figure 2-30.

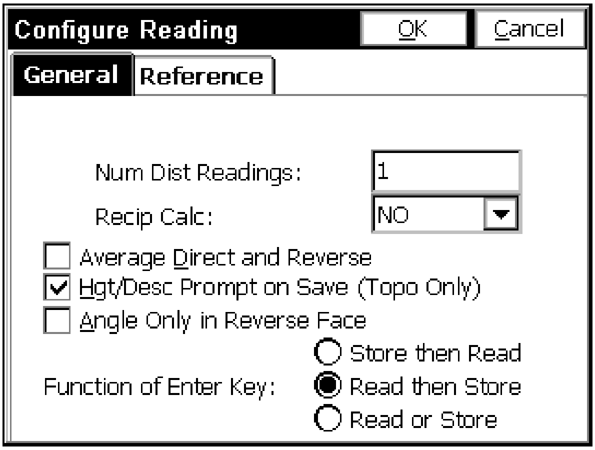


Figure 2-30

- **Num Dist Readings**: Specifies the number of distance readings that will be taken on each observation. Values between 1 and 9 are accepted. If the Distance (EDM) Tolerance is exceeded between readings, a Warning Screen will appear.

Note: The Num Dist Readings setting does not apply to Manual Total Station mode. In this mode, you can use the calculator to average distances. When prompted for Slope Distance, enter "?". This goes to the Calculator routines. Choose the Scientific Tab. Then here's how to enter 3 values:

141.213 Enter

141.211 Enter

141.220 Enter

Now press + on the keyboard twice and with the first +, 141.220 is added to 141.211 to get 282.431, then with the second + you get 423.6440.

Then enter 3 and type "/" for divide. This gives the result: 141.2147.

Choose the Copy button at the bottom of the screen, then Paste at the top.

- **Reciprocal Calculation**: This option has 3 settings: No, Prompted and Always. It governs the calculation of foresight points taken with a total station, where a backsight measurement is also taken. When set to Always, the program will calculate the distance to the foresight point and delta elevation by combining the foresight and backsight measurements. When set to Prompted, the program will detect the backsight measurement and ask the user if the occupied point should be calculated using both previous foresight and current backsight. If set to No, the program calculates foresight points based only on the foresight measurement.
- **Average Direct and Reverse**: When clicked on the Sideshot/Traverse dialog box prompts for two observations, direct (F1) and reverse (F2) readings. The two readings are then combined to produce an average observation record for the vertical circle, which is stored in the rw5 file as a sideshot (SS) record. For calculation purposes, the routine only averages the vertical circle readings, and uses the direct horizontal reading for the direction. Both the direct and reverse readings are stored in the rw5 file as a note record. When clicked off, (default setting) only the direct foresight shot will be taken.
- **Hgt/Desc Prompt on Save**: When clicked off, the program expects entry of target height and point description prior to storing the shot within Sideshot/Traverse, Elevation Difference, Store Points (GPS) and other commands. Thus when the shot is taken, the correct target height and description must already be entered. Many users prefer to enter the target height and description for a shot after the shot is taken. They expect to be prompted and reminded. Although this adds an extra prompt screen, it can reduce errors (you no longer have to anticipate the shot and get the information in ahead of time).

So when Hgt/Desc Prompt on Save is clicked on, you get the dialog shown in Figure 2-31.

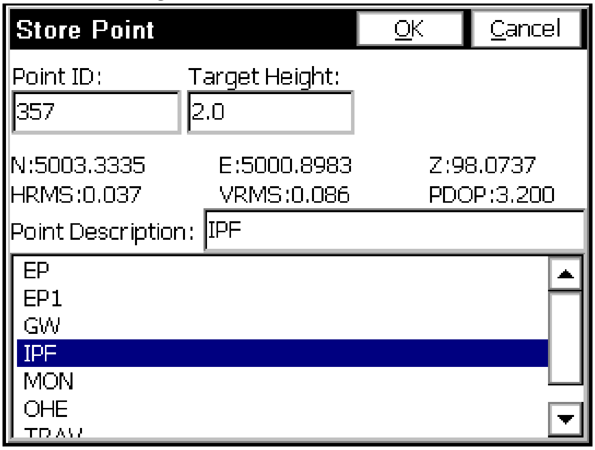


Figure 2-31

The cursor is located on the Point Description prompt, but you also have the option to re-enter a different point number and change the target height. Note that all the field codes identified in the Feature Code List under Surv are available for touch or arrow key selection, provided this option is activated in Job Settings (Use Code Table for Descriptions). Also, if you enter the first character of a code (as in I for IP), it will automatically highlight the first field code starting with I, allowing you to arrow key to the one you want, or accept the highlighted option. It is not case-sensitive. A small "i" will locate the IP option.

- **Angle Only in Reverse Face**: When taking Face 1 and Face 2 foresights, or when doing Set Collection, you will be prompted only for the angle, not the distance measurement.

- **Function of Enter Key**: Since the Enter Key is a convenient way to take shots in the command Store Points, FAST Survey allows the user to define the effects of the Enter Key. These different uses of Enter (for total stations) apply not only to Store Points but also to Elevation Difference.

  - **Store then Read**: This is similar to the effects of the Read key on the original SDR data collectors. After a backsight, the first time Enter is used, it will take the shot and display the results.

Then when you foresight the next point, Enter will "Store Last, Read Next". This procedure is best used with the above Hgt/Desc Prompt on Save turned off. If that option is on, then when you turn to the new shot and press Enter, the new shot doesn't take right away, but instead, you are prompted for the target height and description of the previous shot. That could cause some confusion. But with Hgt/Desc Prompt turned off, it is very efficient. You press Enter and take your first shot. You see the results displayed, and can alter descriptions or target heights or point numbers for that shot. You sight your next foresight, and press Enter and the last shot is correctly stored and the next is taken. The information is displayed. You can review and alter it. You sight your next foresight, press Enter and store the last shot and shoot the next, etc.

- **Read then Store**: With this option, the Enter key takes the shot and stores the point. This options works very well with the Hgt/Desc Prompt on Save turned on, in which case Enter takes the shot, then displays the results and provides opportunity for editing, as in the Store Point dialog shown above.
- **Read or Store**: The first Enter takes the reading and the second enter stores the reading.

Reference Tab, Total Station Configuration

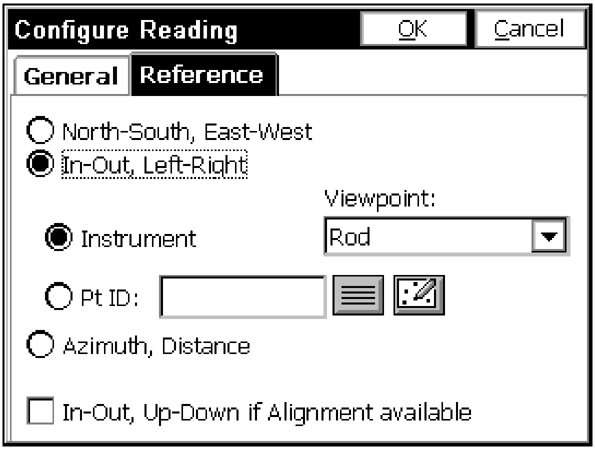


Figure 2-32

- **Direction to Point—North-South, East-West**: When total stations are used, the direction to go in stakeout can be North-

South, East-West. The program might advise, North 3.582, East 1.917. This method is better suited to GPS work and is subject to having a sense, in the field, of the north direction.

- **Direction to Point—In-Out, Left-Right**: Nearly all surveyors choose this method. If you are staking a point 100 meters from the instrument, and take a measurement at 97 meters, the program would respond, "Out 3". If the In-Out, Left-Right option is selected, additional options become available for defining left-right. The "Instrument" setting has 2 Viewpoint options: Rod and Instrument. If the Viewpoint is from the "Rod", then left would advise the rodman to move left of the line defined by the rod to the instrument. If the Viewpoint is from the instrument, then left would be left of the line defined from instrument to rod. If the Pt ID option is set, then the point is substituted for the instrument, and left/right is either from the "rod to point" perspective (Rod setting) or from the "point to rod" perspective (Point setting).

- **Direction to Point—Azimuth, Distance**: This directs you to the point for stakeout by the total distance and the azimuth, in either the 360 circle or 400 circle if configured to grads.
- **In-Out, Up-Down if Alignment is Available**: This option overrides the settings above, and if the stakeout involves a centerline, the program will direct the user by distance in to or out from the centerline and up and down station (up being in the forward direction of the stationing or chainage).

GPS Configure Reading Dialog – see Figure 2-33.

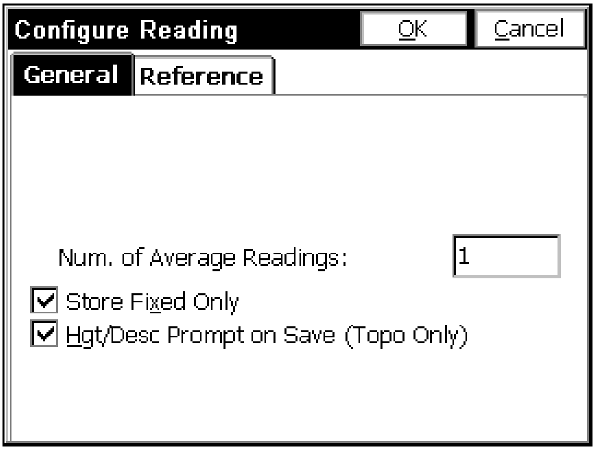


Figure 2-33

- **Number of Average Readings**: Specifies the number of GPS readings to average before storing the point. The default value is 1.
- **Store Fixed Only**: When toggled ON, only data gathered in the fixed (locked) status will be stored to the point file. If attempting to store data when the receiver is not fixed, a message will appear stating, "Position is not fixed! Continue storing?". The program will prompt to store the point anyway. This allows for overwriting the “store fixed only” variable without having to go back to configure reading menu.
- **Hgt/Desc Prompt on Save**: Prompts for target height, point number and description after the point is shot, within Store Points or Sideshot/Traverse. It works the same for GPS as it does for total stations, as documented above.

Reference Tab, GPS Configuration

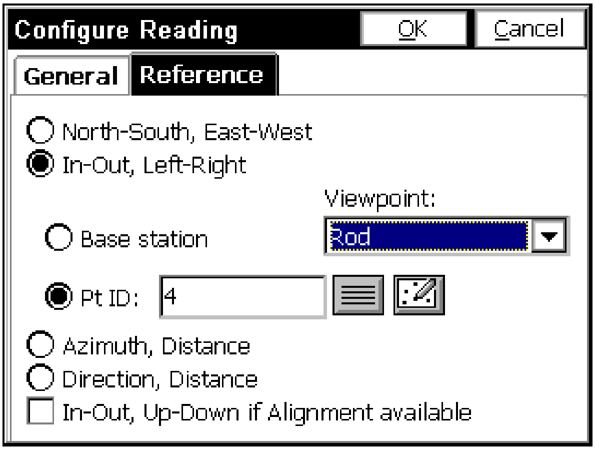


Figure 2-34

- **Direction to Point—North-South/East-West**: This option is commonly used for GPS stakeout, but requires a good sense of "where north is" on the job site.
- **Direction to Point—In-Out, Left-Right**: This option will reference in-out to either a base station or a point. The Viewpoint governs the direction. In would be to the base station or Pt ID, as selected. But left and right would be from the Rod looking at the base station or point (point 4 as shown here) or as seen from the Pt ID or base station looking at the rod (rover antenna). The Rod Viewpoint is by far the most common in the In-Out, Left-Right setting.
- **Direction to Point—Azimuth, Distance**: This selection directs you to the point by the azimuth and distance from your measured point to the desired point. Again, a good sense of the north direction is required.
- **Direction to Point—Direction, Distance**: This follows the direction of your current, most recent movement, and advises you to go left or right of that movement, and the total distance to go. As you veer to the left, say, and over-compensate, you will be directed right. After a few such back-and-forth directions, you can often settle in on the approximate direction and simply go the necessary distance until you are close. In this command, it is good to bounce back between left and right, since it implies you are nearly on course.

- **In-Out, Up-Down if Alignment is Available**: This option overrides the settings above, and if the stakeout involves a centerline, the program will direct the user by distance in to or out from the centerline and up and down station (up being in the forward direction of the stationing or chainage).

Feature Code List

Function

This command allows you to define feature code lists. You can create multiple feature code lists and each list can contain an unlimited number of codes. Each feature code consists of a short code, a longer description, a polyline toggle and a polyline type setting. The initial dialog box is shown in Figure 2-35.

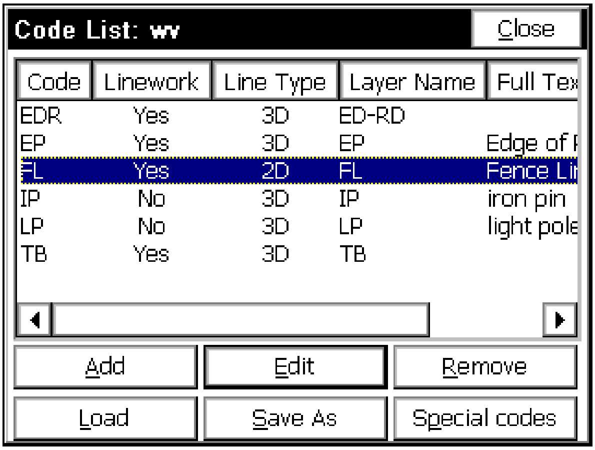


Figure 2-35

Select a Feature Code File

Tap the Load button to select a file to edit. Choose an existing file or enter a new file name to create a new Feature Code List. Note: Feature Code List files have an .FCL file extension.

Saving the Feature Code List

The Save As button will let you save the current feature code list. You may select a new file name or save the current file.

Remove a code from the list

To remove a code from the list, highlight an existing code and press the Remove button. FAST Survey will ask you to confirm deletion of the code.

Edit an existing code

If you wish to edit an existing code, double tap on the code. It will appear in the Edit Code dialog shown in Figure 2-36. Edit the code information as necessary and press OK.

- **Code**: Enter the name of the Feature Code. For example you might use EP for edge of pavement.
- **Full Text**: Enter a description for the code. This is only for your information. It is not added to the point description.
- **Polyline ON**: This setting determines whether points with this code are joined together with linework when the points are plotted.
- **Polyline is 3D**: Choose whether the polyline should be 3D or 2D. If you choose YES, then each polyline vertex is located at the elevation of the point. If you choose NO, then the entire polyline is constructed on elevation 0 (zero), regardless of each point's elevation. This setting is not applicable if Polyline ON is set to NO.

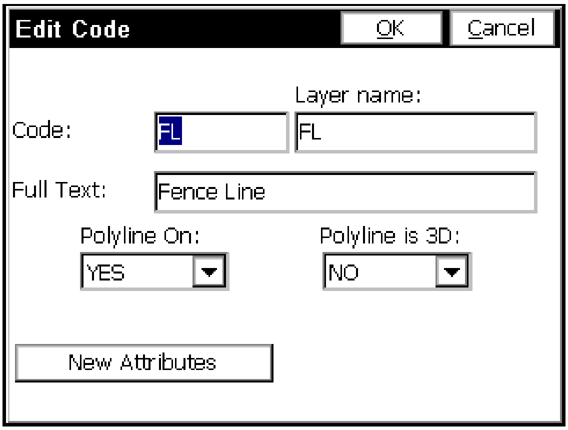


Figure 2-36

- **New Attributes**: This option leads to "GIS" type attributing, where you can further describe the code (here a fence) with additional attributes. For example, one attribute might be Fence Type, and there may be 4 options, with a default option. These can be set up, one time, by using the "Add" option within New Attributes, and then whenever a fence is chosen, the attributes can be selected from a list. These attributes store in the raw file and most importantly, will output to an ESRI Shapefile (Map Screen, File Pulldown, Export SHP File). You can even control the "prompt" and what the default attribute is (here "barbed wire") and whether some attribute entry is required, or just optional. With this setting, any shot to "FL" for fence will jump into the GIS attribute screen. The setup screen for attributes is shown in Figure 2-37:

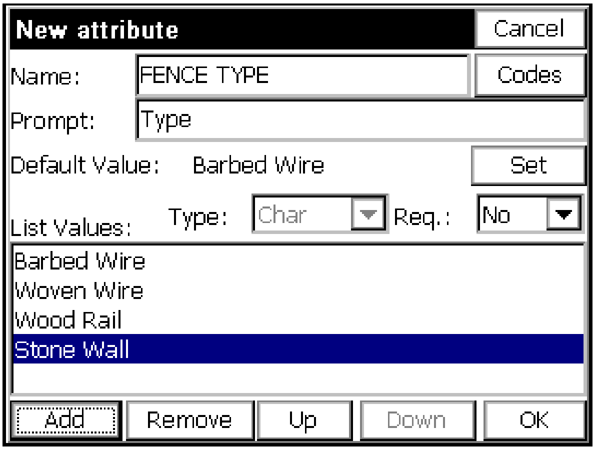


Figure 2-37

Fence type is a user-defined attribute. But many attributes of the feature are "known" by FAST Survey (eg. the current instrument being used, the date and time, etc.). These types of "known" attributes appear in a list of "Codes" selectable above, and shown in Figure 2-38:

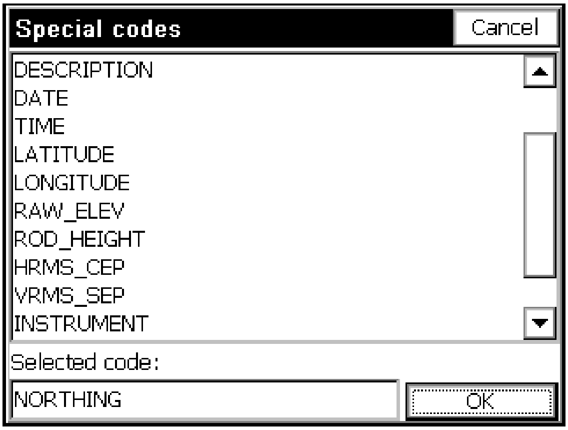


Figure 2-38

Now when you are collecting the points with an "FL" code, and the program detects that you have shot a "point-only" feature, or if a line, that you have ended the line (eg. FL END), then you will be prompted as shown here in Figure 2-39 (the ID refers to the polyline entity in the DXF file):

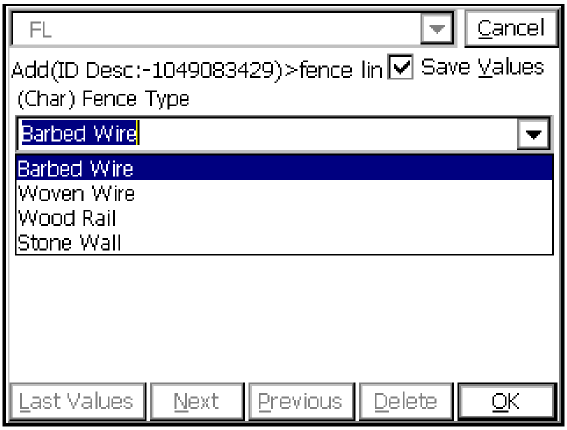


Figure 2-39

If there were several attributes associated with the fence (eg. height, condition, etc.), then the Next and Previous buttons would be active. If you had just show 3 points along a fence line with GPS, the RW5 file would appear, within COGO, Process Raw File, option Review, as follows:

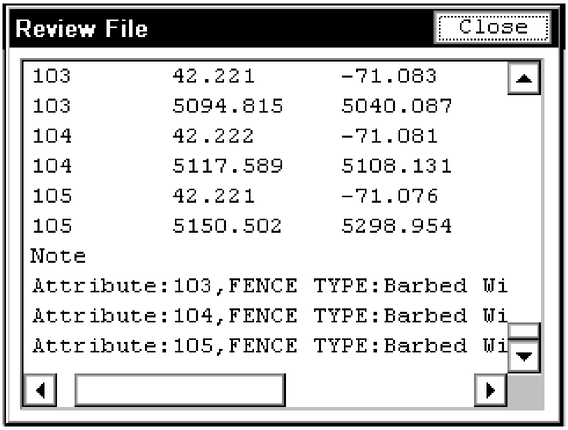


Figure 2-40

You have the option to not save the attribute information, in which case it would not appear in the raw file or be convertible to shape files using the Tools command in the Map screen.

Add a new code

Press the Add Code button to add a feature code to the list. The same fields apply as described under Edit Code above.

Special Code Suffixes

In addition to the codes that you add to the Feature Code List, there are some predefined code suffixes that you may use. They are described below.

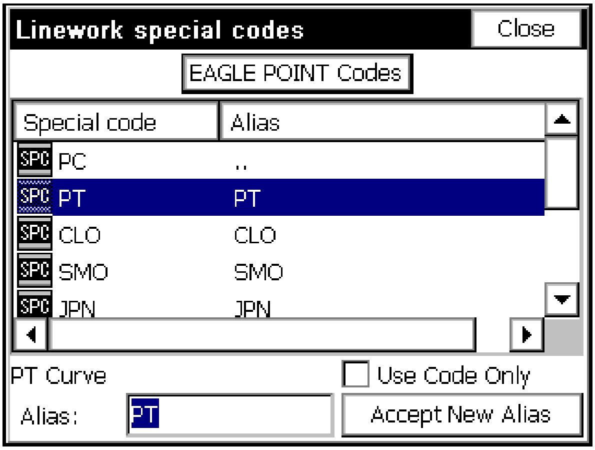


Figure 2-41

- **PC & PT**: Used to specify the point of curvature (PC) and point of tangency (PT) of a curve. If you are taking shots on a curve, use PC to specify the beginning of the curve and PT to specify the end of the curve. In Figure 2-42, point 5 and 8 use the PC suffix and points 7 and 10 have the PT suffix.

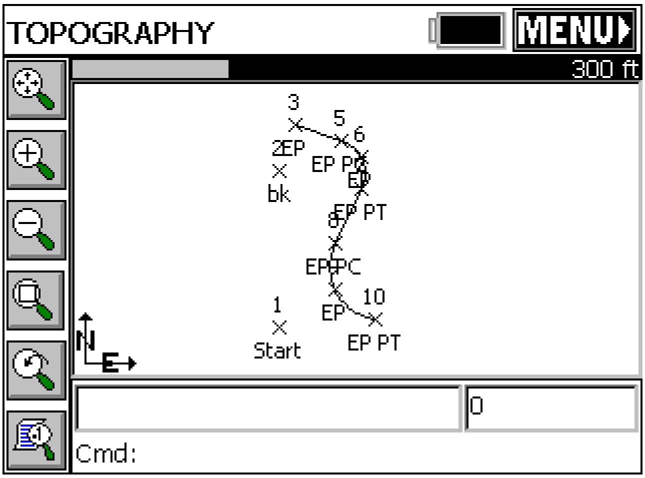


Figure 2-42

- **CLO**: Used to close a polyline. Figure 2-43 shows how this code is used. Points 11-13 are coded “BLD”, point 14 is coded “BLD

CLO". This tells the polyline to close from point 14 back to point 11.

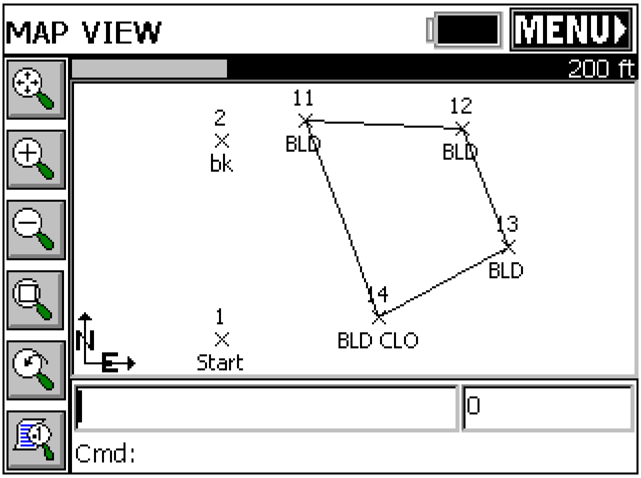


Figure 2-43

- **SMO**: Use this code suffix to smooth the polyline through the points. Figure 2-44 illustrates two sets of identical linework. The top polyline was constructed using the standard code EP. The bottom polyline was also constructed using the code EP, except the final shot was coded "EP SMO". Note that for clarity, the points were turned OFF for the screen shot.

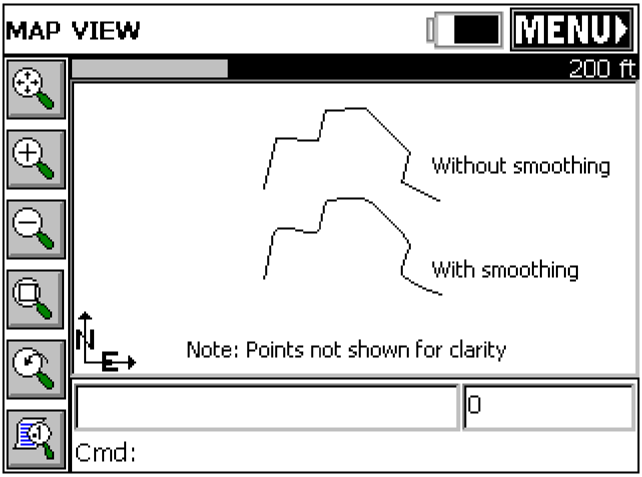


Figure 2-44

- **JPN:** Using this code followed by a point number # will create a new line segment between the current point and the entered point number.
- **END (or -7)**: Use this code suffix on a point to end the linework at that point. Figure 2-45 shows that all shots are coded EP. Points 5 and 6 are not connected because of the END suffix on point 5. Points 9 and 10 are not connected because of the END suffix on point 9.

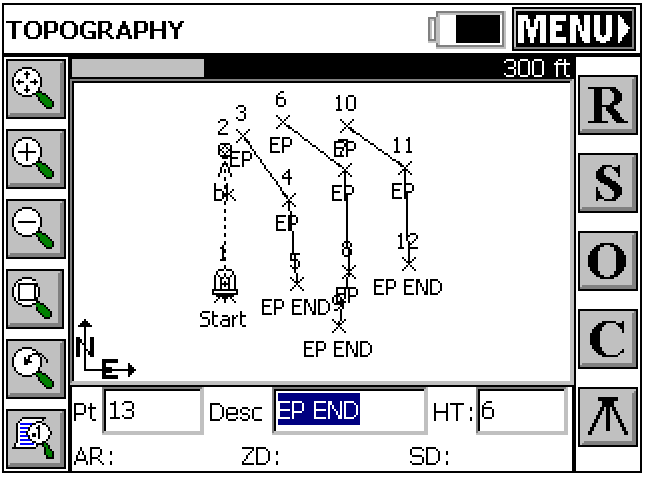


Figure 2-45

■ +7: Default code for "Start Line"—can be used to "force" linework on codes that are normally used for points only. It can also be used with standard linework codes (eg. FL for fence line, as in FL+7) to start a new line, which automatically ends any previous fence line already started.

■ **Special Codes (Aliases)**: All the special codes can be altered to suit your practices. For example, if your crews start curves by the code CS (Curve Start) and end with CE (Curve End), these can be substituted for PC and PT as "aliases". Furthermore, the special codes can occur before the description or after the description (normal practice). So whereas by default, curves might be coded EP, EP PC, EP, EP (no EP PT is needed, 3-point curves are default), coding could be EP, CS EP, EP, EP (through use of aliases). This is illustrated below:

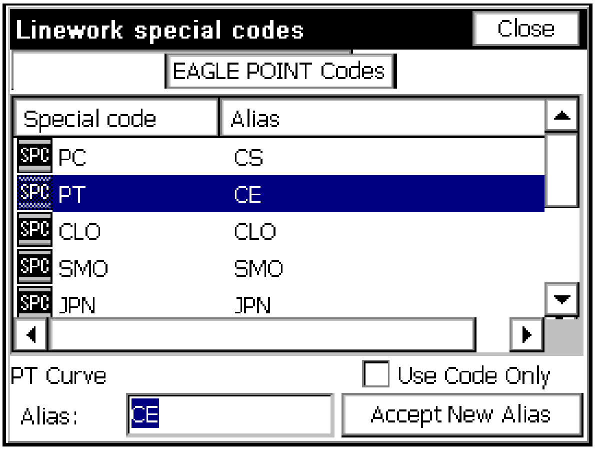


Figure 2-46

In the earlier dialog example that ".." was substituted for PC. So even a description such as EP could launch into a curve, and may be easier to type.

Note: The main purpose of the flexible line coding is to create linework in the field that will be re-created in the office using office software. The field linework is typically used for confirmation—if a curve is drawn, the field surveyors know it will create a curve when processed in the office, whether in AutoDesk, Carlson or other types of office software. But linework created in the field is stored as a DXF file and will draw in most CAD programs when copied from the CE device to the office PC.

- **Eagle Point Codes**: Here you can set special Field Code, End Line and Close Line coding to draw per Eagle Point conventions and set up normal processing of linework when downloaded to Eagle Point office software.

Data Transfer

Function

This command prepares FAST Survey for transferring data to and from a desktop PC. Data Transfer requires that a companion program on the PC is running to receive and send files. FAST Survey, using the Data Transfer option, must "handshake" with the program on the PC in order for the transfer to be successful. A serial cable must connect the PC to the handheld device running FAST Survey. COM ports must be identified correctly, as well as baud rates. The Data Transfer screen in FAST Survey is shown in Figure 2-47 below.

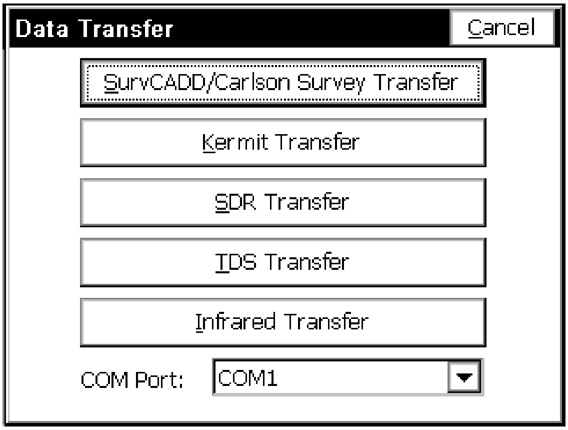


Figure 2-47

- **SurvCADD/Carlson Survey Download**: This option is designed to work with Carlson Software products (SurvCADD, Carlson Survey, & X-Port). It also works with the standalone SurvCom program that is included with the purchase of FAST Survey. The handshake is designed for simplicity and robustness. Carlson Software products use the same native file formats as FAST Survey, so no file conversion occurs—only transfer.
- **Kermit Transfer**: This command leads to a send and receive screen that works with the Kermit program on the PC. This is a readily available data transfer program.
- **SDR Transfer**: This command is designed to work with existing programs that communicate with the SDR. For example, if you have LDD, Integraph, SurvCADD SelectCAD or other software

that contains an SDR33 transfer routine, then this option is designed to mimic that protocol. When an RW5 file is selected, it is automatically converted to a Sokkia RAW file and downloaded to the PC. When a CRD file is selected, it is automatically converted to a Sokkia RAW file with "08" records for points. This allows users to use and process the data in FAST Survey similarly to the data in the SDR33. You can also upload into the FAST Survey field computer Sokkia RAW files that contain point records. All the points will be stored in a CRD file on FAST Survey.

Sending data to a computer using the SurvCADD/Carlson Survey Download Option

1 Connect your serial cable to your PC. Select Data Transfer from the File menu. Choose SurvCADD/Carlson Survey Download. This leads to a File Transfer screen on FAST Survey, which says "Awaiting Connection". All the action is on the PC side. There is no time delay in this handshake. It will wait for the PC program to catch up. When you connect the cable from FAST Survey to the PC, MicroSoft ActiveSync may interfere and say "Connect to PC?" If you get this question, say No and on your PC, click off the MicroSoft ActiveSync serial linkage if it is on.

2 Execute SurvCom, or for Carlson Survey or SurvCADD users (July, 2001 build or later), choose Tools, Data Collectors, SurvCE/SurvStar option. If you get "Failed to open Com 1 error code -3", the most likely culprits include no cable connection or interference by Microsoft ActiveSync. If connection is automatically established, FAST Survey will display, "Connected to PC". On the PC side, you will see the dialog shown in Figure 2-48.

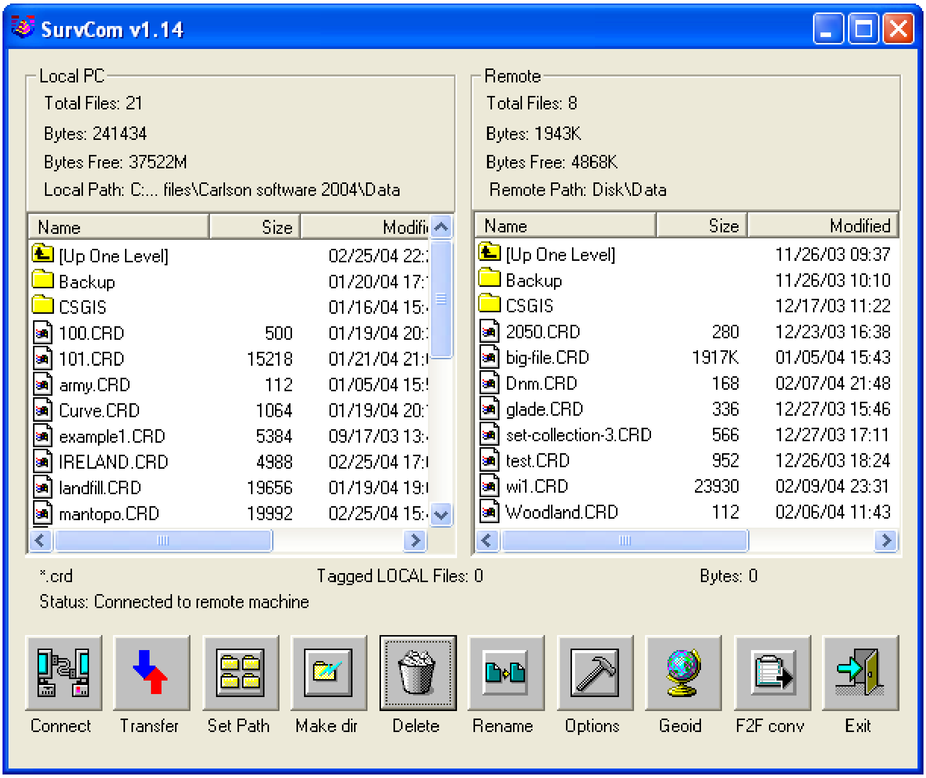


Figure 2-48

3 If only the left side of the screen displays data, then you do not yet have a connection. Press the Connect button located at the bottom left of the file transfer dialog. The transfer program will respond with Retrieving File List. Once the file list has been retrieved, the left side of the dialog box will show files located in the specified path on the PC and the right side of the dialog displays the files located in the designated path on the remote. You can change directories by scrolling to the top of the file list and choosing Up One Level (just like in Windows). In the above dialog, a filter was applied so that the only files in the form of *.crd are displayed. Filters such as this can be set up using the Options button.

4 To transfer one or more files, simply select or highlight the desired files and select the transfer button. More than one file can be transferred from the remote to the PC or from the PC to the remote during the transfer process. Standard Windows selection options apply. For example, selecting one file and then while pressing the shift key on the PC, selecting another file deeper on the list will select all the files in between the first and last selected. You can also select the first file to transfer and press and hold down the shift key and use the down arrow to specify the range of files to transfer. Pressing and holding the control key on the keyboard allows for the selection of multiple files in any selection order, by picking the files with the left mouse button.

5 After the files have been selected, press the transfer button. When the transfer is complete, the program will return Transfer Complete message and will then proceed to update the file lists on the PC and the Remote.

SurvCom Commands (located in the SurvCom dialog box, Figure 2-48 above)

- **Connect**: After selecting Data Transfer from the File menu, press this button to connect to the PC. Once connection is made, the status line on the file transfer utility dialog box will show Connected to the remote machine.
- **Transfer**: Pressing this button transfers selected files from either the Remote to the PC, or the PC to the Remote.
- **Set Path**: This option allows for the specification of the desired source and destination drives and folders for both the PC and the Remote device. For example, if you were downloading, or copying files from the Remote device to the PC, to specify a source path on the remote device, select the Remote Machine toggle and then type in the desired path in the path field. To specify a destination path on the PC, select the Local PC toggle and type in the desired path the path field. When a change to either path is made, the transfer utility will retrieve a new file list from the specified paths.
- **Make Dir**: This option allows for creation of directories on both the PC and the Remote device. Specify the machine to create the directory on and then enter the directory name.
- **Delete**: This option allows you to delete the tagged files.
- **Rename**: Select a file and rename it.
- **Options**: This command allows you to set various options for data transfer. The dialog shown in Figure 2-49 will appear.

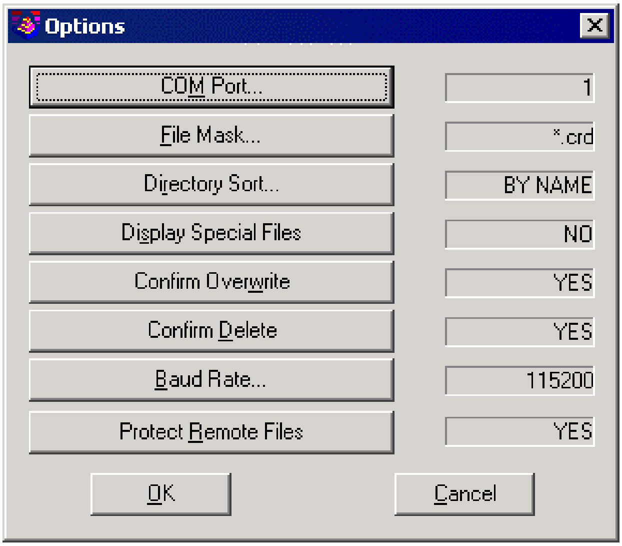


Figure 2-49

- **Com Port**: You must select which com port on the PC to use.
- **File Mask**: You must select a file filtering syntax.
- **Directory Sort**: You must select how to sort the list of files.
- **Display Special Files**: Toggle whether or not you should see special files.
- **Confirm Overwrite**: Check this to confirm before overwriting files.
- **Baud Rate**: You must choose the baud rate for transferring data.
- **Protect Remote Files**: Check this to protect files on the mobile device.
- **Set Geoid**: This command will carve out a portion of the Geoid 99, EGM96, Canadian CGG2000, Canadian HT2.0, Canadian HT1.01, Australian GDA94 and Great Britain OSG-MO2 grid files and send it to FAST Survey. Since these geoid grids are very large, this carves out a precise portion of it and avoids overloading the memory on the remote device running FAST Survey. You will be prompted for the directory, on the PC, of the source Geoid grid file, and the approximate latitude and longitude of the job, and the size of the area desired in miles, kilometers or degrees of latitude and longitude. See Figure 2-50

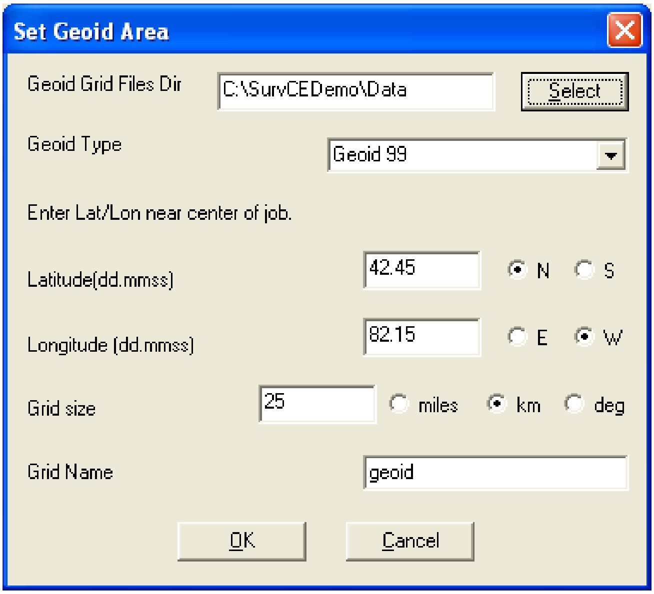


Figure 2-50

- **F2F Conversion**: This converts the more thorough and detailed Carlson Survey field code file (for field-to-finish work) to the more simplified Feature Code List that runs in FAST Survey. The Feature Code List in FAST Survey handles Linework (on or off), Line Type (2D or 3D), Layer (= Code) and Full Text (Description).
- **Infrared Transfer**: This command leads to a send and receive screen that works with the Window Socket IrDA server/client objects only between two CE mobile devices. This is a readily available data transfer program. Please make sure you align your devices so that the infrared transceivers are within one meter of each other, and the transceivers are pointing at each other. For a easy connection it is preferable to start first the server (the device that will receive the data file) and after that the client (the device from which the data file will be sent).
- **Bluetooth Transfer**: If the mobile device has a Bluetooth emulated serial COM port, the user will be able to select it from the list and transfer data from/to another device that has Bluetooth available.
- **Exit**: This command will exit the File Transfer Utility

Import/Export ASCII File

Function

This function allows you to import an ASCII file to job data or export job data to an ACSII file. When you choose this command, you will get a secondary dialog where you choose to Import or Export.

Import ASCII File

This command converts point data from an ASCII text file into the FAST Survey format. The source ASCII file can contain any combination of point number, northing, easting, elevation, and description. You may select any of the predefined formats or create your own custom format. Figure 2-51 shows the Import Ascii dialog box.

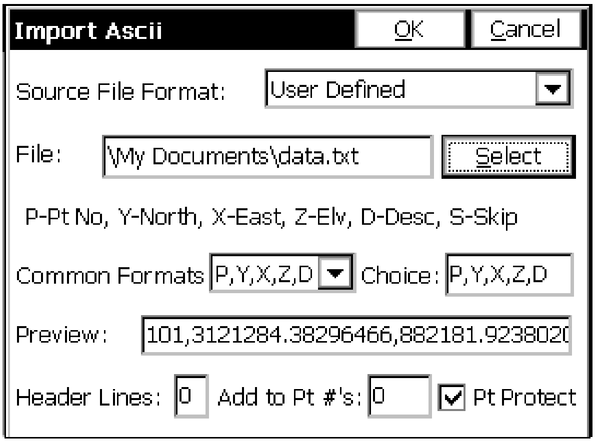


Figure 2-51

- **Source File Format**: You must choose the format of the source file. The choices include
  - **User Defined**: For importing most .TXT and .ASC files. The coordinate order in the Choice field is used.
  - **Traverse PC**: For importing Traverse PC .TRV files.
  - **TDS**: For importing TDS .CR5 files
  - **Geodimeter**: For importing Geodimeter .OBS files.
  - **Trimble**: For importing Trimble .POS files.

- **CRD File**: Allows importing a FAST Survey CRD file into the current, active CRD file, and setting the range of points to import.
- **SDR File**: For importing point data within Sokkia SDR files.

- **File**: You must choose the file to import.
- **Select**: Choose this button to browse for the file name.
- **Common Formats**: If your Source File Format is set to User Defined, choosing one of these settings copies the contents into the Choice field, which will be used to import the file.
- **Preview**: Shows you a preview of the first line of the ASCII file. This is helpful in determining the correct coordinate order format.
- **Header Lines**: Specifies the number of header lines to skip in the ASCII file.
- **Add to Pt #'s**: Specifies a value to be added to each point number during the import process.
- **Pt Protect**: Specifies whether or not to check each point number to see if it already exists in the current CRD file. If this is toggled ON and you attempt to import point numbers that already exist, you will then be prompted to overwrite each existing point number or to cancel the operation.

In Figure 2-51, the ASCII file to import is comma delimited and contains point number, northing, easting, elevation and description. Figure 2-52 shows the results of running the List Points command after importing that file.

Pts in File: 40 Highest Pt: 140 Close

Pt ID	Northing	Easting	Elevat...	De
101	3121284.3830	882181.9238	128.0000	
102	3121277.9941	882267.6928	127.3000	
103	3121275.3544	882375.2331	126.5000	
104	3121272.5151	882482.8741	126.4000	
105	3121262.3587	882580.8497	126.4000	
106	3121233.1097	883133.6035	126.8000	
107	3121224.4734	883240.4674	127.2000	
108	3121238.4622	882990.6757	127.1000	
109	3121249.2086	882930.3733	127.2000	
110	3121254.0871	882798.1404	126.2000	
111	3121260.0324	882694.0851	125.6000	

Figure 2-52

Export ASCII File

This command converts FAST Survey point data to an ASCII text file. Figure 2-53 shows the Export Ascii dialog box. Choose a coordinate order, type of delimiter, range of points and precision.

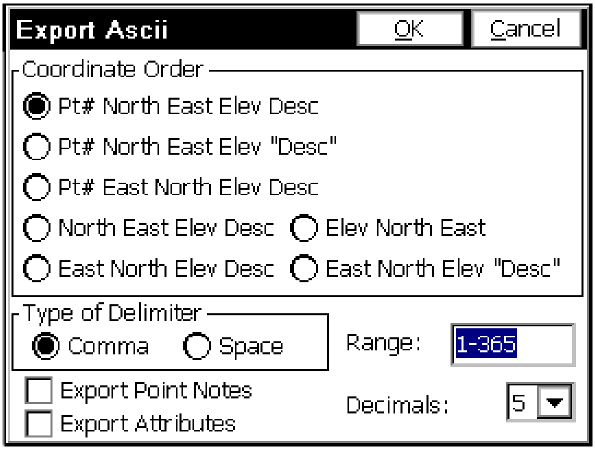


Figure 2-53

- **Coordinate Order**: You must specify the output format for the ASCII file. There are seven different formats to choose from. Each can either be space or comma delimited, giving you a total of fourteen choices. Two of the options include quotes around the description field so that your descriptions can include spaces and/or commas.
- **Type of Delimiter**: You must specify the character used for delimiting the fields in the output ASCII file. You may choose either a space or a comma.
- **Range**: You must specify the range of points to output.
- **Export Notes**: When this is toggled ON, any point notes associated with the current job will be exported to a .NOT file. These files are used with SurvCADD (and other Carlson office software products).
- **Export Attributes**: GIS attributes can be assigned to points that are stored based on settings in the Feature Code List. If a point that is shot is a manhole (eg. MH) and attributes such as concrete, 5 rungs, 2 inlets are entered for this point, these attributes will be exported to an ASCII file for use by external programs with this option clicked on.

- **Decimals**: You must specify the output precision for northings, eastings, and elevations. This setting does not affect point numbers or descriptions.

After choosing the settings in this dialog box, press OK. A standard file dialog will appear. In this dialog, choose a name for your ASCII file and then press OK.

After the file is written, a dialog will appear telling you that it is done. Figure 2-54 shows the result of exporting a job to an ASCII file.

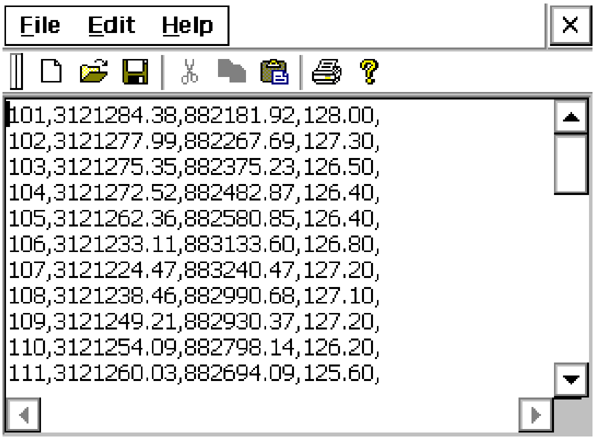


Figure 2-54

Delete File

Function

This command allows you to remove any existing file from any directory to free up memory. It is always a good idea to back-up your data by transferring it to a PC before deleting files. FAST Survey does NOT require you to back-up your data before deleting. Figure 2-55 shows the standard file selection dialog where you choose the file name to delete.

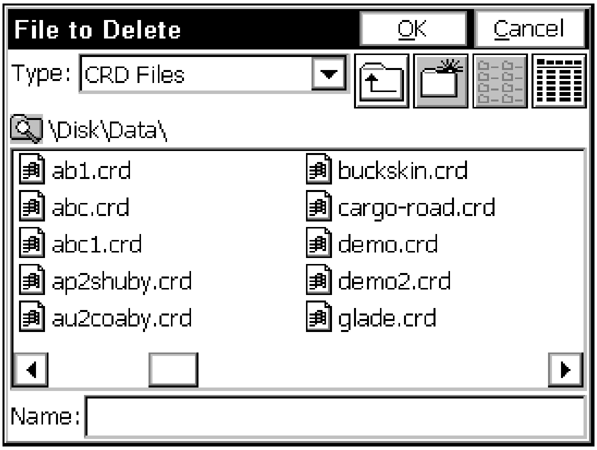


Figure 2-55

Select the file you wish to delete from the standard file selection dialog box and pick OK. FAST Survey will ask if you want to delete all files associated with the job (eg. the .dxf file, the .rw5 file, etc.). FAST Survey will warn you if the file or files to be deleted have never been downloaded before, see Figure 2-56.

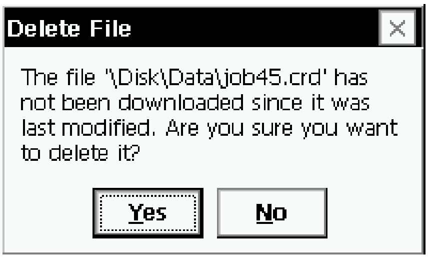


Figure 2-56

Press Yes, if you wish to continue. You will be asked to confirm your file selection once more as shown in Figure 2-57.

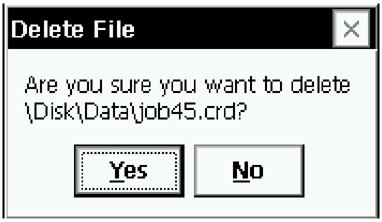


Figure 2-57

Press Yes to accept the deletion of the file, or No to cancel the selection.

Add Job Notes

Function

This command allows you to enter job notes as ASCII text. These notes are saved with the job. Figure 2-58 shows the Notes dialog.

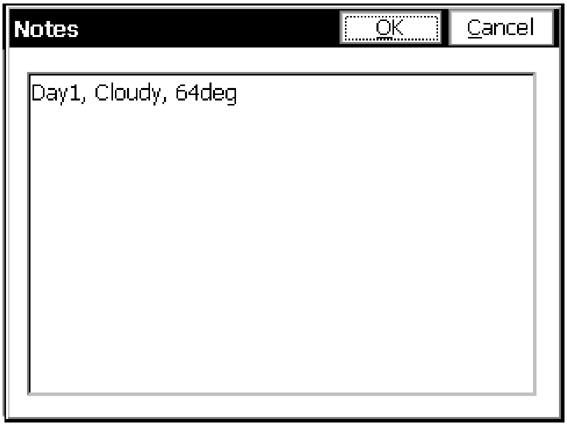


Figure 2-58

Exit

Function

This command will exit the FAST Survey program.

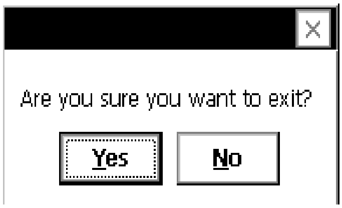


Figure 2-59

Figure 2-59 shows the confirmation dialog. If you choose Yes, FAST Survey will exit and your data files are saved. If you choose No, FAST Survey does not exit.

3

Equip Menu

This chapter describes the commands found in the Equip menu.

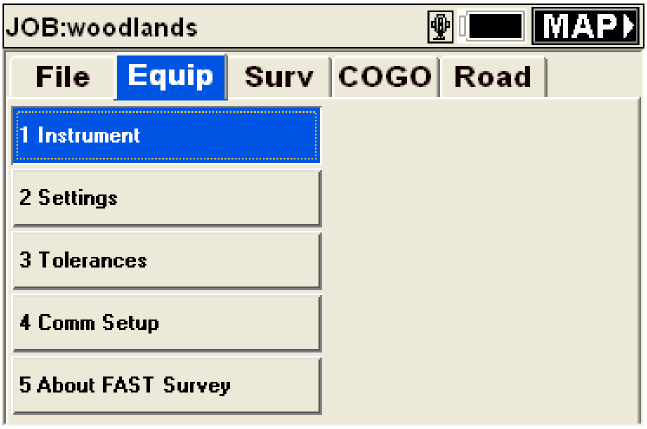


Figure 3-1

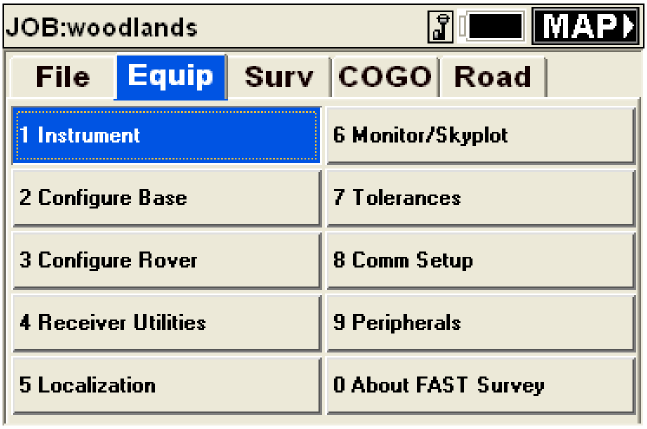


__Figure 3-2__

Instrument

Function

This command allows you to set the equipment type that you will be using. Figure 3-1 shows the Instrument dialog. Choose the correct equipment from the drop down list then tap OK.

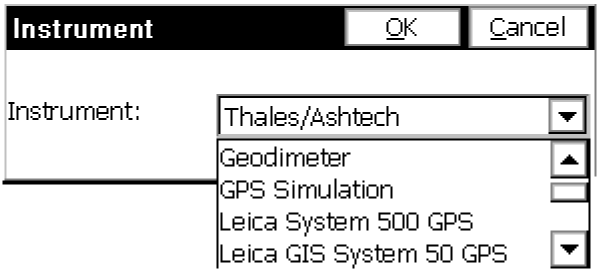


__Figure 3-3__

Note that if there are several Leica or Topcon or Sokkia instrument options, you can keep hitting the first letter (“L” for example) and the program will scroll from one to the next until you see the correct selection.

Settings

Function

This section discusses features found in the Settings command, which only applies to total stations. Settings options vary based on which type of equipment is selected. Not every total station type has special features found within Settings. Setup and work flow for many total stations are discussed in more detail under Setup Procedures. This section supplements the Setup Procedures chapter.

Geodimeter or Trimble 5600

The following information describes the various options available for the Geodimeter and Trimble total stations.

The software allows for the user to run the instrument in several modes depending on the instrument itself.

Parameters

■**Connect to [Station]:** If the instrument is not robotic or the user wants to operate it as a standard total station, the Station mode should be used. This mode activates the dialog below and provides the following options:

- □ **Read Mode [STD]**: Standard EDM mode.
- □ **Read Mode [TRK]**: Tracking EDM mode.
- □ **Read Mode [Rep STD]**: Standard Repetition EDM mode.
- □ **Read Mode [Fast STD]**: Fast Standard EDM mode.
- □ **Turn to Point in Stakeout**: Turns the instrument to the horizontal angle as computed to the stakeout location specified.
- □ **Turn to Vertical Angle in Stakeout**: Turns the instrument to the vertical angle as computed to the stakeout location specified. This option is not typically used unless a true elevation is known for the stakeout location specified.

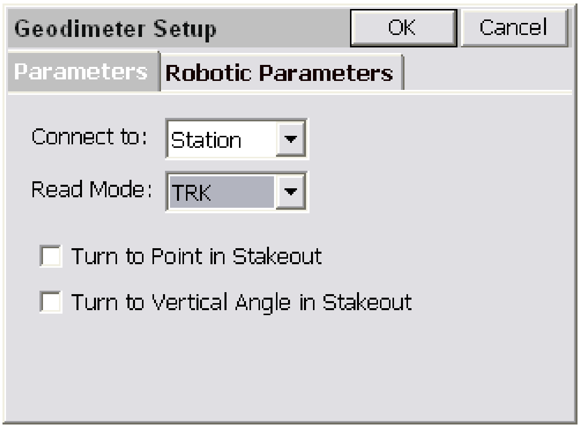


Figure 3-4

■**Connect to [Direct Robotic]:** This mode works exactly as the GeoRadio mode except a cable must be used in lieu of the radio. The instrument must also be robotic and be operating in the Remote mode with the faceplate removed. This mode activates the dialog shown below and provides the following options:

- ☐ **Turn Off Instrument:** Turns off the instrument.
- ☐ **Initialize Instrument:** Turns on the instrument and initializes the instrument.
- ☐ **Read Mode [STD]:** Standard EDM mode.
- ☐ **Read Mode [TRK]:** Tracking EDM mode.
- ☐ **Read Mode [Rep STD]:** Standard Repetition EDM mode.
- ☐ **Read Mode [Fast STD]:** Fast Standard EDM mode.
- ☐ **Read Mode [RL]:** Reflectorless EDM mode.
- ☐ **Tracklight [Off]:** Turns off the tracklights.
- ☐ **Tracklight [Low]:** Turns on the tracklights on low power.
- ☐ **Tracklight [High]:** Turns of the tracklights on high power.
- ☐ **Search before Read:** This toggle will force the instrument to perform a search before initiating a reading if the instrument is not locked on the prism.
- ☐ **Search when Lost Lock:** This toggle will force the instrument to begin searching for a prism as soon as lock is lost.
- ☐ **DR Series Instrument:** This toggle informs the software that the instrument is a reflectorless (Direct Reflex) model.

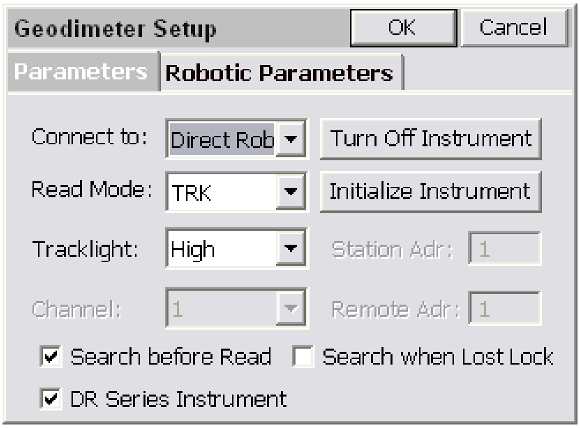


Figure 3-5

- **Connect to [GeoRadio]**: This mode works exactly as the GeoRadio mode except a cable must be used in lieu of the radio. The instrument must also be robotic and be operating in the Remote mode with the faceplate removed. This mode activates the dialog shown below and provides the following options:
  - **Turn Off Instrument**: Turns off the instrument.
  - **Initialize GeoRadio**: Turns on the instrument and initializes the instrument. The GeoRadio must be on.
  - **Read Mode [STD]**: Standard EDM mode.
  - **Read Mode [TRK]:** Tracking EDM mode.
  - **Read Mode [Rep STD]**: Standard Repetition EDM mode.
  - **Read Mode [Fast STD]**: Fast Standard EDM mode.
  - **Read Mode [RL]**: Reflectorless EDM mode.
  - **Tracklight [Off]**: Turns off the tracklights.
  - **Tracklight [Low]**: Turns on the tracklights on low power.
  - **Tracklight [High]**: Turns of the tracklights on high power.
  - **Station Adr:** This input box allows the user to specify the station address of the GeoRadio.
  - **Remote Adr**: This input box allows the user to specify the remote address of the instruments radio.
  - **Channel**: This input box allows the user to specify the channel of the GeoRadio.

- ☐ **Search before Read**: This toggle will force the instrument to perform a search before initiating a reading if the instrument is not locked on the prism.
- ☐ **Search when Lost Lock**: This toggle will force the instrument to begin searching for a prism as soon as lock is lost.
- ☐ **DR Series Instrument:** This toggle informs the software that the instrument is a reflectorless (Direct Reflex) model.

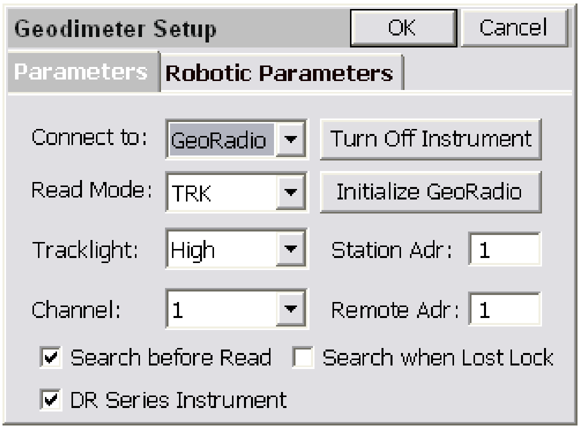


Figure 3-6

Robotic Parameters

- **Search Range:** These input boxes allow the user to specify the range to search for the prism when a search function is initialized.
- **Allow Week Signal:** This will allow the instrument to return a distance when the signal is week.
- **Standard Deviation:** Defines the allowable standard deviation of the instrument readings.

Pentax

The Pentax total station has a few settings options as shown:

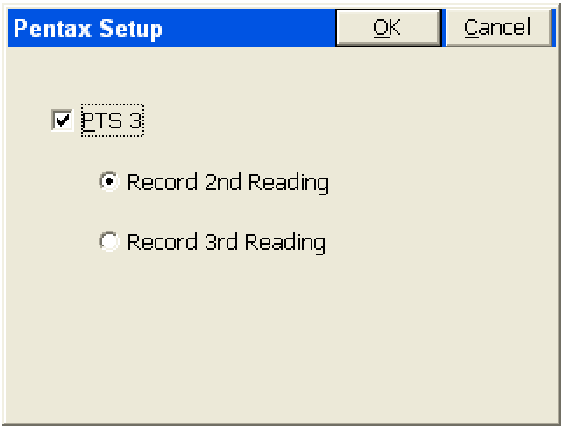


Figure 3-7

For Pentax instruments, select the "PTS3" checkbox if you are using a PTS3 series instrument. PTS3 instruments will first send out the last reading before sending the current reading. For some users, you may wish to choose to record the 3rd reading for the most accuracy.

Sokkia Set

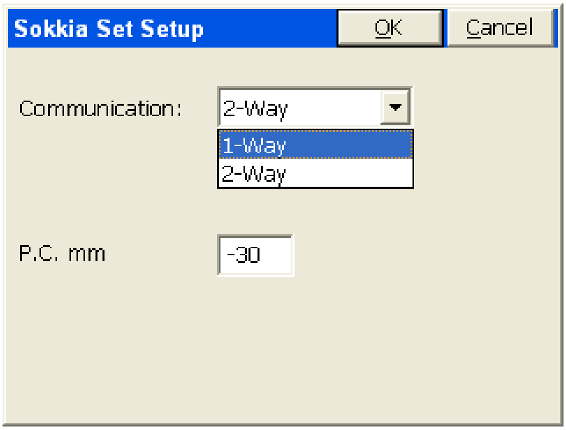


Figure 3-8

■ **1-Way vs 2-Way:** The 1-Way option mimics the operation of most total station instruments using FAST Survey. The 2-Way option has the one big advantage of sending the angle to turn into the instrument during stakeout, so that looking at the instrument panel, you "turn to zero" to aim at the target point. It is recommended that Nikon instruments be run in Sokkia Set emulation mode, enabling the 2-Way communication.

- **P.C. mm:** Enter the prism offset here.

Topcon 800/8000 Direct

- **Read Method**: Choose between coarse, tracking, fine and reflectorless. Reflector less "ghosts" unless enabled at right.

- **Turn Method in Stakeout**: A "tiered" method of turning to points is provided. If you select "Turn to Point in Stakeout" for the robotic Topcon 800/8000, the option below "unghosts" allowing you to also require that it turn to the correct vertical position of the point.

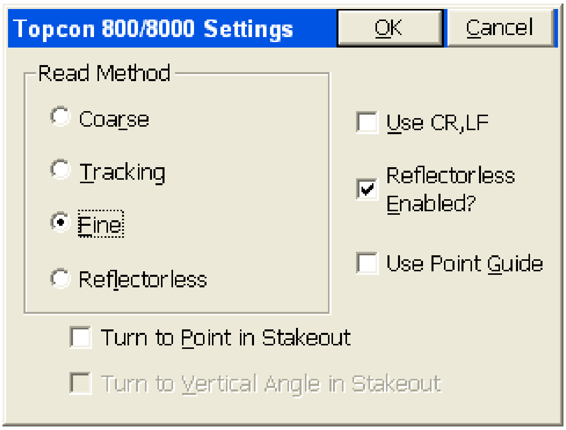


Figure 3-9

- **Use CR/LF**: If set, this must match the settings on the instrument.
- **Use Point Guide**: Option to enable use of tracking lights.

Setup Procedures

Function

This section discusses general setup procedures for various brands of equipment, where extra detail and perspective is appropriate.

Allen-Osbourne

■ **Parameters**: First time into this selection, as most others, the program shows the Comms Setup screen. Note that Allen-Osbourne GPS, like nearly all equipment, can utilize Bluetooth (wireless) connection. There is no Configure Base, Configure Rover or Receiver Utilities for Allen-Osbourne. FAST Survey reads the NEMA string characters and all setup is done on the instrument itself.

Thales/Ashtech Setup

■ Receiver Type: You must specify the model of Thales/Ashtech equipment to be used within Configure Base and Configure Rover. FAST Survey works with the following high precision, centimeter accurate RTK GPS equipment produced by Thales/Ashtech: Z12/Sensor, ZSurveyor, GG24, Z-Xtreme and Z-Max. FAST Survey also works with the Ashtech Reliance USCG/DGPS RTCM sub-meter RTK GPS receivers. The Thales ZMax with an Allegro data collector is shown below.

Figure 3-10

Figure 3-11

Shown in Figure 3-11 is the front panel view of the Ashtech Z-Xtreme, as it appears in the top of the backpack. Shown in Figure 3-12 is the cabling for the Z-Xtreme looking at the back panel.

Figure 3-12

- **Station Type**: You must select the station type. Choose between Base or Rover.
- **Configure Base Station**: This command initiates the receiver connected to FAST Survey to be a base and begins broadcasting its stationary position and satellite corrections to the rover.
- **Base Rod Hgt**: This is entered in feet or meters, as a vertical or "slant" height. The slant height is the distance from the base of the pole or from the "hub and tack" up to the edge of the metal band that goes around the circumference of the antenna on the "slant", while the vertical height is measured plumb, straight down from the base of the antenna (where it screws into the SECO adapter).
- **Antenna Type**: A pulldown list includes approximately 50 options.

Figure 3-13

Shown in Figure 3-13 is the Geodetic 4 antenna.

- **Elevation Mask**: This specifies the cutoff vertical angle above the horizon. Any satellites below this angle will be left out of calculations.
- **Configure Rover**: This command has a "Parameters" tab that sets items from Multipath and Dynamics to the Ambiguity Fixing Parameter.
- **Multipath Type**: You must specify this setting in order to filter out interference in the satellite signals caused by nearby objects.
- **Dynamics**: This setting is applied to all Thales equipment types with the exception of the Z-Max. Here you may specify the dynamics setting. Static is selected only when the Rover receiver is stationary. The default is Walking. When set to Static, the HRMS and VRMS values (measurements of accuracy) will fall to very low numbers (high accuracy), but lock will not hold unless the antenna is motionless. Static is recommended when the antenna and pole are secured by a tripod or bipod.
- **Ambiguity Fixing Parameter**: This controls the confidence level of fixed positions. The default is 99.0. At a lower confidence interval the system solves much faster. If the system incorrectly solves the position, then the position error will be much greater than the reported RMS value.
- **Fast CPD**: This option specifies whether or not the program will allow approximating the rover's position if your position is lost briefly. Off is the default. Fast CPD is generally toggled on when Dynamics is set to Automobile.
- **Data Port**: You must select the data port on the GPS receiver that is connected to FAST Survey. The default setting is B. Changing this setting will change the internal setting of the receiver.

- **Radio Port**: You must select the data port on the GPS receiver that is connected to the radio modem. The default setting is A. Changing this setting will change the internal setting of the receiver.
- **Message Type**: You must specify the message type. For high precision centimeter RTK GPS, set this to Ashtech (CPD). For USCG/RTCM DGPS sub-meter accuracy, set this to RTCM.
- **Radio Baud Rate**: This setting allows you to change Pacific Crest radio baud settings through the receiver. The default baud rate is 9600. (Note: If there are communication problems with either port A or B on the Ashtech ZSurveyor receiver, turn off receiver and turn it back on with both keys depressed to reset receiver to factory defaults.)
- **Send Settings to Receiver**: This command uploads the settings from FAST Survey to the receiver. The settings are retained in the receiver for future use.
- **Hard Reset**: Re-boots the receiver.
- **Soft Reset (Reset RTK Engine)**: Re-acquires the satellites.
- **Send Command to Receiver**: This command allows experienced users to type in commands using Ashtech GPS receiver commands to set or report internal settings. (See the Thales/Ashtech operations manuals for a complete list of GPS receiver commands.)

CSI – DGPS Max

This GPS system is typically used for GIS-type surveys with 1 to 3 meters accuracy. Corrections are obtained from satellites, WAAS or U.S. Corps of Engineers beacons.

Geodimeter 600 Setup

Putting the 600 in the "Remote Mode"

1) Turn the 600 On.
2) Answer the initial questions.
3) If you have not selected the Radio Channels and Address, do the following:
   a) Press <Menu>.
   b) <1> for Set.
   c) <5> for Radio.
   d) Select Channel (1-8).
   e) Select Station Address (1-99).

f) Select Radio Address (1-99).

4) Press <RPU>.
5) Press <3> for Remote.
6) Press <1> for OK.
7) Press <No> for Sector.
8) Press <No> for Measure Ref Object.
9) Press any key when prompted. You do not have to remove the keyboard as prompted. FAST Survey will control the total station.

The total station is now in Remote Mode.

Running the 600 by Direct Connection

You can run all the Robotic functions on the Geodimeter 600 while hooked directly to the instrument.

Select "GEOSERVO-" as the total station. YOU MUST have the Geodimeter C&C software on the 600 to use "GEOSERVO-".

If you are using an external battery, connect the cable to the battery. Otherwise, plug the serial cable into the port on the instrument.

Take the keyboard off the Geodimeter.

In FAST Survey, do Initialize GeoRadio within Equipment Settings. All commands work as if you were running the instrument remotely via the radios.

Leica System 500 Setup

Default values in Comm Setup are 9600, Parity None, Char Length 8, Stop Bits 1. These can be set by hitting "Defaults".

- **Power Cycle Receiver**: The receiver can be turned off and on in the command "Receiver Utilities", option "Power On/Off Receiver". The Configure Base and Configure Rover commands will typically turn on the receiver automatically. Sometimes, turning off and turning on the receiver can be used as a "troubleshooting" technique to clear conditions and start from a clean slate.
- **Configure Base Station**: This command opens the Base Configuration dialog. The most common setting for the base antenna is AT502 Tripod type. The AT501 Tripod, AT502 Tripod, AT503 Tripod and AT504 Tripod settings will all prompt to "Measure to Base of 36cm Height Hook". See Figure 3-14.

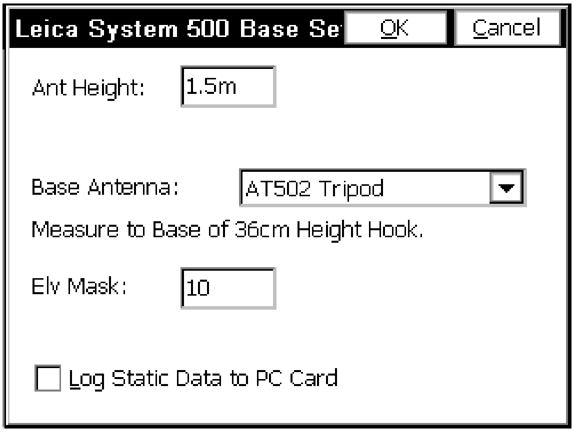


Figure 3-14

When the height hook is used, the Antenna Height is measured down to the hub and tack elevation from the fixed mounting position of the height hook (see Figure 3-15). The measurement is typically in meters, so if you are configured to units in feet, you can enter the Antenna Height in meters with the "m" suffix, as shown above, and the program will do the conversion automatically. You can omit the "m" suffix if you are configured to metric units.

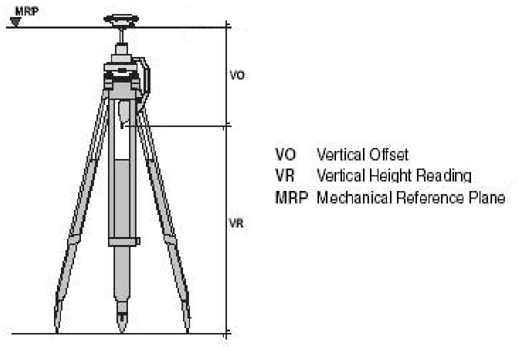


Figure 3-15

Other Antenna settings for Leica GPS are AT201, AT202/302, AT202/302GP, AT303, AT501, AT501 Pole, AT502, AT502 Pole, AT503, AT504, SR299/399 Internal and "Other". In all these cases, the antenna height is measured from the ground elevation to the base of the antenna (the "base" is where it would rest if you removed it and placed it on a table—the "base" is the lowest point).

- **Elv Mask**: This specifies the cutoff vertical angle above the horizon. Any satellites below this angle will be left out of calculations. An elevation mask of 10 degrees is typical. It is advisable to use some elevation mask between 5 and 15 degrees. Satellites low to the horizon can actually degrade the resolving of the GPS position.
- **Log Static Data to PC Card**: This option will log static data in binary form to the PC Card in the GPS receiver whether or not you choose to conduct RTK GPS work. The static data can be processed using the Leica SKI-Pro program.
- **Configure Base Station and Localization**: The Configure Base Station command must be entered prior to conducting a new localization on a job site. If the base antenna height changes from day to day, then you must use Configure Base Station, From Known Position Tab, Read from File, option and enter the new antenna height each time the height changes, even if the same localization file is used on the job site. Applications of Configure Base Station for all types of GPS equipment are discussed later in this section.
- **Configure Rover**: This command is used primarily to set the appropriate antenna height and antenna type for the rover. Leica typically offers a 2-meter pole, so for antenna height, the most common entry is 2m or 6.5617 feet. The default antenna is the AT502 Pole.
- **Log Baseline Data**: This option stores raw vector data and Cartesian coordinate data for both the base and the rover and stores to the FAST Survey data collector, in the "Data" directory. The file will be Jobname_SKI.ASC, depending on the name of the coordinate file. This vector file can be further processed in the Leica SKI-Pro program.
- **Receiver Utilities**: This command is used to configure the GPS radios and set the message type to use. This command is used to set radio configurations for both base and rover receivers. The dialog is shown below in Figure 3-16.

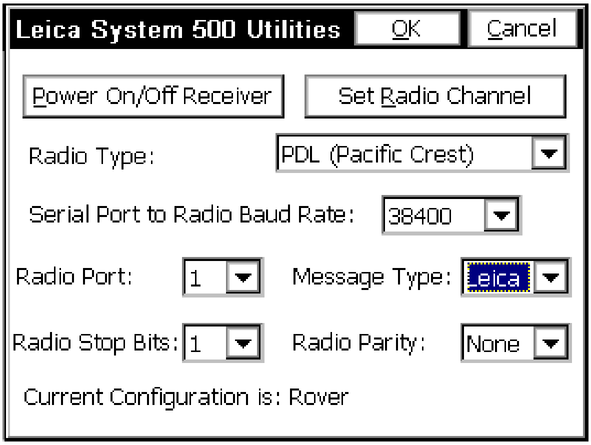


Figure 3-16

- **Radio Type**: The Pacific Crest PDL radio type is the default setting, operating at 38400 baud rate. Older Pacific Crest radios are often type RFM96W, defaulting to 9600 baud rate. Other options include Motorola Cell Phone, 3COM Faxmodem and User Defined Modem. Phone numbers for cell modems will accept up to 49 characters. When using Freewave or Tait "spread spectrum" radios, the radio type doesn't matter, but can be set to "User Defined Modem". Baud rate for Freewaves is often 19600 baud.
- **Motorola Cell Phone**: With Freewave and other spread spectrum radio linkages, communication must occur within a line-of-sight distance, typically no more than 2 to 5 kilometers except in very flat terrain. With Pac Crest radios, the signal can "bend" somewhat, and achieve maximum distances of 10 kilometers, typically. Cell phone linkage allows corrections to be transmitted within the coverage of the cell phones themselves and maintains accuracy up to as much as 50 kilometers. Contact your Leica GPS vendor for appropriate cables for connectivity details. When you select the Motorola configuration, the "Set Radio Channel" button becomes "Connect Modem", and when tapped, you are prompted for a Phone Number for the actual cell phone (for the rover to call the base). The base must also be hooked to a cell phone. The base can actually be set to both cell phone and radio linkage, with the rover set to either cell or radio as preferred. The rover will go from autonomous to float (cell phones are communicating) to fixed with cell phones just like with radio linkage.

Note: Base and rover GPS receivers must have matching radio configurations. If cell phones are used for the rover, then the base must be configured for cell phone use. If Pac Crest PDL radios are used on the rover, than Pac Crest PDL radios must be used on the base. Also note that cell phone switching is made possible through the C icon or Alt C "on the fly" from commands such as Store Points or Stakeout Points. This is because of the availability of a "Utilities Tab" in Configure Reading when configured Leica GPS.

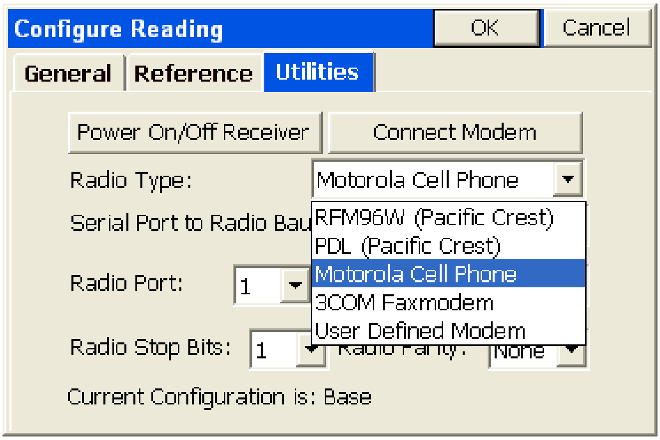


Figure 3-17

- **Set Radio Channel**: This is normally set to channel 0 or channel 1. FAST Survey allows up to 16 radio channels (0 to 15). The procedure is to pick the channel, then tap "Set Radio" as seen in Figure 3-18. Radios on base and rover must be set to the same channel.

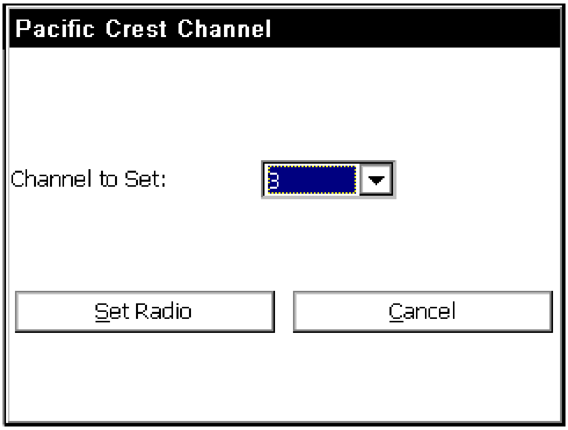
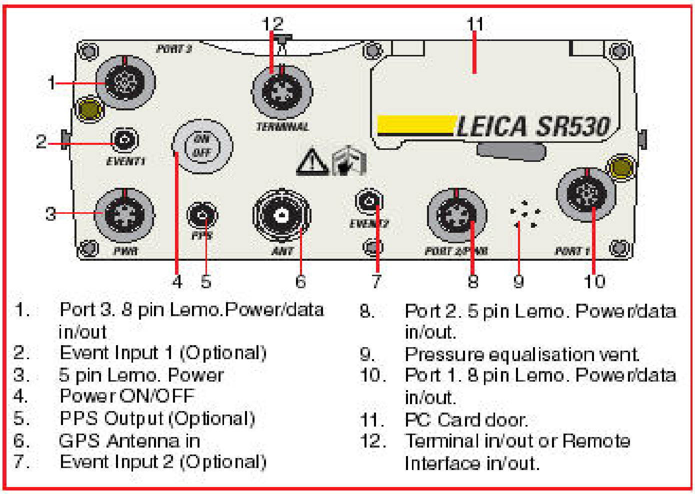


Figure 3-18

- **Radio Ports**: The Leica receiver has 2 main radio ports (ports 1 and 3). See Figure 3-19.



SR530 Receiver, front panel

Figure 3-19

- **Radio Stop Bits**: Typically set to 1.
- **Message Type**: Standard setting is Leica Proprietary. Other message string options are RTCM (an industry standard) and CMR

(Trimble message string). RTCM and CMR are used when it is necessary to communicate with non-Leica GPS.

■ **Radio Parity**: Typically set to None.

■ **Reference Station**: To obtain corrections from a reference station to a single rover, you typically must set to cell phone or modem linkage, depending on what is required by the reference station.

Leica GIS System 50 GPS

The Leica System 50 gets its corrections from the Corps of Engineer's beacons (free) or you can sign up for an annual subscription and pick up corrections from the Racal satellite at a rate of approximately $800 per year. You would need to order a special part with your GS50 system to read the satellite corrections. Though the Corps beacons are free, they are not available everywhere, and coverage is typically up to about 100 miles from each beacon. There are also line-of-sight issues, and you can "lose" the Corps beacons when in deep valleys, for example. Typical accuracies are 0.3 to 1 meter horizontal and 1 to 2 meters vertical. Configure Base, Configure Rover and Receiver Utilities do not apply, but the Localization command can be used to translate (1-point) or transform (multi-point) from the configured coordinate system to local coordinates. It is still important, under Job Settings, GPS tab, to set the correct Transformation (eg. NAD83) and Zone (eg. KY North) so that the Lat/Longs are converted to coordinates on the local system.

Leica TPS Series

This series covers most of the current Leica standard total stations such as TPS 600/800, TPS 300, TPS 700, TPS 1000 and TPS 1100. Many of these units come with the "motorized" option.

- **Comm Setup:** Default baud rates are 9600 and Even Parity, 7 Char Length and Stop Bits 1.
- **Settings:** Default settings are shown in Figure 3-20.

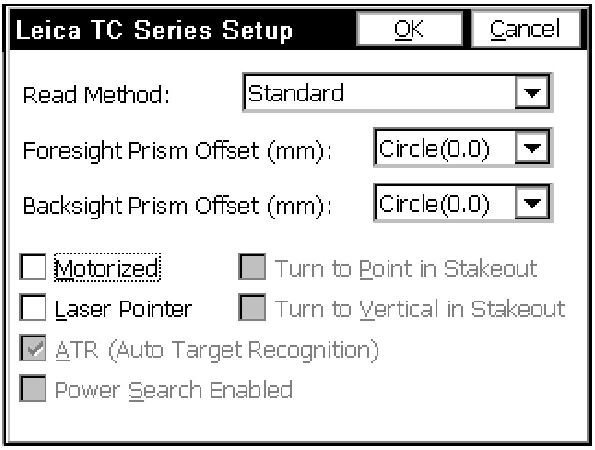


Figure 3-20

- **Read Method**: Default setting is Standard. Standard is a 3-second shot, typically. Other settings are Tracking, User-Defined and Reflectorless. User-Defined can be set to "Fast" on the gun, which produces a 1-second shot. One application of Reflectorless is to toggle between a 0 prism offset (shooting a rock face or brick wall) versus shooting a prism with a non-zero prism offset. When set to Reflectorless, the prism offset automatically goes to zero. When return to Standard, the previous non-zero prism offset is recalled. Reflectorless also sets the rod height to zero, and when set back to Standard, the original rod height is restored. Turn to Point for stakeout and PowerSearch are disabled in Reflectorless mode. The Read Method (Std, Fast, Reflectorless) will appear in the upper right of the graphic screen for most types of Leica total stations, in commands such as Sideshot/Traverse, Stakeout Point, etc.

- **Foresight Prism Offset**: Here is the list of standard prism offsets. Note that Leica prisms default zero to equate to -34.4 mm. So a prism offset of 34.4 equals a zero "net" offset.

    - (360) (23.1): Prism offset of 23.1 (Leica model).
    - Circle (0, 0): Standard Leica round prism.
    - Mini (17.5): Leica mini prism.
    - ReflTape (34.4): Equates to zero offset (wall, surface).
    - 30mm: Other manufactures (Sokkia, Seco).

- 40mm: Other manufacturers.

- **Motorized**: When clicked off, this also ghosts out most items in the lower half of the dialog. When clicked on, 4 additional options become available. They are ATR, Power Search, Turn to Point in Stakeout and (if on), Turn to Vertical in Stakeout.

- **ATR (AutoTarget Recognition)**: For the TPS 700, TPS 1000 and TPS 1100, this option will find the prism after you point in the approximate direction. It searches over a fixed range of motion and detects all prism types and locks on to the exact center of the prism. Saves "dial in" time.

- **Power Search Enabled**: The Power Search option can be purchased with all motorized Leica total stations. This option activates the "Pwr Srch" button in the "banner line" at the top of the survey and stakeout screens. When Power Search is pressed, the total station will typically find the prism in 10 seconds regardless of the direction it is initially pointed. If it has found one prism and you hit "Power Search" again, it will leave that prism and find the next one as shown in Figure 3-21.

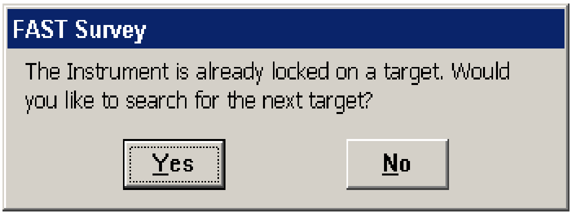


Figure 3-21

If you have only 2 prisms on the job (foresight and backsight), it will conveniently rotate from the foresight to the backsight and back again each time it is pressed.

- **Turn to Point in Stakeout**: You would always want to click this on with a motorized total station. In stakeout (with the exception of slope staking), the program "knows" the angle and distance to turn. When clicked on, this would turn the correct horizontal angle to the stake point, automatically. When on, it also activates the next option, "Turn to Vertical in Stakeout". Turn to Point in Stakeout is disabled when in Reflectorless mode, since staking out should require the "certainty" of a prism placed vertically over the target point.

- **Turn to Vertical in Stakeout**: When auto-turning to stakeout points, you have the option to turn horizontally but not vertically. If "Turn to Vertical" is clicked off, you would need to manually "dial in" the vertical position of the prism in stakeout. However, if rod heights are unchanging, this should be clicked on, and will turn the gun to the correct vertical position, factoring in the current rod height setting.
- **Laser Pointer**: Ideal for indoor or "dark" evening surveying, this option sends a red beam out. It is often used when doing reflectorless work, and makes a red mark on the wall, floor or object being surveyed, thereby confirming the position prior to the shot. The beam should not be directed into someone's vision or eye.

Leica Robotic Total Station

This series covers most of the current Leica standard total stations such as TPS 1000 and TPS 1100 series. For best results, set the instrument to Geocom Online mode. From the Main Menu, go to Configuration/Communication Mode/GeoCom Online Mode.

- **Comm Setup**: Default baud rates are 19200 and Parity None, 8 Char Length and Stop Bits 1, shown in Figure 3-22.

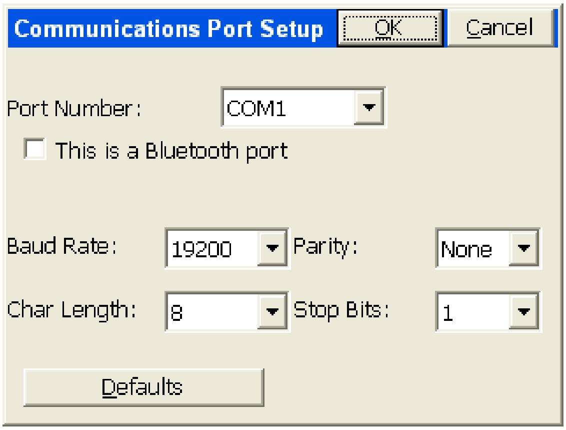


Figure 3-22

- **Wireless Connection:** Using the Juniper Allegro CE/RCS, a built-in radiomodem and internal antenna is included which permits wireless communication with the robotic total station when using the RM2410 radio. This wireless connection is through the Leica propriety radio and does not involve Bluetooth per the Comm Setup screen. The Comm port for the internal radio on the Allegro is Com 3. For one-man operation, the pole and prism become “freed” from wire connection and can be placed anywhere for a shot or reading, with the process driven “remotely” by the data collector communicating with the robotic total station.

- **Settings:** Default settings are shown in Figure 3-23.

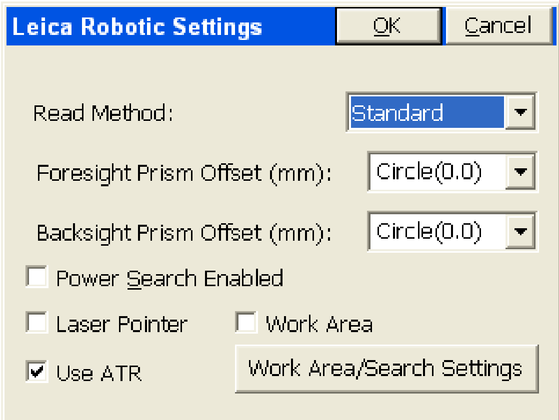


Figure 3-23

- **Read Method:** Methods are Standard (1.5 to 2 seconds) and Fast. When in the  option in all modes of data collection, you are in “Rapid Tracking” mode. Clicking that icon goes to the “No Distance” or “Tracking Only Mode” (no distance measurements). Avoiding taking distance measurements will save battery usage. So the “Dist” button refers to the selectable mode you will “go to,” not the mode you are currently in. In Rapid Tracking mode, S for Store will always take a “Rapid Tracking” shot, and Enter will take a Rapid Tracking shot if Enter is configured to Store only (to mimic S). R for Read will always take a configured reading, as will Enter when set to Read and Store. Figure 3-24 shows the Rapid Tracking mode, which follows the movement of the prism by taking rapid distance measurements much like RTK GPS.

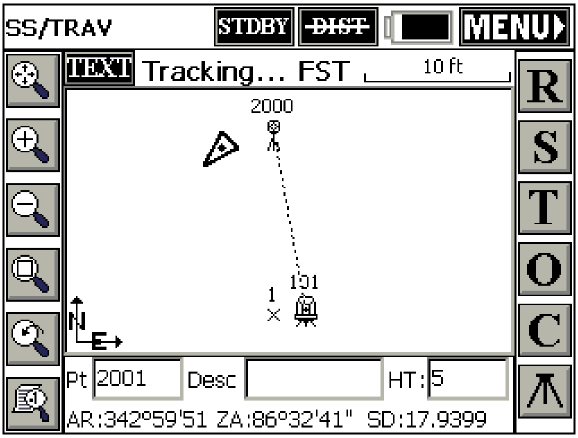


Figure 3-24

Note that in the above screen we are in "Fast" read mode for a configured reading, and in "Rapid Tracking" mode for display and quick readings by S. Clicking the "No Dist" icon leads to angle measurement only and this screen:

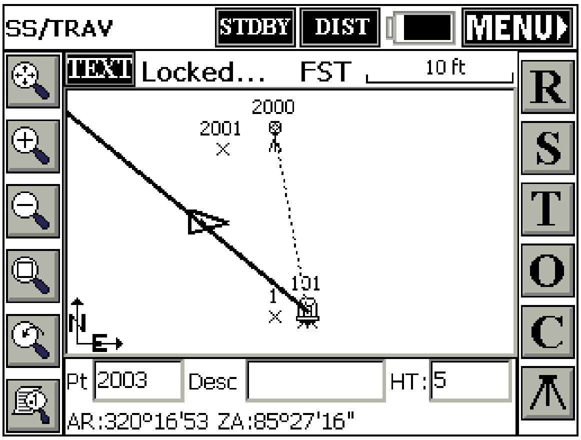


Figure 3-25

In this mode, the line represents the direction of measurement and will move dynamically with movement of the target.

- **Foreseight and Backsight Prisms, Laser Pointer:** These are covered in the section on Leica TPS instruments.

- **Use ATR:** When configured to standard or fast reading, ATR (Auto Target Recognition) will be used when this is set, and then the instrument will return to its previous state once the reading is completed.
- **Work Area:** This will define a limiting area for searching. This can speed up both the standard ATR Search and the PowerSearch.

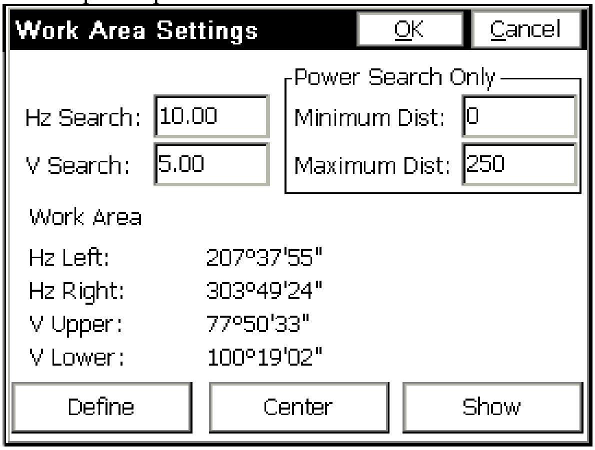


Figure 3-26

The upper left of the screen controls the ATR Search and the upper right controls the PowerSearch. The Work area angle ranges apply to both searches. The Show button will show the two positions of the search window, first by moving immediately to Position 1. You will be prompted to press OK to see Position 2. Having defined a "window" of searching, Center will move that window to a new center position. You will be prompted to "Sight on Centered Position and Press OK". The Define button prompts you to shoot the lower left and upper right positions, which are then displayed above under "Work Area".

If the Work Area is set to start at 0.0000 horizontal, for example, searching would send the instrument to the backsight point.

- **Troubleshooting**: If your Leica robotic total station has any communication issues, it is typically a matter of verifying firmware and configuration settings. Investigate and note down the firmware version of the various components on your instrument, if calling or emailing for tech support. For example, a Leica TCRA 1103 with PowerSearch might display the following firmware settings:

- System Version: Sept. 17, 2002, 2.20
- EDM Version 2.02
- ATR Version 2.02
- PS Version 1.01
- GeoCom Version 1.07

Most important is the GeoCom Version, which you can check for this instrument by going to Configuration, then Info (F5).

Navcom

There are three sets of three LED's on the front panel of the Navcom receiver. The GPS lights indicate the quality of the receiver's GPS position reading. One or more base lights will be on if the receiver is acting as a base. These lights will also indicate the RTK message type being broadcast. When functioning as a rover, all base lights should be off. The number of link lights indicates the strength of the signal the receiver is getting from a base. Blinking link lights, or no link lights, indicates that a base has not been found. For a full description of the meanings of these LED's, consult your Navcom User's Manual.

Navcom receivers are equipped with two serial ports, and sometimes a built-in radio port. FAST Survey refers to the serial ports as A and B, although on some receivers, they are labeled 1 and 2.

Nikon 310/500 Series

This configuration covers such instruments as the Nikon 520, 521, 522 and 552.

Although the Nikon total stations have their own configuration, they also can be set to Sokkia emulation. If set to Sokkia emulation, they should be configured as Sokkia Set. In this mode, you can turn on the "2-way" communication mode. This enables the Nikon's to "turn to zero" in stakeout (set out) mode. In this setting, when you stake point 10 and the angle right to turn is 75 degrees, 15 minutes, the instrument panel will display 75 degrees, 15 minutes, and as you turn towards the point, the display will count down to zero. So without looking at your data collector, you watch the screen until you obtain zero degrees—this means you are on target. In a sense, the performance of the Nikon total stations is enhanced in Sokkia emulation mode.

Nikon 800 Series

The 800 Series configuration will also apply to the older 700 series. To use that product the user must select SET mode on the instrument and have the connection speed set at 1200 baud then select the Nikon 800.

NMEA GPS Receiver

This GPS configuration is typically used to pick up the standard, commonly output NMEA string from a variety of receivers, including Magellan, the Sokkia GPS01 Toughbook (shown in Figure 3-27) and some brands of Trimble equipment.

Figure 3-27

The Sokkia GPS01 Toughbook, for example, has an integrate L1 GPS receiver using WAAS for corrections and has accuracies of 1 to 2 meters. That same unit can be connected to real-time GPS or total stations and therefore functions as a dual-use device, locating on-the-ground positions (Lat/Long, state plane, UTM) and permitting standard precision surveying. The GPS receiver is powered on whenever the

Toughbook 01 is on, and uses COM3 as the GPS port. Note the "stabilizer bar" which effectively secures the com port connection for use in the field.

Some low-accuracy (10 to 50 meter) GPS outputs NMEA Lat/Long data by default and has no accurate "setting" or method. Alternately, certain accurate RTK brands of GPS, if setup with their proprietary equipment to run RTK, will transmit the NMEA string and allow FAST Survey to pick up the message from the rover receiver. For this reason, NMEA has no Configure Base, Configure Rover or Receiver Utilities option. It is a "plug and play" method, which will pull from the receiver whatever position it is outputting. That Lat/Long position will respond to the transformation defined in Job Settings, GPS and will also respond to any localization file to transform it further to local coordinates.

Novatel

Setup and configuration are similar to the Sokkia Radian.

Sokkia Radian

This is the driver for the original Sokkia Radian "real-time" GPS with centimeter accuracy. Sokkia Radian GPS, like all real-time, high-accuracy GPS requires a base receiver sending corrections to a rover receiver. Most commonly used GPS antenna types include the SK600 and SK502. All Sokkia GPS receivers will accept and transmit RTCM, RTCA and CMR message strings.

Sokkia Radian IS

The Radian IS is an "integrated" GPS receiver with a fixed antenna type, the SK600.

Figure 3-28

Antenna height on the integrated Radian IS with built-in SK600 antenna is measured to the base of the rubber bumper around the antenna. Sokkia provides a measuring tape that connects to the rectangular indentations for precise height measurement. A diagram of the phase center offset (antenna height) is included on the receiver. Similar “hook points” exist on all Sokkia antennas.

Sokkia GSR2600 GPS

The GSR2600 is a modular version of the Radian IS, with a variety of antenna types available. The Log Static Data routine in FAST Survey will initialize the storing of raw data to the receiver. This raw data can be post-processed in Sokkia Spectrum Survey.

Sokkia Set

The driver applies to all current Sokkia total stations, including the 110M when used in manual mode. It also applies to many non-Sokkia instruments which have a Sokkia or “Set” emulation mode, including Nikon, Pentax and Topcon. The advantage of Sokkia emulation is that the Sokkia driver includes a “2-way” setting that will upload configuration settings into the instrument such as units, prism constant and the backsight circle. Most important, for stakeout, the “2-way” setting will upload the angle to turn, so that you turn to zero to get on target. The Sokkia Series 30R is reflectorless is shown in Figure 3-29.

Figure 3-29

The “On” key is the upper right, which takes you to the “Measure” screen where it is ready to work with FAST Survey. Commands would not be accepted, for example, if you were in the “Config” screen. Use the instrument to activate reflectorless mode, and in FAST Survey, be sure to set target height to zero. The gun will control prism offset in non-prism modes.

Sokkia Set 110M Series

This driver is necessary to utlize the motorized features of the 110M. For example, in stakeout, it will turn to the point automatically. The motorized features will turn to the appropriate horizontal and vertical angle in most commands when the 110M is set to “Remote” mode.

Figure 3-30

Note that baud rates on the 110M must be set to 9600 in remote mode but are typically set to 1200 baud in direct mode. Change on the instrument and in FAST Survey, Equip, Com Setup.

The Settings options for the 110M are shown below:

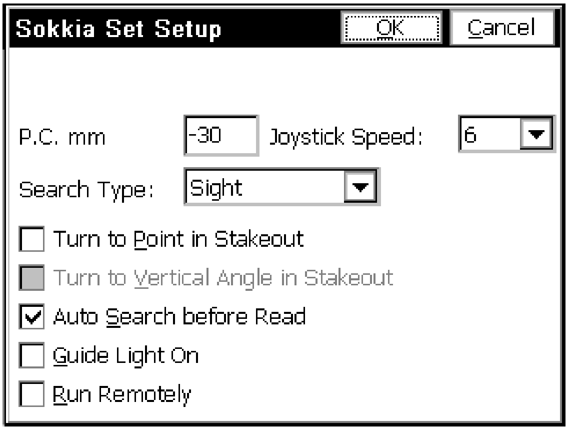


Figure 3-31

Joystick speeds are 1 to 6 (for arrow key response turning gun). For reference 6 is approximately 6 degrees per arrow press. Search types are Sight (field of view of gun, or 1 degree, 30 minutes or 10 meters at 100 meters), H Wide, V Wide and HV Wide. The wide views are 6 times field of view. Auto Search before Read finds the prism center exactly before taking a measurement (useful in Set Collection, for example, and in Stakeout). Run Remotely sets the left and right turning of the gun, referenced from the pole, and not from the instrument. This is distinct from left and right referencing for stakeout which refers to movement of the rodman.

Sokkia Axis/Axis 3 GPS

The Sokkia Axis 3 is the current GIS-level GPS product from Sokkia and obtains corrections from Coast Guard beacons, WAAS and OmniStar. There is no subscription fee for beacons or WAAS, but there is for OmniStar. The subscription can be by month or year or any other time period (even "weekend" use). Accuracy varies on correction method used, but is typically sub-meter to 3 meters. For example, 0.5 meter accuracy (1.5 feet) is common with beacon corrections when located within 60 miles of a Coast Guard beacon. The Axis 3 is designed for GIS and environmental applications, which are effectively addressed by FAST Survey through use of attributing on feature codes and through ESRI import and export features.

TOPCON (GPS+) Setup

This configuration covers all Topcon GPS receiver types, including Hiper Plus, Hiper Lite, Hiper GGD, Hiper GD, Odyssey E, Legacy E, Legacy H. Of these receivers, the Hiper Plus, Hiper GGD, Odyssey E and Legacy E utilize Glonass satellites as well as the standard U.S. satellites.

Glonass refers to the Russian satellite constellation (Global Navigation Satellite System). There are approximately 24 U.S. satellites active (more will launch over time) and there are approximately 10 Glonass satellites currently active. A full "24 satellite constellation" is anticipated by 2005 for the Glonass satellites. With a minimum of 2 Glonass satellites available or "seen" by the base and rover receivers, satellite coverage is improved, and work is sometimes possible in canopy, urban or deep pit environments where non-Glonass receivers do not have coverage.

Figure 3-32

Shown here is a HiperPlus with HiperPlus Antenna (all built in one). For measuring antenna heights, in vertical setting measure to base of the HiperPlus (the point at which the unit would rest on a table). For measuring slant height, measure to the point indicated by the arrow pointing to the bottom middle of the receiver panel.

Figure 3-33

This receiver and antenna is similar to the HiperPlus in terms of where to measure vertical and slant heights for antenna height input. For rover-mounting, typical vertical heights using the standard Topcon pole is 2m. Both HiperPlus and HiperLite have a Bluetooth wireless communication option. Bluetooth connection is possible with several CE devices including the FC1000, Ipaq and Recon.

All Topcon GPS receivers have a “Minter” screen on the panel that has a “stat” light that flashes green indicating number of U.S. satellites and orange indicating the number of Russian satellites. Within the Sat Info Screen in Monitor on FAST Survey, the Russian satellites are number 45 and up and the U.S. satellites are number from 1 to 24. The command “Set Satellite Status” in Receiver Utilities enables you to “turn off” particular statellites, both U.S. and Russian. When using PacCrest radios, a “TX” light blinks about every second indicating the radio is transmitting. The “RX” light would blink if you were getting interference.

- **Station Type**: You must select the station type. Choose between Base or Rover. In Configure Rover, the RTK Calculation Mode should be set to Delay, which forces a fresh reading, as opposed to Extrapolate, which will project the next reading by your direction of movement, and may apply to difficult shots in tree lines.
- **Receiver Utilities**: Use Set Base Radio and Set Rover Radio to be sure that both radios are on the same channel. Recommended settings are base on low “digisquelch” (low sensitivity) and rover on medium or high digisquelch.
- **Radio Port**: You must select the radio port. This setting on the TOPCON base and rover receiver is usually C. Data Port is always A. When using Pacific Crest radios, TOPCON recommends the new PDL Pacific Crest radios. These must be set to 38,400 baud rate. TOPCON can also use Spread Sprectrum radios, which work at 115,200 baud rate. The HiperLite GPS uses Spread Spectrum radios running at 57,600 baud. The standard Hiper uses Pacific Crest PDL.
- **Rod Height**: Slant heights or vertical heights can be used to measure antenna heights.
- **Power Cycle Receiver**: This command is the same as turning the TOPCON receiver off and then on.
- **Restore Factory Defaults**: This command resets the TOPCON receiver to factory settings and the receiver stops acting as base or rover. The baud rate of Port A will be set to 115,200. Reset this to 9600 by turning the receiver off and then on while holding down the FN button. Watch the REC light go from orange to green to red and then let up the FN button. This method can be used if FAST Survey cannot establish communications at any time.

- **Clear Non-Volatile Memory**: This command does everything Restore Factory Defaults does and also clears the almanac data that tells it where to look for the satellites. The receiver then downloads a new almanac from the satellites.
- **Send Command to Receiver**: This command allows experienced users to type in commands using TOPCON GPS receiver commands to set or report internal settings. (See the TOPCON operations manuals for a complete list of TOPCON GPS receiver commands).

Post-Processing: All Topcon GPS receivers can be used for post processing and will store raw GPS data on the on-board RAM in the receiver. The post-processing can be activated by the Log Static Data command found in the Surv menu of FAST Survey. On every receiver, you can also activate logging purely through hardware by holding down the FN key, watch the light turn orange to green, then release. To turn off by hardware, press FN until the light turns off. Since FAST Survey will prompt for antenna height, type and other parameters, it is recommended that software be used to initiate logging. Topcon logging files typically start off with the word "Log" followed by the date, and are post-processed using Topcon Tools. Topcon Tools will output a Rinex ASCII file of the logging data for use with programs such as NGS's OPUS.

Topcon and Bluetooth

In addition to the discussion of Bluetooth (wireless) connection found under the subject of Comms Setup, there are additional trouble-shooting considerations with Topcon Bluetooth.

a) If the OAF file is not current the Bluetooth will not work. An OAF file is used by Topcon for the firmware of their receivers. With an expired OAF file, many features (including Bluetooth) will not work.

b) Normally the Bluetooth port (usually B) must be enabled in the OAF file for the Bluetooth to work.

c) It is possible to set the Bluetooth port baud rate. Normally it is 9600, 38400 or 115200. This can be checked from the "A" com port using GRIL (command manual for Topcon receivers) commands. The baud rate in the Com Setup should be the same.

Topcon GTS Series

Most standard Topcon total stations will work configured to Topcon GTS Series. This includes the older Topcon 3B, 4, Topcon 300 clear through the Topcon 2000 and the new Topcon 230 (which uses Bluetooth wireless communication). However, the GTS Series "driver" does not include a "reflectorless" option. For that you would want to choose the Topcon 300/600/700/2000 configuration.

Topcon 200 Series

This is another option that can be tried when the GTS Series or other configuration does not communicate. It uses a different speed and mode of linkage.

Topcon 300/600/700/2000

Similar to the Topcon GTS Series, these drivers offer the reflectorless option. Typical baud rates for instruments such as the Topcon 303 and Topcon 313, for example, are 1200, E, 7, 1.

Topcon 800/8000 Direct

This configuration works for the Topcon 800 series (800, 802, 800A, 8000), when running in direct mode (measurements taken from the instrument, no radio connection to the prism). All 800 series instruments are motorized. The Topcon 8000 is a reflectorless unit. The Topcon 800A is motorized but not full robitic. The 800AR is motorized and robotic. The Topcon 802 refers to a "2-second" version of the 800 series, for example.

To operate either direct or remote, press the Power button to turn the instrument on. After you level, the instrument will go through a motorized self-test. You obtain a 6-icon menu. To run direct, press F2 for Standard. This puts you in the measure screen. Note that in Direct mode, the Topcon 800 typically expects 1200, E, 7, 1 for communication, but 9600, N, 8, 1 in Remote mode.

Topcon 800/8000 Remote

This configuration works for the Topcon 800 series running in remote mode (radio link active, equipment operation driven from the prism).

The optional RC2 unit, mounted on the prism pole, provides a "quick lock" feature for rapidly guiding the instrument to the prism. Additionally, the RC2 provides an alternative to radios allowing limited remote communication between the data collector and instrument. Be sure that the RC2 unit is pointed directly at the instrument before executing a "quick lock." The RC2 is shown in Figure 3-34 mounted above the prism, along with the Topcon FC1000 data collector running FAST Survey.

Figure 3-34

To operate in remote mode, obtain the 6-icon menu, press F1 for Program, F6 for More, then F3 for External Link. Press F2 to verify your currents settings, then hit Escape and press F1 to execute the remote settings.

Settings for Robotic Measurement

In Settings, you obtain a screen as follows:

1. Cable/Radio Modem/RC
2. Parameter (Cable)
3. Parameter (RC)
4. Parameter (Radio Modem)

The Parameters refer to the 3 ways of communicating robotically (Cable, RC2 and Radio Modem). The Cable option implies 2 operators, one driving the instrument directly with FAST Survey and one at the rod. For the RC2 and Radio Modem options, FAST Survey drives the instrument remotely from the rod. Note that the RC2 "quick lock" function has a maximum range of 1500ft, while the two way remote communication is limited to 800ft.

Cable/Radio Modem/RC: After pressing 1, the up/down arrows are used for menu selection (e.g. RC, Cable, Radio Modem Satel 2ASx, Radio Model Satel 3ASd). For RC2, select RC. If you are running the radio and RC2 together, select the correct radio and the RC2 will also work in conjunction. Press Set, then Esc to return to the 4-item menu.

Parameter Cable: When using radios (and not exclusively RC2), choose Parameter Cable and set to the correct baud (typically 9600). Press Set. For end-of-text character, FAST Survey prefers the ETX option. Leave other items default.

Parameter RC: If you are using the RC2, you must set all items here. On the RC2 itself, there are dip switches located in the battery compartment. Set all 4 off for 2-way, optical communication and set to Channel 1 within Parameter RC. Also set Terminate to ETX, Retry to Standard, Rec-Type to Rec-B. To use RC2 with radios, set dip switch 3 On, others Off and the parameters do not apply. However the radio parameters apply, which is next.

Parameter (Radio Modem): This lead to 3 sub-options:

1. Select Parameters. Choose Rec-B.
2. Set Frequency: This will try to communicate with prism radio and display the current frequency. Make sure you are on the same frequency (and channel) for instrument and remote radio.
3. Set Channel (3ASd): The frequency only applies to the 3ASd. There are 2 choices. Channel B is automatically set for 2ASx. Default is Channel B. Options are A through E and 0 through 9.

Topcon provides distinct cables for radio communication and RC2 communication. The "Y" cable is used with radios and RC2 in combination, but is not required. You can press the yellow button on top of the RC2 to initiate a "quick lock". The "Y" cable is not used for RC2 only communication. The advantages of using both radio and RC2 are range (works remotely over 800ft), speed (faster reading), and ease of operation.

Within FAST Survey, go to Equipment, select Topcon 800 Remote, use default port and baud settings. Next go to Settings. Recommended settings are Tracking 10mm, Search Pattern Normal, Track Sensitivity High (best with Quick Lock), Search Scan Range set to Middle (applies to APL1 only), Tracking Speed Middle, Joystick Middle (this changes the response of the arrow keys). Hit More Parameters and set Vertical Range to 10, Horizontal Range to 10, Wait Time (how soon it starts searching when you lose the link) 3 to 5 seconds (low traffic areas) and 120 (2 minutes, in high traffic areas). Tracking Light Indicator On or Off, user choice. Channel can be set to Channel (A-B, 0-9) or Frequency, where you enter the known frequency. Model options are Satelline 2AS, Satelline 3AS, Cable, RC-2, PDL (Pacific Crest), RC-2/Sat-2AS and RC-2/Sat-3AS. Select Update to send these parameters to the instrument and the program will confirm with a "dling" sound. Then pick OK.

Proceed to the Robotics Screen. You can get there from the main menu with Alt J or from the Backsight screen tab.

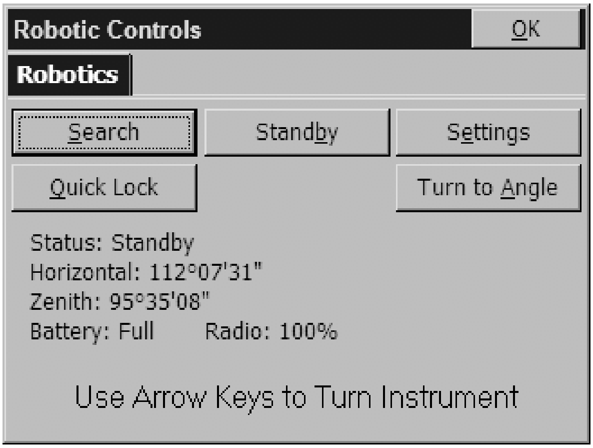


Figure 3-35

If using RC2, Select QuickLock button. Otherwise, use arrow keys to turn the instrument, look for the 2 blinking lights (if track lights are turned on) and then tap Search. Above, we've set the vertical and horizontal search ranges to 10 degrees. When you obtain lock, you will get 3 beeps from the RC2, and in all cases, FAST Survey will say Tracking, meaning you are locked on. Take a backsight in Sideshot/Traverse and you will obtain results such as those shown here.

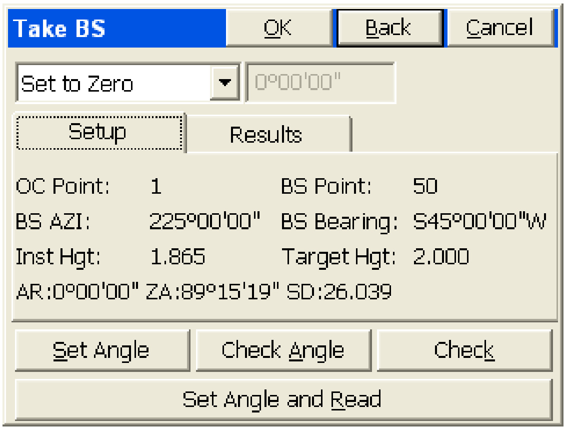


Figure 3-36

The above screen illustrates an azimuth backsight as opposed to a backsight to a known point, so only the measured distance is displayed (there are no "delta distances" to a known point for comparison). If you are taking foresights, and move and lose "lock", the program will advise with the screen shown in Figure 3-37.

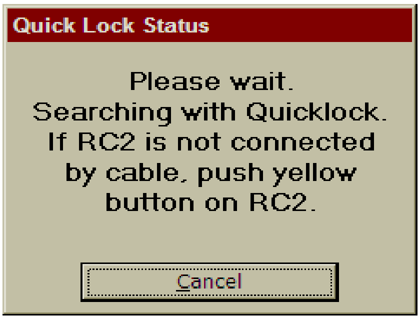


Figure 3-37

FAST Survey will track the prism in the fastest mode (10mm), then switch to configured reading when a shot is taken. Note, configured reading was also set to Tracking 10mm, which will take a nearly instantaneous shot. If configured for Fine (1mm), the shot will take 2-3 seconds. Here we have taken a foresight to point 3 and have moved in tracking mode to a new position, ready for a configured reading on point 4. "Configured Reading" shots are taken with Enter or R for

Read. The "S" button will take a "fast read" or Tracking Read, no matter what the Configured Reading mode.

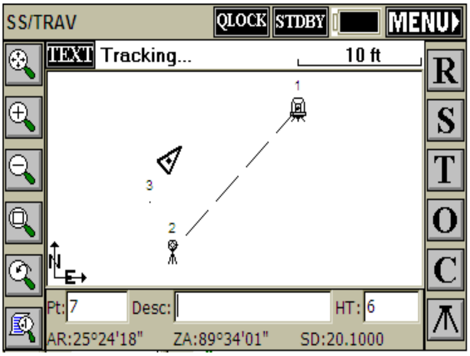


Figure 3-38

Pressing QLOCK does an RC2 "quick lock" search and only appears as an option if you are configured for RC2 or RC2 with radios. Standby let's the instrument hold its position and stop tracking allowing you, for example, to place the rod on the ground and drive a stake, then get on line again and use QLOCK (RC2) or SRCH (non-RC2) to regain the link.

With robotic total stations, commands such as Turn to Angle, Set Collection (choose "robotic" sets) and Check Backsight will turn robotically. Set Collection works best with radio linkage (radio alone or radio with RC2), but has limited functionality in RC2 only mode. Robotic sets use BD-FD/FR-BR observation order. Note, "non-robotic" sets can be done with a robotic total station. The "Angle Only in Reverse Face" can be toggled on for faster Face 2 readings. "Auto Turn," available for all observation orders but Robotic Set, will turn the gun automatically to all known points. The "Robotic Set" option is shown in Figure 3-39 within Set Collection.

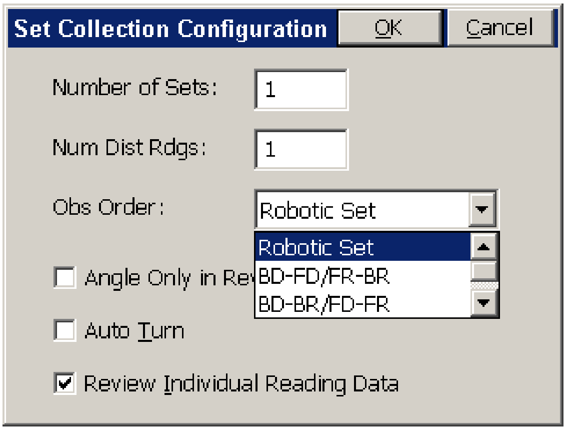


Figure 3-39

An hourglass will appear when Robotic Sets is selected, during which time FAST Survey initiates constantly streaming data. When in robotic Set Collection, an option to obtain the Robotic screen (search and joystick features) is available. See Figure 3-40.

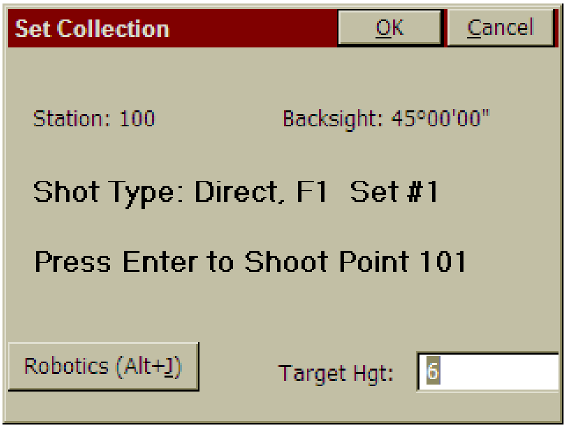


Figure 3-40

After all sets are collected, the user is prompted whether to move to a new setup station, collect still more sets, or review the set data. Close this dialog and Set Collection is complete for that backsight and foresight.

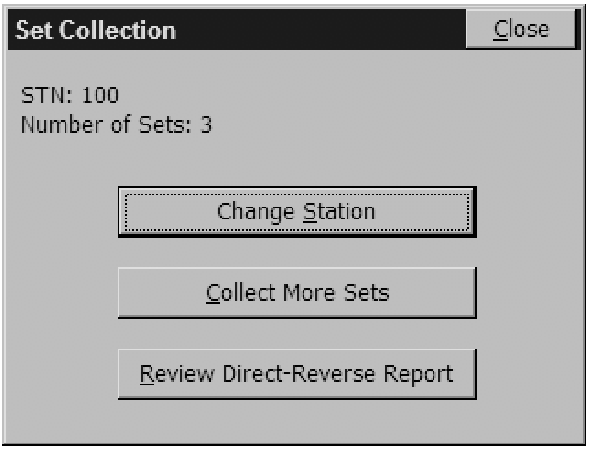


Figure 3-41

Topcon APL1

This is an older Topcon robotic total station with excellent tracking. It's a larger instrument often used in construction and machine control applications. It communicates only by radio with the 2ASx type radios.

Setting the Com parameters on APL1

You only have to do this once.

1) Turn the APL1 on.
2) Press <Menu>.
3) Press <F1> for Parameters.
4) Press <F3> for COM.
5) Press <F3> for Terminate.
6) Select ETX (ONLY) and press <Ent> to accept.
7) Select F2 for Transfer Speed.
8) Select 9600 and press <Ent> to accept.
9) Select F1 for Bit Format.
10) Set to BS, S1, and NONE, Press <ENT> to accept.

Putting the APL1 in the "Remote Mode"

1) Turn the APL1 on.

2) Press <Menu>.

3) Press <F3> for Remote.

4) Press <F1> for Remote.

The total station is now in the Remote Mode.

Trimble 5600 DR200+ (Station Mode)

Trimble 5600 DR200+ (Station Mode) - Firmware version 696-03.05
To check firmware version, Menu 5, 4, 1
Trimble - Communication Settings (9600,8,None,1)

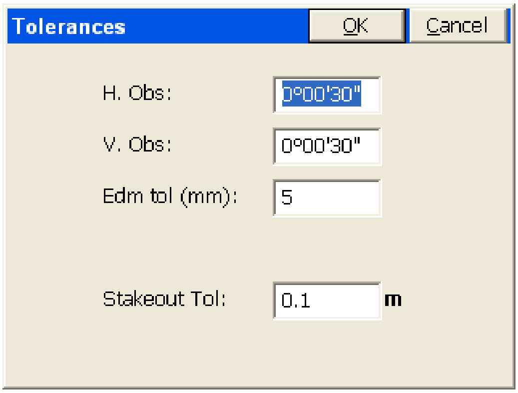


Figure 3-42

- Turn on the instrument
- Level the instrument

If communication settings need to be set continue with step 3, if not, go to measurement screen.

- Select MNU, ENT, 4 (Data com), 1 (Select device), 2 (Serial)
- At prompt “Serial ON?”, select ENT
- Verify COM=1.8.0.9600 followed by ENT
- At prompt “Table no=”, select ENT
- At prompt “Length=”, do what’s right and get back to the measure screen
- In FAST Survey, select the Trimble 5600 driver from “Equip → Instrument”

- Verify the FAST Survey communication settings by selecting "Equip → Comm Setup" (This only needs to be set the first time you use this equipment)

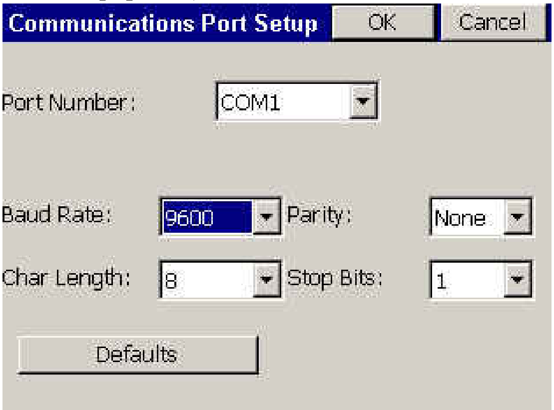


Figure 3-43

- Set "Equip → Settings" as shown below:

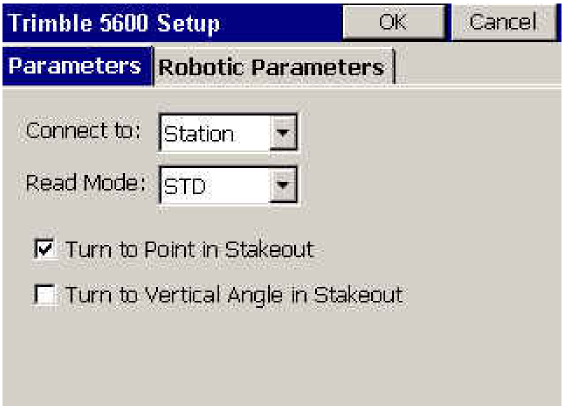


Figure 3-44

- Select the "OK" button

Trimble 5600 DR200+ (Direct Robotic Mode)

Trimble 5600 DR200+ (Direct Robotic Mode) - Firmware version 696-03.05

To check firmware version, Menu 5, 4, 1

Trimble - Communication Settings (9600,8,None,1)

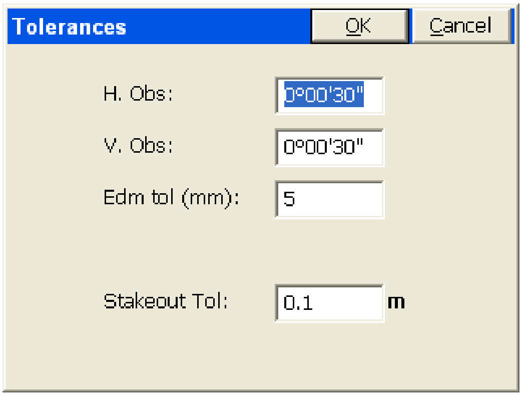


Figure 3-45

- Turn on the instrument
- Level the instrument and allow instrument to compensate

If communication settings need to be set continue with step 3, if not, go to step 8.

- Select MNU, ENT, 4 (Data com), 1 (Select device), 2 (Serial)
- At prompt "Serial ON?", select ENT
- Verify COM=1.8.0.9600 followed by ENT
- At prompt "Table no=", select ENT
- At prompt "Length=", do what's right and get back to the measure screen
- Make sure the handheld is on and FAST Survey is running
- Turn Off the instrument
- Remove the faceplate
- In FAST Survey, select the "Trimble 5600" driver from "Equip → Instrument"
- Verify the FAST Survey communication settings by selecting "Equip → Comm Setup" (This only needs to be set the first time you use this equipment)

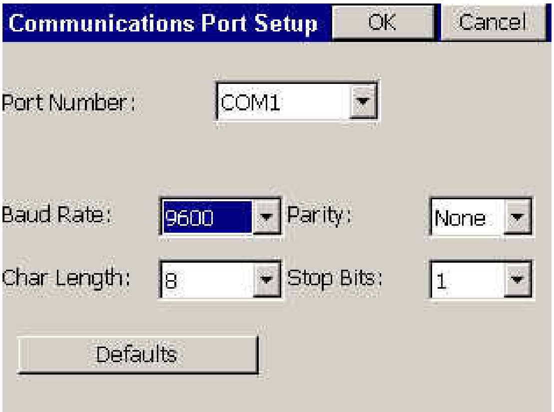


Figure 3-46

▪ Set "Equip → Settings" as shown below for "SS/Trav" routine used for topographic surveys. When using the "Set Collection" routine to collect angle sets during a traverse, the "Read Method" must be "STD".

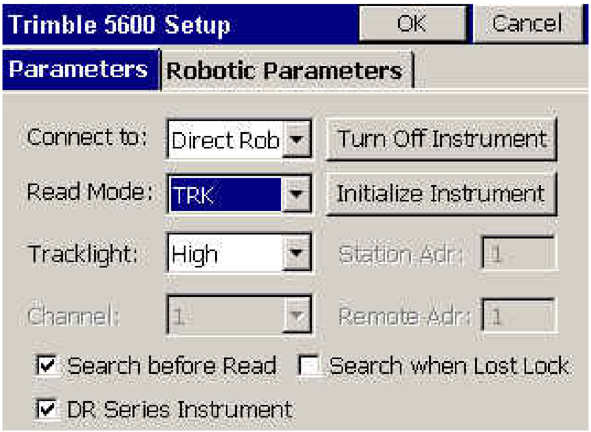


Figure 3-47

▪ Select "Initialize Instrument" button shown above. Instrument will perform the compensator function.
▪ Select the "OK" button.

To shut down the Trimble 5600 when running in robotic mode:

- Select "Equip → Settings"
- Select the "Turn Off Instrument" button shown above

Trimble 5600 DR200+ (Robotic Mode)

Trimble 5600 DR200+ (Direct Robotic Mode) - Firmware version 696-03.05
To check firmware version, Menu 5, 4, 1
Trimble - Communication Settings (9600,8,None,1)

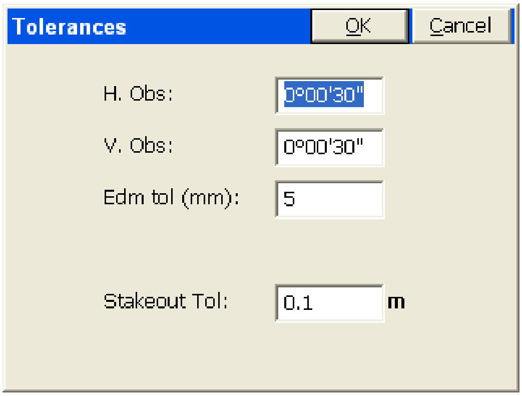


Figure 3-48

- Turn on the instrument
- Level the instrument and allow instrument to compensate

If communication settings need to be set continue with step 3, if not, go to step 8.

- Select MNU, ENT, 4 (Data com), 1 (Select device), 2 (Serial)
- At prompt "Serial ON?", select ENT
- Verify COM=1.8.0.9600 followed by ENT
- At prompt "Table no=", select ENT
- Make sure the handheld is on and FAST Survey is running
- Turn Off the instrument
- Remove the faceplate
- In FAST Survey, select the "Trimble 5600" driver from "Equip → Instrument"

▪ Verify the FAST Survey communication settings by selecting "Equip → Comm Setup" (This only needs to be set the first time you use this equipment)

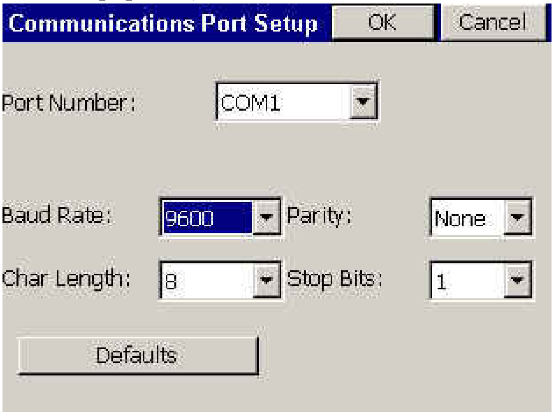


Figure 3-49

▪ Set "Equip → Settings" as shown below for "SS/Trav" routine used for topographic surveys. When using the "Set Collection" routine to collect angle sets during a traverse, the "Read Method" must be "STD".

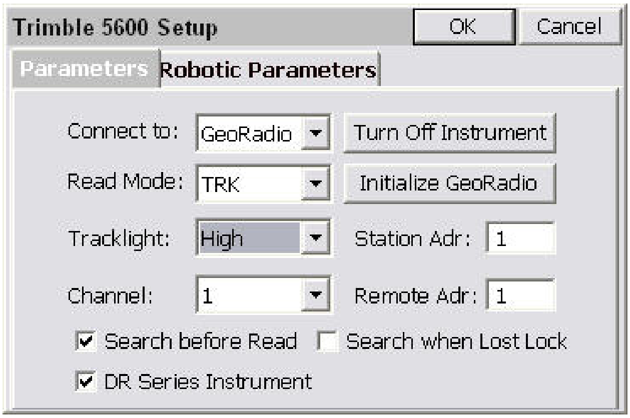


Figure 3-50

▪ Select "Initialize Instrument" button shown above. Instrument will perform the compensator function.
▪ Select the "OK" button.

- Set the configuration for the ENTER button. Select "File → Configure Reading" and make sure the options shown below are set. The ENTER button has two modes that affect how fast a reading is stored during topo and stakeout routines. The "Store Only" option allows the user to store the current buffer reading. This is extremely fast, but the user must make sure the rod has been still for a second or two. The "Read and Store" option is slower but mandates that the instrument takes a fresh reading on every shot.

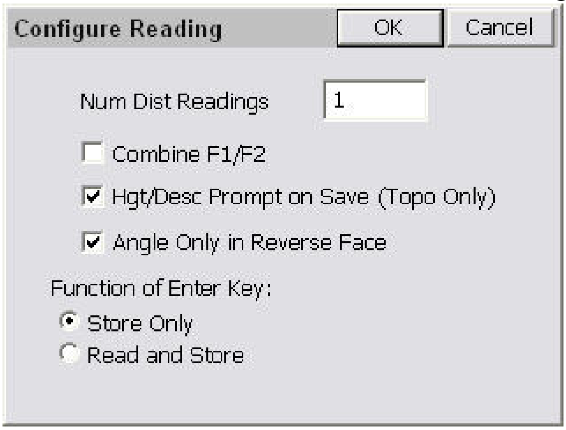


Figure 3-51

To shut down the Trimble 5600 when running in robotic mode:

- Select "Equip → Settings"
- Select the "Turn Off Instrument" button shown above

Trimble 4000 GPS

The Trimble GPS 4000 is an older series of GPS receiver. The panel on the receiver itself can be used on the Trimble 4000 to configure for RTK. There is no Configure Base or Configure Rover in FAST Survey for the Trimble 4000. However, Receiver Utilities are provided, as shown below in Figure 3-52:

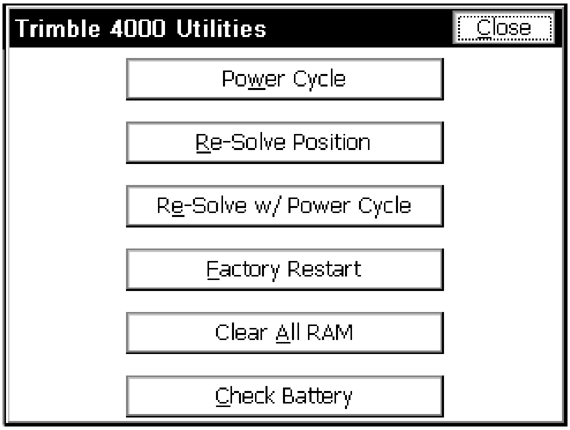


Figure 3-52

Trimble GPS General (5700 and 5800)

This configuration is used for most current brands of Trimble GPS, including the Trimble 5700 and Trimble 5800. The Trimble 5700 is often used as a base in conjunction with the Trimble 5800, which has the wireless "Bluetooth" communication feature. To use the Bluetooth feature, the Trimble TSCe is outfitted with an adapter on one of its serial ports which includes the internal radio. For use with FAST Survey, the standard serial cable is recommended, as shown in Figure 3-53. To use the cable, disable "Bluetooth".

Figure 3-53

The Trimble 5800 with Zephyr antenna has a panel, as shown below in Figure 3-54, that includes an On-Off button at right.

Figure 3-54

There are 3 LCD lights. From left, the first round light is yellow and flashes or pulses at 1 per second when sufficient satellites have been acquired for RTK, and flashes quickly when insufficient satellites are available. The second round light is a pulsing green light indicating radio linkage. When the pulse is intermittent, radio connection is being interrupted. The third, rectangular light is green and indicates battery status. It is steady on when there is sufficient battery power. A typical base setup, with the 5700, is shown below in Figure 3-55:

Figure 3-55

Here, a Trimmark high-wattage radio is used with the Trimble 5700 base receiver. Note on the Trimble 5700 that the power on-off button is on the right, the next 2 buttons to the left show the usage of battery 1 and an optional battery 2. Three LCD lights appear along the bottom left of the 5700 panel. The middle button pulses red and is a satellite indicator: steady 1 second pulse means good satellite reception and fast pulsing means insufficient satellites. The LCD to the left is steady on amber if static data is being logged to the receiver. When you configure the base with the Trimble dataloggers, you can set it to do RTK with PPInfill, which will do both RTK and static logging. FAST Survey can be used to configure the base or will drive the rover when the base has been configured by the Trimble datalogger. A typical antenna usage would be the Zephyr Geodetic for the base (mitigates multi-path) and the Zephyr for the 5800 rover. Consult your Trimble reference manuals for more detailed information.

Trimble PathFinder

This is another "GIS-level" receiver, which typically gets corrections from either a Beacon or a dedicated satellite in space (Racal), and has an approximate accuracy of 1 meter. There is no Configure Base or Receiver Utilities option, but there is a Configure Rover option, as shown in Figure 3-56.

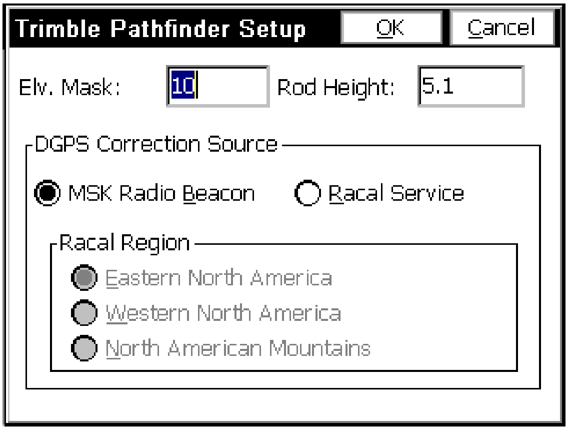


Figure 3-56

Configure Base

Function

For GPS equipment, it is necessary to set up the base antenna and record the correct antenna height, the antenna type (for certain equipment), and the methods used for localizing (obtaining the desired coordinates). This is accomplished with the command Configure Base, which only appears in the Equip menu if a GPS instrument is selected.

Much of Configure Base is common to most instruments. For example, the Base Ant. Height would be entered in feet or meters, depending on the setting specified in Units within Job Settings. Vertical or Slant height refers to the method used to measure the height of the base antenna. Vertical refers to the distance from the ground point to the antenna disk, measured plumb. Slant refers to the distance from the edge of the antenna disk down to the ground point directly beneath the center of the antenna. Elevation Mask refers to the degrees above the horizon above which satellites will be used for GPS "correction" calculations, and below which satellites will be ignored. Keep in mind that it is not always better to lower the elevation mask below 10 or 15 degrees. Satellites closer to the horizon than 10 degrees will often degrade the calculation of coordinates.

The "alternative" to Configure Base is Configure Rover. GPS receivers can usually function as either type, but must be "configured" for the role they will serve. You will be warned when you switch receiver configuration from Base to Rover and vice versa, to confirm that is what is intended.

With all RTK GPS Equipment selections (except GPS Simulation), Configure Base will first bring up settings and then proceed to the 6-option Configure Base screen which "locates" the base position. The 6-button Configure Base options, common to all, are discussed first, followed by equipment-specific settings.

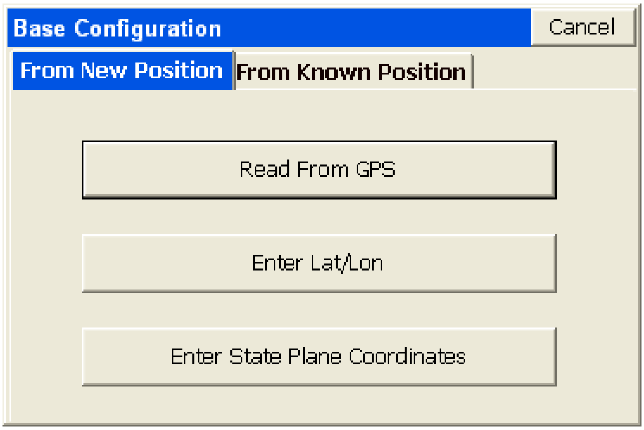


Figure 3-57

Configure Base for All RTK GPS Brands

For all brands of GPS, the Configure Base button is the command that starts the base receiver broadcasting GPS corrections to the rover. You must click the Configure Base button in GPS Setup while you are connected to the base receiver. The base needs a set of coordinates to use as its stationary position. Given that you are configured for a particular coordinate system, there are 2 main "types" of localizations: (1) Enter an Accurate Base Position and work from that point outward on the scale and "true north" of that system (no rover localization), (2) Enter an Accurate or Semi-Accurate (Read from GPS) Base Position and then localize to known rover points that transform to the local coordinate system (required if the local system is not true GPS north). There is also a “mixed” base-rover approach. To use the base in the localization, you should configure the base with the "Use Local Coordinates" option under "From Known Position". Here, you configure the base by entering the local point (5000, 5000,100, etc.) and start a new localization file (or use an existing one if it applies). Then, at your rover, you can add more points to the localization as necessary. In this case, a single rover point within Localization will produce a scale factor and best fit to the local coordinates.

There are six methods to set the stationary base position, organized into 2 categories: From New Position includes Read from GPS, Enter Lat/Long and Enter State Plane Coordinates. The From Known Position tab includes Previously Surveyed Point, Use Local Coordinates and Read From File. When you are starting a new job (no information in the raw RW5 file yet), always use the options in From New Position.

From New Position Options

- **Read from GPS** - This method takes a specified number of GPS readings from the base receiver’s autonomous position and uses it as its “true” position. The autonomous position can be off of the actual position by 150 feet. The base will calculate corrections based on this autonomous position. If you set up the base with this method, the rover points must be used for localization since the corrections they are using are based on the approximate position of the base antenna. Read GPS, combined with rover-based localization, is one of the most common methods used to start a GPS survey.

When Read from GPS is used, the program will present the current position, as shown below:

Latitude: N 42d21’28.35882”

Longitude: W 71d08’12.87540”

Elevation: 116.376

Continue with Base Setup?

Yes No

If you like the result, press Yes and continue on. You will then be prompted for the Reference Station Number. This is an "ID" that will store to the raw file and permit post-processing of the raw GPS data. A typical entry is 0001. The final prompt will say,

> Base Configuration Successful. Save Settings to File?
>
> Yes No

Answering Yes will bring up an entry screen for the reference file name. Reference files are stored with a ".ref" extension. It is important to save a reference file if you plan to return to the job at another date. Without re-localizing to control points, you can set up over the same base position, recall the reference file, and enter the new antenna height for the base position, and start working.

The Read from GPS option is sometimes referred to as "Find Me". This option is accurate to about 10 to 50 meters, typically, and it enables the corrections to broadcast with enough accuracy to permit localization and sub-centimeter real-time work. Be sure that your GPS zone in Job Settings is set correctly before using this option. Also, give the base enough time to find itself. When first set up, the base receiver has to "collect" satellites and "resolve ambiguities". If you Read from GPS too early, you may find a position, but one that is not fully resolved and ends up slowing down the speed at which the rover fixes.

- **Enter Lat/Lon** - Requires you to enter the latitude and longitude for the position of the base antenna. This is useful if you are setting up over a monument whose lat/lon you know. It can also be used over a control point whose position is known from GPS post-processing. This will put you on the NAD83, NAD27, UTM or other coordinate system specified in Job Settings, GPS Tab. You can still do a rover-based alignment to transform to a local system. Rover-based localizations are always improved by more accurate base positioning. If the GPS detects that your entered Lat/Long is not near the current GPS readings, the program will warn:

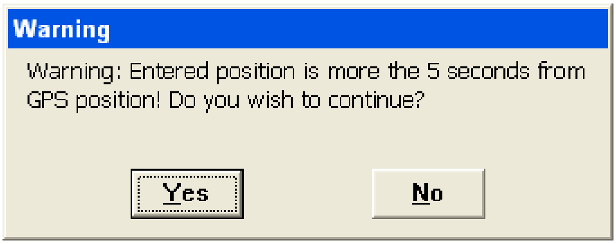


Figure 3-58

This method should be used if you are reasonably sure of the accuracy of the latitude and longitude—it should be at least as accurate as the "Read from GPS" option, or otherwise you will have difficulty getting a "fix" on the rover. If it is a very accurate lat and long, you will get the best results. Figure 3-59 is a screen capture of the lat/long entry dialog.

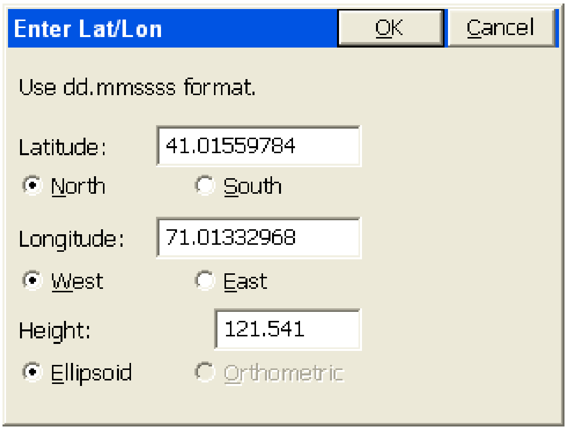


Figure 3-59

Pressing OK leads to the same options to store the base position as a reference file, similar to Read from GPS.

- **Enter State Plane Coord**: Requires you to enter the grid system northing and easting for the point that the base is occupying. This applies to any projection that you have configured, including U.S. state plane, worldwide UTM or any individual country or user-defined grid system. This is useful if you are setting up over a monument whose coordinates you know. An accurate base position, either by entry of Lat/Long or State Plane Coordinates (coordinates on the configured coordinate system), will enable immediate data collection without rover-based localization, but also will improve rover-based localization.

The Coordinate method is similar to the Lat/Long method, since Lat/Longs convert to Grid Coordinates based on the current "zone" set in Job Settings, GPS option. The Grid Coordinates will convert back to the Lat/Long coordinates needed by FAST Survey to configure the base.

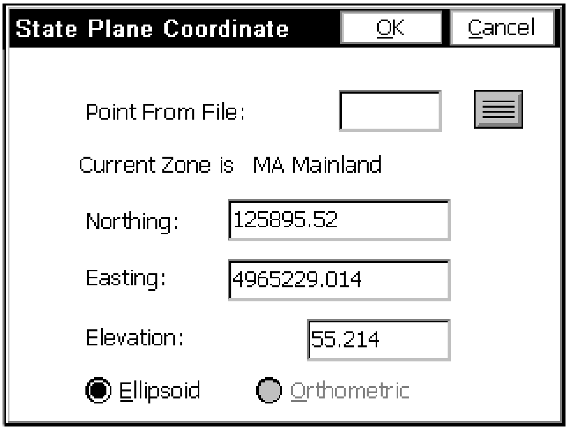


Figure 3-60

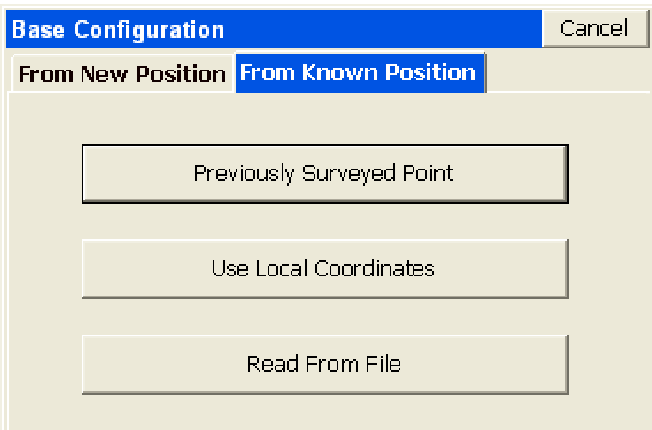


Figure 3-61

From Known Position Options

- **Previously Surveyed Point** – Requires you to enter the coordinates, on the configured coordinates system, of a known, surveyed point. This will transform and localize to the local coordinate system, and optionally can be followed by rover-based localization. The known point must be found in the RW5 file in a form that includes its Lat/Long (a previous GPS measurement). This Lat/Long, just as with New Position options, is used to establish the base position. This method requires that you are working within an existing job that has a raw file including Lat/Long positions for the points being used.

Figure 3-62 is an example of the prompting:

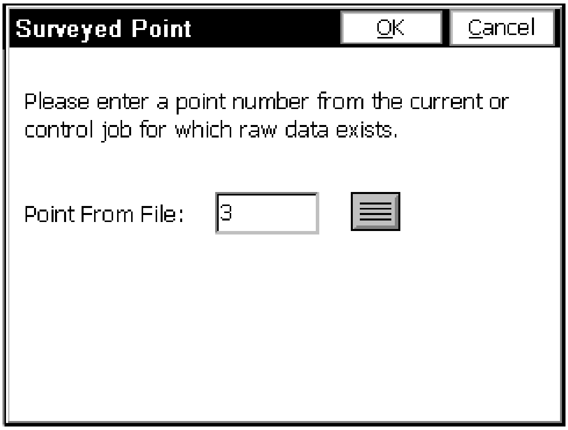


Figure 3-62

Like the other options, this continues on by showing the corresponding Lat/Long for the coordinate and allowing the user to save the result in a reference file.

- **Use Local Coordinates:** If you have "localized" using option 5 (Localization) within the Equip menu, you obtain a "dat" file. This localization file is used to convert any Lat/Long reading into a local coordinate. By the same token, you can take a local coordinate, run it back through the dat file and obtain a Lat/Long for the base receiver setup. That is the procedure used in this option. Here is the screen:

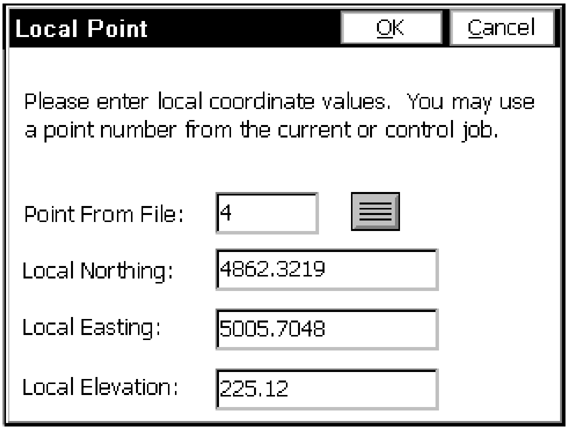


Figure 3-63

When OK is pressed, you will be asked to load the associate ".dat" file, in a dialog similar to below:

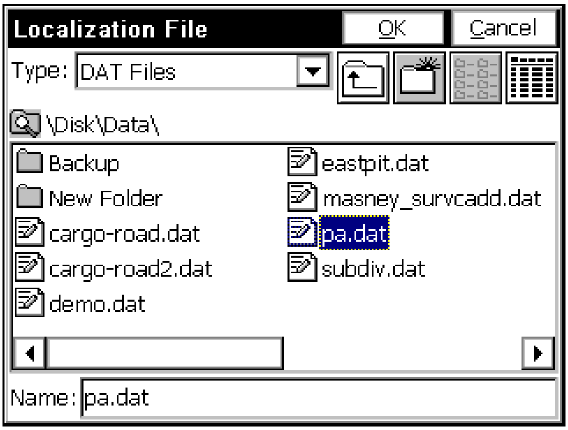


Figure 3-64

- **Read From File** - Reads a previously saved base position file. All of the other methods of setting up the base let you save the base position at the end of setup. If you return to a site, set up the base in exactly the same position, use Read From File to use the same base position and you don't have to re-align the rover: the old alignment is still valid.

This option recalls a reference file in a dialog similar to that above. Then you will receive the standard prompting:

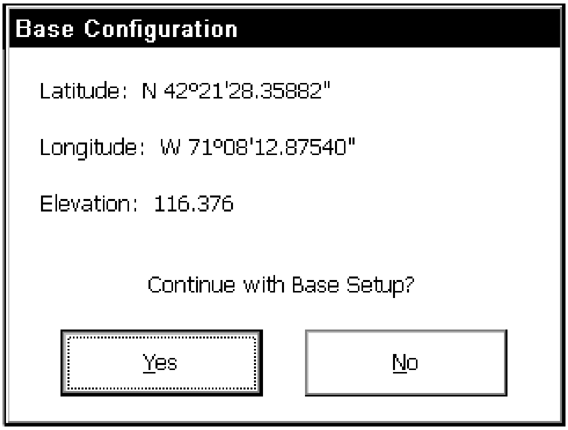


Figure 3-65

This is followed by the Reference Station ID prompt (showing the default ID). The “new” base antenna height, which will change with each new set up, is entered back at the first set of dialogs. Only if you set the base antenna on the same horizontal and vertical position each day would the base antenna height remain fixed. If the base antenna height and x,y position is the same from day to day, then you do not need to do Configure Base each day. You would simply power up the base, power up the rover and start working in that case. Keep in mind that in certain power surge conditions, receivers can lose their settings, and a re-configuration may be necessary, even if the base receiver antenna has not been moved.

Note: One method of obtaining Latitude/Longitude and state plane coordinates in the U.S. is to occupy a point, any point, for 2 hours or more, logging the static data, then submit the Rinex file to the NGS “OPUS” program accessible on the web. You must log the data with dual frequency equipment. The OPUS program is fully automated, and will return the x,y,z, lat, long, ellipsoidal height and orthometric height. This data can then be entered in during base localization. Though most post-processing programs (Trimble Geomatics Office, Leica SKI-Pro) use proprietary post-processing file formats, they will output the ASCII “Rinex” format needed by OPUS.

Thales/Ashtech Base Configuration

When configured to Ashtech GPS, the Configure Base routine leads immediately to the screen shown in Figure 3-66.

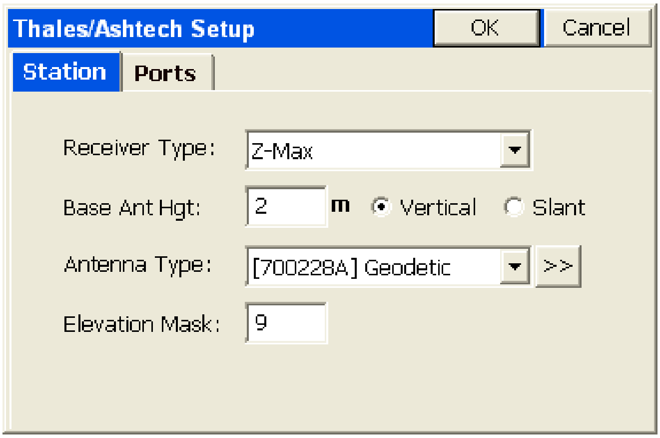


Figure 3-66

For Thales, receiver types include:

- **Z12 or Sensor**
- **ZSurveyor** (shown above)
- **GG24** (Glonass)
- **Reliance**
- **Z-Xtreme**
- **Z-Max**

For Thales, antenna types include a wide variety of Geodetic, Marine and Choke Ring as well as Locus, ProMark2 and DSNP NAP. The parameters for the antenna are displayed when you click the double right arrow button, as shown in Figure 3-67:

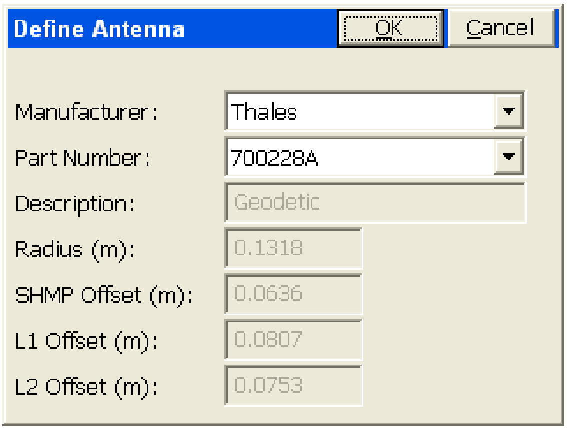


Figure 3-67

If the "Ports" tab is selected, these screen options appear:

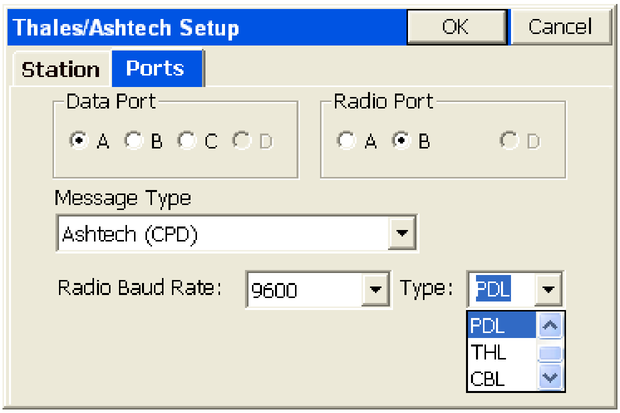


Figure 3-68

These settings for the base are default for the Z-Max. Typical settings for the Z-Xtreme are Data Port A, Radio Port C and for the GG24 and Z-Surveyor they are Data Port A and Radio Port B, which will in fact also work for the Z-Xtreme. (Note that for the rover, using the Z-Xtreme, the Data Port is A and the Radio Port is D. Other Ashtech models set the Data Port to A and the Radio Port to B for the rover.) The Reliance works with one receiver and does not require a radio port setting.

Message string options for the Z-Max including the default Ashtech (CPD), plus CMR (Trimble), RTCM-RTK and RTCM-DIFF. On older models prior to the Z-Max, only Ashtech (CPD) and RTCM-RTK is offered. Note that RTCM refers to a more generic, less proprietary message string, and may allow the older Ashtech models to communicate with other rover receivers set to RTCM. CMR permits communication with Trimble.

Radio Type includes GSM (ZMax only), PDL (standard Pac Crest PDL radios) as well as THL and CBL. The THL is a PDL-style UHF radio made by Thales. CBL is not actually a radio. This is used rather for a direct cable connection between the base and rover.

The Thales ZMax has an extra option in the Ports tab that allows it to be configured as a GSM base for broadcasting corrections by cell phone modem to a single Thales ZMax rover. The screen appears below:

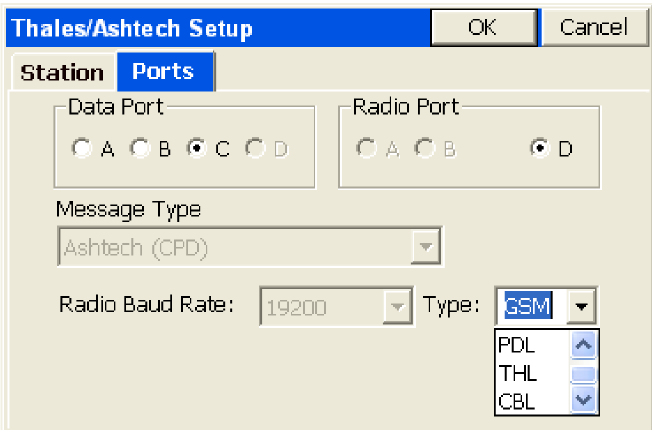


Figure 3-69

The procedure for activating a Thales ZMax rover as GSM receiver is covered in the Configure Rover section below. The base GSM setup is similar but it will not have a dial button, nor a phone number or calling option. GSM behaves just like a PDL radio, except that the rover must first call the base before it can receive corrections.

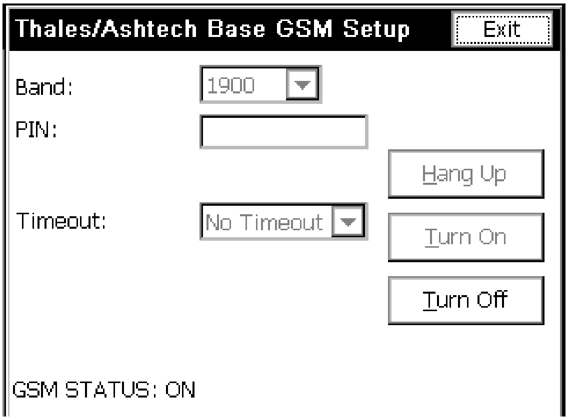


Figure 3-70

Note: If Bluetooth (wireless radio link from FAST Survey to the Receiver) is configured in Comm Setup, then on pressing OK and existing Configure Rover, the Bluetooth Manager screen will appear, allowing you to select the receiver name and ID and make other changes.

Leica System 500 Base Configuration

This configuration, which covers both the Leica 500 and 530 systems, allows base setup without requiring use of the red controller from Leica. The first screen appears as follows:

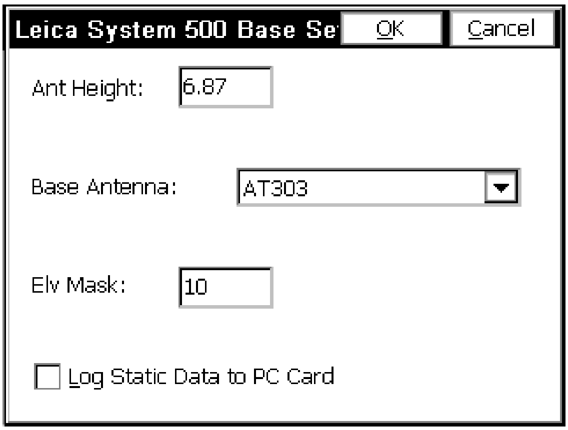


Figure 3-71

Base Antenna options include AT201, AT202/302, AT202/302 GP, AT303, AT501, AT501 Pole, AT501 Tripod, AT502, AT502 Tripod, AT503, AT503 Tripod, AT504, AT504 Tripod, SR299/399 Internal and Other. When a tripod option is selected, the program prompts "Measure to Base of 36cm Height Hook". This height hook is typically provided by Leica to go with tripod setups, and simplifies height of antenna measurements (a built-in tape drops from the height hook to the hub or other ground position). The Leica GPS can also be directed to Log Static Data to the PC Card. Be sure to insert a PCMCIA card into the Leica GPS PC Card slot, if this logging option is to be used. For Leica, when not using the height hook, measure antenna heights to the base of the GPS antenna (the same point that the antenna would rest on if placed on a table, for example).

Navcom Base Configuration

Note: You must connect to the Navcom receiver in order to continue to either the Configure Base or Configure Rover dialogs.

If the "Messaging" tab is selected, the following screen options appear:

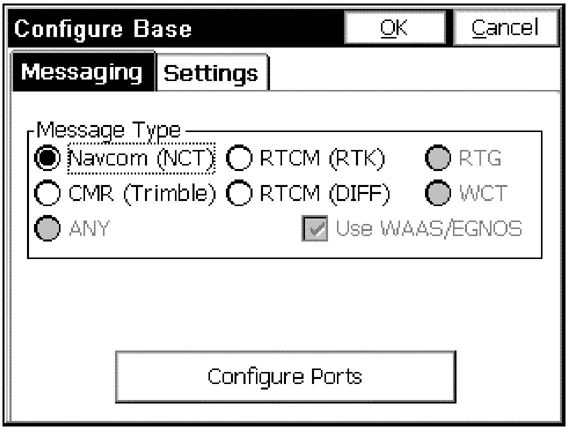


Figure 3-72

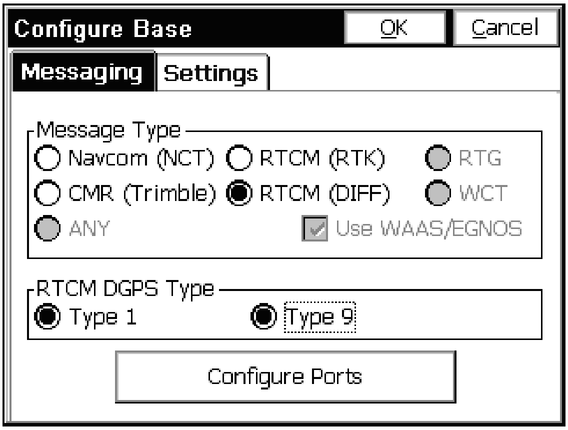


Figure 3-73

- **Message Type:** Your GPS receiver supports four messaging formats: NCT (Navcom native format), CMR (Trimble's format), RTCM RTK, and RTCM DIFF. You may also enable WAAS here for increased accuracy running differential GPS (DGPS), but this feature will not be active when a receiver is using RTK.
- **RTCM RTK Type**: If you choose to broadcast RTCM RTK message types, you have the option of sending either message types 18 and 19 or message types 20 and 21.
- **RTCM DIFF**: If you choose to broadcast RTCM DIFF message types, you have the option of sending either message type 1 or message type 9.

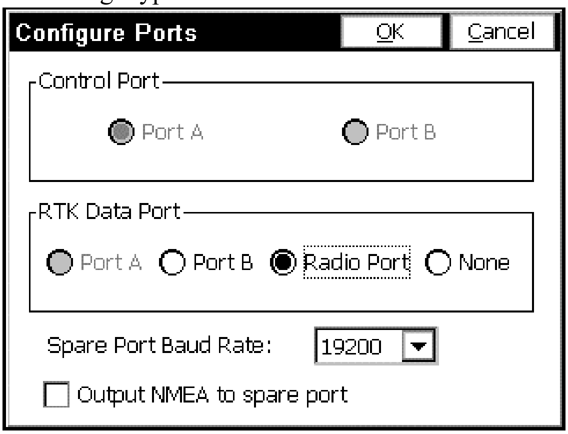


Figure 3-74

- **Configure Ports:** Press the configure ports button to choose the RTK port to either radio or serial depending on whether you intend to use the internal radio for RTK. For more information on Configure Ports, see the Receiver Utilities section of this manual.

Selecting the Settings tab brings up additional options, including the all-important Base Antenna Height. If, for example, the base antenna is set up on a tripod over a known point, and the height varies day-to-day, then even if you are using the same localization file, you must go to Configure Base, Settingss and enter the correct Base Antenna Height each day it changes. Then you would "Read from File" to use the previously stored Localization File. If the "Settings" tab is selected, the following screen options appear:

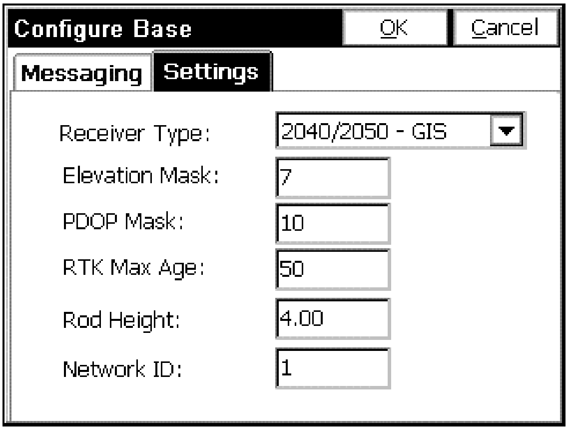


Figure 3-75

- **Receiver Type:** If you're using a Starfire receiver (models 2040 and 2050), set this option as shown above. If you're using receiver model 3010 or 3020, set to these model numbers. Unlike the 3010/3020, Starfire receivers are capable of receiving Starfire RTG and WCT subscription-based corrections as well as WAAS/EGNOS. On the other hand, the 3010/3020 has build-in radios, allowing for easy base-rover set up without the use of external radios.
- **Elevation Mask:** You can configure your GPS receiver to ignore satellites that are low on the horizon. This value is an angle from 0 to 90. At 0, all satellites may be used. At 90, no satellites may be used. The factory default value is 7 degrees.

- **PDOP Mask:** You can configure your GPS receiver to only report positions when the PDOP is below a certain value. This value can range from 0.0 to 25.5. The factory default is 10.
- **RTK Max Age:** This feature is only applicable to rover configuration.
- **Rod Height:** Enter the height of your GPS antenna above the ground if you wish the value calculated to be based on ground height.
- **Network ID:** When using the internal radios, your base and rover must be set to the same network ID. In scenarios where multiple bases are present, use these numbers to ensure that your rover gets its corrections from the intended base.

NovAtel, Sokkia Radian and Sokkia GSR2600 Base Configuration

The NovAtel and Sokkia Radian base receiver options appear below:

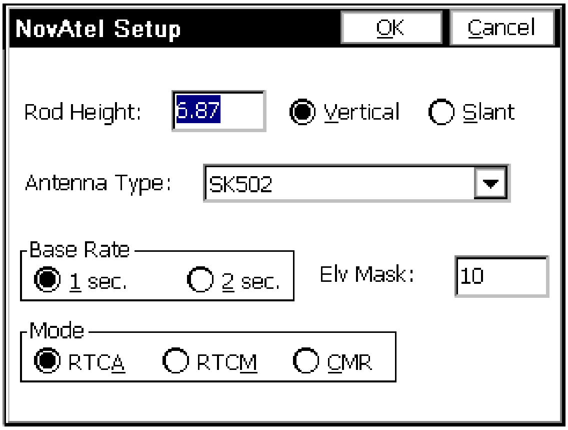


Figure 3-76

Antenna types include SK502, SK600, Geod2, Geod3, Marine3 and Other. Note that RTCA is the proprietary mode for NovAtel, but that it will also read RTCM and CMR. The CMR mode is another message type that can allow one brand of GPS to communicate with another. For example, most Trimble receivers will broadcast CMR.

Sokkia Radian IS Base Configuration

The Sokkia Radian IS is the "next generation" receiver after the Sokkia Radian. Its startup screen is very similar, but uses only one specific Antenna Type, as shown here:

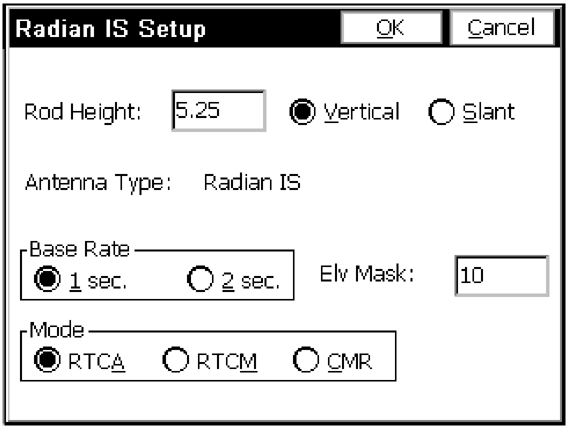


Figure 3-77

Sokkia Axis/Axis 3 GPS

These receivers, typically providing "GIS-level" accuracy, do have options within Configure Base, as shown here in Figure 3-78:

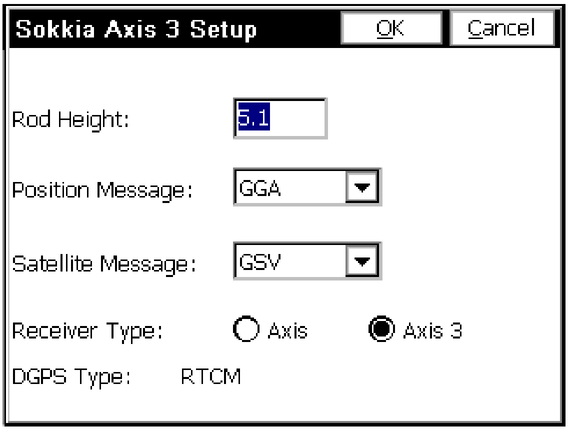


Figure 3-78

Position Message can be GGA, GLL, GNS, GGK, GGQ and GGK PT. The Satellite Message can be GSV or GSA.

Topcon GPS+ Base Configuration

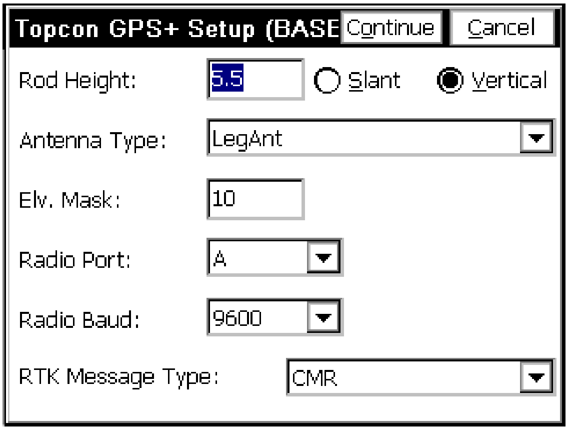


Figure 3-79

For Topcon GPS, antenna types include LegAnt, RegAnt-SD, RegAnt-DD, Regency-SD, Regency-DD, Odyssey, HiPer (Internal), LegAnt-3, HiPer GD, HiPer GGD and Other. RTK Message Type options include CMR, CMR+, RTCM 2.1, RTCM 2.2 and RTCM 2.3.

Trimble GPS General

The Trimble 5700, for example, can be used as either a base or rover, and is often used as a base in combination with the Trimble 5800 as rover. When used as a base, the 5700 defaults to Data Port 1, Radio Port 3. Both the 5700 and 5800 use the Trimble GPS General configuration. If set to Trimble GPS "General", Configure Base leads to the following dialog:

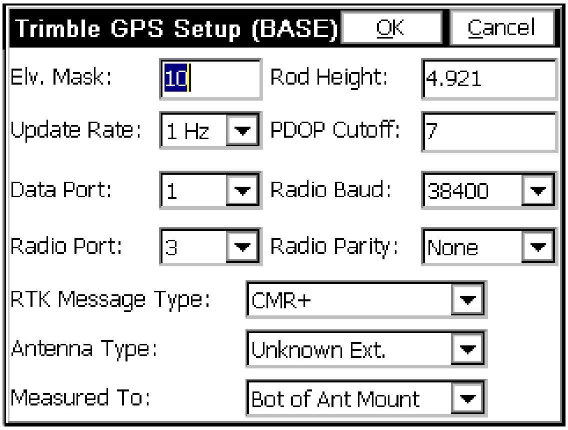


Figure 3-80

Update rates are 1 Hz, 5 Hz and 10 Hz (10 per second). Data Ports are 1 to 3 and Radio Ports are 1 to 3. Message types include RTCM, CMR and CMR+. Antenna Types are Unknown, MC L1/L2, MC L2/L2 with GP, Rugged MC L1/L2 with GP, Compact L1/L2 with GP, Compact L1/L2, 4800 Internal, Zephyr, Zephyr Geodetic and 5800 Internal. The Measured To option has Bottom of Antenna Mount, Hook with 4800, True Vertical, Bottom of Notch, Top of Notch, Bottom of Corner and Bottom of GP. A typical base configuration is Zephyr Geodetic, Measured to "Bottom of Antenna Mount". Note that a vertical Rod Height is expected for this measurement, not a "Slant Height."

Configure Rover

Function

For many brands of GPS, receivers will perform differently depending on whether they are set as base or rover receivers. Even though the receivers are identical, they perform differently depending on whether they are configured as a base or a rover. Multiple rover receivers can communicate with a single base receiver. The Configure Rover command is used to set the rover receiver to the correct parameters and to instruct the receiver that it is, in fact, a rover.

Thales/Ashtech Rover Configuration

When configured to Thales or Ashtech GPS, the Configure Rover command goes to this dialog:

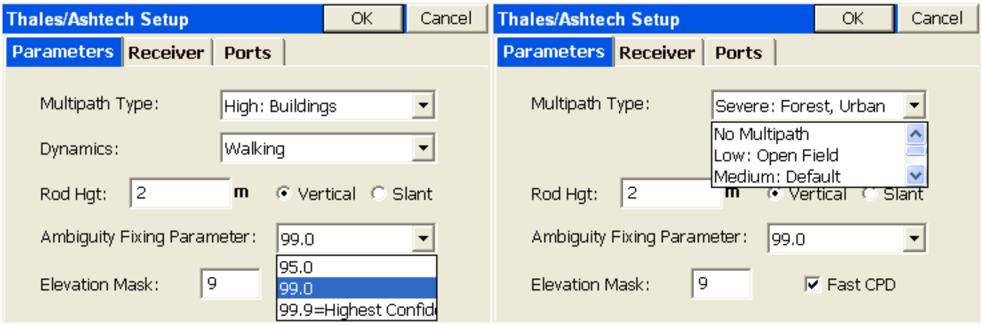


Figure 3-81

Multipath refers to the effects of reflective surfaces which interfere with satellite signals. Being next to a metal building would cause high multipath, for example. Ashtech receivers will respond to multipath settings by using different message filtering techniques. The Multipath options here include:

- No Multipath
- Low: Open Field
- Medium: Default
- High: Buildings
- Severe: Forest, Urban.

Ashtech GPS also functions differently depending on the Dynamics settings. Note that Dynamics does not appear if the Receiver is set to ZMax (dialog above, right). In this case, Walking mode is automatically set. Here is a table of Dynamics settings and the accuracy (in feet) and conditions to be expected (English units):

Dynamics	**Hrms**	**Vrms**	**Performance**
Static	0.01	0.02	Will “lose lock” if you move.
QuasiStatic	0.02	0.04	Will fix, but slowly, if you move.
Walking	0.04	0.06	Normal operation, won’t lose lock walking.
Automobile	0.08	0.12	Remains fixed even at driving speeds

speeds.

Note that the Hrms and Vrms are measures of the accuracy of the shot. They tell you that there is a high probability (>65%) that the measurement you take will be at least as accurate as the rms values.

The Ambiguity Fixing Parameter controls the speed at which the receiver will fix. We recommend using 99.9=Highest Confidence for survey work. As is well known in the GPS industry, it is possible to get a bad fix, since at rates of 1 in 1000 to 1 in 10000, receivers may pick up a bad reading and calculate incorrectly. Therefore, minimize the chances of obtaining a poor fix by keeping this setting at 99.9, even if it means waiting a few more seconds for the fix to occur. A lower reliability setting may be necessary, however, to obtain a fix when fewer satellites are available and there are tree obstructions.

Ashtech also has a special setting for Fast CPD. With Fast CPD clicked on (the default), the receiver works faster, but it is less accurate, reflected in the Hrms and Vrms values that are displayed in Monitor and other commands. If you click off Fast CPD, you will have a slightly slower update rate, but you will be more accurate. You may also notice that the screen occasionally blanks out the real-time coordinates and display items, when a calculation fails to meet the standards of "Slow CPD". Coordinates quickly return as the calculation gets back on track.

The Receiver Tab brings up the following dialog:

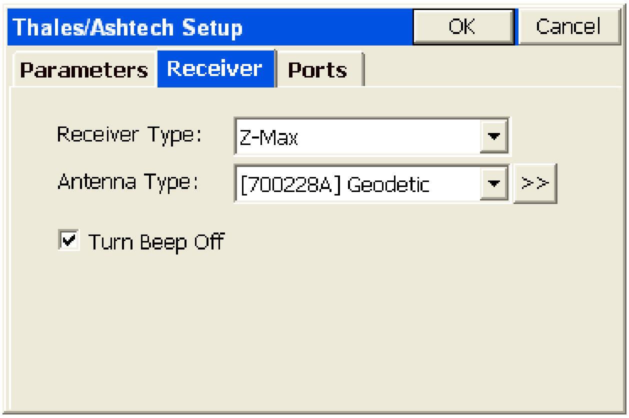


Figure 3-82

The Receiver Type and Antenna Type are identical to the Base Configuration options. The ZMax and Z-Xtreme configurations are very similar, so you can try the ZMax with the Z-Xtreme configuration if you wish to experiment with dynamics settings. They were removed with ZMax to simplify and setup. The Turn Beep Off is an option to turn off the beeping sound that emanates from the rover receiver itself, which is often placed in a backpack.

The Ports tab is shown below. For most Thales/Ashtech GPS, the default data port is A and the radio port is usually set to B. Linking to public reference station (VRS) is available with several types of receivers. The Thales ZMax, however, has an option for GSM cell phone communication with its own GSM base. (This allows for corrections over a longer distance than line-of-sight or normal PDL radios, which may go up to 10 kilometers). Shown below might be a configuration for GSM. For the Zmax tieh internal Thales Radio, default data port is C and radio port is D. GSM stands for Global System for Mobile computing.

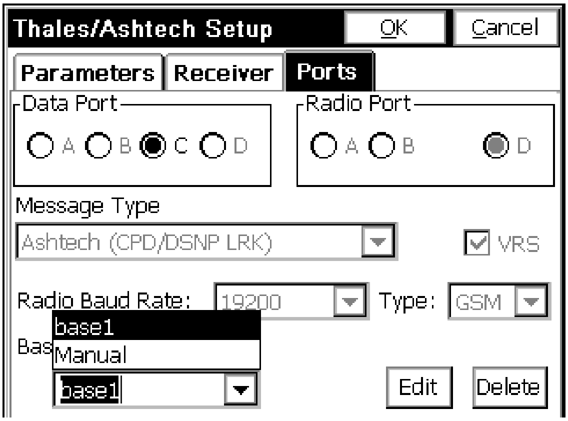


Figure 3-83

VRS Cell Phone Modem Corrections

VRS (virtual reference station) is a message transmission method common in Europe, where multiple users can obtain corrections from GPS base reference stations. It is very widespread in Germany, for example, permitting companies to operate real-time kinematic (RTK), high-accuracy GPS off of a single rover in communication by cell phone modem to public reference stations. The dialing up process discussed below for GSM applies to public VRS cell phone connection. VRS is the "public access" form of GSM.

GSM Modem Corrections

The Thales ZMax receiver can act as a GSM base or a GSM rover. As a GSM rover, a single rover can pick up the message from its own GSM base, or any number of rovers can receive the corrections from "public" VRS base stations. In effect, NMEA strings are sent out and received by rover receivers over the radio port. GSM uses a cell phone modem "dial-up" system.

The lower options in the Ports tab for the rover apply to making a GSM connection using Thales GPS. The configuration of GSM can be accomplished manually or via configurations from the Configure Rover Screen. Choosing Manual will turn on the GSM modem but not set any GSM parameters. Choosing a GSM base configuration will allow the user to set the GSM band, pin, phone number, and other parameters. If Manual is selected, "New" becomes the option in the lower right of the screen. Select new to add a new configuration, fill in the appropriate values, and click OK. In the Configure Rover screen, click Edit to change these values.

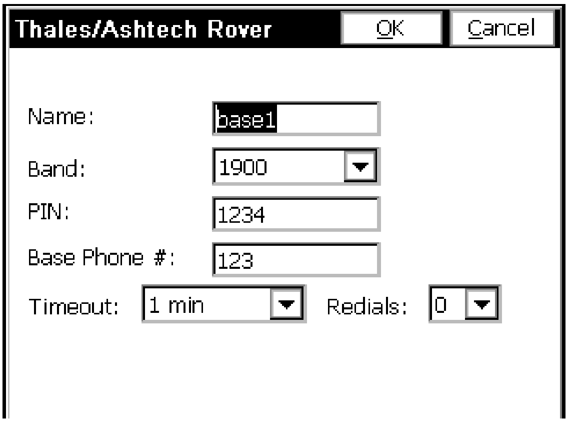


Figure 3-84

The above screen will appear after you click the "New" or "Edit" buttons on the "Ports tab". Note that "Band", "Pin", "Phone #", etc are only available when the "Type" on the ports tab is GSM. If one of the other "types" is selected, you can still "add" configurations but the only field is “name”. This allows users to create custom memorized settings for their instruments regardless of radio “Type”. Default values are recalled during the next field usage.

When the GSM modem is on, no parameters except phone number may be changed. To change parameters, turn the modem off, reset the parameters, and turn the modem on.

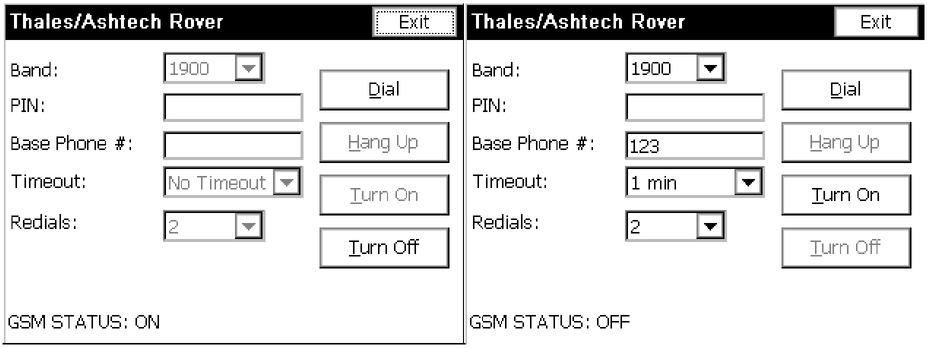


Figure 3-85

After the On button is selected, the receiver and GSM are initialized with the new GSM settings. Then the receiver shows the status on. After a moment, the status changes to ready.

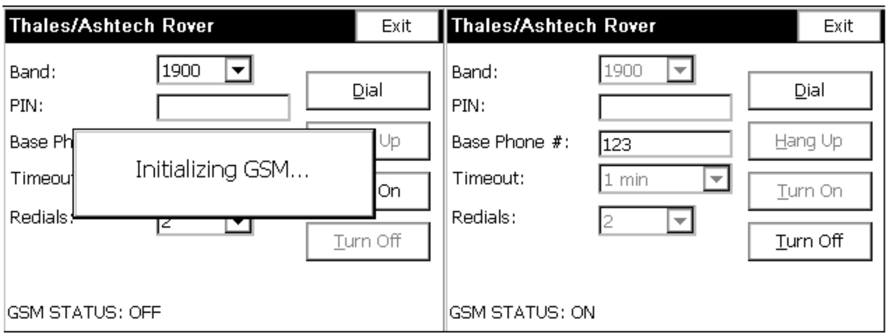


Figure 3-86

Click the Dial button to dial the base. Click the Hang Up button to hand up from a call currently in progress.

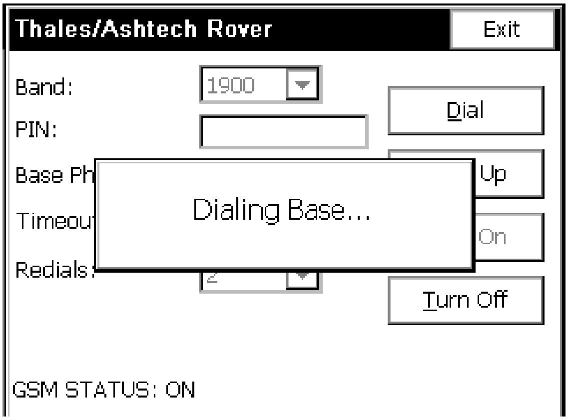


Figure 3-87

Note: If Bluetooth (wireless radio link from FAST Survey to the Receiver) is configured in Comm Setup, then on pressing OK and existing Configure Rover, the Bluetooth Manager screen will appear, allowing you to select the receiver name and ID and make other changes.

Leica Sytem 500 Rover Configuration

The Leica rover options are contained in a very simple dialog, as shown here:

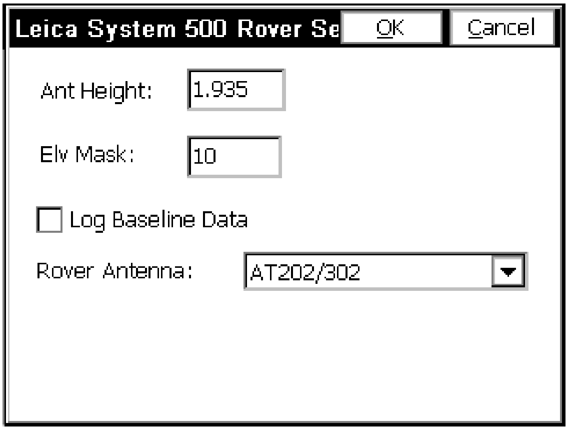


Figure 3-88

The Log Baseline Data option allows simultaneous logging of the baseline measurements as real-time work is conducted. The Log Baseline Data feature will tag point data in an ASCII file on the data collector every time a point is stored. This file can be found in the "Data" directory and will be called <job_name>_ski.asc, where <job_name> is the current job. This file, often referred to as a "vector" file, can be transferred to the PC and brought into Leica's Ski Pro software. No file is collected at the base as the base station data is stored in the rover file. Rover antenna types are identical to those outlined in Configure Base.

Navcom Rover Configuration

Note: You must connect to the Navcom receiver to continue to either the Configure Base or Configure Rover dialogs.

If the Messaging tab is selected, the following screen options appear:

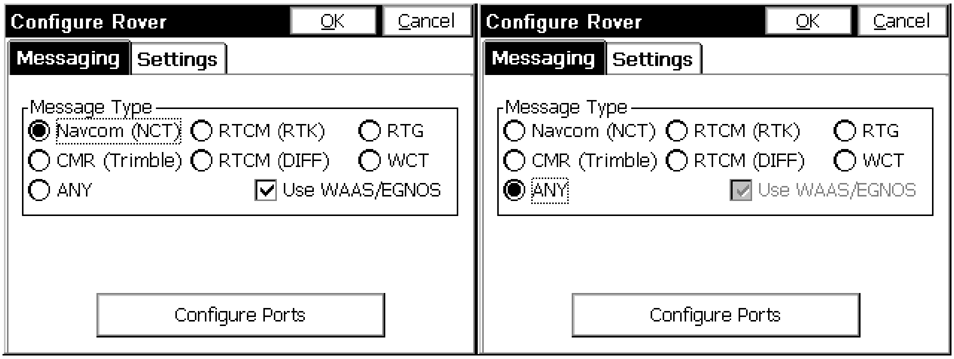


Figure 3-89

- **Message Type:** Your GPS receiver supports seven correction types: NCT (Navcom native format), CMR (Trimble's format), RTCM RTK, and RTCM DIFF require access to or setup of a local base station to broadcast corrections. RTG and WCT are Starfire Satellite corrections, which are only accessible if your receiver is a Starfire model, and you have a subscription (your subscription can be enabled from Receiver Utilities). You may also enable WAAS here for increased accuracy, but this feature will only activate when no other corrections are available. If any is selected, the receiver will look for corrections in the following order of precedence: NCT, RTG, WCT, RTCM DIFF, WAAS. This option will ignore CMR and RTCM RTK corrections.

The Configure Ports dialog is identical to that discussed in the section on Configure Base.

If the Settings tab is selected, the following screen options appear:

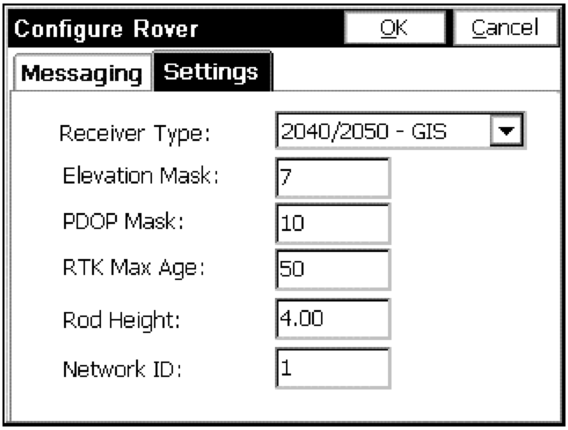


Figure 3-90

- **Receiver Type**: If you're using a Starfire receiver (models 2040 and 2050), set this option as shown above. If you're using receiver 3010/3020, set the receiver type to these models. Unlike the 3010/3020, Starfire receivers are capable of receiving Starfire RTG and WCT subscription-based corrections. On the other hand, the 3010/3020 has built-in radios, allowing for easy base-rover set up without the use of external radios.
- **Elevation Mask**: You can configure your GPS receiver to ignore satellites that are low on the horizon. This value is an angle from 0 to 90. At 0, all satellites may be used. At 90, no satellites may be used. The factory default value is 7 degrees.
- **PDOP Mask**: You can configure your GPS receiver to only report positions when the PDOP is below a certain value. This value can range from 0.0 to 25.5. The factory default is 10.
- **RTK Max Age**: You can configure your rover to remain in lock for a specified amount of time after it loses communication with the base. The factory default is 300 seconds, but to ensure accurate data collection, it is recommended that you set this value to 30 seconds or less.

- **Rod Height:** Enter the height of your GPS antenna above the ground if you wish the value calculated to be based on ground height.
- **Network ID**: When using the internal radios, your base and rover must be set to the same network ID. In scenarios where multiple bases are present, use these numbers to ensure that your rover gets its corrections from the intended base.

NMEA GPS Rover Configuration

Many receivers will output a NMEA string of information. FAST Survey can work with these receivers. While there is no Configure Base option for NMEA GPS, there are options for the rover, as shown below:

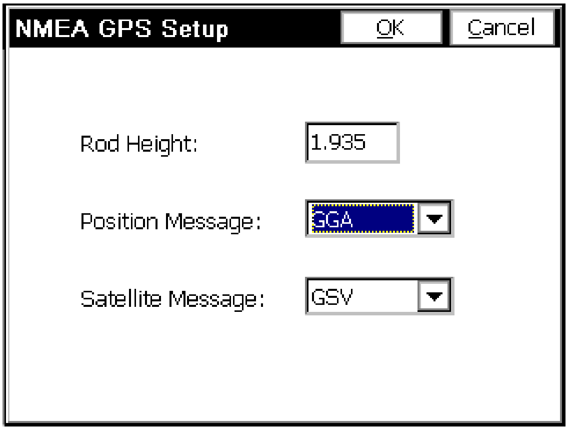


Figure 3-91

The Position Message options include GGA, GLL, GNS, GGK, GGQ and GGK PT. There are two Satellite Message options: GSV or GSA. Garmin HVS and Garmin LVS, Magellan, the original Leica MK31 marine antenna, all report out a NMEA string. Some NMEA receivers work stand-alone and have 50-meter accuracy. Other NMEA receivers will pick up corrections from stationary sources (Garmin from WAAS, MK31 from Corps of Engineers Beacons) and obtain accuracies of 1 to 10 meters.

NovAtel, and Sokkia Radian/GSR2600 Rover Configuration

The NovAtel and Sokkia configuration for the rover is virtually identical to the configuration for the base. Receiver types include

OEM3 and OEM4 (which is available in a "board" form). The one difference, seen below, concerns Dynamics. If Dynamics are set to Kinematic, a fix can be more easily obtained, versus the Static mode, which sets higher standards for obtaining a fix, along with more accurate rms values.

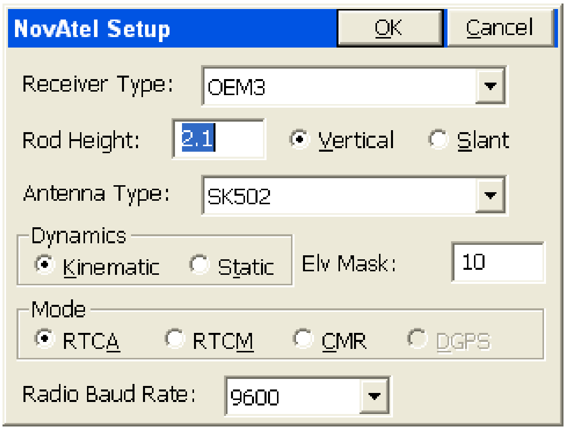


Figure 3-92

Radian IS Rover Configuration

The Radian IS Rover configuration screen is shown below.

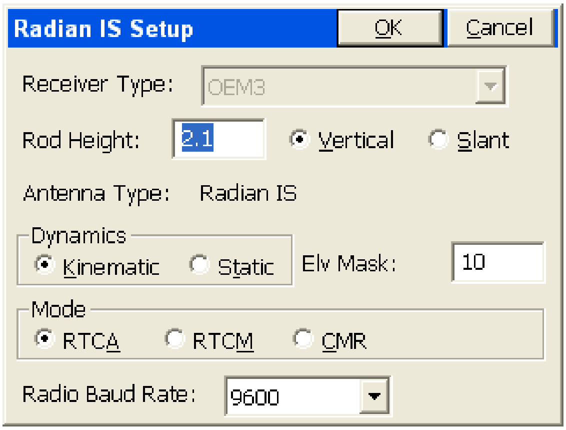


Figure 3-93

Sokkia Axis/Axis 3 Rover Configuration

The Sokkia Axis and Axis 3 GPS receivers are used primarily for GIS and lower-accuracy data collection. They pick up a variety of fixed sources for correction, including Corps of Engineers Beacons, WAAS, the OmniStar satellite and RTCM. Position Message options are GGA, GLL, GNS, GGK, GGQ and GGK PT. Satellite Messages are GSA and GSV. The options are shown in Figure 3-94:

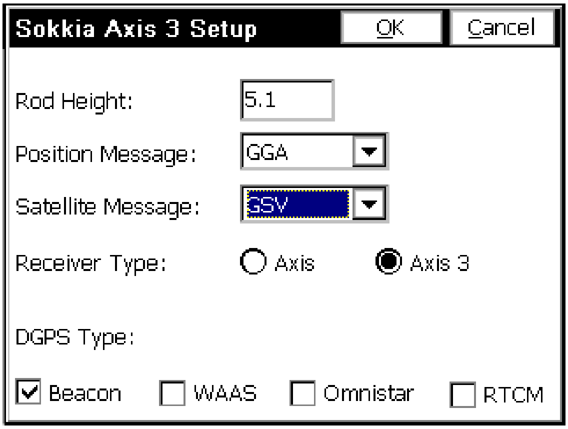


Figure 3-94

Topcon GPS+ Rover Configuration

Many special options are available for the Topcon GPS+ rover, as seen below:

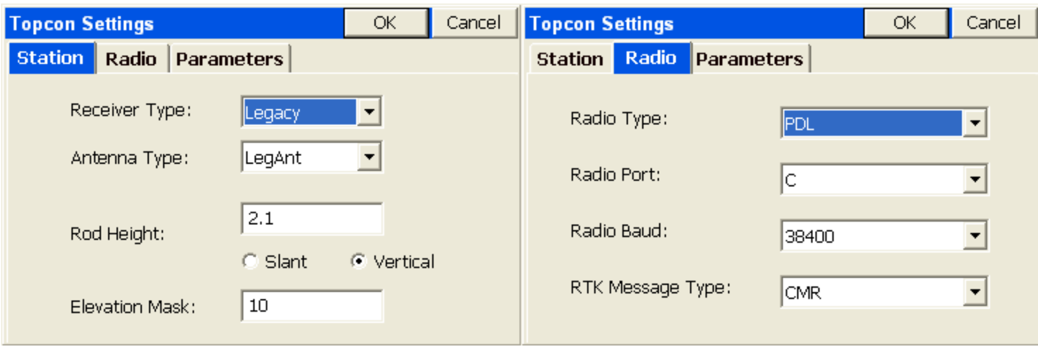


Figure 3-95

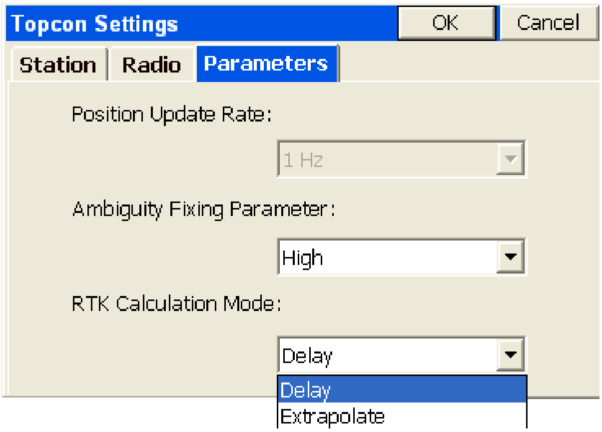


Figure 3-96

The antenna types include the same list found in Configure Base. Position update rate can be set to 1 Hz (1 per second), 5 Hz (5 per second) or 10 Hz. The Ambiguity Fixing Parameter is best set to Medium, but can be set to Low in difficult environments (trees) or high for high-precision work. The RTK message types are identical to those described in Configure Base. The rover message type must match the base message type. The RTK Calculation Mode is default Extrapolate (not wait for next calculation but will extrapolate), but can be set to Delay (wait for next calculation, slightly higher accuracy, slightly slower). It is recommended, in general, that Extrapolate be used for topo work and that Delay be used for control or stakeout. Delay only works at 1 hertz and will only report "Fixed" if each epoch from the base is being received for corrections. Extrapolate will work at 1, 5 or 10 hertz and will continue to report "Fixed" for up to 3 missing epochs from the base—useful in cases where radio interference briefly interrupts the signal.

Note: Satellite constellations can vary through the day, as satellites disappear and others reappear. The algorithms associated with GPS receivers begin by first "acquiring satellites" and then when sufficient satellites are acquired, the routines "resolve ambiguities", "fix" or "lock", and then calculate Latitudes and Longitudes. If satellites disappear and the constellations change abruptly, the calculations may briefly be based on "former constellations" and lead to slight discrepancies in x,y,z position. This can be avoided by occasionally tipping the rover antenna, forcing it lose lock and to "re-acquire" the current satellite constellation, and resolve ambiguities and fix using a fresh calculation. "Checking in" to benchmarks and known points occasionally is also a recommended practice in GPS.

Trimble GPS General Rover Configuration

Selections are identical to those described for the base configuration. Receiver types include 5700/5800, 4800 and other. The Trimble 5800 is often used as a rover in conjunction with the Trimble 5700 base. The Trimble 5800 typically is set to Data Port 1 and Radio Port 1, as shown in Figure 3-97.

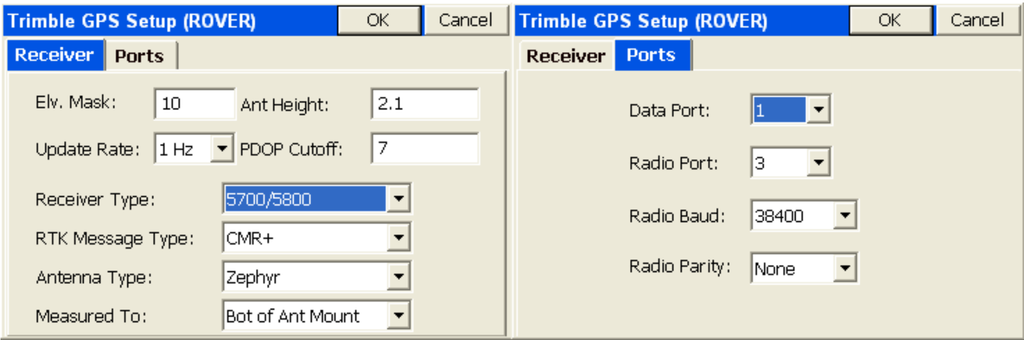


Figure 3-97

The Trimble 5800 typically uses the Zephyr antenna mounted on a 2 meter pole. When OK is pressed, a sound occurs confirming connection to the rover has been established. If for any reason the rover connection is lost, and commands such as Monitor or Store Points indicate "No Response", the first step should be to go to Configure Rover, verify settings, and press OK to re-establish communication. After that, battery status or radio connection should be examined.

Trimble PathFinder Rover Configuration

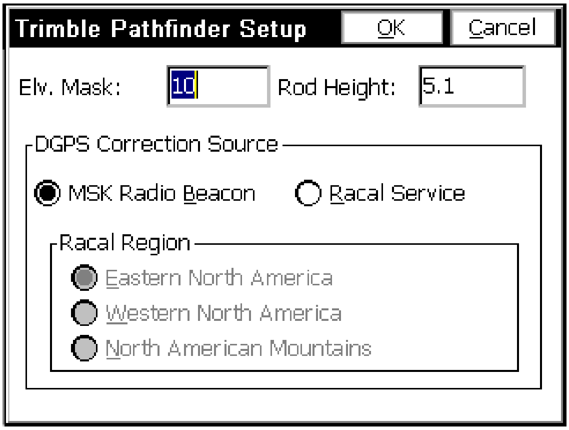


Figure 3-98

By using the MSK Radio Beacon or Racal Satellite for corrections, the Trimble PathFinder can obtain horizontal accuracies of 0.3 to 1 meter and vertical accuracies of 1 to 2 meters. This is ideal for GIS type work, locating utilities, residential locations for 911 service, etc.

Receiver Utilities

Function

The primary function of Receiver Utilities is to reset and/or troubleshoot the GPS receiver. There are features for changing radio channels, message strings, radio port protocols, radio type and other such options. Features vary according to GPS receiver. They are analyzed below in alphabetical order.

Note: Receiver Utilities covers receiver communication, and one of the increasing popular methods of communication is by cell phone. Cell phone communication between base and rover enables longer distance communication and takes 3 forms: (1) Multiple Rovers communicating with public access base receivers transmitting corrections (very popular in Europe), (2) Base Cell Phone to Single Rover Cell Phone and (3) Base Cell Phones transmitting to Multiple Rover Cell Phones. Individual companies can set up base to single rover cell phone linkage, but can also configure their own base transmitter capable of transmitting to multiple rovers.

Thales/Ashtech

The Ashtech Receiver Utilities screen has the following options:

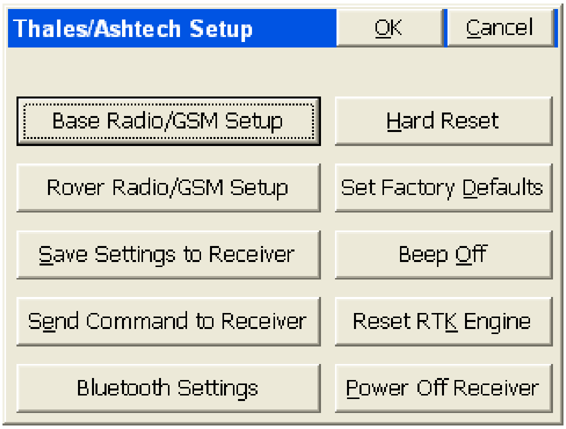


Figure 3-99

- **Base and Rover Radio/GSM Setup:** The Base and Rover Radio/GSM setup options will read the receiver, display the current radio channel, and allow the user to change to another channel. This feature is available for Pacific Crest PDL and RFM Series radios and Ashtech internal radios. Be sure that you have the right Radio Port set under the Configure Rover or Configure Base "Ports" tab. For GSM, see discussions under Configure Rover. The Base and Rover radio buttons work similarly. It is important for the user to choose the right button (base radio setup for base receiver and rover radio setup for rover receiver) to ensure that the software will try to connect to the radio on the correct port.

Thales/Ashtech Radio Setup – PDL

Select the appropriate button (from above). The following screen will appear:

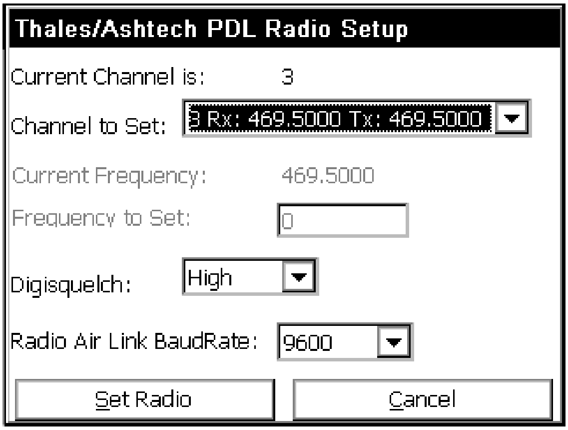


Figure 3-100

If the radio is an American PDL radio, it will appear as above. The user can change the channel, the digisquelch (sensitivity), and the over air radio link baud rate. If it is a European radio, channels are not available. Instead, the user will be able to set the frequency, the digisquelch, and the over air radio link baud rate. The digisquelch is best high on rovers and low on bases. To set changes, click on the Set Radio button and the following screen appears:

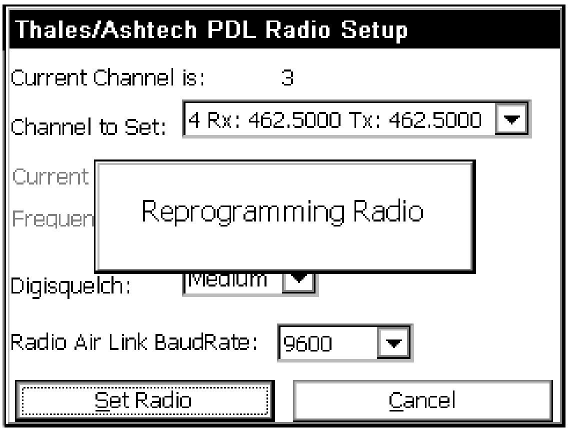


Figure 3-101

Thales/Ashtech Radio Setup – Thales UHF

Select the appropriate button (see above). The following screen will appear:

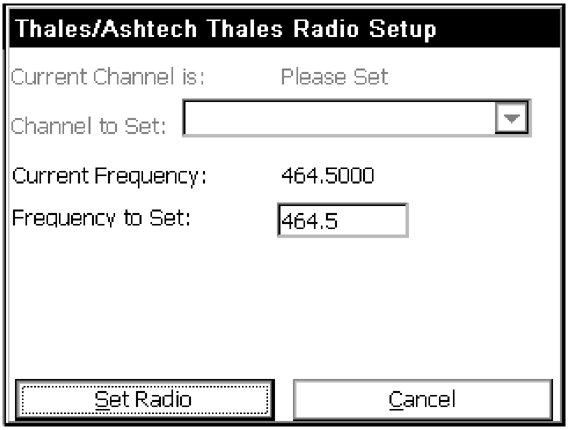


Figure 3-102

Change the frequency to the desired frequency and click Set Radio. The following screen will appear.

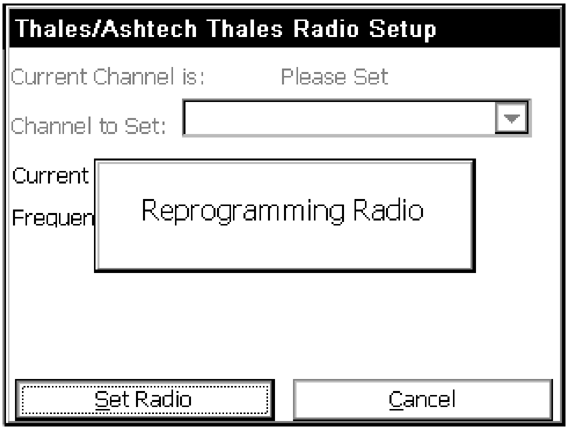


Figure 3-103

Thales/Ashtech Radio Setup – Cable

No configuration options are available when the software is configured to cable.

Thales/Ashtech Radio Setup – Older Receivers

Currently, the only radio option available for non-ZMAX Thales/Ashtech receivers is a PDL radio. The Base/Rover radio setup options will assume the radio is a PDL radio on these receivers, and try to configure them accordingly. All the same settings (channel, digisquelch, over air link rate) should still be available, however.

- **Hard Reset:** Shuts down the receiver and brings it up again with default settings. Resets all port baud rates to 9600 and resets the internal memory.
- **Set Factory Defaults:** Resets the receiver and changes all parameters to the factory defaults. It is useful in troubleshooting problems.
- **Save Settings to Receiver:** Use this command is issued as part of the Configure Base and Configure Rover operations. However, you can run this command at any time as an extra “confirmation” of your settings changes (including settings changes within Receiver Utilities). This sends the $PASHS,SAV,Y command to the receiver.
- **Beep Off:** This disables the Beep sound that emanates from the Receiver when it is turned on.
- **Send Command to Receiver:** You can send what are known as “pash” commands, internal Thales/Ashtech codes, to the receiver. This should be done only in consultation with your Thales dealer.
- **Reset RTK Engine:** This resets the carrier phase ambiguities. This is a useful command if you are having difficulty obtaining lock and want to start the process of fixing over again. Receiver settings are retained (so you can think of it as a “soft reset”).
- **Bluetooth Settings:** The Bluetooth settings in FAST Survey’s Bluetooth Manager (discussed in Comm Setup) do not actually change anything in the receiver itself. In order to make changes to the receiver’s internal Bluetooth settings, it is necessary to go into Receiver Utilities and click on Bluetooth Settings.

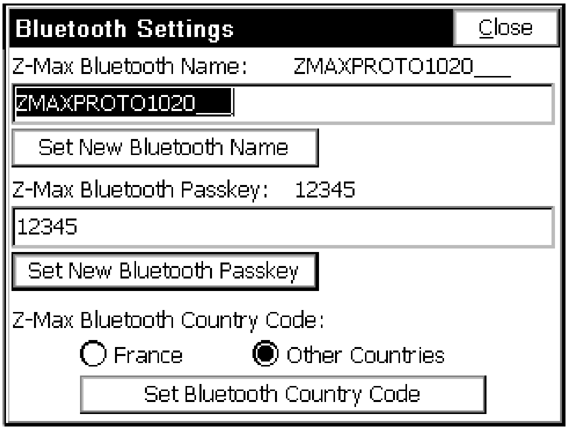


Figure 3-104

In this dialog, the user can change the Bluetooth receiver name (Receiver ID in Bluetooth Manager), the Bluetooth passkey (PIN in Bluetooth Manager), or the country code (currently the only choices are France and other countries because France has unique Bluetooth specifications).

To change the name, change it in the appropriate text field and click Set New Bluetooth Name. A message confirming success will appear.

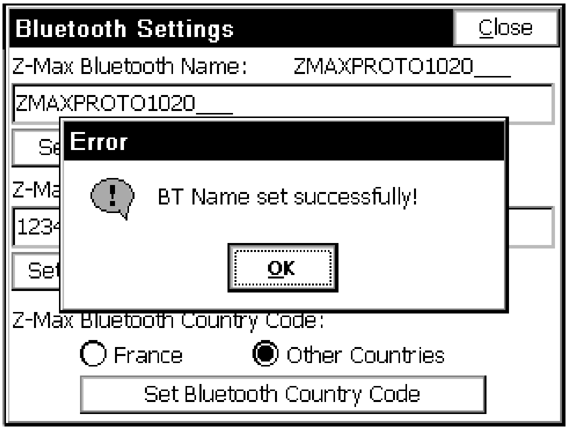


Figure 3-105

To change the passkey, change it in the appropriate text field and click Set New Bluetooth Passkey. A similar message confirming success will appear. To change the country code, click the appropriate radio button for the country and click Set Bluetooth Country Code. A similar message confirming success will appear.

- **Power Off Receiver:** Sends a command to power off the receiver.

Leica System 500

The Leica 500 receivers (which include the ruggedized 500 as well as the 530) offer the following receiver utilities:

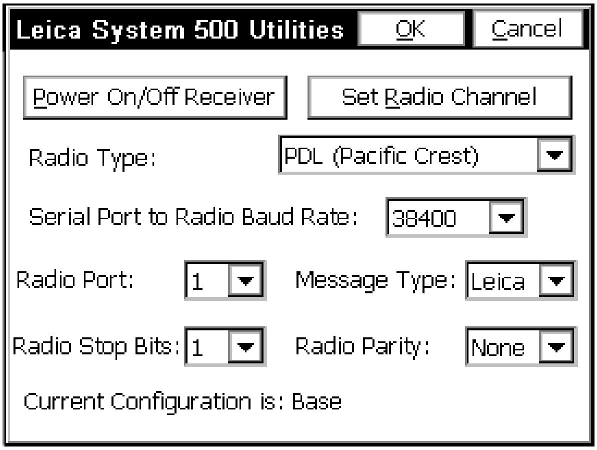


Figure 3-106

If FAST Survey is used in conjuction with the Red Controller from Leica, a serial port to radio baud rate of 38400 is often pre-set. FAST Survey should be set to conform to that baud rate, as shown above. The Power On/Off Receiver function simply turns on or turns off the receiver, depending on its current status. The Set Radio Channel option allows you to choose from up to 16 channels. Radio types include RFM96W (Pacific Crest), PDL (Pacific Crest), Motorola Cell Phone and 3COM Faxmodem, as well as User Defined Modem. Message types include Leica Proprietary (Leica), RTCM and CMR. A useful feature of the Receiver Utilities is to verify the status of the receiver as either a Base or a Rover (bottom status line).

Navcom

The Navcom receiver utilities include the following options:

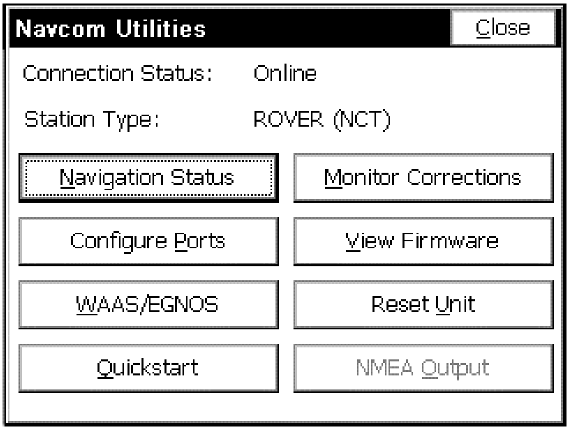


Figure 3-107

- **Navigation Status**: This page contains much of the same information as the Monitor GPS page, but has more specific information on the type of autonomous or locked navigation the receiver is in, along with information on any navigational errors that might be occurring.

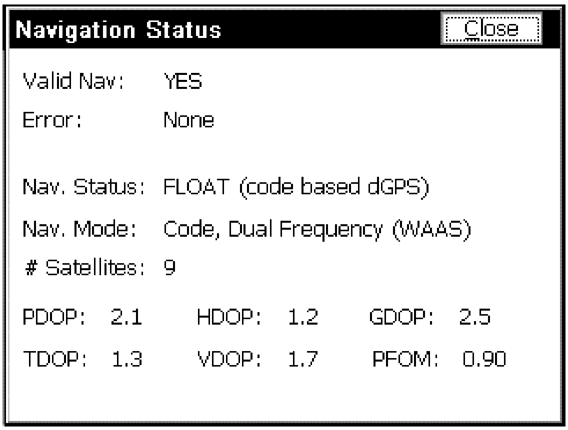


Figure 3-108

- **Monitor Corrections:** Use this page to find out how recently the last base corrections were received.
- **Configure Ports:** Use this page to change your control and RTK data port settings. This can also be done during base or rover configuration.

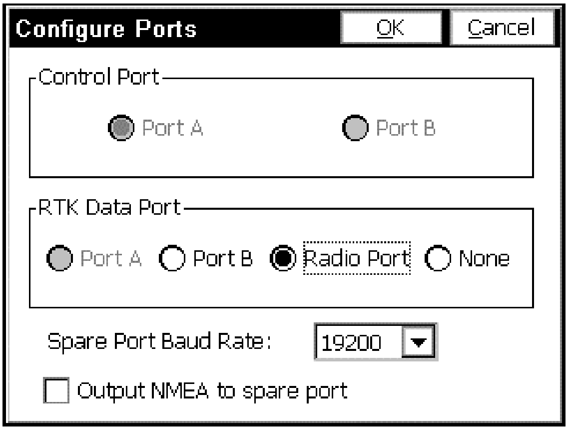


Figure 3-109

- **Control Port:** The port on your Navcom receiver to which your data collector is attached.
- **RTK Data Port:** The port through which your rover will receiver RTK corrections when a base is present. On receivers without an internal radio, the Radio Port option is not available.
- **Output NMEA to spare port**: When this option is checked, the receiver will output its position in NMEA format on whichever port is not being used as the control port.
- **Spare Port Baud Rate**: This determines the baud rate of the port that is not being used as the control port. This baud rate can apply either to NMEA output or to RTK input, but does not apply to the radio port.
- **View Firmware**: Use this tool to view your receiver type and the installed Navcom firmware version. Also, for Starfire Receivers (2040-2050) use this screen to input an activation code for the Starfire satellite correction service. This information can either be input manually, or the file LBM.dat containing the subscription info can be placed in the data directory. Press Activate to apply the activation code.

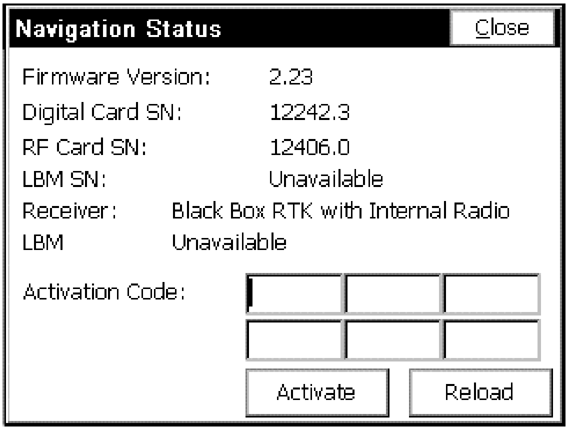


Figure 3-110

- **WAAS/EGNOS:** Use this tool to manual configure the channel on which to look for WAAS or EGNOS corrections. This may vary from region to region, but in the U.S., they can generally be set to channels 134 and 122.

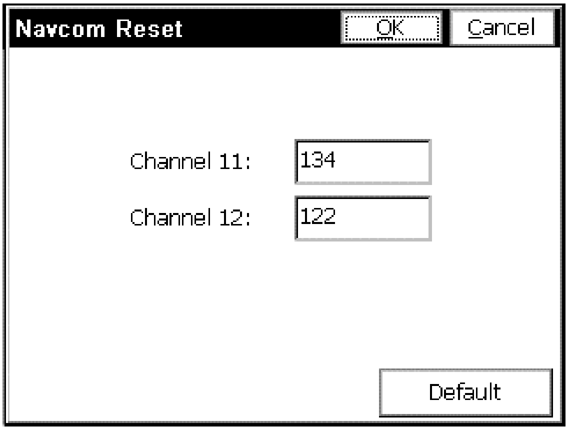


Figure 3-111

- **Reset Unit:** Use this tool to reset your receiver (soft reset or factory reset).
- **Quickstart (Starfire Only):** Starfire corrections often take some time to acquire high levels of accuracy. If you're returning to a previously surveyed area, you can save time by storing a known

position to a reference file, and then initializing the Starfire system with this position upon return to the site.

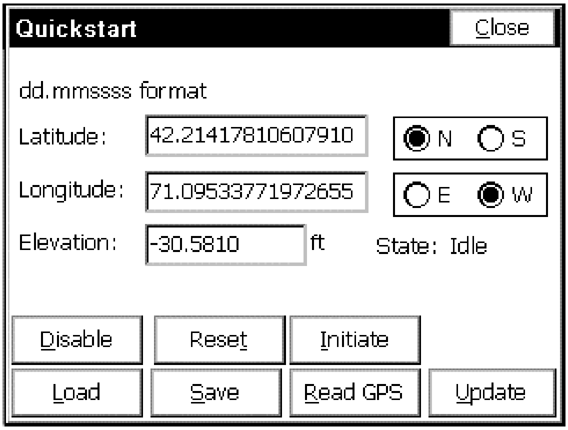


Figure 3-112

At the end of the first day, verify that you're receiving Dual-Frequency Starfire corrections (RTG or WCT) by entering the Navigation Status utility. Enter the Quickstart menu, and press **Read GPS**. Be sure to physically mark this position in some way so the exact position can be returned to later. When you have a GPS position, click **Save** to save the position to a reference file. When you return to the site, first ensure that you're receiving dual-frequency Starfire corrections, and that you're set up on the position marked the previous day. Then enter the Quickstart menu and choose **Load** to select the previously stored reference file. Press **Initiate** to input the loaded starting position to the receiver. To disable an input position, press **Disable**. Note that if the input position is inaccurate, using the Quickstart routine will slow down the processing of acquiring an accurate position.

- **NMEA Output:** Use this tool to select the desired combination of NMEA message types to be output on the NMEA output port. (The NMEA output port must also be enabled in Configure Ports).

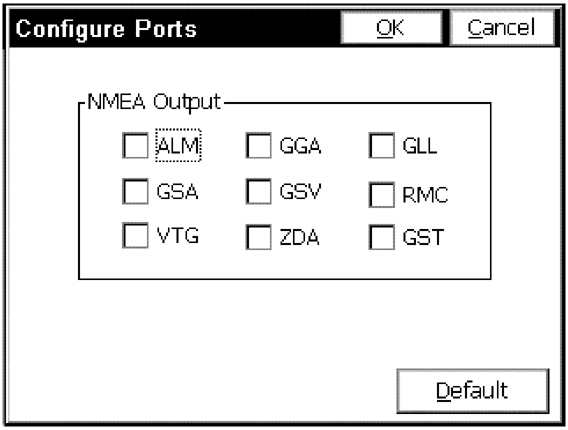


Figure 3-113

NovAtel, Sokkia Radian, Sokkia Radian IS and Sokkia GSR2600

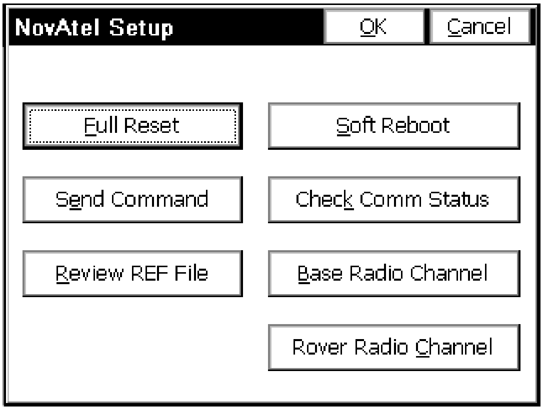


Figure 3-114

The NovAtel and Sokkia GPS options, like Ashtech, allow for hard and soft resets, permit sending commands to the receiver (consult your dealer) and allow the review and re-setting of base and rover radio channels for Pacific Crest PDL and RFM series radios. Additional options check the communication status (shows the quality of the message string). The Review REF File will display the reference file (which stores the GPS base position information), which also helps in troubleshooting.

Topcon GPS+

The utilities for Topcon appear below:

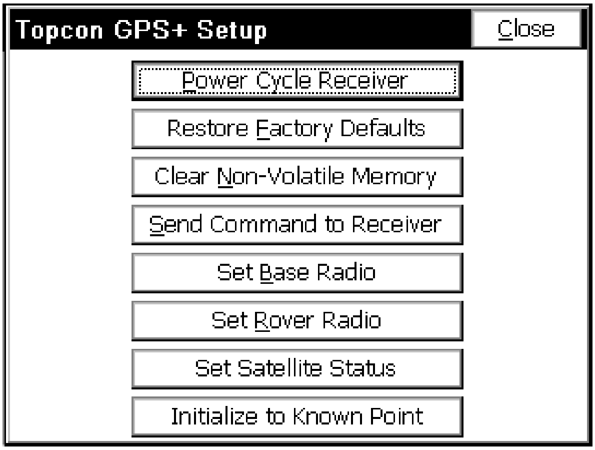


Figure 3-115

The Power Cycle Receiver is often used when the receiver is having difficulty fixing or has been hooked to another controller and needs to be re-set. The Restore Factory Defaults and Clear Non-Volatile Memory are additional re-setting options useful when troubleshooting. Be sure to confer with your dealer if using "Send Command to Receiver". The Topcon GPS has a special feature to Initialize to a Known Point which can greatly speed up "move ups" from one base position to another.

Trimble 4000

The basic troubleshooting options of the Trimble 4000 receiver are shown below:

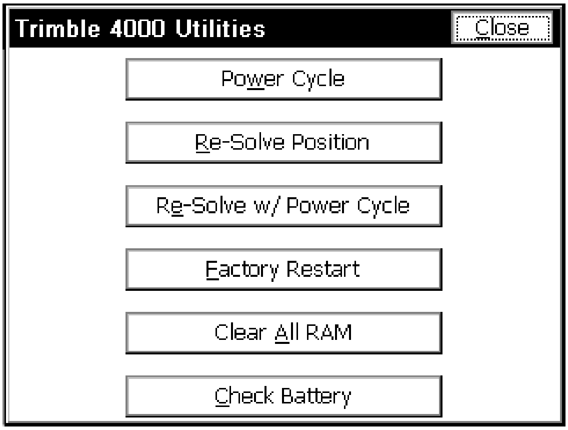


Figure 3-116

Trimble GPS General

Receiver Utilities will lead to 4 options:

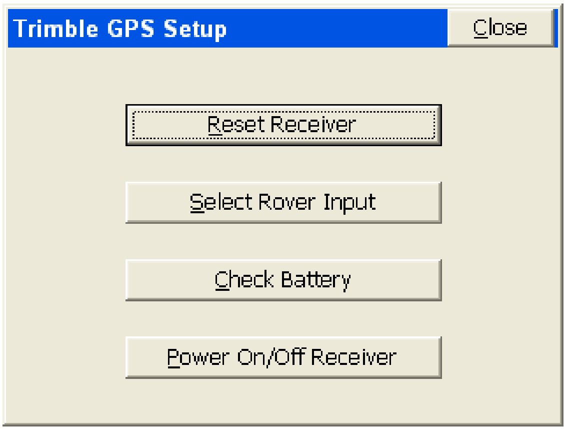


Figure 3-117

If you choose Select Rover Input, you can identify the "station id" of the base to avoid picking up inappropriate base corrections from the wrong base receiver, as shown in Figure 3-118:

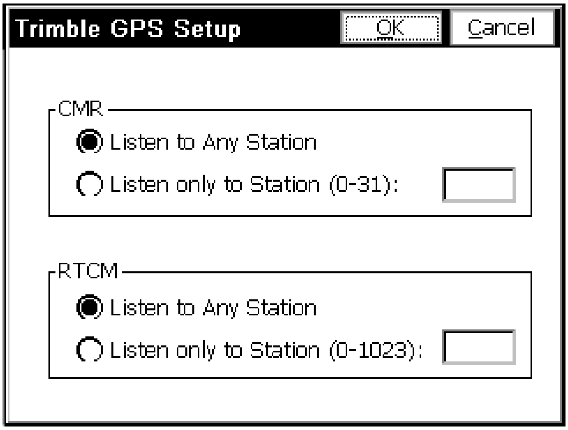


Figure 3-118

Localization

Function

This command allows you to align on a local coordinate system using the GPS rover receiver. The base receiver can be on a known point but may also be on an unknown point and located using Read from GPS within Configure Base. The Localization command is essentially "Rover-Based Localization". Further discussions on localization are found in Tutorial 2 near the back of the manual. The Localization screen is shown in Figure 3-119.

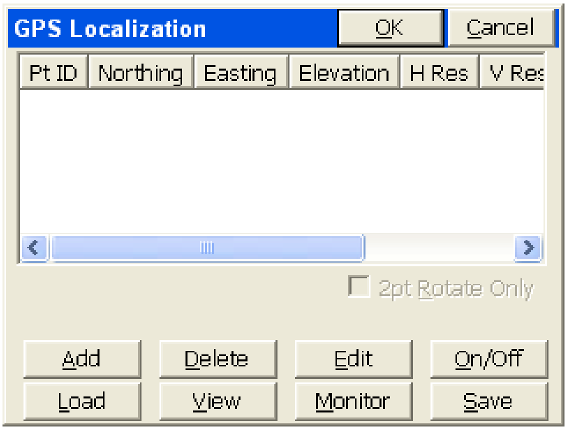


Figure 3-119

- **Add**: Enter the alignment or localization points by coordinate values or by entering a point number. If you choose the point number method, you can enter a point number, pick a point from the screen, or select them from the point list. If you choose the "from list" method, you can access points in the Control File, if a Control File is active (See Job Settings, Options). You can average as many readings as you like when you add points, and view the range and residuals.

  Once you click OK in the coordinate dialog, the user will have three options for establishing the GPS position for the named local point.
- **Read GPS:** This allows the user to collect measurements from the GPS receiver and average as many readings as they like. Once the readings are complete, the software will present a dialog that displays the range and residuals of the averaged readings.
- **Enter Latitude/Longitude:** This allows the user to enter in known geodetic coordinates for the local position. The elevation should be the ellipsoid elevation in the jobs current units if a geoid model is not applied. If a geoid model is applied, then the elevation should be the orthometric elevation in the current job units.
- **From Raw File:** This allows the user to use a point from the raw data file that has been previously collected via GPS.
- **Delete**: Allows you to delete the selected item from the list. Note that it is not necessary to delete a localization point if you simply want to avoid using it. You can turn "Off" both the horizontal and vertical component of the point, but keep it available for use later.

- **Edit**: Allows you to edit the selected item in the list. It will display the northing, easting and elevation of the localization point, which can be changed.
- **On/Off**: Allows you to remove the horizontal or vertical components of your localization points. This is a frequently used feature that enables use of 1 point for vertical control only (turn off its horizontal component) and other points for horizontal control (turn off their vertical, if appropriate). Points with no known elevation (0 for example), would obviously be used only for horizontal control, as shown in this example:

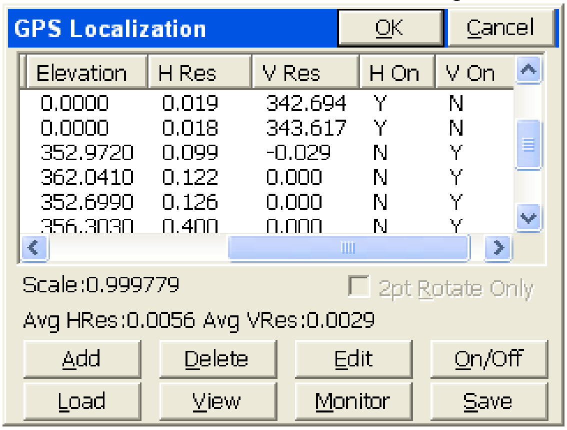


Figure 3-120

Note that in this example, the 2 upper points are used for horizontal control only and have good "horizontal residuals". The 4 lower points are used only for vertical control and have excellent "vertical residuals". It takes 3 horizontal control points, active "H On = Y" to get horizontal residual results, and 4 vertical control points, active "V On = Y" to get vertical residual results. You can on a trial basis remove different points from consideration both vertically and horizontally and watch the residuals of the remaining control points improve or degrade. In this way, if you have 4 or more total control points, you can determine the best combination to use as horizontal and vertical control.

- **Load**: This allows the user to load any localization file for modifying or for the purpose of associating it to the current job. Note that the OK button must be used if the intension is to associate the loaded file to the current job.

- **View**: Allows you to toggle between northing and easting values and latitude and longitude.
- **Monitor**: Goes to the standard Monitor screen. This is particularly useful to verify the quality of your satellite coverage and your fixed or float status. You always want the best possible fixed status when conducting a rover-based localization.
- **Save**: Allows you to save the control points in a file.
- **2 pt Rotate Only**: Allows you to use the second point in the localization file for direction but not for scaling. In this case, any scale factor set in Job Settings, Units, would be active.

Pressing OK will temporarily recall the current Localization as you work. If you change the Localization file, Save, then Cancel, the original Localization file will still be active. Pressing OK is what makes it active, and current. In this case, you would need to Load the new Localization file and press OK to make it active. You could choose to "add" localization points midway on a job, and not actually use them by pressing Save, then Cancel. Then when the job is complete, you could recall the Localization file with all the old and added localization points, go to Process Raw File, and re-calculate all surveying points according to the new Localization.

Discussion of Localization Techniques: If you do a base localization by entering Latitude and Longitude or known coordinates on the designated coordinate system, then you do not need to add localization points. A base localization would put you on grid north and grid scale and would work for any new job where you are not trying to "match" existing coordinates. However, any time you are working on a project that has existing coordinates, you will most likely need to do a Localization. Even if that existing job is supposedly on state plane, UTM or another known coordinate system, the project coordinates often fail to match grid scale and grid north exactly, requiring localization. When localizing, it is advisable to use at least 3 points for horizontal control and 4 points for vertical control, in order to get a measure of "residuals" or accuracy. The program will "best fit" a plane through all activated (H=On and/or V=On) control points. The residuals are how much each activated point is "off" of the plane surface. Because multiple elevation points may create a slightly "tilted" plane, some surveyors will verify that the vertical control has low residuals and is accurate using multiple vertical control points, then turn off all but one (V=Off) and use only the nearest vertical (elevation) as they progress through the job.

Note: The Scale Factor set in Job Settings, Units, will cause all surveyed coordinates to be multiplied by the scale factor. It is used, for example, to go "ground to grid" when surveying by total station. When configured to GPS, the scale factor in Job Settings, Units is "grid to ground", to better match total station scaling. So "Read GPS" might, for example, produce a scale factor greater than 1 (eg. 1.0011913) if taken at significant elevation, to "expand to ground" from sea level. However, if a non-zero scale factor is active, 1-point localizations (either base localizations or 1-point rover localizations) will be impacted by this scale factor, and all surveyed points will be scaled accordingly as measured from the single localization coordinate. GPS shots might then fail to match known control points. If your goal is to work on the specified state plane, UTM or other coordinate system set in the GPS tab of Job Settings, and you are planning to use a 1-point localization, then the scale factor should be set to 1. For GPS work in general, the scale factor should be set to 1, unless you are trying to match "ground" coordinates with a 1-point localization, where the coordinates are "true north" but not "true scale". In all other cases, matching ground coordinates with GPS is best accomplished with a multi-point rover-based localization, in which case the scale factor ghosts (it is fixed by the localization). The resulting "effective" scale factor will appear in the localization screen, such as the 0.999779 value shown above in Figure 3-120.

After a change in a localization file, any points measured in the field by GPS will be converted from Lat/Long to local coordinates by using the new localization file. For this reason, it is a good idea to re-convert older GPS measurements to the same, compatible coordinate system by going to Process Raw Data, Adjust, in the Cogo menu.

Monitor/Skyplot

Function

The Monitor/Skyplot command allows you to review local position and quality of data.

1 Under the Monitor tab you see values for northing, easting, and elevation. See Figure 3-121. Additionally, you can monitor horizontal and vertical RMS values, as well as PDOP, HDOP, and TDOP values. Some instruments refer to RS values as CEP and SEP.

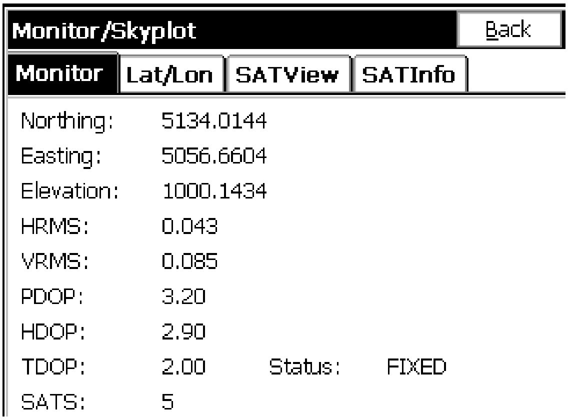


Figure 3-121

The Status is shown as either:

- **AUTONOMOUS**: No radio communication between base and rover.
- **FLOAT**: Communication has been established, but ambiguities have not been resolved.
- **FIXED**: Position has been resolved.

The number of satellites (SATS) is shown.

If a Thales/Ashtech receiver is configured to GSM, and is a rover, the Moitor tab will look like the figure below. When it is a base, the hang up and dial buttoms are not available.

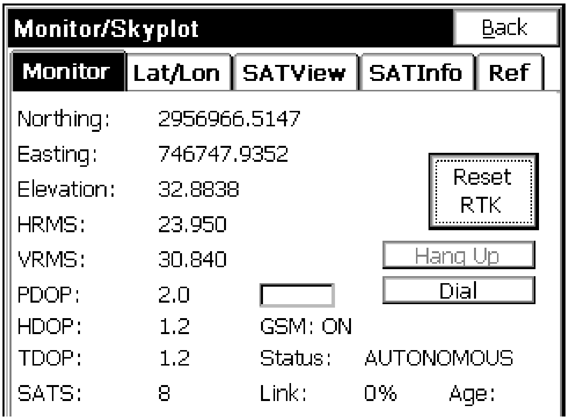


Figure 3-122

2 Under the Lat/Lon tab you see the current position given in latitude, longitude, and elevation. State plane northing (SP North) and easting (SP East) values are shown. See Figure 3-123:

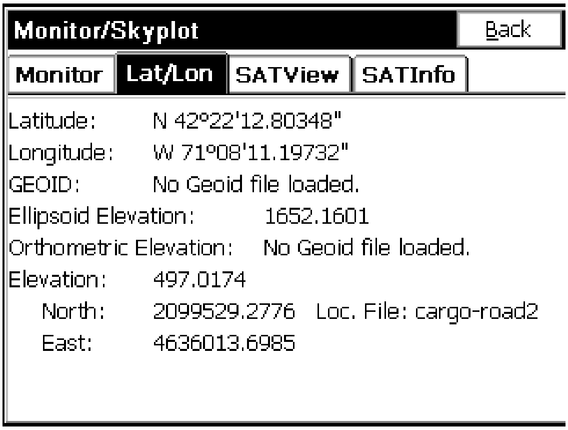


Figure 3-123

The Geoid file is loaded onto FAST Survey using Carlson X-Port. You first select the area of interest, then X-Port "carves out" the geoid for that area and downloads it to FAST Survey. You set the Geoid file to use in Job Settings, GPS tab. The Geoid should be used principally with 1-point localizations. Starting with a known position for the base (or using a 1-point rover localization and approximate base position), the program will add or deduct the geoidal separation from the computed Z value on all measurements, and will match more closely to geoid-based surface elevations. The Geoid can also be used with multiple-point rover localizations, since the added accuracy provided by the geoidal calculation can reduce vertical residuals. This is true, however, only if the points being matched had Z values that, themselves, considered the geoid. Since you will get a best-fit plane that minimizes vertical residuals with or without use of the geoid, it is often not used with rover-based localizations.

3 Under the SATView tab, the spatial orientation of the satellite constellation is shown. See Figure 3-124.

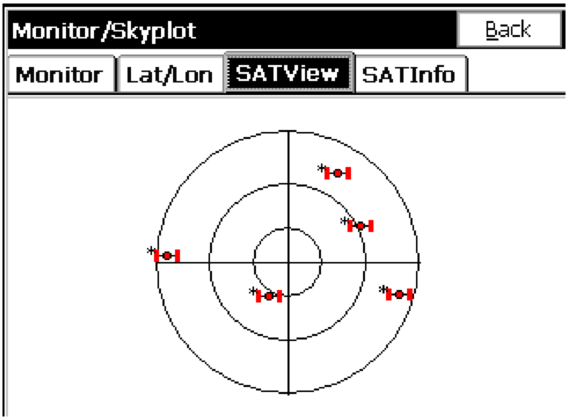


Figure 3-124

4 Under the SATInfo tab, the number designation (PRN) of each satellite is given along with the azimuth (azi) and the elevation (ELV) of the satellite above the horizon.

5 The Ref tab to the right of SAT Info appears with most GPS configurations (not with GPS Simulation).

The typical Ref tab screen is shown below:

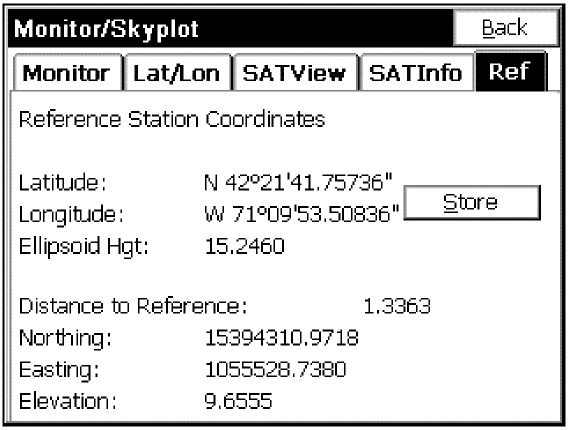


Figure 3-125

The Ref tab will show the base station information stored to the reference file, as created using Configure Base. The Thales GPS, for example, would also show the distance from rover to base. The base coordinates can also be stored by pressing the Store button.

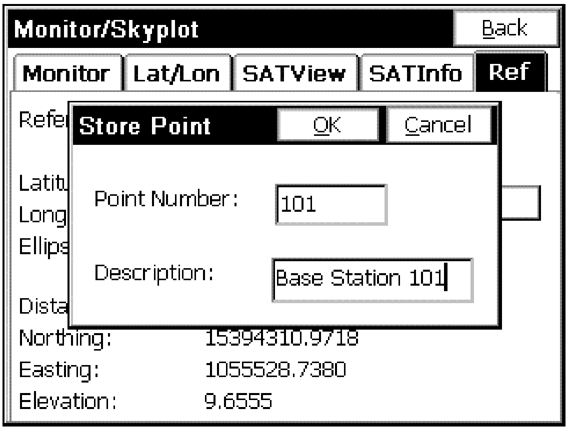


Figure 3-126

You simply enter a point number and description, and the precise base coordinates are stored in north, east and elevation form, according to the localization file settings. Then the base coordinate point can be used for total station work as a setup or backsight.

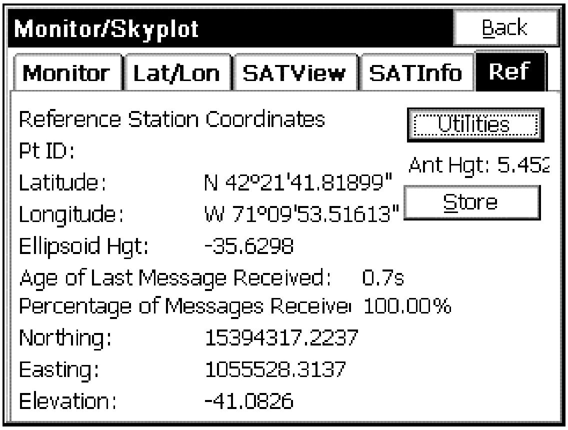


Figure 3-127

With Leica GPS (shown here), it also shows the status of the radio signal in the middle 2 lines. If the radio signal is interrupted, a "No Radio" message will appear. The Utilities button associated with the Leica GPS configuration takes you straight to the radio settings, including cell modem configuration.

Tolerances

Function

This command allows you to set operating tolerances. There are different settings depending on whether you are configured for GPS or Total Station use. Figure 3-128 show the Tolerances for Total Station dialog and Figure 3-129 shows the Tolerances for GPS dialog.

Total Station Configuration

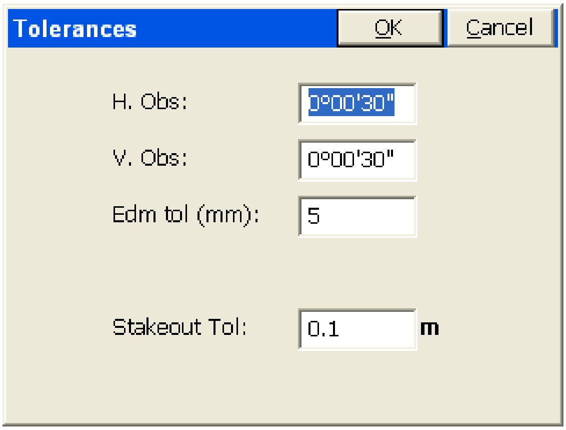


Figure 3-128

- **H. Obs**: This specifies the horizontal observation tolerance as an angle field. A tolerance of zero is not allowed.
- **V. Obs**: This specifies the vertical observation tolerance as an angle field. A tolerance of zero is not allowed.
- **Edm tol (mm)**: EDM fixed tolerance in millimeters specifies the EDM error that is independent of the length of the line measured
- **Stakeout Tol**: This specifies the maximum difference between the target location and actual staked point. When the staked point is beyond the tolerance, FAST Survey displays a warning dialog.The Stakeout Tolerance is systematically applied to all stakeout commands. The program will respond with a warning screen such as "Stakeout is beyond the Tolerance Setting. Do you wish to continue storing?" The angle and distance tolerances are applied to multiple distance measurements (when Configure Reading specifies multiple "Num Dist Readings") and when multiple angle measurements are taken in Set Collection.

GPS Configuration

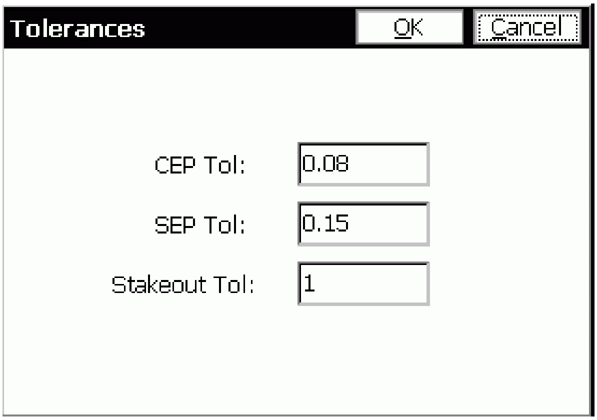


Figure 3-129

Note: CEP tolerance and SEP tolerance are only used by Novatel Radian and Radian IS. All others refer to it as HRMS and VRMS Tolerance.

- **CEP/HRMS Tol**: A measurement of accuracy defined by the radius of the circle containing 50 percent of the individual measurements being made, or the radius of the circle within which there is a 50 percent probability of being located.
- **SEP/VRMS Tol**: A measurement of accuracy defined by a sphere within which there is a 50 percent probability of locating a point or being located. SEP is the three-dimensional analogue of CEP.
- **Stakeout Tol**: This specifies the maximum difference between the target location and actual staked point. When the staked point is beyond the tolerance, FAST Survey displays a warning dialog.

Typical default values for these settings are shown in the dialogs above.

Comm Setup

Function

This command allows you to specify communication parameters for the data collector. Figure 3-130 shows the Communications Port Setup dialog. For certain equipment, a "Bluetooth" wireless serial connection is possible. The user can detect if there is any Bluetooth emulated serial COM port available on the CE device by using the "Set Port to Bluetooth" button. FAST Survey can use Bluetooth to communicate only with instruments that have Bluetooth incorporated on it. Also, the user can change the name and the password for the Bluetooth present on the instrument end by using the "Bluetooth Settings" button. The dialog shown below will allow the user to change the existing name and password for the Bluetooth on the remote device.

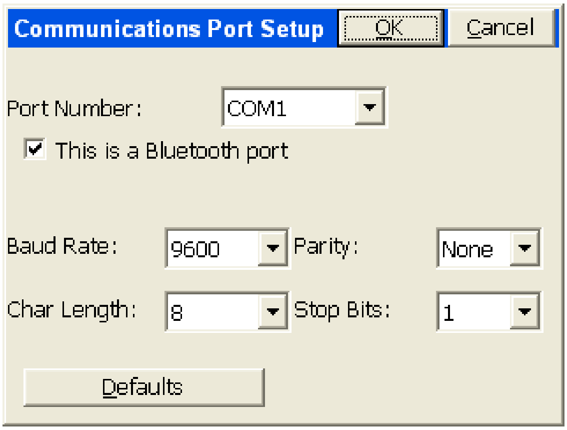


Figure 3-130

- **Port Number**: You must select the COM port to use.
- **Baud Rate**: You must select the baud rate for data transfer.
- **Parity**: You must select the parity setting.
- **Char**: You must select the character setting.
- **Stop Bits**: You must select the stop bits setting.

Clicking Defaults will utilize the standard default settings for the configured instrument. For some of the newer equipment, a "Bluetooth" wireless serial connection is possible. FAST Survey can use Bluetooth to communicate only with instruments that have Bluetooth incorporated on it.

Bluetooth Wireless

Bluetooth is automatically detected, leading to the Bluetooth screens below. The com port settings to use Bluetooth vary from unit to unit. For example, Com3 is typical for the Compaq Ipaq and Com5 is typical for the Topcon FC1000, though it may use any of Com 4, 5 or 6. On the Allegro, the Bluetooth port is typically Com 4, 5, 8 or 9. The Bluetooth serial com port settings can be found in the "My Bluetooth Device" menu selection.

Bluetooth connection is available, for example, with Thales ZMax.

For Thales/Ashtech, set the baud rate in Comms Setup to match the baud rate set for Port C on the ZMax receiver which is typically used for Bluetooth communication. For Topcon, set the baud rate in Comms Setup to match the baud rate for Port B on the Hiper receiver, which is typically used for Bluetooth.

If Bluetooth is available and the Bluetooth option is clicked on, when you OK the Comm Setup screen, the Bluetooth port will be searched for and if found, a confirmation screen is presented, as shown here:

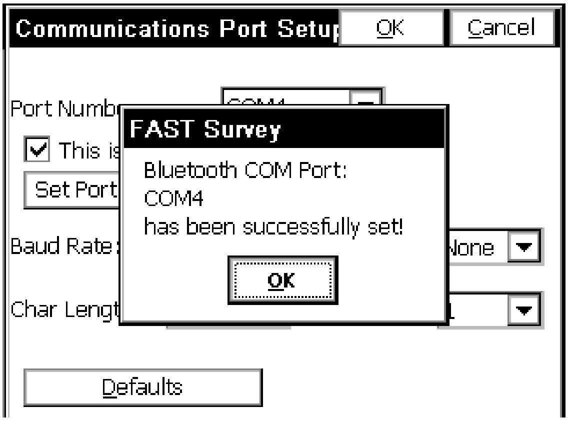


Figure 3-131

Then the program proceeds to the Bluetooth Manager screen. This screen gives you the option to choose which GPS receiver you would like to connect to via Bluetooth. If you click Cancel, no Bluetooth connection will be established. Select a receiver and click Connect.

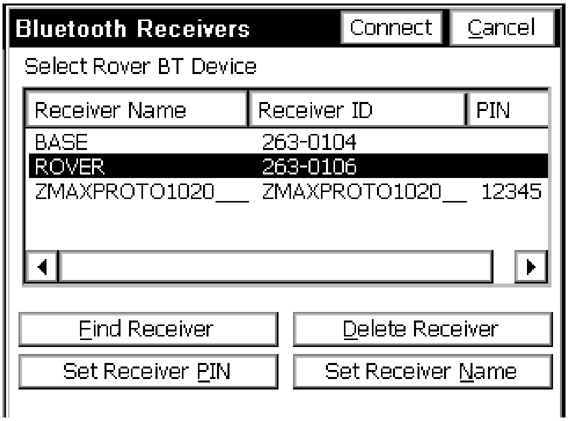


Figure 3-132

First time into this routine, no receivers will be listed. Select Find Receiver and you can add the connected receiver to the list. Find Receiver will "ghost" if bluetooth is not an active Bluetooth connection to a receiver. Find Receiver will only work on ARM processor devices, which includes the Allegro and Symbol 8100. Users with "non-ARM" devices (like the SH4 processor-based FC1000) will have to make their Bluetooth receiver configuration file manually (BTconfig.txt, in \Survstar\ directory), in the following format:

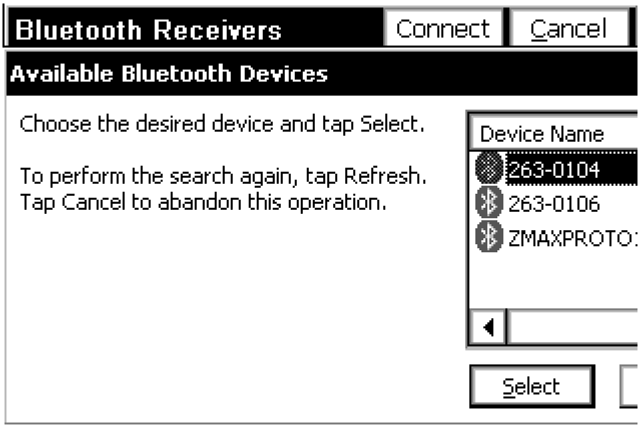
<receiver name>, <receiver id>, <bluetooth address>, <bluetooth pin>

<receiver name>, <receiver id>, <bluetooth address>, <bluetooth pin>

……etc.

When you click Find Receiver to add another receiver to the list, the following dialog pops up:

Figure 3-133



You can change the receiver PIN by clicking "Set Receiver PIN" and you can change the receiver name by clicking "Set Receiver Name" as shown below:

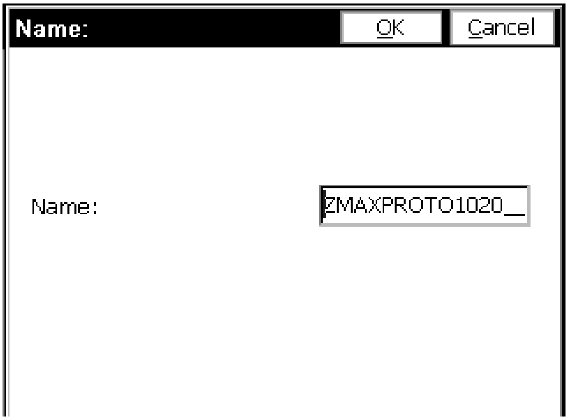


Figure 134

The Bluetooth manager will appear in many places: entry into the program, clicking OK from Comm Setup, Configure Base, and Configure Rover (it works the same from all of them). After making a successful connection, the software will let the user know. If the connection fails, there will be a warning, as shown below:

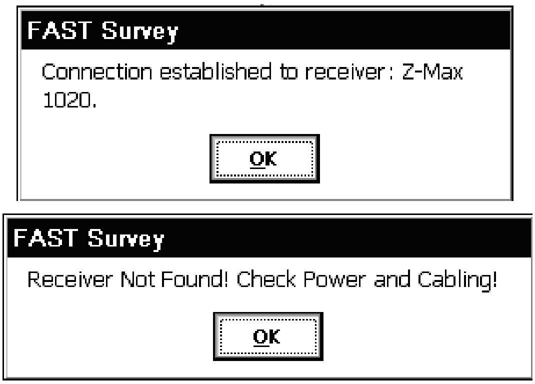


Figure 3-135

Trouble-shooting Notes: Be sure the GPS receiver is turned on before trying to connect and that you are within 30 feet of the receiver. If the user can't see the device from the Bluetooth Devices program it is not going to work in FAST Survey.

The Bluetooth manager works somewhat better with a passkey but it is not strictly necessary. Sometimes the Bluetooth registry settings don't work correctly with an empty passkey. A pass key is the name the Bluetooth driver uses for a password. This is always used on Thales/Ashtech and can be used on Topcon. It makes the Bluetooth connection more reliable.

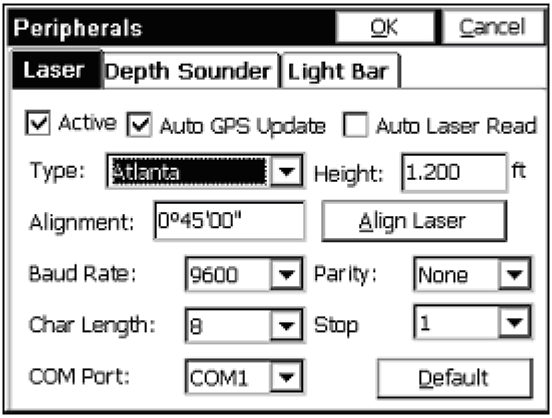
Peripherals

Function

A Peripheral is a device that must be used in tandem with a GPS receiver or a total station. Peripherals can all be configured from the Peripherals menu under the Equipment tab. Lasers, Light Bars, and Depth Sounders are all supported as peripherals. If a peripheral is not currently in use, it is strongly recommended that you deactivate it, so it does not slow down other operations.

Lasers

Currently supported lasers are **Laser Atlanta**, **Leica Disto**, **Laser Impulse IP200**, **Laser Impulse CR400**, and **Sokkia Contour**. If you have a different laser, you can contact Carlson Software to discuss adding support for it. With GPS enabled, a laser can be used to provide an offset from a GPS reading. For more information, see the **GPS Offset** section of the manual. With a robotic total station enabled, a laser can be used to automatically measure the rod height of each total station reading.



To activate a laser for use with GPS, follow these steps:

- Plug in your laser to any of your device's COM ports, make sure it is adequately charged, and turn it on.
- Enter the **Peripherals menu**, and select the **Laser** tab, as shown above.
- Check **Active**
- Select the **type** of laser you are using.
- Enter the **height** of your laser from the ground. This value will be added to the vertical offset returned by your laser. For accuracy, this value should be specified with respect to the same ground elevation that your GPS rod height was specified.
- Directions for aligning your laser will be given in a different section. For now, leave the **laser alignment** value set to 0.
- If you want GPS to be automatically updated between each laser read, enable **Auto GPS Update**. If you want the **Read Laser** button to automatically trigger the laser, enable **Auto Laser Read**.
- Set appropriate COM port settings. To load the default settings for the laser you specified, select the **Default** button. However, you will still need to set your **COM port** number manually.
- Click OK to save settings, or Cancel to revert back to yoru old settings.

Activating a laser for use with a Robotic Total Station follows a similar procedure, except to access the peripherals menu, you must enter the **Total Station Offset** routine from **SideShot/Traverse**, select the **Settings** tab, check **Read Target Height from Laser**, and click

Laser Settings. Attach the laser to the prism, pointing towards the ground. Every total station read will automatically trigger the laser, and the read value will be used as the rod height.

Using the Laser

- Once the laser has been properly set up, enter the **GPS Offset** method and press **Read Laser**.

Figure 3-136

- A progress window should pop up, indicating that FAST Survey is ready to read from the laser. Aim the laser and fire at a target point. Keep firing until your laser returns a valid reading, and the progress window disappears.
- To test whether your shot was successful, verify that the values on your screen correspond to the values on your laser's internal display. Note that not all lasers return azimuth and vertical offset data, in which case this information will have to be entered manually.

Aligning the Laser

This option is only relevant to lasers with internal. The purpose of this option is to allow you to compensate for any discrepancy between the laser's internal compass and the North determined by GPS. The alignment factor will be automatically added to all azimuth values returned by the laser. The alignment factor can either be entered manually, or calculated using the laser and GPS. To calculate this factor using the laser, follow these steps:

- If you don't already have two known points in your vicinity, use GPS to store two points within fifty feet of each other.
- From the **Laser** tab of the **Peripherals** window, select **Align Laser**.

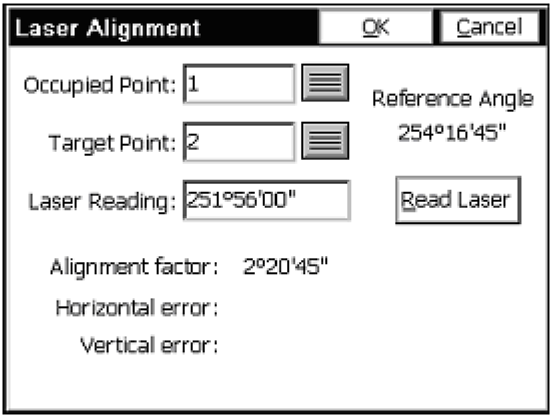


Figure 3-137

- Choose an **Occupied Point** from your point list, and prepare to fire your laser from that point.
- Choose a **Target Point** from your point list, and prepare to fire your laser at that point.
- Click **Read Laser**, and when the **Reading Laser** progress bar appears, fire your laser at the target point from your occupied point. An azimuth reading will appear in the **Laser Reading** box, and two values will be calculated: The **Reference Angle** is the azimuth of the vector from the occupied point to the target point. The **Alignment Factor** is the difference between the azimuth read by the laser and the **Reference Angle.**
- Press **OK**, and the **Alignment Factor** that was calculated will appear in the **Laser Alignment** box.
- Click **OK** again to save the new alignment settings.

Laser-Specific Configurations

If you're having trouble establishing communication with the laser, you may need to change certain settings on your laser's instrument panel. Here are laser-specific setup instructions for some of the lasers we support.

Laser Atlanta

Make sure your Laser Atlanta baud-rate and message formats agree with those you specified in FAST Survey. Also, make sure the laser format is set to "Laser Atlanta Original" (LA1KA). Consult your Laser Atlanta manual for instructions on how to do this.

Laser Impulse

Make sure your Laser Impulse baud-rate and message formats agree with those you specified in FAST Survey. Supported formats are IP200, and CR400. Consult your Laser Impulse manual for instructions on how to do this.

Leica Disto

Make sure your LeicaDisto's baud-rate agrees with those you specified in FAST Survey. Consult your Laser Impulse manual for instructions.

Sokkia Contour

Make sure your Sokkia Contour's baud-rate agrees with those specified in FAST Survey. Consult your Sokkia Contour manual for instructions.

Depth Sounders

Currently supported depth sounders are **Horizon**, **Hydrotrac**, **Innerspace**, and **Odom Digitrace**. If you have a different depth sounder, you can contact Thales Navigation to discuss adding support for it. You can use a depth sounder with GPS to map an underwater surface. When the depth sounder is enabled, FAST Survey will alternate between reading from GPS and reading from the depth sounder, so if you aren't using a depth sounder, you must be sure this feature has been deactivated, or else you may experience slow GPS readings. When active, incoming Depth readings are viewable in **Monitor/Skyplot**. Elevation values in the **Store Point** screen are automatically depth adjusted.

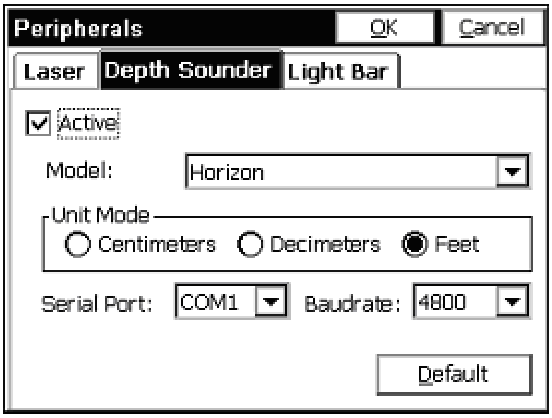


Figure 3-138

To activate the Depth Sounder, follow these steps:

- Plug in your **Depth Sounder** to any of your device's unused COM ports and turn it on.
- Enter the **Peripherals menu**, and select the **Depth Sounder** tab, as shown above.
- Check **Active**
- Select the **Type** of Depth Sounder you are using.
- If the **Unit Mode** radios are not grayed, you will have to set the units to correspond to those output by the depth sounder.
- Specify the **Port** the Depth Sounder is plugged in to.

Light Bars

Currently supported light bars are **Mikrofyn** and **Apache**. If you have a different light bar, you can contact Carlson Software to discuss adding support for it. Light bars can be used with either GPS or total stations to provide prominently displayed direction arrows, when staking out a polyline/centerline, or in the **Elevation Difference** routine, when trying to cut or fill toward a target elevation.

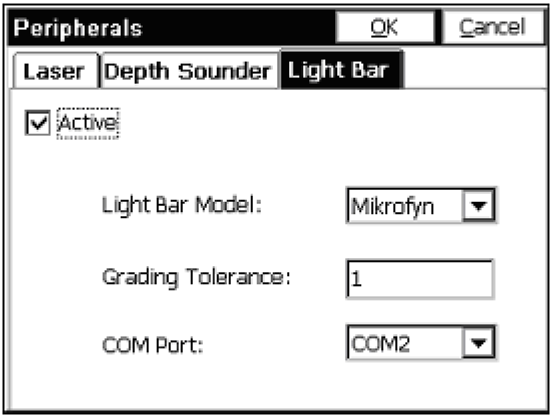


Figure 3-139

To activate the light bar, follow these steps:

- Plug in the lightbar to any of your device's unused COM ports and turn it on.
- Enter the **Peripherals menu**, and select the **Light Bar** tab, as shown above.
- Check **Active**
- Select the **Type** of light bar you are using.
- Set the **Grading Tolerance** to the maximum permissable deviation from the target path or elevation.
- Specify the **Port** the Light Bar is plugged in to.

Instrument Recall

The instrument recall feature allows user to store and recall all instrument related settings as a user named configuration.

Configure all of the settings as desired and select the instrument icon located at the top of the main menu. The items that are saved are as follows:

- Instrument Settings
- Communication Settings
- Configure Reading Settings
- Stakeout Reference Settings

The instrument icon will display the dialog shown below.

- **Close:** This button will dismiss the instrument recall dialog without affecting settings.

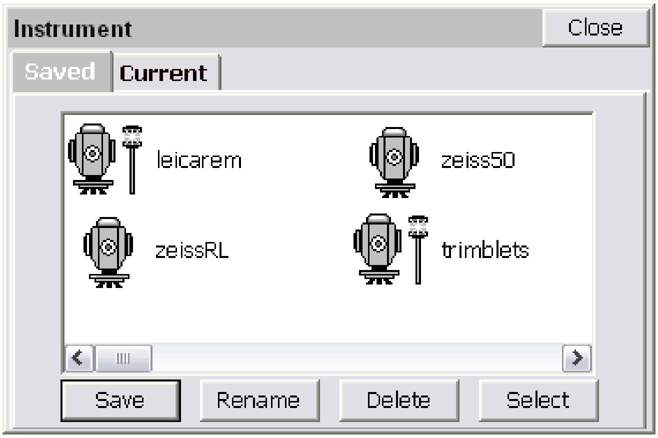


Figure 3-140

Saved

The Saved tab displays all of the icons available for switching to various instrument configurations and has the following options:

- **Save:** This button will save the current settings and present the dialog shown below. This dialog allows the user to enter the name of new icon that will be created to represent the current instrument settings.
- **Rename:** This button will allow the user to rename the selected icon via the same dialog shown below.

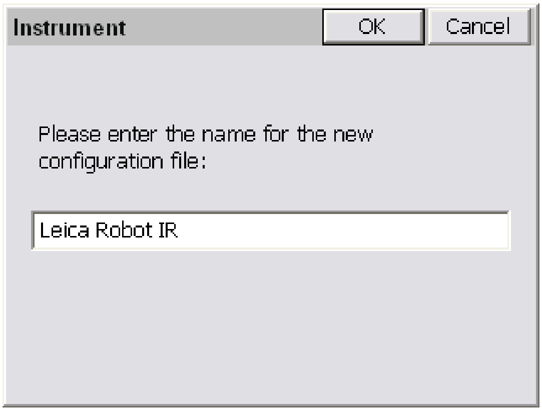


Figure 3-141

- **Delete:** This button will remove the selected icon.
- **Select:** This button will switch all settings as defined by the selected icon.

Current

The Current tab displays the current instrument selection.

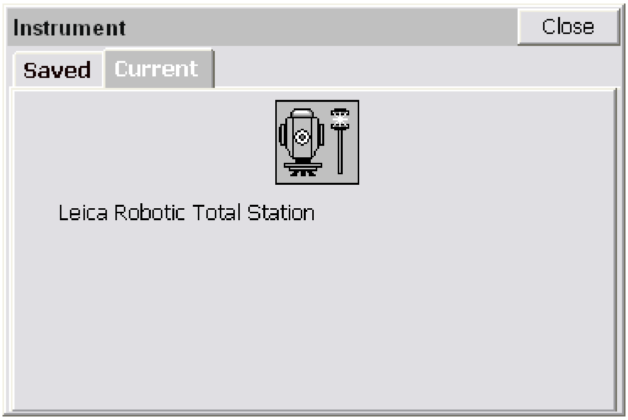


Figure 3-142

About FAST Survey

Function

This command allows you to view information about FAST Survey and change your registration.

4

Surv Menu

This chapter describes the commands found in the Surv menu.

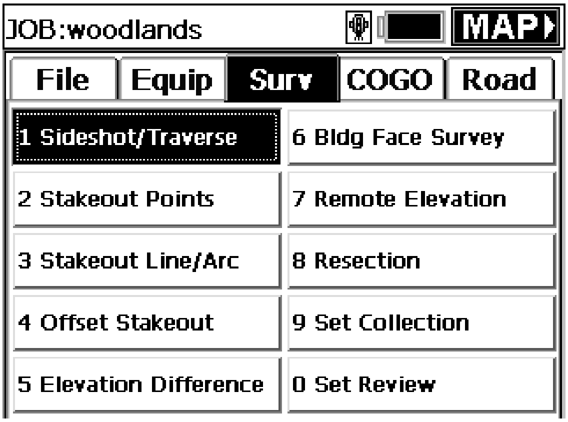


Figure 44-1

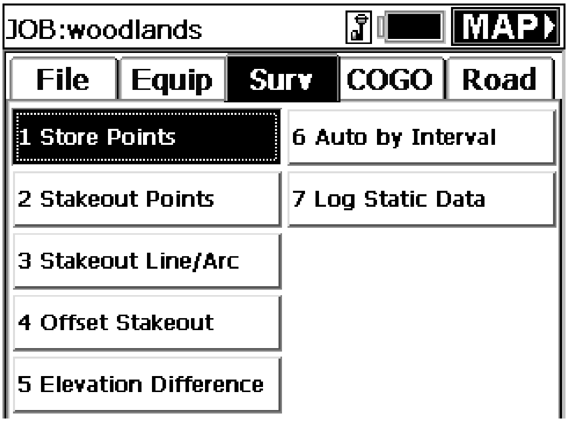


Figure 4-2

Sideshot/Traverse

Function

This command, designed for total stations and manual entry, establishes the backsight and takes foresights. It is the principle data collection routine with total stations. Sideshot/Traverse interacts with numerous settings, including the feature codes and will draw line work. All settings in Configure Reading will impact Sideshot/Traverse, including the Number of Distance Readings, Average Direct & Reverse, Hgt/Desc Prompt on Save, Angle Only in Reverse Face and Function of Enter Key. Sideshot/Traverse collects and displays points in a Map view, although there is a Text view option as well. Backsights and foresights to existing points are checked against the original point coordinates, and the differences are displayed. In total station mode, Sideshot/Traverse will also conduct a Remote Benchmark calculation, which establishes your occupied station elevation based on one or more readings to backsight points with known elevation.

Sideshot/Traverse Command Flow

The Sideshot/Traverse command is best understood by referencing the flow chart below. When you select the command, you are immediately queried whether you want to accept the current occupied point and backsight point information. If everything is OK, (you simply turned off the instrument for lunch and are starting up again), then you can answer "Yes" and proceed straight to the foresight screen. If the occupied point, backsight point or instrument height has changed, you can revise the setup information. If only the target height has changed, that can be revised within the foresight screen.

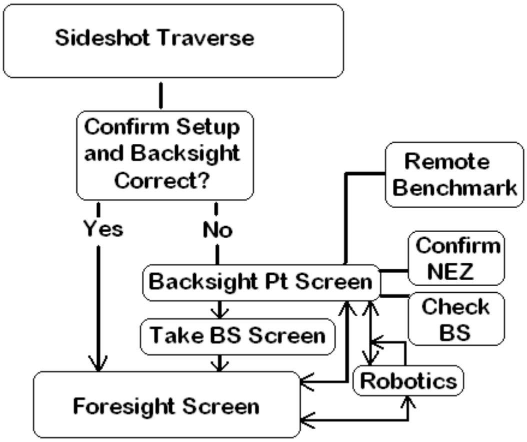


Figure 4-3

Note that once in the Foresight Screen, you can select the "Backsight" icon and return to the Backsight Pt Screen for a Check Backsight reading or to re-set the setup information. When configured to robotic total stations, the "Backsight" icon takes you first to the robotics control screen for quick adjustments and then back to more foresights, or from there, you can tab to the backsight screen and access all the backsight functions, returning when done to the Foresight Screen. If you go from the Foresight Screen to the Backsight Pt Screen (to view things), Cancel will return to the Foresight Screen. But if you come to the Backsight Pt Screen from the Confirm Orientation Screen, you must pass through the Take BS Screen on the way to the Foresight Screen.

Backsight Example, Standard Total Station

Let's say that you wish to set up on point 1031 and backsight 1032, using a total station. If you have an electronic total station with a port for data collection, then you need to configure for the correct equipment within the Equip tab, Instrument option. Or you can set your Instrument to Manual Total Station and enter the measured data within Sideshot/Traverse. Figure 4-4 shows a graphic of our example backsight.

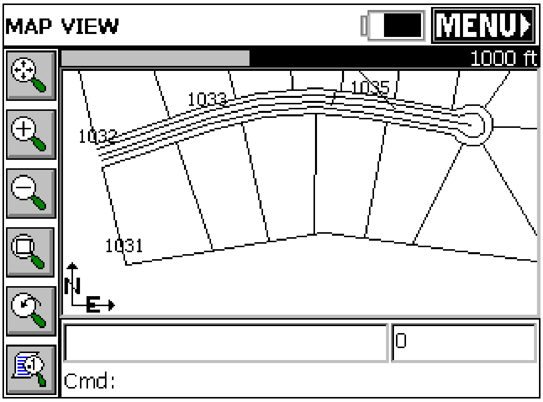


Figure 4-4

In this example, point 1031 has coordinates N 4520.8913, E 4560.3811, Z 500, IP and point 1032 as coordinates N 4788.3008, E 4496.2173, Z 500, CP. When you choose Sideshot/Traverse, you will first go to a Confirm Orientation screen as shown in Figure 4-5.

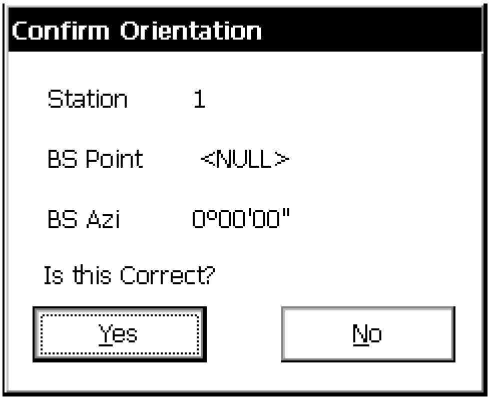


Figure 4-5

On a new job, this screen will typically default to Occupied Station at point 1, with a <null> backsight point and a backsight azimuth of 0 degrees. For our example, we will press No to the Confirm Orientation, which allows you to identify the correct backsight information in the following dialog shown below.

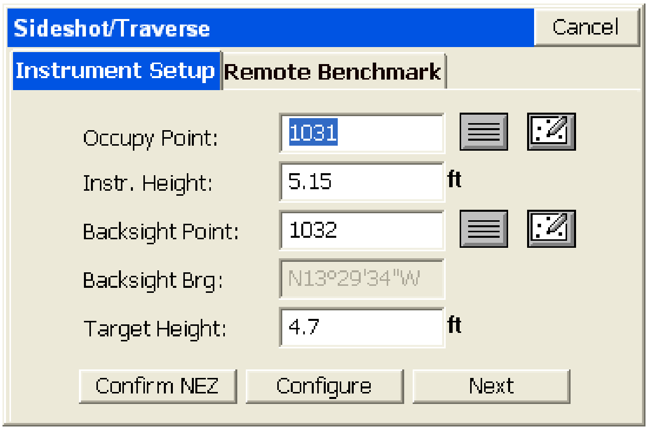


Figure 4-6

Backsight Point Screen

- **Occupy Point**: Enter the occupied point ID (occupied/setup point). You can also click the list icon (dashed line icon) and select the point from a list of points, or click the map icon (dots with pointer icon) and select the points from the map itself, literally by touching point 1031.
- **Instr. Height**: This is the height of the instrument from the center of measurement (typically middle of the lens) to the tack in the hub or ground elevation over which the instrument is set. If you are configured English, this height is in feet. If you are configured to Metric, this height is in meters. The units for the job are displayed (ft, ift or m).
- **Backsight point**: Here you enter your backsight point ID, or pick it from a list or from the map itself, using the icons to the right. A backsight point ID is required, even if you choose to enter an azimuth or bearing only.
- **Backsight Bearing or Azimuth**: This displays the bearing or azimuth between the two entered points, when both points have coordinates. If Job Settings, Units, is set to "Angle Type" equals Bearing, then a backsight bearing will appear. If set to "Angle Type" equals Azimuth, then the backsight azimuth is shown. When both point IDs have coordinates, the backsight is fixed and predetermined and therefore the bearing/azimuth field is disabled since it cannot be altered. However, if no backsight point is entered, or the backsight point has no coordinates, then you must

enter a backsight bearing or azimuth, which will be used to calculate the null or zero coordinate point ID.

- **Target Height**: This is the height in feet or meters (depending on your configuration) of the target, from ground elevation to the center of the lens.

Note: The backsight target height will default to the previous backsight target height on future setups. The foresight target height is kept distinct and will default to previous foresight target heights, but will not automatically match the backsight target height. So if you prefer to survey by setting the prism pole to a fixed height for both backsights and foresights, be aware that you will have to put in 2 initial target heights: one for the first backsight in the backsight screen and one for the first foresight in the foresight screen, in order to get both "remembered" values established.

- **Confirm NEZ**: This option will display the full coordinates and description of both the setup and backsight points as shown in Figure 4-7. By default, the Setup coordinates will be displayed. You can tab to the backsight coordinates. Press Enter or tap OK to exit this dialog.

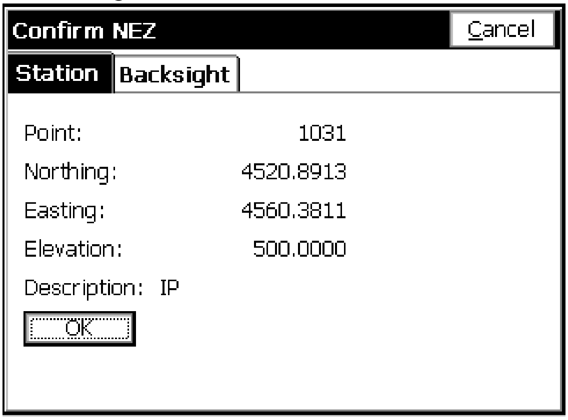


Figure 4-7

- **Configure**: This accesses the Configure Reading screen for a variety of condition or settings changes (eg. Hgt/Desc prompt on save).

■ **Next**: Continues to the "Take Backsight" screen.

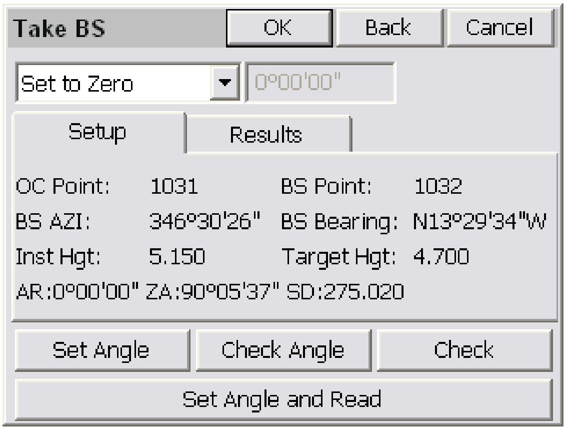


Figure 4-8

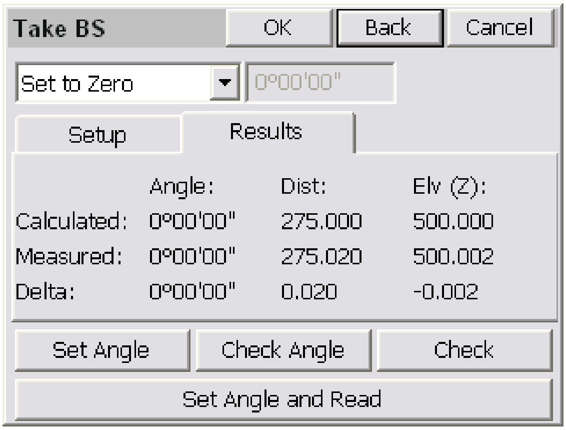


Figure 4-9

The program defaults to the "Set Angle and Read" option (the large, lower button), on the assumption that most often, you will be taking a distance measurement to the backsight. If you are just backsighting an object or plumb bob without a measurement, choose "Set Angle". You can tap Set Angle on the screen or using the keyboard, enter Alt S. (The underlined letter can access the button in question by entering Alt and the letter. Alt A would go to "Check Angle".) Choose Check Angle to re-sight on the backsight and obtain an angular error report (no distance comparisons are made). The "Check" option measures and compares both angle and distance to the backsight, and is discussed below in more detail.

There are 4 backsight options for setting the reference angle. They are found in the option list in the upper left of the Take BS screen (Figure 4-8):

- **Set to Zero**: This is the most common usage. A message is sent to the instrument to set it to zero, then the backsight is taken at a zero reference angle, and angles then are typically turned to the right from zero.
- **Set to Backsight Azimuth:** In this scenario, the backsight direction in the gun is set to the azimuth of the backsight. If the backsight azimuth was 180 degree, then an angle to the right of 10 degrees would read 190 degrees from the instrument. This is useful in underground mine surveying because it keeps the readings displayed by the total station always referring to true azimuth. Some surveyors are “azimuth” surveyors and others prefer “set zero”.
- **Set to: User-Entered Azimuth:** This option allows the user to “force” a particular backsight azimuth into the total station as a reference direction. Sometimes non-zero backsight angles are deliberately entered in set collection, to use different quadrants of the 360 circle.
- **Use Current (Do Not Set Angle):** Uses whatever direction reading is already in the instrument.
- **Check:** This enables the surveyor to determine whether the instrument has "drifted off" the point. Based on what is presented here, the surveyor may decide to reset the BS angle, or to actually re-level and re-shoot the BS point. More commonly, you would do a Check Backsight after taking a lot of foresights. You may want to be sure you haven’t bumped the instrument or experienced settlement in the tripod legs. With robotic total stations, you have the option to “Auto Turn to Backsight” as shown in Figure 4-10.

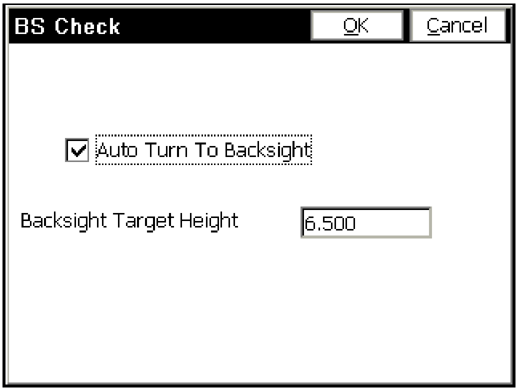


Figure 4-10

Whether in a conventional or Manual Total Station configuration, pressing Read or pressing Enter initiates a Take BS shot. In Manual Total Station configuration, it will lead to a dialog where you input the angle and distance measurements. This dialog is shown in Figure 4-11.

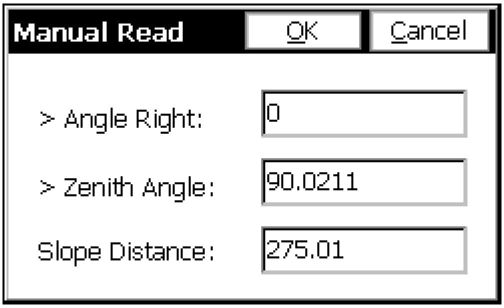


Figure 4-11

When you press Enter, or tap OK, this leads to the foresight screen, shown in Figure 4-12, where shots are taken, readings are presented and points are plotted graphically.

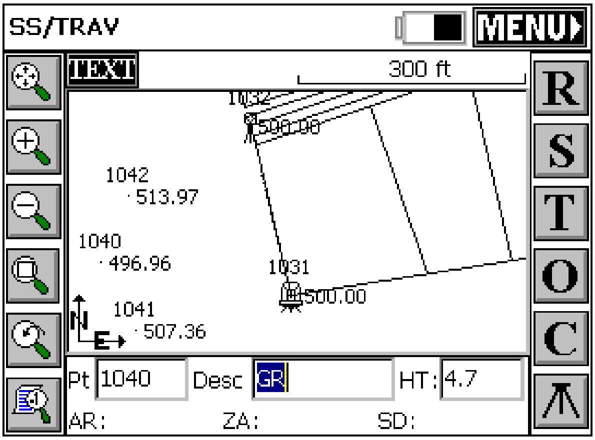


Figure 4-12

That completes the backsight procedure leading up to the taking of foresights. Note that pressing Enter will take you through the entire backsight process, which we will review here: In the initial Backsight screen, Enter will move down from Occupy Point to Target Height and on to the Next button. Enter will Zero the Gun and take the shot (Set angle and Read) leading to display of Results. The last Enter here continues on to the foresight screen. So although FAST Survey is a touchscreen-oriented program, use of the prominent Enter button drives most procedures, as noted here.

Types of Total Station Backsights - Handling Missing Information

The FAST Survey backsight procedure will allow "last minute" entry of the backsight coordinate values if none are found, or will calculate the backsight coordinates using the azimuth and distance of the measurement. If both the Station and Backsight have coordinates (non-zero northings, eastings and elevations), the backsight azimuth is computed, and the coordinate values are not altered:

- **Known Station and Backsight Azimuth to Backsight Point of unknown coordinates**: A Backsight Point will be calculated. Note that when a zero-coordinate Backsight point is encountered, the program will ask the user to Enter Coordinates or Use Azimuth. This prompt appears only when the Use Azimuth option has been selected.

Taking Foresights in the Sideshot/Traverse Command

Graphic Features of Sideshot/Traverse Screen

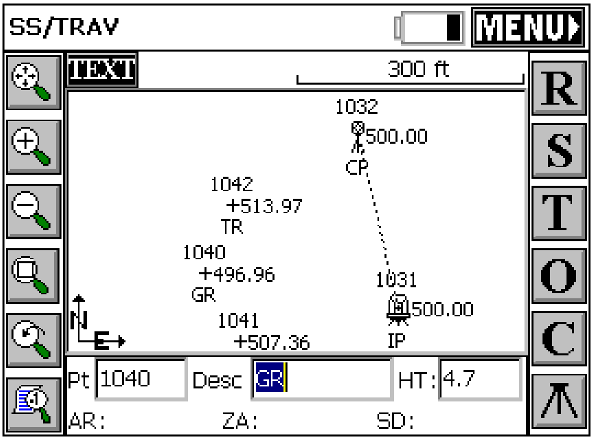
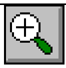
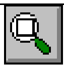
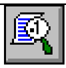


Figure 4-13

	Zoom extents: Zooms to the extents of the map, showing all points and objects.
	Zoom in: Zooms in 25%.
	Zoom out: Zooms out 25%
	Zoom window: Zooms into a rectangular area that you pick on the map screen.
	Zoom previous: Zooms to the previous view, FAST Survey remembers up to 50 views.
	View Point Options: Displays the View Point Options dialog box seen in Figure 4-14, where you can control aspects of points such as the symbol, the style of the plot and the freezing or thawing of attributes such as descriptions and elevations. To avoid "point clutter", you can even set it to show only the last stored point along with setup and BS.

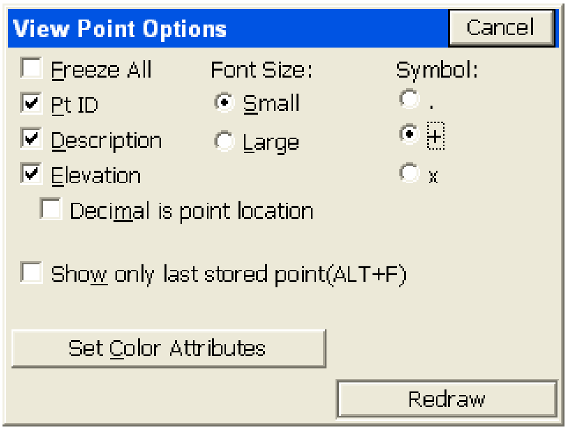


Figure 4-14

To save some space and "condense" the plot, you can click off (and freeze, or prevent from displaying) the Descriptions. You can also select the option "Decimal is point location". This leads to the graphic plot shown in Figure 4-15.

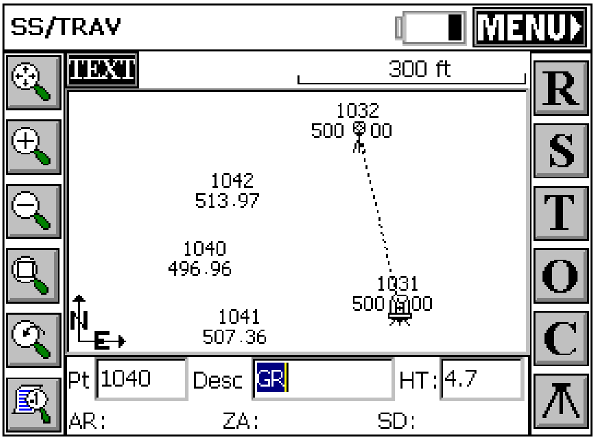
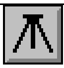


Figure 4-15

Pan: You can also "pan" the screen simply by touching it, holding and dragging your finger or stylus along the screen surface. Pan is automatic and needs no prior command.

Command Features of Store Points and Sideshot/Traverse Screen

R	R stands for Read and takes the shot and presents the data. Storing is optional.
S	S stands for Store or Shot (or even SideShot). S will Store any shot that was Read just prior to selecting S.
T	T stands for Traverse. T will store the previously read shot and give you the option of occupying that point.
O	O stands for Offset. Three types of Offsets are offered, as shown in Figure 4-16 below.
C	C stands for Configure Reading, allowing the user to reset the next point or to change the number of distance readings, or activate the Rod Hgt/Description prompt after the store.
	The Tripod stands for Backsight. The Backsight Screen is a “tabbed” screen that includes the standard backsight, “Instrument Setup”, but also “Remote Benchmark” and for Robotic Total Stations, “Robotics”. When configured to running a Robotic Total Station “remotely” (from the pole), pressing the Backsight icon will take you to the Robotics tab directly, within the Backsight screen. With Robotics, if your goal is to re-establish a new setup and backsight point, simply press Tab once to move to the standard backsight screen.
TEXT	Pressing Text will take you to an alternate, “text-only” backsight screen, as shown in Figure 4-18 below.
MENU	Pressing Menu in the upper right will exit to the Main Menu. This can also be accomplished by pressing ESC for Escape

The Offset command, shown in Figure 4-16, allows you to calculate and store points by entering offsets from the measured position.

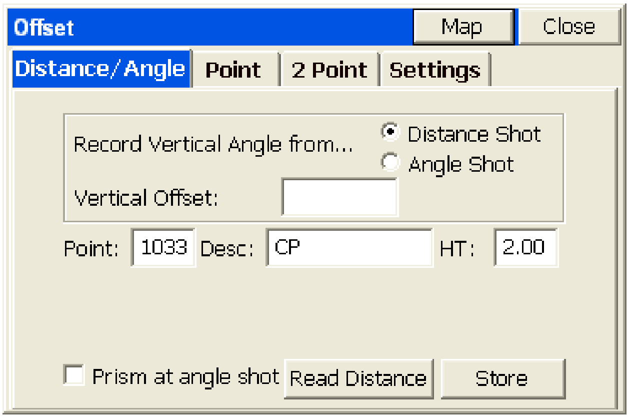


Figure 4-16

Foresight Screen Options: Shown in Figure 4-13 is the "Text" screen option in Sideshot/Traverse, which is an alternative to the "Graphic" screen option shown in Figure 4-17.

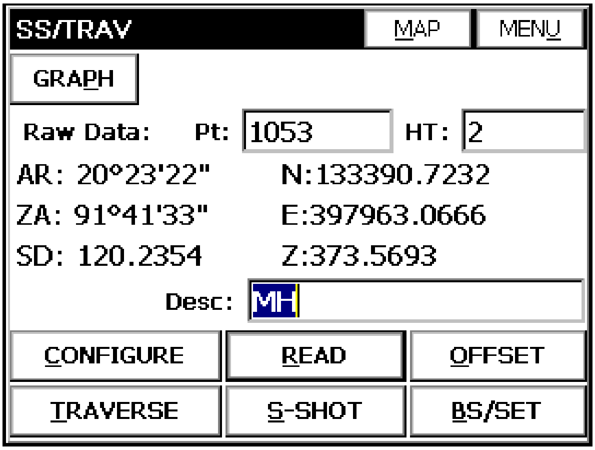


Figure 4-17

Foresights

The Foresight Screens are entered automatically after exiting the Take Backsight screen. The Foresight Screen is also entered quickly, after selecting Sideshot/Traverse from the main menu, if you answer "Y" (yes) to Confirm Orientation. When you choose Sideshot/Traverse, you are always given the option to accept the default backsight orientation and go straight to your foresights.

There are 2 major types of Foresight Screens: (1) Standard Total Station, (2) Robotic Total Station. The GPS screen is discussed under the Store Points chapter. The total station screens are discussed next.

Standard Total Station Foresight Screen

Since we have already examined the Standard Total Station Foresight Screen in some detail (it is identical to the graphic screens above), we can discuss it further by examining procedural options using Standard Total Stations.

Graphics or Text. Sideshot/Traverse (standard sideshots and traverses) can be run in either full graphics mode or full text mode.

Graphic "Backgrounds" can include linework that you create yourself using commands such as PL and 2DP and O2 (offset), or the graphics can include drawings that you "dxfin" using the command IDXF ("in" DXF) found in the Map view of FAST Survey. When you exit FAST Survey, this linework can be configured to "save on exit" and stay associated with your point file. Shown below is our same example with linework from a subdivision displayed. Note that linewwork drawn by feature codes or "dxf'd in" is on layers which can be "frozen" (hidden) or "thawed" (shown) by the Layer command under View in the Map screen.

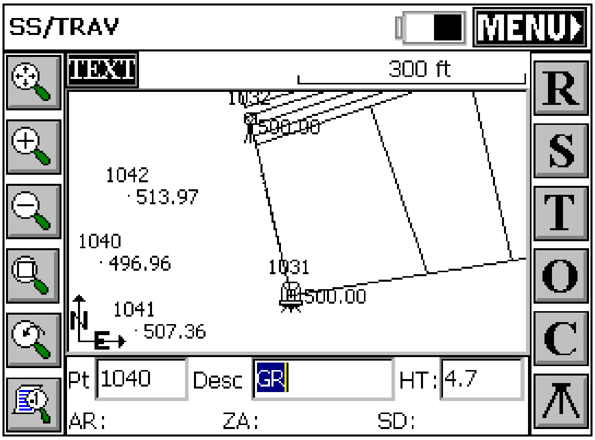


Figure 4-18

Unless the "rod hgt/description" prompt is clicked on, the Sideshot/Traverse screen is designed to "quick-store" points, with the user expected to enter, ahead of time, the correct description and rod heights in the edit boxes shown at the bottom of the dialog.

Sokkia-Style: The SDR33 and earlier SDR data collectors had a convenient concept for "Store Last, Read Next". You get your descriptions set up and take a shot. The reading is displayed at the bottom line of the screen. You examine it, satisfy yourself it is correct, move to the next point, and take another shot. This was done on the SDR collectors with the "Read" key, but with FAST Survey, can be accomplished with Enter, if you configure Enter as shown in Figure 4-19 below (press C for Configure Reading to obtain this screen).

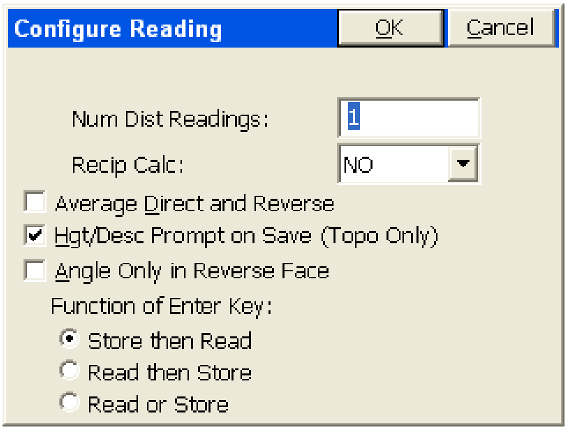


Figure 4-19

Normal Foresight Style: Most popular collectors are known for their Read & Store procedure, with an "after-shot" pop-up box for entering descriptions and rod height values for the point just measured. This approach is accomplished by the Enter key (for the shot) by using the configuration shown below in Figure 4-20.

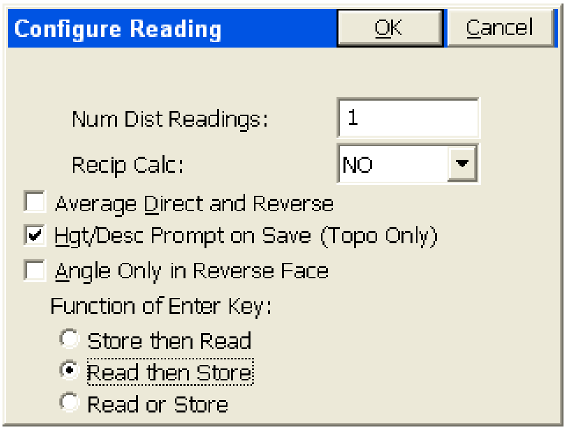


Figure 4-20

Enter Key for Read First, Store Later. This is the "Read or Store" version. Your first Enter is a Read only (like pressing R or entering Alt R). Your second Enter is a Store, which can be followed by the Hgt/Desc Prompt on Save. This is the "most cautious" designation of the use of the Enter key for taking shots. Note below that after the

Read, the point is displayed with a question mark, and the raw data is displayed. It is saved only when Enter is pressed again (or S is pressed, or even Alt S—all of which store a previous Read).

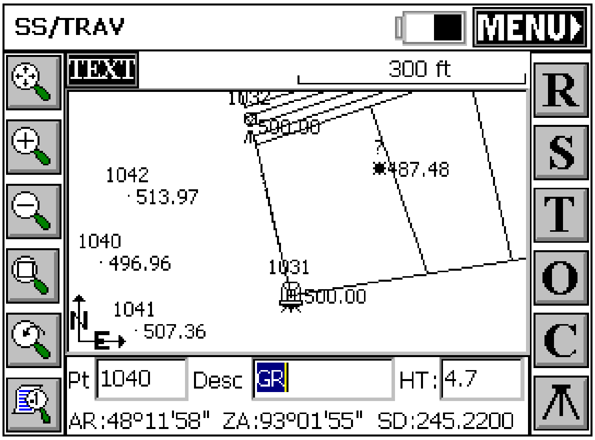


Figure 4-21

(Note that you are about to deliberately store a second point 1040, which would be recognized as a duplicate foresight point, and would lead to the Point Protect dialog, allowing you to Overwrite, or Use New Point Number).

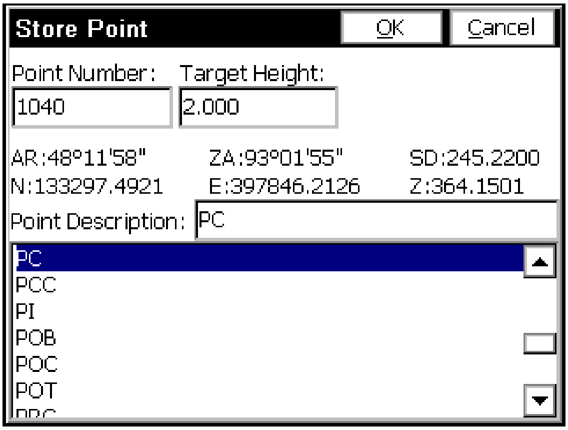


Figure 4-22

In the final Store Point dialog (with Rod Hgt/Desc prompt turned on), you are placed in the Point Description field, where Enter continues on. All descriptions entered for this job will accumulate in the available Point Description List (here showing PC, PCC, PI, POB, etc.), allowing the user to select the text graphically, arrow key to the desired text, or highlight and select the correct text after entering the first character in the edit box. An entry of “P” goes right to all text starting with the letter “P”. Then you can pick the one you want.

Average Direct and Reverse

When this option is turned on within Configure Reading, you will press the Read button to automatically take the Face 1 shot. Then, you will be prompted for the Face 2 reading. Face 2 is the reading with the theodolite inverted. Typical prompting and readings might be:

Horizontal: 45-23-56

Zenith: 95-34-25

Slope Dist: 345.21

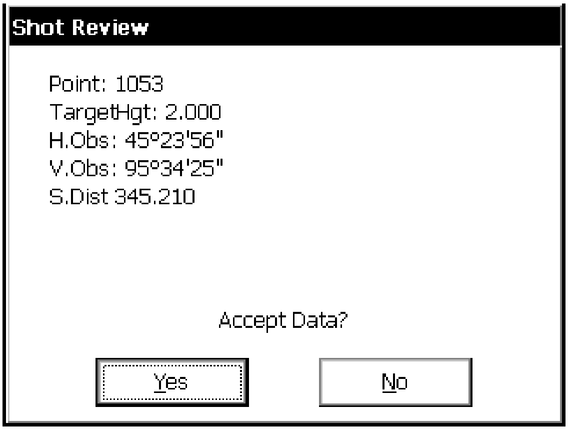


Figure 4-23

Face Two

Figure 4-24

Horizontal: 225-23-51

Zenith: 264-25-30

Slope Dist: 345.21

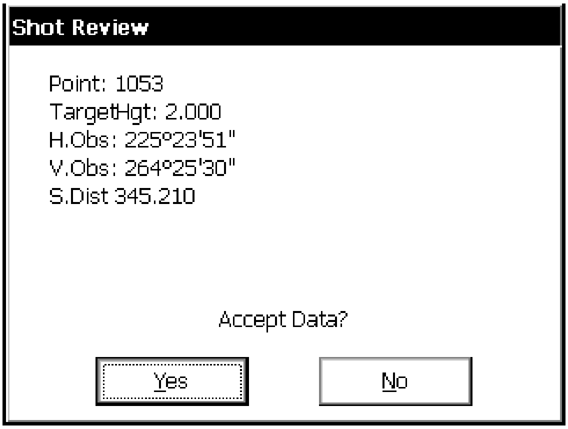


Figure 25

This leads to an F1/F2 Report screen, shown here in Figure 4-26.

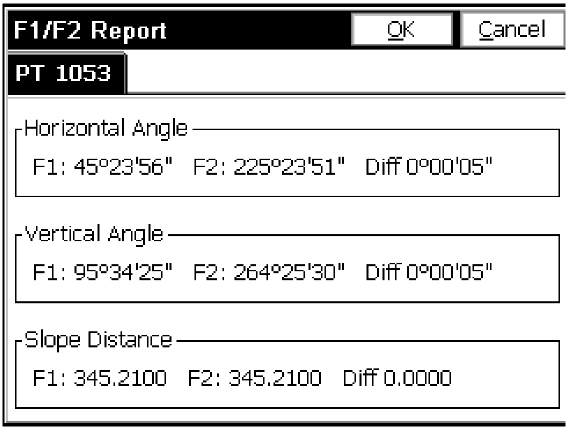


Figure 4-26

This leads immediately to point storage, or to the Hgt/Desc prompt screen if that option is turned on in Configure Reading. The F1/F2 option applies strictly to foresight measurements as currently implemented, and stores the raw data to the RW5 file for re-processing at the office.

Angle Only in Reverse Face

The option applies to F1/F2 style of foresights and to the Set Collection command. When turned on, the distance used in the Face 1 reading is used again in the Face 2 measurement, and only angles (horizontal and vertical) are utilized from the Face 2 measurement itself. Prompting is identical to the normal F1/F2 or Set Collection routines.

Robotic Total Station Screens and Options

Robotic Total Stations have expanded options in the Backsight and Foresight dialogs within Sideshot/Traverse. Starting with the Backsight, the Robotic Total Station screen appears as shown in Figure 4-27 below.

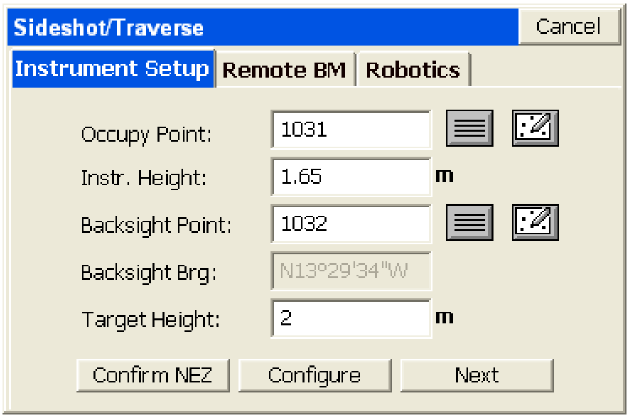


Figure 4-27

The "Robotics" applies to Geodimeter (Trimble 5600), Leica robotic and Topcon robotics instruments. Selecting Robotics takes you to the following screen, with some variations per equipment type.

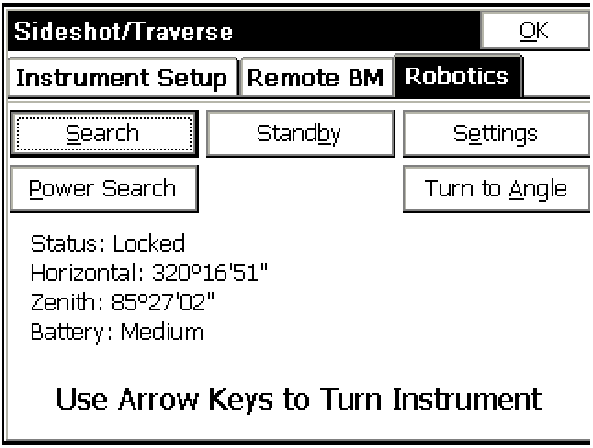


Figure 4-28

The screen shown here is for a Leica rotobic total station (showing PowerSearch). For Leica, arrow keys are used as follows: Tapping in the direction you want (e.g. up) once goes slow, two taps medium and 3 taps fast speed. Tapping the other direction (e.g. down) stops the movement.

For other instruments, holding down the arrow keys on the keypad of the CE data collector allows you to move the base instrument up and down, left and right. When you release the key, the motion stops.

Search will initiate a Search and look for the prism or reflector. For Leica Search initiates an ATR search. For Leica, the PowerSearch option will conduct a “fast search” taking typically less than 10 seconds. PowerSearch will find the prism no matter what direction the instrument is pointing.

Topcon has an additional search option called Quick-Lock which appears when configured for Topcon 800/8000 Remote using RC2. A Quick-Lock search will find the prism in less than 15 seconds.

Standby takes the instrument out of “tracking” mode and allows the user to set the prism pole down to drive a stake for example. Pressing the Search or Quick-Lock buttons will lock the instrument to the prism and put the instrument back into “tracking” mode.

Turn to Angle opens an additional dialog (Figure 4-29) that prompts you for the angle to turn (which can be entered, picked from the Map, or point-based).

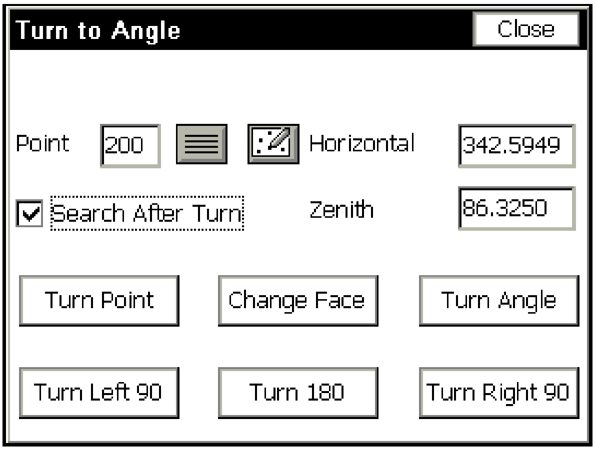


Figure 4-29

You can turn to a known point number (as shown here) or to an entered horizontal and zenith angle using “Turn Angle”. “Search After Turn” searches and locks on a prism after turning the angle (potentially changing slightly the computed angle). Change Face reverses the face.

The lower three buttons (Turn Left 90, Turn 180 and Turn Right 90) are common angle turns and minimize user entry when needed.

Settings leads to a series of Settings screens that allow you to dial in the speed of motion, range of motion and other factors governing arrow key-driven movement and automatic searching. Alt J will take you directly to the Settings menu from elsewhere in the program. The arrow-key motion is sometimes referred to as the Joystick Speed.

Below is a series of screen captures showing the variety of configurations available for the various brands of robotic total stations.

See Figure 4-30, Figure 4-31, Figure 4-32, and Figure 4-33.

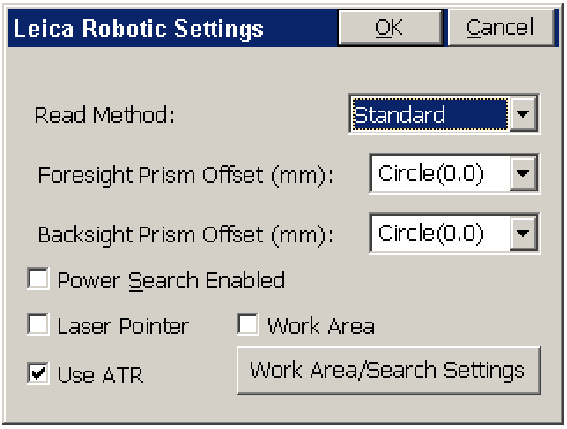


Figure 4-30

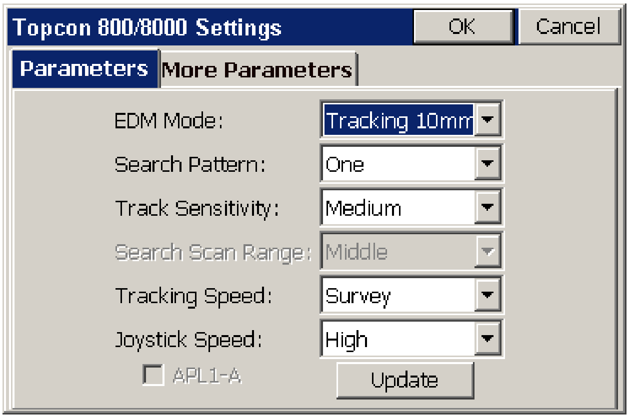


Figure 4-31

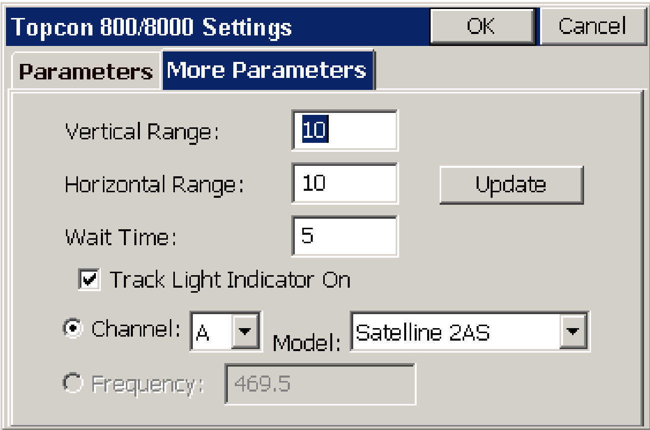


Figure 4-32

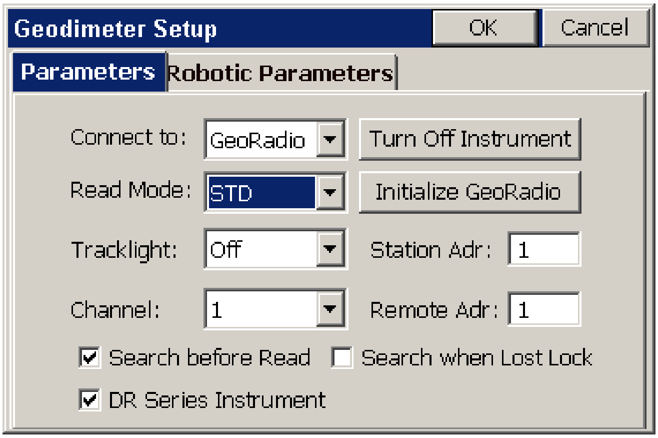


Figure 4-33

With all settings correct, there are two Foresight Screens that appear within Sideshot/Traverse, one graphic and one text-based. The graphic screen for Topcon and Trimble brands is shown below.

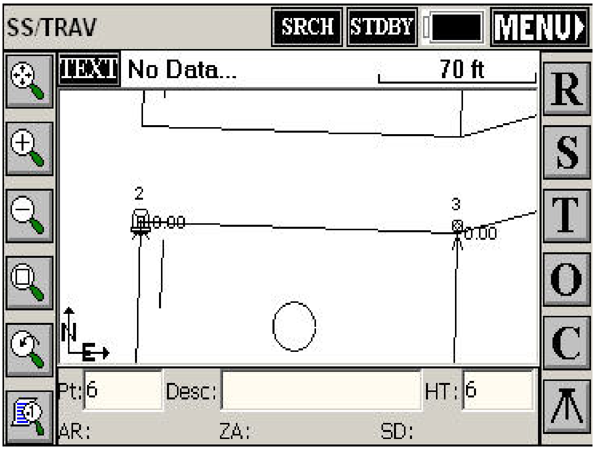


Figure 4-34

The "status" of the robotics is displayed in the upper left-center, next to TEXT and above the Map. Status modes include "Tracking" (locked onto the prism and following it), "Standby" (stopped in the last position it was in and ready to resume Tracking, "Searching" or looking for the prism and "No Data…" (Brief mode between losing the prism and beginning an automatic Search).

The upper left "button", here shown as "SEARCH", let's you initiate a Search after a "Lost Lock" condition, or go Standby if Tracking was active (to drive a hub and stop the gun from moving), or go back to Search, leading to Tracking, from Standby (after driving the hub).

The "arrow" button, which is alternately an "arrow" and an "X", takes the EDM signal on and off. With the signal on (indicated by an arrow), more power is used, but you gain a lot by seeing continuous, real-time distance readings and by seeing your position on the screen, in the form of a triangle. Shots are nearly instantaneous, but respond to the "fast-tracking" mode of the EDM (typically 10mm). If taken out of EDM Tracking (touch the Arrow, get the X), you lose your real-time movement on the screen, but measurements will respond to the accuracy of your Equipment Settings, which may call for standard or fine mode.

The Text button in the upper left takes you to the equivalent Text screen for robotic total stations, which is shown in Figure 4-35 (Leica Robotic version is shown here).

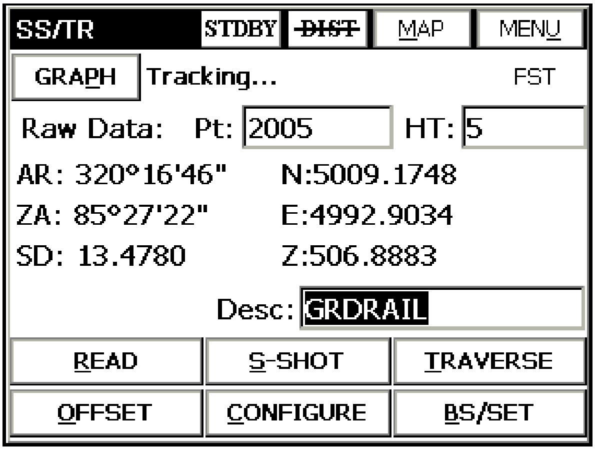


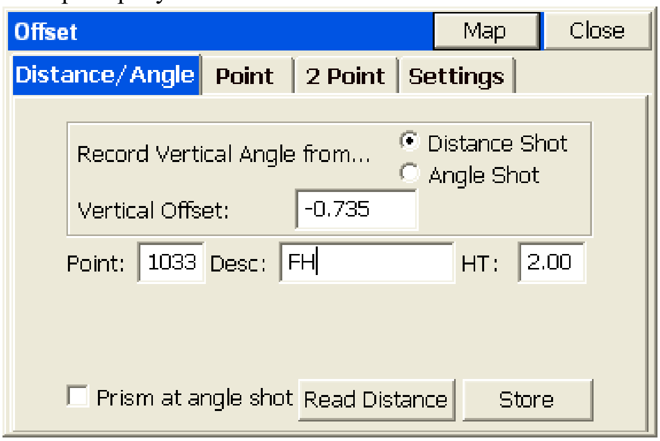
Figure 4-35

Note: The response to losing lock when taking foresights with robotic total stations is for the instrument to stop where it is. If you have set "Search when Lost Lock" on, the instrument will start searching immediately on loss of lock. Alternately, when running remote, you can use the joystick-arrow controls to move the instrument towards you and obtain lock again.

Offsets

To make offset points using a Total Station requires entry of Alt O or selecting the O/Offset button within the Sideshot/Traverse Foresight Screen. This works from both the Graphic and Text screens when foresighting. There is no distinct Total Station "Offset" command—it is an offshoot (literally) of standard Sideshot/Traverse. The Total station Offset command must be selected each time it is used. It has three options:

- **Distance/Angle** (sometimes referred to as "Shoot a Big Tree"): The Distance/Angle method requires two measurements. The first measurement is the distance. Note how the dialog in Figure 4-36 prompts you to "Read Distance" first.



<u>**Figure 4-36**</u>

In the case of shooting a large tree, where the goal is to shoot the center of the tree, you would take a shot to the middle-side of the tree, equivalent to the distance to the center of the tree. Then you would take a second shot, as prompted, to the middle of the tree, for horizontal angle only. Note that for the elevation of the shot, you can use the distance measurement or the angle measurement (second reading), and apply the vertical offset, if any, accordingly. After both measurements are taken, the results are displayed as shown in Figure 4-37. You are then returned to the dialog to take your next offset. Tap Close to exit to the main Foresight screen.

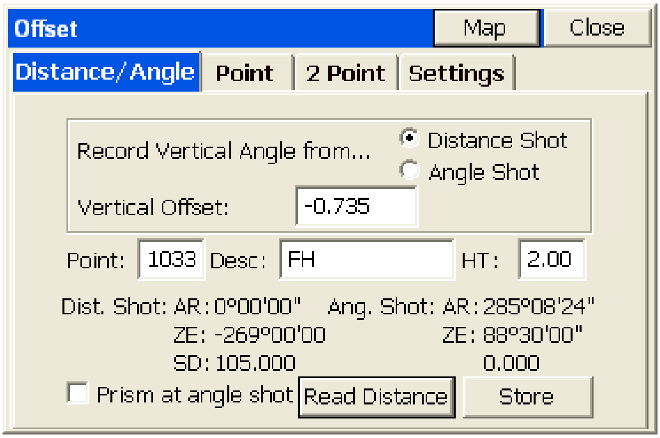


Figure 4-37

- **Point (Plus/Minus)**: The Point Offset takes a shot and deducts or adds a distance relative to the line-of-sight in all 3 directions (L/R, In/Out, Vertically Up/Down) using the dialog shown in Figure 4-38.

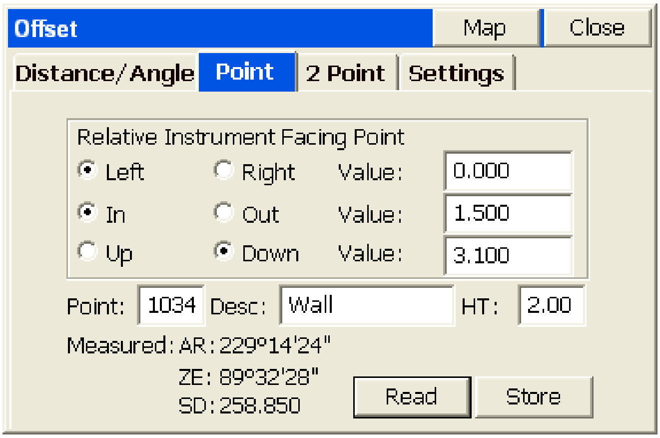


Figure 4-38

Before the shot, tap Read. After the shot, when the raw data is displayed in the lower left, tap Store. You will remain in the command until you tap Close.

- **2-Point Offset**: This creates a 2-point "vector", where the offset direction, distance and vertical offset is computed from the delta N, delta E and Delta Z of the 2 points that are measured or entered. If "Read Inst" is clicked on, then the 2 points are measured in the field.

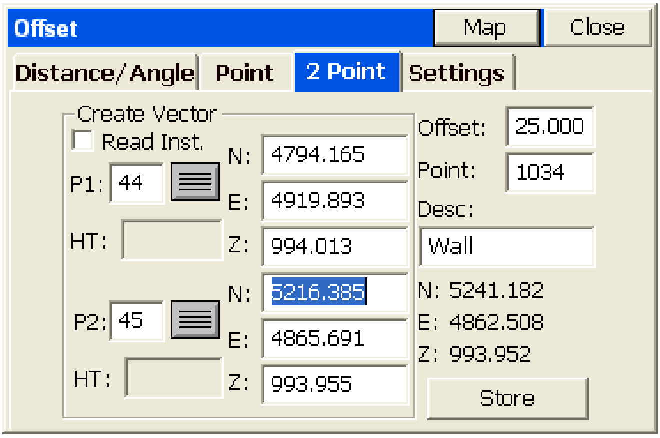


Figure 4-39

If instead you wish to obtain the offset vector from 2 points, then click off Read Inst. and enter the 2 point numbers as shown in **Error! Reference source not found.**. The offset entered will extend the vector from point "P2" in the direction of "P1" to "P2". The vector offset will also impact the elevation that is calculated. This might be used to calculate a point at the top of a cliff, for example, where you stand above the cliff top and pick up 2 points on the slope to the cliff edge, and estimate the distance to the cliff face from the 2nd point.

- **Settings**: The Settings tab permits reading the target height from a laser and accesses the entire range of laser devices found in the Peripherals menu option under Equip.

Remote Benchmark

This is a command for total station applications only, in which the elevation of one or more "remote", but known, points are used to compute the elevation of the occupied Station. Remote Benchmark is the 2nd "tab" to the right in the Backsight screen. The main screen is shown in Figure 4-40.

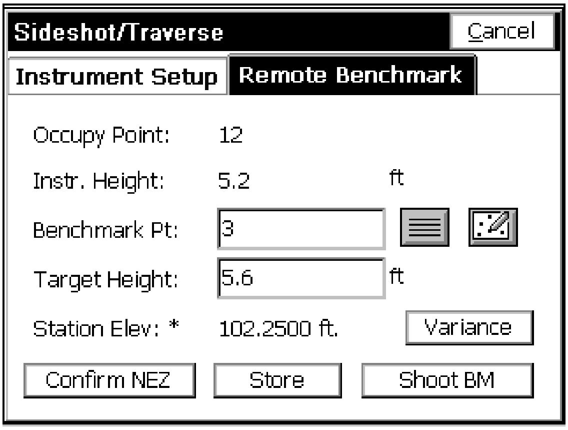


Figure 4-40

You have the option to backsight the same benchmark (e.g. point 3) many times, or several benchmarks points any number of times each. Note that the current station elevation is 100.1986. The shots taken to the benchmark are reported as shown below.

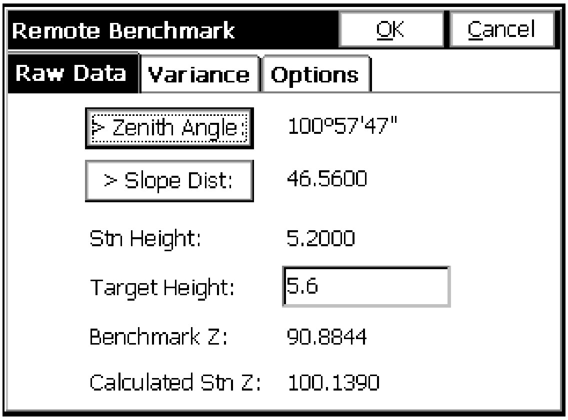


Figure 4-41

Each shot that is taken is added to the list of backsights, and appears in a "Variance" table, which can be accessed from the Raw Data screen or the main Remote Benchmark screen. It is shown here below.

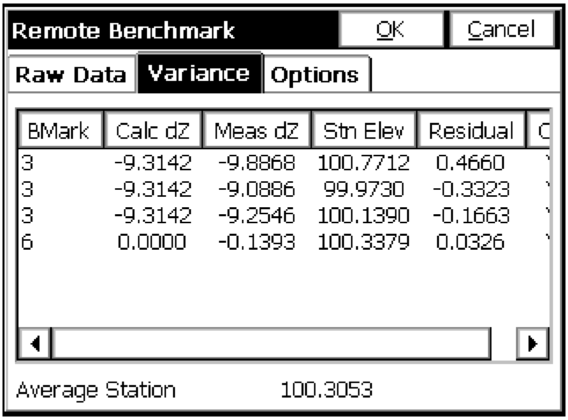


Figure 4-42

This is a very important screen. The right-hand column is an On-Off column. You can cancel out and turn off any very bad shots. In our example, with 3 backsights to point 3 and one to point 6, clearly the first shot was a missed reading, after which the average approximates 100.1. So we could turn off the first shot, and use the remainder for our calculation of the Station elevation. When you are ready to calculate the Station elevation, select Options. Your choices are shown below.

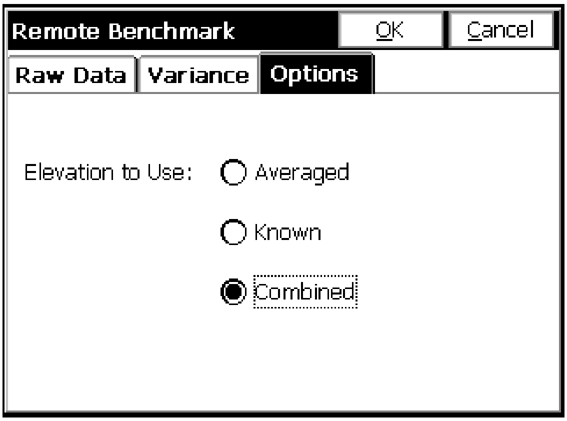


Figure 4-43

You can average together all the selected backsights to determine the Station elevation, you can simply keep your current Station elevation, and lastly, you can do a combined calculate of all your accepted "on" shots and your current known Station elevation.

Store Points

GPS Store Points Screen

Store Points is the principle data collection routine for GPS equipment. Store Points interacts with numerous settings, including the feature codes, and will draw line work. The Store Points screen in GPS shows the cursor moving on the screen in real-time. Shots can be taken anytime by pressing Enter. The screen will pan automatically, so you are always in view as you move. Points will plot on the screen as shots are taken.

In GPS mode, Enter has only one function: Read & Store. If you want the "after-shot" rod height and description prompt, then that can be turned on in Configure Reading (or hit Alt C from the Store Points screen). The screen appears as shown below. If you don't have the height and description prompt turned on, then each shot is a single press of Enter, and you must put any rod height changes or description or point ID changes in ahead of time, prior to pressing Enter.

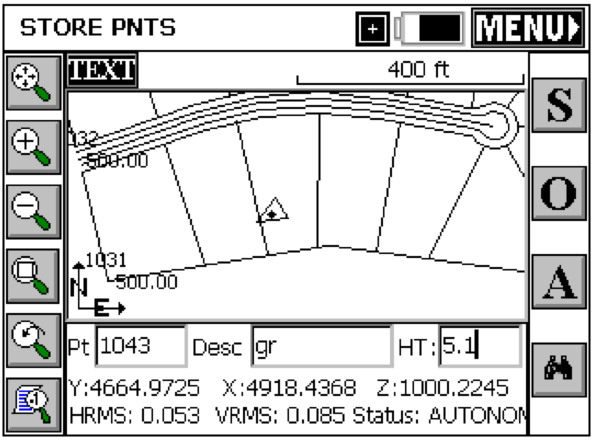


Figure 4-44

Coordinates are displayed at all times, as well as the Status (Fixed, Float, Autonomous) and HRMS and VRMS accuracy estimates (CEP and SEP values).

The icons at the left are for zooming and panning. From top to bottom, they are zoom extents, zoom in, zoom out, zoom window, zoom previous and point display control. They are described in more detail on page 102. If you prefer to work in a pure "Text" screen, without graphics, you can tap the "Text" button in the upper left.

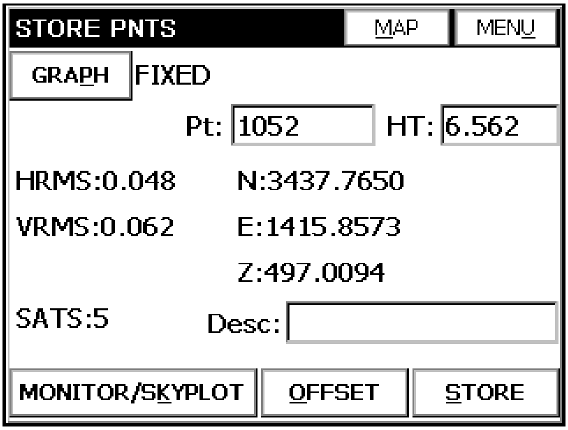
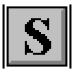
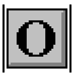


Figure 4-45

The Text screen uses a large character size for easy viewing, and limits options to Monitor/Skyplot, Offset and Store. You can return to the "Graph" view by tapping the Graph button. You can also temporarily view your points on the screen by tapping "Map", then tap "Back" to return to the text-based data collection screen. Note that the program will "remember" which screen you were in last (Graph or Text) and return to that "mode" of data collection automatically.



In addition to pressing Enter, Points can be stored by tapping S on the screen or Alt S on the keyboard.



Pressing O for Offset leads to a GPS Offset screen that has options for keyed in offsets as well as offsets taken by laser devices that measure distance only or distance and azimuth (by compass). The screen appears as follows:

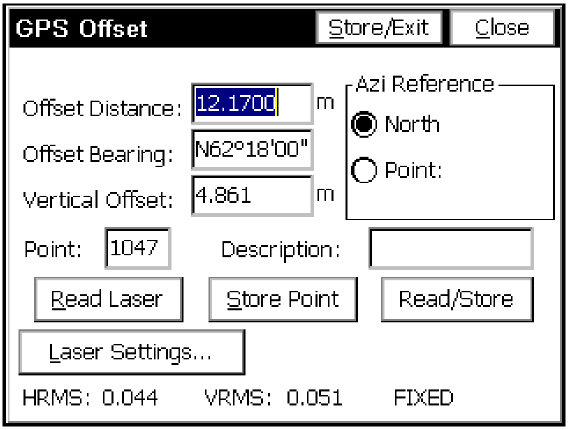


Figure 4-46

GPS Offset

The GPS Offset command allows you to calculate and store points by specifying an offset from a GPS position. Offsets can either be entered manually or read automatically from a laser. There are three GPS offset methods: Distance/Angle, Intersection, and Two Point. The current method can be set from the **Method** tab.

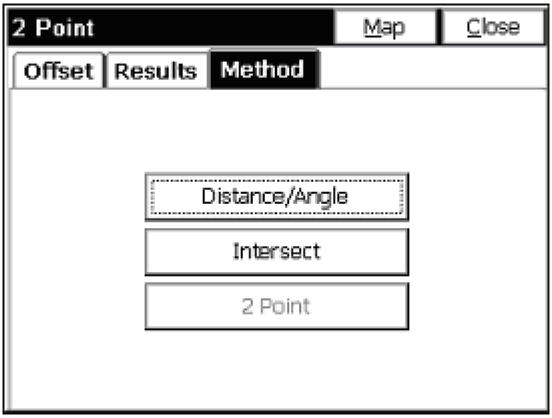


Figure 4-47

Offset by Distance/Angle

In the Distance/Angle method, offsets can be specified manually by choosing the **Manual** tab, or with a laser, by choosing the **Laser** tab.

Manual Offset

Under the **Manual** tab, offsets are specified by entering azimuth, vertical, and horizontal distance offset values as show below. The azimuth can either be specified with respect to north, or with respect to a specified point. Current GPS coordinates are shown at the bottom, and can be updated with the **Read GPS** button. When all necessary data has been entered, you'll be able to store by clicking **Store**, or to preview the point you're storing by clicking **Map**, or **Results**.

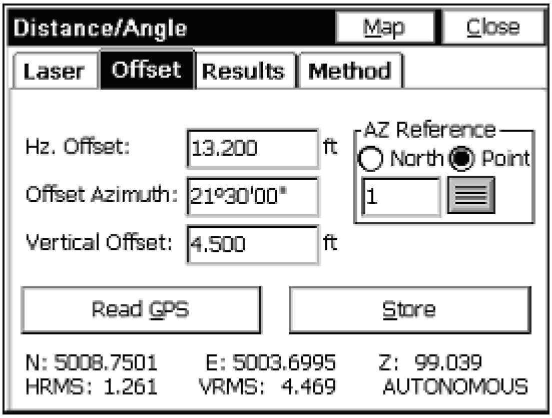


Figure 4-48

Laser Offset

Laser Offsets: For more accurate offsets, lasers can be used for either the distance (with direction and vertical offset entered by the user) or for both distance and direction (where the laser gun includes compass directions). The Leica Disto, for example, would provide distance only. The Laser Atlanta provides both distance and direction. Laser measurements are popular on construction sites and mine sites where it is dangerous to stand beneath "highwalls" and unstable rock conditions. Readings are taken from a "safe" location to the rock or dirt face, as shown in **Error! Reference source not found.**. They are also useful for utility pole surveying and other forms of "windshield" surveys.

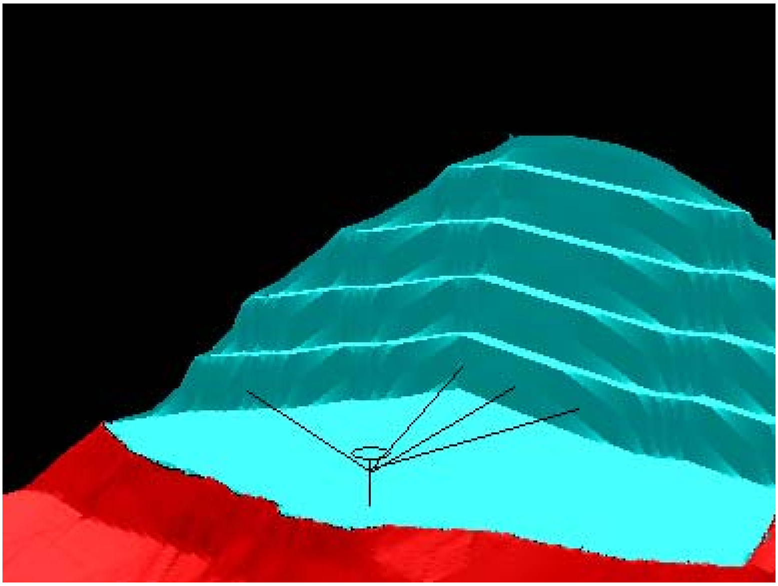


Figure 4-49

The laser devices are often mounted right on the pole beneath the GPS antenna. Special poles are made that offset around the lasers, allowing them to mount vertically "in-line" with the center of the pole. If the antenna height is 2.5 meters, and the laser is mounted 0.7 meters below the antenna and 1.8 meters above the ground, you would enter 1.8 as the "Laser Height". Laser types and laser height are set by clicking "Settings" in the Laser tab within Offset, taking you to the same screen accessed in Equip, Peripherals.

Under the **Laser** tab, offsets are read automatically from the **Laser** attached to the serial port. Upon triggering the **Laser**, you will see the reading displayed in terms of five parameters: Horizontal Offset, Vertical Offset, Slope Offset, Azimuth, and Zenith Angle, as shown below. The azimuth can either be specified with respect to north, or with respect to a specified point. Current GPS coordinates are shown at the bottom, and can be updated with the **Read GPS** button, or you can choose to have the GPS position read automatically before each point store by choosing **Settings** and enabling **Auto GPS Update**. When all necessary data has been entered, you'll be able to store by clicking **Store**, or to preview the point you're storing by clicking **Map** or **Results**.

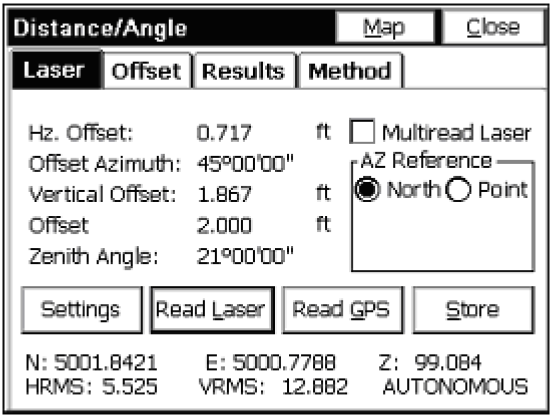


Figure 4-50

Before you can begin using the **Laser** offset feature, you must configure the laser, either by clicking **Settings**, or by selecting **Peripherals** from FAST Survey's main menu. Under the peripherals menu, you will have to activate your laser, select your laser type, and choose a COM port. It is also recommended that you deactivate all other peripherals except GPS while using the laser. For more details on laser setup, see the **Peripherals** section of this manual.

Once you have activated a laser, you may click **Read Laser** to begin collecting data from the laser. In order to expedite the data collection process, the methodology for reading an offset from the laser has been optimized so that you do not need to touch your data collector between shots. This option can be enabled by selecting **Multiread Laser**. If you are a first-time user, it is recommended that you disable this option.

If **Multiread Laser** is disabled, pressing **Read Laser** will pop up a dialog asking you to trigger the laser, as shown below. From here, you can either cancel, or fire the laser to record the shot.

Figure 4-51

If **Multiread Laser** is enabled, when you press **Read Laser**, a dialog will appear asking you to trigger the laser, as shown below. Each time you trigger the laser, a new shot will be collected, and if there was a previous shot, it will be automatically stored. Between shots, the laser reading and the offset-adjusted position to be stored are displayed. If **Auto GPS Update** is enabled during peripheral setup, a new GPS position will be read for each shot. If a bad reading is taken, you can prevent it from being stored by pressing **Reject Last Shot**. When finished, click **Exit Shot Sequence**.

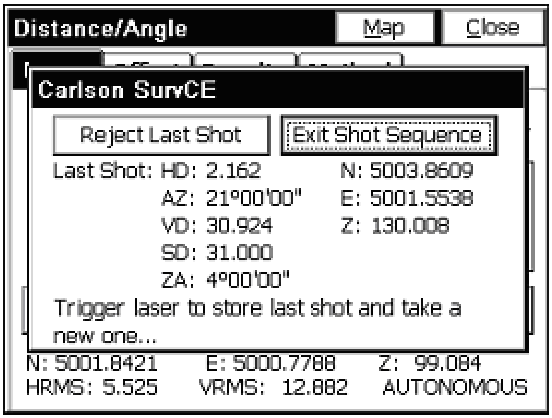


Figure 4-52

Results

Before storing, you can preview the data by selecting the **Results** tab. If valid data has been entered in the **Laser** or **Offset** tab, the result will appear as shown below. In this window, you can also change the GPS antenna height, or specify a vertical difference for your target point.

You can also specify the point ID and description for the point that will be stored.

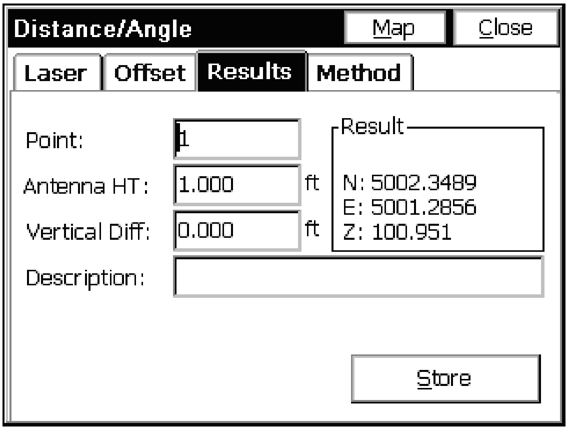


Figure 4-53

Offset by Intersection

Use **Offset by Intersection** to calculate a point based on two GPS positions and two distance offsets. The distance values can either be manually entered or input with a laser. To use a laser, you must first activate it by selecting **Settings**. For more information on laser setup, see the **Peripherals** section of this manual.

Offset

Under the **Offset** tab, press **Read Point 1** to read the first point from GPS. Now enter the distance of the point to be stored, or press **Read Dist 1** to read this distance from a laser. Repeat this process for the second point. Switch to the **Results** tab to see your solution. If your distances and GPS can't be triangulated, you may have to return to this tab to adjust the values.

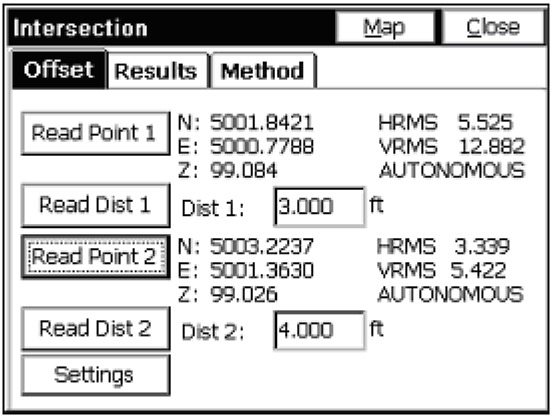


Figure 4-54

Results

After you've have 2 GPS positions and 2 distances that form a valid triangle, click on the **Results** tab to view the resulting point. If valid data has been entered in the **Offset** tab, the result will appear as shown below. In this window, you can adjust the GPS antenna height, or specify a vertical difference for your target point. You can also specify the point ID and description for the point that will be stored. The intersection method generates two solutions, so you will have to select which one you want by clicking the appropriate radio button.

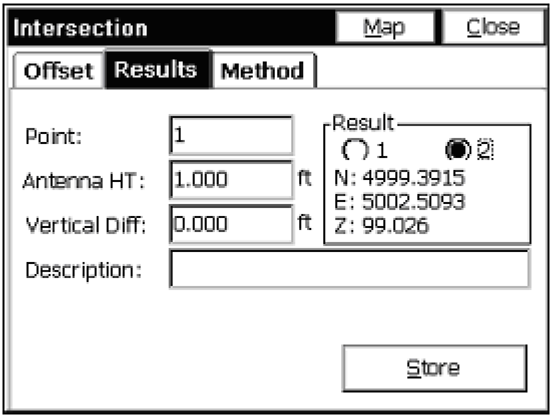


Figure 4-55

Offset by Two Point

Use **Offset by Two Point** to calculate a point based on two GPS positions and a distance from the second point. If **Straight** is selected, the distance offset from the second point is along the 3-D vector created by the two GPS points. If **Left** or **Right** is selected, the offset is perpendicular to the 2-D vector created by the two GPS points, and, the second point's elevation is used as the elevation of the resulting point. The distance offset can either be manually entered or input with a laser. To use a laser, you must first activate it by selecting **Settings**. For more information on laser setup, see the **Peripherals** section of this manual.

Offset

Under the **Offset** tab, press **Read Point 1** to read the first point from GPS. Repeat this process for the second point. The GPS antenna height used for each GPS read can be adjusted individually by editing the **HT** fields. Now enter the offset of the point you would like to store, or press **Read Dist** to read it from a laser. Finally, specify the direction of your offset, and switch to the **Results** tab to see your solution.

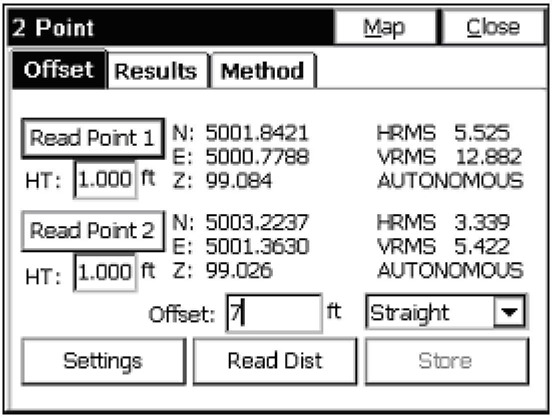


Figure 4-56

Results

After you have two GPS positions and an offset, click on the **Results** tab to view the resulting point. If valid data has been entered in the **Offset** tab, the result will appear as shown below. In this window, you can specify a vertical difference for your target point. You can also specify the point ID and description for the point that will be stored.

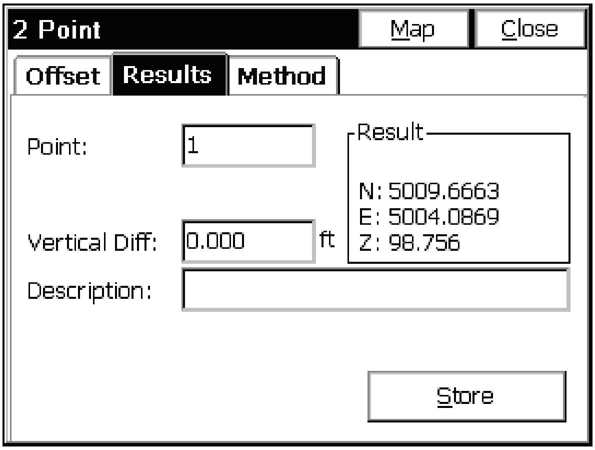
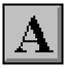


Figure 4-57



With GPS, since shots "cluster" around the true point location, it may add to accuracy to average 10 or more GPS readings when taking measurements. You will be prompted for how many readings to take (up to 999). Taking 100 readings is also a way to guage how fast your GPS equipment takes measurements. If 100 readings are taken in 10 seconds, you are reading at 10 per second, or 10 "hertz" (hz). After the readings are taken, a display appears showing the range and standard deviation of the readings:

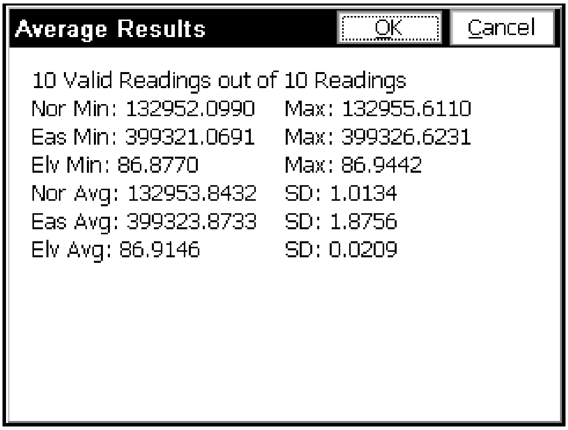
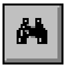


Figure 4-58


The Monitor/Skyplot screen is available for further status feedback by clicking the "Binoculars" icon. Monitor has both a Coordinate and Lat/Long display, as shown in **Error! Reference source not found.**.

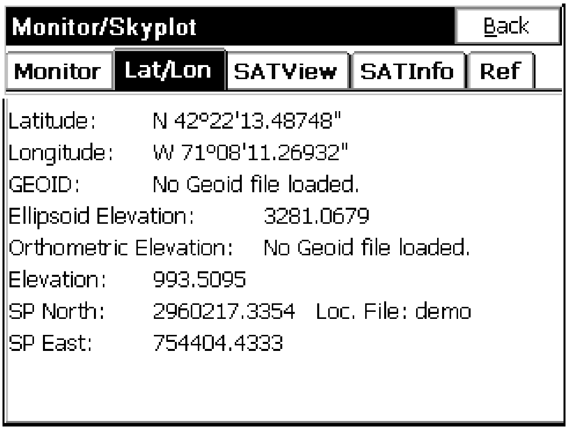


Figure 4-59

Note: Latitude/Longitude "tab", you can verify use of a Geoid for elevation adjustment, and also see your "Localization File", which governs the transformation from Latitude and Longitude to local coordinates. It is a good habit to verify your Localization File in this screen prior to starting work, to ensure you are using the correct file. If no "Loc. File" is shown, then you will get unadjusted coordinates based solely on your Latitude and Longitude as applied to the configured Transformation (eg. UTM, SP83, etc.).

Stakeout Points

Function

This command allows you to stakeout to a selected point by guiding you to the point with a series of commands and directions. There are some configuration settings that can be setup to guide you to the point with various options. You should review the Job Settings under File before staking, as there are about five settings for different methods. The dialogs are varied slightly with respect to total station or GPS equipment. Both types are documented here, illustrating the differences between the dialogs.

Features of Stakeout Points

When the routine is selected from total station mode, you are immediately placed in a Confirm Orientation dialog, where you are asked if this is correct. The opening or main dialog appears as shown in Figure 4-60.

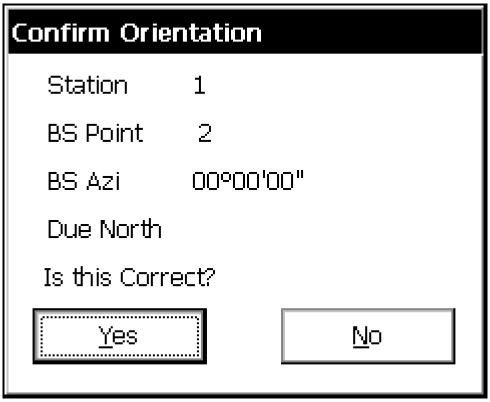


Figure 4-60

You are presented with the Station, BS Point and BS Azi. If the three items are correct, select Yes to move on to the Stakeout Coordinates dialog, or select No and you are taken to the standard Backsight dialog to setup the instrument correctly. After the instrument is correctly configured, then you are taken to the Stakeout Coordinates dialog (see Figure 4-61). In GPS mode, you are taken to the Stakeout Coordinates dialog immediately to select the point for stakeout.

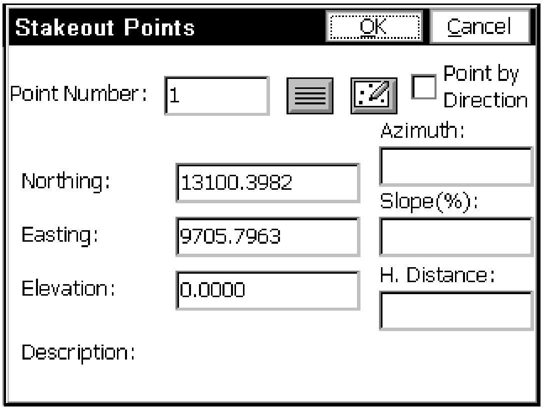


Figure 4-61

- **Point Number**: This is the number of the point which you are staking. You can enter it in here and hit the enter key to view the elevation, northing and easting before selecting OK. If you want to stake out a range of points, you can enter in the points in the following format: 3-10,2,15-20. This would stake out the points from 3-10 sequentially, then point 2, then 15 through 20 sequentially. If you are using a control file in total station mode and you enter a point number which also is present in the current job file, it will choose the control file point if "control file has priority" is turned on in Job Settings, Stakeout. If you enter a point number that is not in the control file, but is in the current job's coordinate file, then that point will be used. You can also select the points to stakeout from a list by selecting the List icon. If you select the list option, you can select the points for stakeout from the active Job file or the Control file. To do this toggle between the files by selecting between the Job and Control toggles at the top of the dialog. You can select a range of points by selecting the first point to stake then pressing the shift key and selecting the last point to stake. All points between the two selected points will be staked in sequential order. You can also add to the selection of points to be staked by pressing and holding the CTRL button and individually selecting the points to be staked. You may also select an individual point to be staked by selecting the Map icon and tapping on the point to be staked.

- **Northing, Easting, Elevation**: You must have a northing, easting and elevation entered in for the point you are staking out. If you type in the point number of an existing point and hit return, they will appear automatically. The description of existing points is displayed at the bottom of the dialog.

After selecting OK, the main stakeout window appears in map view. In manual total station mode, the angle to turn to and the distance to the stake point will be displayed at the bottom of the screen. A read function is required to update the directional display information. You should see your points in the map with an icon of where you need to stakeout to (the circle with the X inside).

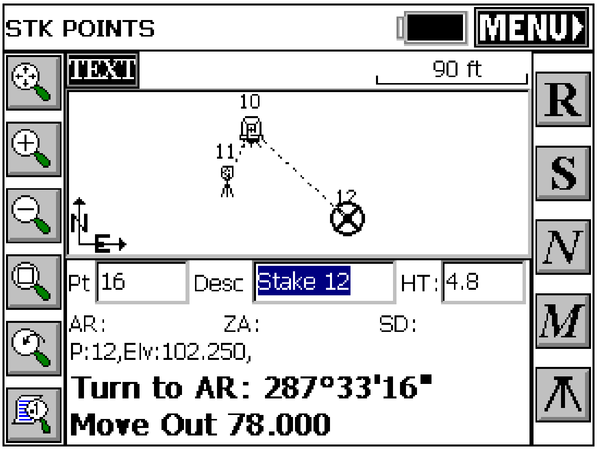


Figure 4-62

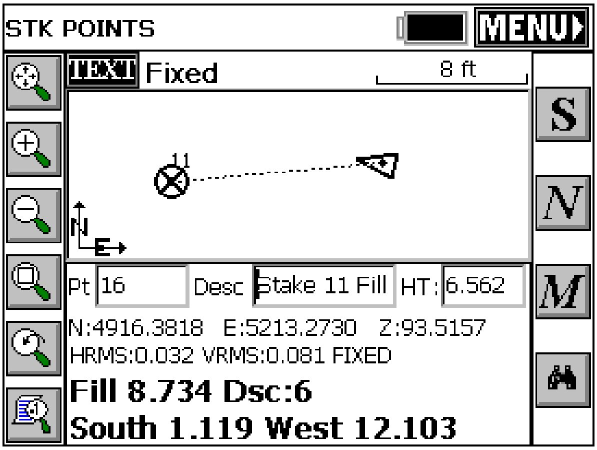


Figure 4-63

Figure 4-62 shows the stakeout points window when configured for total station. Figure 4-63 shows the stakeout points window when configured for GPS. Shots are taken typically by pressing Enter.

- **Read (R)**: This button takes a reading to the current position of the target when using a manual total station. After reading and taking the shot, the display will be updated with a distance and direction to the stakeout point. In GPS or Robotic Total Station, with tracking on, your current position is read immediately. Depending on your settings in Job Settings, the direction to stake will either be right/left distance or North/South East/West in the Map screen. See View screen below for additional options. The cut or fill is the elevation difference between the point read and the point being staked. Normally, you take a shot simply by pressing Enter. After a total station shot is taken, you will see your "In-Out" distance to the target point. See Figure 4-64.

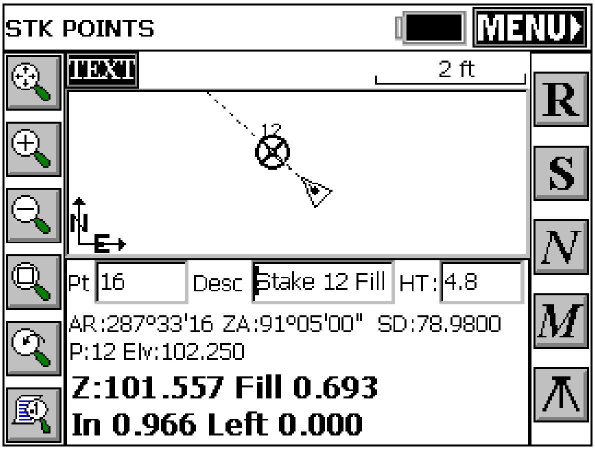


Figure 4-64

- **Store (S)**: This will store your location to the point file. If the tolerance distance is exceeded for staking out, you will be notified and asked if you want to continue storing. (Stakeout Tolerances are set under Tolerances in the Equip Menu). Selecting OK will display the Stakeout Report dialog shown below.

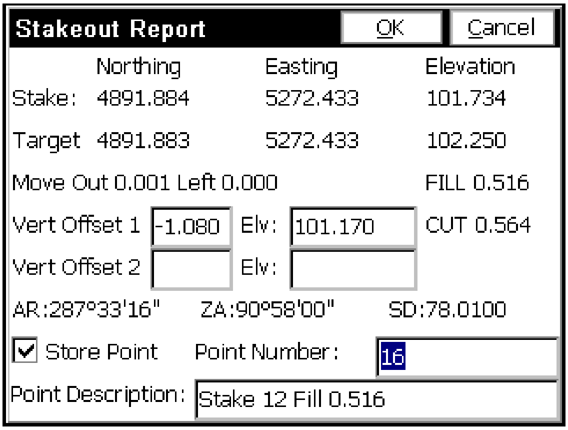


Figure 4-65

The coordinates for the Stake Point and the Target Point are displayed. The delta North, East and the elevation difference (Cut/Fill) is also displayed. The Vert Offset 1 and Vert Offset 2 allow for elevation calculations based on the input vertical offset values. If the Store

Carlson Cutsheet Data in Note File has been toggled, the vertical offset(s) specified will be recorded in the .not file for the job. If under Job Settings, Stakeout, Set Cutsheet Format, a Set Pt Cutsheet Format has been established with a named file for storage, then cut and fill data will be saved to a cutsheet ASCII file. If using GPS, the HRMS, VRMS, and PDOP values are also displayed. Fields for Point number and point description input are also displayed. After the point has been stored, you are taken back to the Stakeout Points dialog to select the next point for staking. For total stations, if the Use Control File option is set under the Job Settings, you have the option of staking control file points. If you enter in a point number to store that is the same as a point number in the control file, the point in the control file will remain unchanged. It will only modify the point in the current coordinate file. After storing a point, you are taken back to the Stakeout Coordinates dialog to select the next point. In GPS mode, if the point being stored is the same as one in the current job file, the Point Protect dialog box appears stating that the point you chose is already used. The next available point number is listed with the option to overwrite the current point, or use the new number.

- **Next (N)**: This will take you to the next point on the list for staking out. You will be directed back to the Stakeout Points dialog for choosing the next point.
- **Menu (M)**: This returns to the stakeout menu and does not increment the point number to be staked.
- **Setup**: This is the button in the lower right corner of the screen for total stations. It takes you to the setup screen for additional instrument setup and benchmarking.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This brings up the Monitor/Skyplot dialog. See Monitor/Skyplot in Chapter 3 for information on this dialog.
- **Zoom**: The buttons along the left side of the dialog are for changing your view of the map. From the top down they are: zoom extents, zoom in, zoom out, zoom window, zoom previous and view point options. Notice that when zooming in or out, the bar scale at the top of the map changes in relation to the scale.

Features of TEXT Stakeout Mode:

Selecting the TEXT button at the top left of the Map View screen will take you to a detailed text orientated stakeout dialog. This dialog has a graphical display with a bullseye representation of the stakeout point. The type of survey equipment used, Total Station, Robotic Total Station or GPS will determine the format of the graphic display and various options on the screen. A typical GPS screen shown is in Figure 4-66.

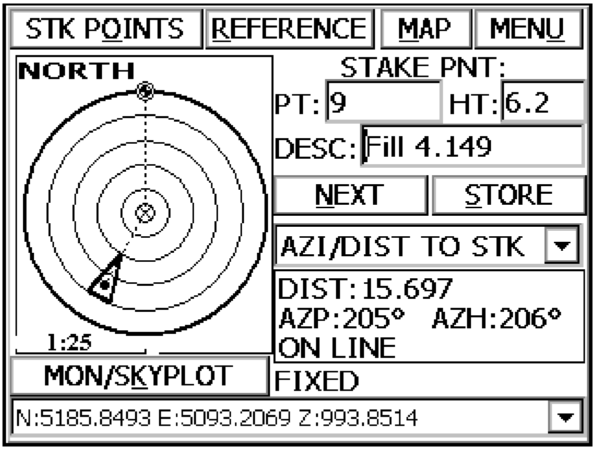


Figure 4-66

Typical Robotic TS screen shown in Figure 4-67.

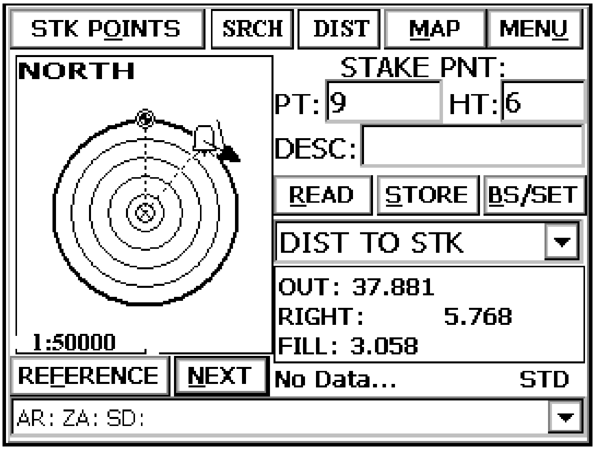


Figure 4-67

Typical Standard TS screen shown in Figure 4-68.

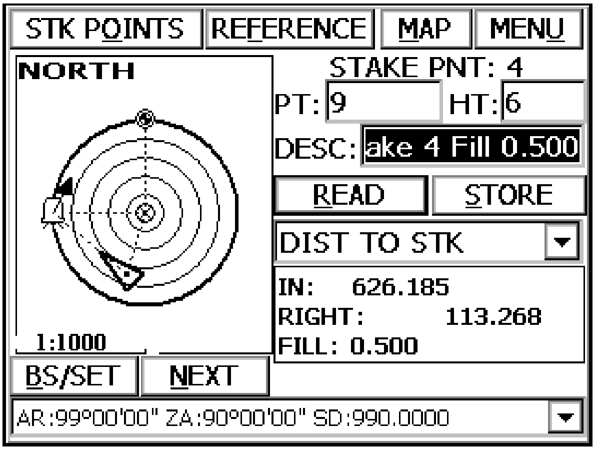


Figure 4-68

Bullseye (Graphic Display) An arrow indicates your current position in GPS and an instrument symbol represents your position using manual or Robotics. The center of the bullseye is the point to be staked. A small circle with an hour glass in it indicates your reference point. Your position is updated continuously if using GPS or Robotic Total Stations in tracking mode. If using a Manual Total Station the current position is updated after you take a reading to the position of the target. The triangle marker indicates your position in relation to the desired stake point. If you are short of the point, then the marker will be between the center of the bullseye and the instrument symbol, if using manual or robotic total stations. If the triangle is beyond the center mark you are beyond the desired stake point. As you get closer to the target, the scale of the display, located below the bullseye, is updated. When you get within your defined stakeout tolerance, each corner of the bullseye will display a diamond as shown in Figure 4-69.

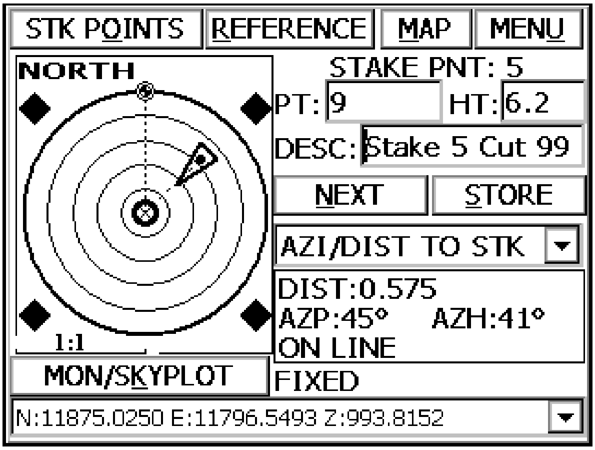


Figure 4-69

Your specified reference is displayed in the upper left corner of the bullseye. For example, if your reference is North, then North will be listed at the top left of the bullseye. The survey equipment used will dictate the options located at the bottom of the bullseye. In GPS mode, the MON/SKYPLOT option, is available. In Robotic Total Station mode the REFERENCE and NEXT options are available. In Manual Total Station mode, the BS/SET (Setup) and NEXT options are available. Each of these options are documented above.

Tabs: The tabs across the top of the view screen change depending upon the survey equipment selected.

STK POINTS: Once in the View screen, pressing this tab takes you back to the map screen. If you exit the program while in the View screen for stakeout, the next time you go to stakeout the View screen will be active and is now set as the default stake out screen. To change back to the Map screen as the default, press the STK POINTS button.

REFERENCE: This option allows for defining a reference point for orientation of the bullseye. The type of survey equipment used determines reference options. With manual and robotic total stations, the reference options are North, Point and Instrument. With GPS, the options are North, Point, and Base Station. North is always represented by the small circle with the hour glass, and the specified reference point is always represented by the larger empty circle. When north is referenced, the smaller circle is inside of the larger circle.

Note: Staking out in GPS by reference to a point or to the base is only available in the "Text" screen within the Stakeout commands. In the graphics screen, the visual display of movement towards the target point is provided, rendering these other referencing options less critical.

Map: This tab takes you to the map screen. When in the map screen, the BACK tab will take you back to the View screen.

Menu: This tab takes you to the main FAST Survey menu screen.

SRCH: Robotics only. This puts the instrument in search mode.

STDBY: This tab places the robotic total staiton in Standby mode, meaning it will suspend tracking mode (eg. allowing you to place the pole down, drive a stake, then resume work).

STAKE PNT: Point to be staked

PT: Number used if store is executed.

HT: Target Height

DESC: Description for point if stored.

Read, Store, BS/Set: All documented above. BS/Set is the same as Setup icon.

Directional Commands: These options are located above the READ and STORE buttons. These options are dependent upon the survey equipment used. The different options are:

(TURN/MOVE to STK), (N/S, E/W to STK), (DIST to STK) – Manual/Robotic Total Stations

(AZI/DIST to STK), (N/S, E/W to STK), (DIST to STK) – GPS Systems

You can change the format of the directional commands at any time by selecting the down arrow and picking the format desired. TURN/MOVE to STK will always show the initial angle and distance to turn from the setup point to the stake point if using total stations. It does not update. When READ is pressed, then the directional display updates to show DIST to STK. Going back to TURN/MOVE to STK will display the original angle to turn and dist to travel.

Directional Display: This is the data field directly under the directional commands. The information shown in this display is dependent upon the settings specified for the directional commands documented above. Survey equipment used will determine if this screen is updated continuously or requires a READ command to update. This screen displays the directional information that leads to the stake point.

Configuring and Storing a Point CutSheet: When staking out known points, you are often interested in cut and fill data, where the elevation of the measured point is compared to the elevation of the design point. Say that you goal was to create a table as shown here:

Design Point	Design Elev.	Meas Elev.	Cut	Fill

This can be configured within Job Settings, Stakeout Tab. In the screen shown below, you would select Set Cutsheet Format.

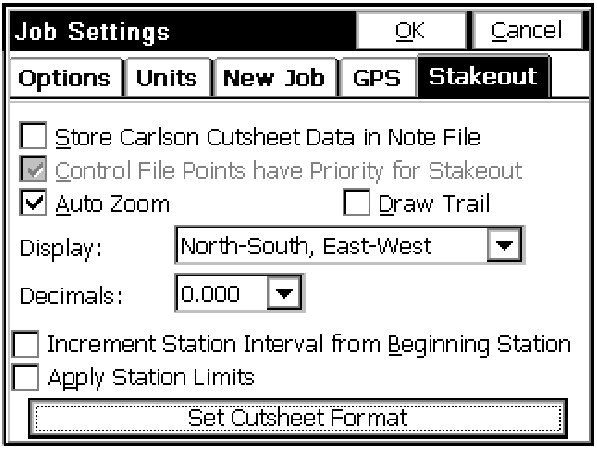


Figure 4-70

Then you would select "Set Pt Cutsheet Format". In the next screen, which controls the format of the cutsheet, you name the file to create in the upper left, turn off all items you don't wish to report, and even change the header "name" for each item (shown here, the label for Stake Elv. is being changed to "Meas Elev." as shown below.

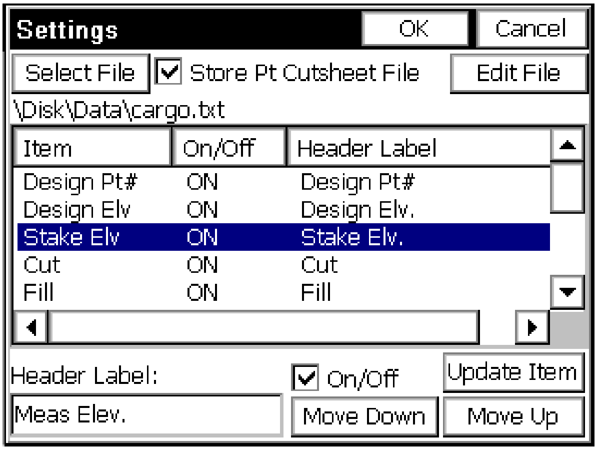


Figure 4-71

Then when you click Update Item, Meas Elev. will appear as the official "header" for that column. The table is cutsheet data is made automatically when doing Point Stakeout, and can be reviewed by going to the above screen within Job Settings, GPS Tab, and clicking Edit File. It takes 2 screens to fully display the complete table:

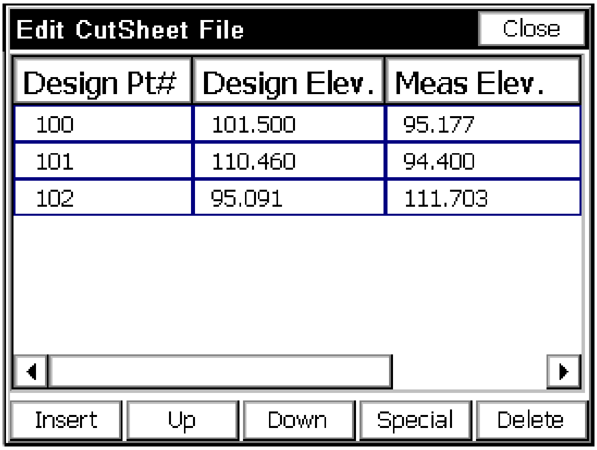


Figure 4-72

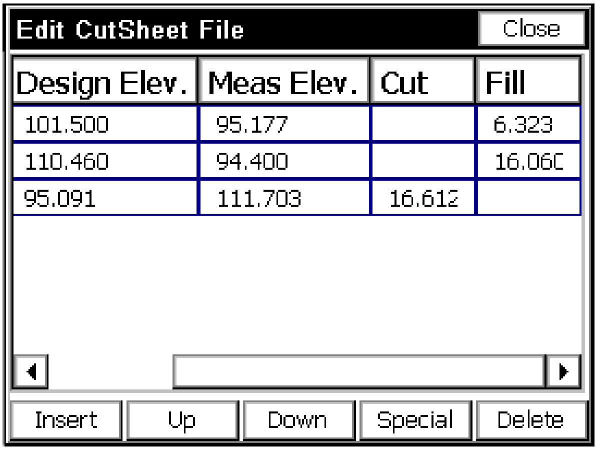


Figure 4-73

Note that you can slide the column bars tighter or wider by picking them in the "header" line and moving left or right, much like with Microsoft Excel and other such spreadsheet packages. The file, in this case Cargo.txt, can be uploaded to a PC and presented directly in tabular form in a word processor program or any office spreadsheet program.

Stakeout Line/Arc

Function

This command opens a secondary dialog where you can choose between Stake Line, Stake Centerline, Stake Arc (3 points) and Stake Arc (PC, R, PT). These functions are documented below.

Stakeout Line

This command allows you to stakeout to a line between two points by guiding you to the point with a series of commands and directions. This option is for setting out points along a line including the cut or fill, or for staking out points relative to the line. One application, for example, would be staking a pipe between 2 known points (inlet and outlet), where offset stakes can be set with cut/fill noted. Station Store might even be used to calculate the inlet and outlet points, based on known station, offset and elevation. There are some configuration settings that can be setup to guide you to the point with various options. You should review the Job Settings, Stakeout under File before staking. The dialogs are varied slightly with respect to total station or GPS equipment. Both types are documented here, illustrating the differences between the dialogs.

Stakeout Line also has a Point On Line tab that enables, in total station mode, staking of the intersect on the current line-of-sight with the specified line. This is often used to set stakes or flagging along a property line that is obscured by trees. The surveyor finds a gap in the line, takes a reading to the prism and is advised how far to Move In or Move Out to stake the line, at the current line-of-sight. The Point On Line tab also includes the standard Perpendicular method, where any measurement is used to compute the direction and distance to move to go to the point on the line perpendicular to the measured point. For GPS configurations, Point On Line offers only the Perpendicular method.

Features of Stakeout Line

When the routine is selected from total station mode, you are immediately placed in the Confirm Orientation dialog, where you are asked if the current setup is correct. See Figure 4-74.

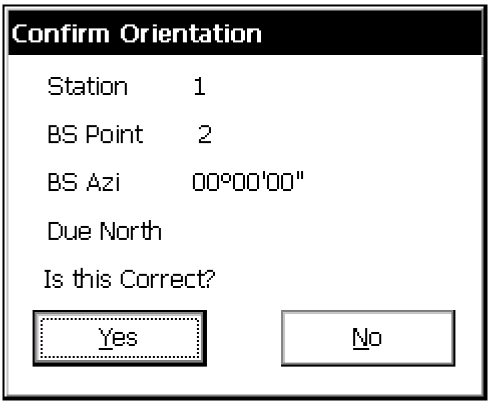


Figure 4-74

You are asked to view the Station, BS Point and BS Azi. If the three items are correct, select Yes to move on to the Point on Line dialog, or select No and you are taken to the Setup dialog to setup the instrument correctly. After the instrument is correctly configured, then you are taken to the Point on Line dialog. In GPS mode, you are taken directly to the Point on Line dialog (see Figure 4-75) to select the points on the line for stakeout or the starting point and azimuth with slope %.

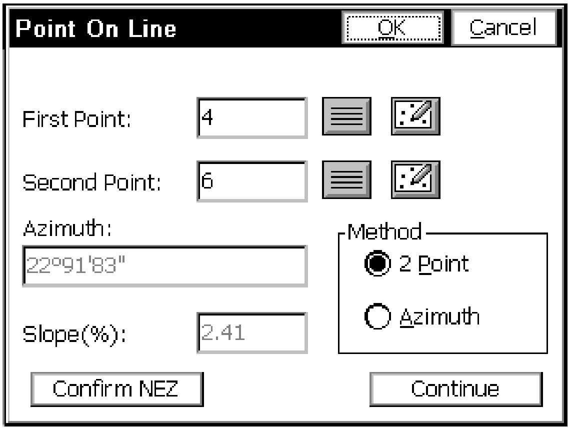


Figure 4-75

- **First Point**: This is the starting point of the line. You can enter it in here by point number. The first button brings up the list points dialog where you can pick from list the starting point of the line. The button beside that brings you to the map view prompting you to "pick a point" from the map. Once you pick a point from the map, it takes you to the list points dialog to confirm you have selected the correct point with its northing and easting.
- **Second Point**: Pressing Enter from the first point moves on to the second point. This is the ending point on the line that is only available for entry if Method is set as 2 Point for defining the line. The procedure for selecting this point is the same as the First Point.
- **Azimuth**: This option will be available for input only if Method is set to Azimuth. If Method is set to 2 Point, then the Azimuth is inactive, but still displays the azimuth between the two points of the line. The "Azimuth" method will prompt for Bearing if "Angle Type" is set to Bearing in Job Settings, Units.
- **Slope (%)**: Just like the Azimuth, this option will be available for input only if Method is set to Azimuth. If Method is set to 2 Point, then the Slope is inactive, but still displays the slope between the two points of the line.
- **Method**: This is how you define the line. It is either by two points or one point and an azimuth and slope.

- **Confirm NEZ**: Selecting this button brings up the Confirm NEZ dialog box as shown in Figure 4-76.

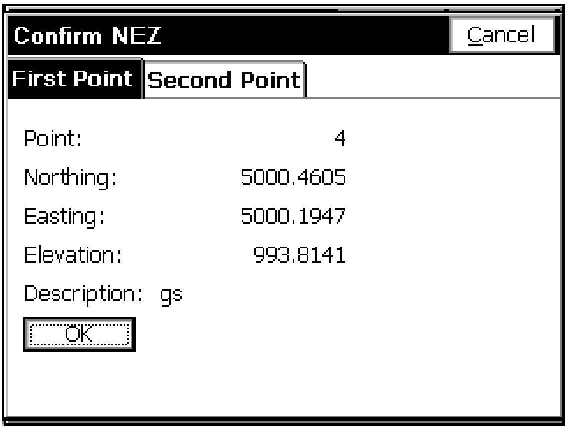


Figure 4-76

This screen displays each point as a tab at the top of the screen. Listed is the point number, Northing, Easting, Elevation and Description of the point(s) selected for the line. After you confirm they are the correct points, selecting OK or pressing Enter will take you back to the Point on Line screen. Selecting either OK or Continue brings you to the next Stakeout Line screen. Enter after Confirm NEZ automatically continues to the next screen.

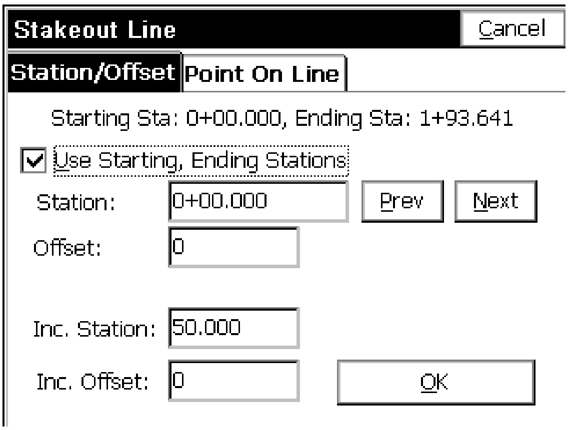


Figure 4-77

- **Use Starting, Ending Station**: Within Stakeout Line, the starting station will always be 0, but the ending station will often be an odd number, like 1+93.641 above. By clicking on this option, the "Next" station option will increment by the specified interval (here 50), but will include the ending station.
- **Station**: This is where you enter the station to stakeout.
- **Offset**: This is where you enter in the offset distance from the line.
- **Inc. Station**: This is where you enter in the incremental stations to locate points and offsets along the line.
- **Inc. Offset**: This is for entering an optional incremental offset along the line. This is a rarely used feature that would trend the offsets away or in to the centerline.
- **Offset to Line**: This option is under the point on line tab. This feature will stake out to the nearest point on the line or the parallel line at the specified offset. With an Offset of 0, it will project the line forward and back and with the first GPS reading or total station shot, find the perpendicular intersect with the line or projected line and direct you to that target point.

After selecting OK, the main stakeout window appears in map view. In total station mode, it will be waiting for a shot or reading. You should see your points in the map with an icon of where you need to stakeout to (the circle with the X inside). Figure 4-78 shows the stakeout window when configured for total station use. Note that this example shows staking of an offset left of the centerline from points 104 to 105. Figure 4-79 shows the stakeout window when you are configured for GPS, showing staking to the line itself with 0 offset specified.

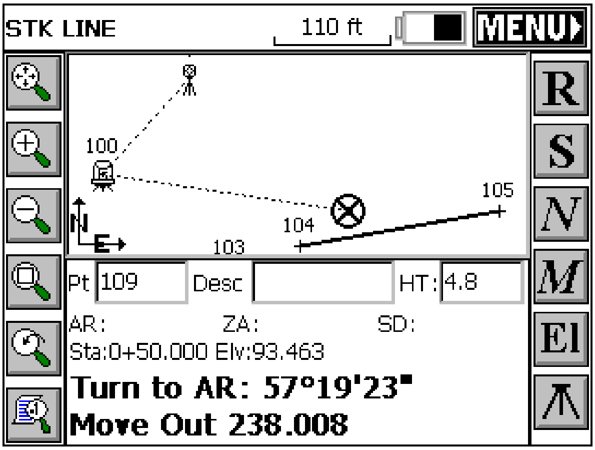


Figure 4-78

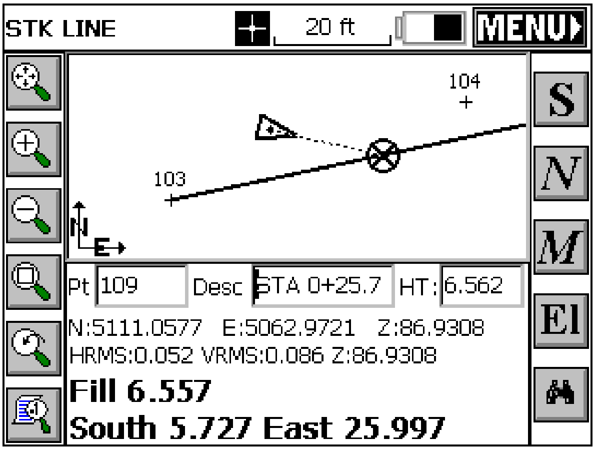


Figure 4-79

- **Read (R)**: This button takes a reading to the current position of the target when using a manual total station. Enter will also take a reading. After reading and taking the shot, the display will be updated with a distance and direction to stakeout. In GPS mode, your current position is read immediately. Depending on your settings in Job Settings, the direction to stake will either be right/left distance or North/South East/West. The cut or fill is the elevation difference between the point read and the point being staked

- **Store (S)**: This will store the last reading to the point file. With total stations, you must first have taken a Read. With GPS, S or Enter will take a shot and store. However, if the tolerance distance is exceeded for staking out, you will be notified and asked if you want to continue storing. Selecting OK will display the Stakeout Report dialog. See Figure 4-80.

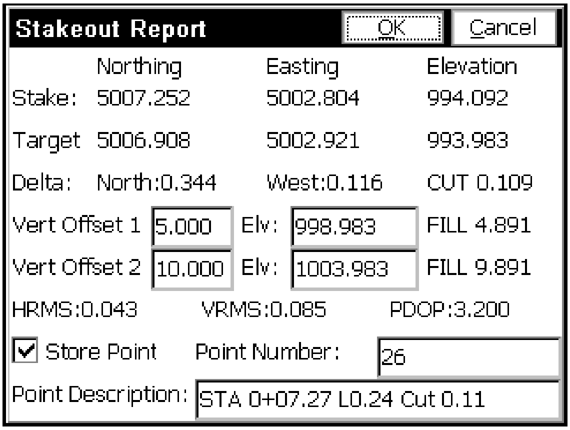


Figure 4-80

The coordinates for the Stake Point and the Target Point are displayed. The delta North, East and the elevation difference (Cut/Fill) is also displayed. The Vert Offset 1 and Vert Offset 2 allow for elevation calculations based on the input vertical offset values. If the Store Carlson Cutsheet Data in Note File has been toggled, the vertical offset(s) specified will be recorded in the .not file for the job. If using GPS, the HRMS, VRMS, and PDOP values are also displayed. Fields for Point number and point description input are also displayed. After the point has been stored, you are taken back to the Stakeout Points dialog to select the next point for staking. For total stations, if the Use Control File option is set under the Job Settings, you have the option of staking one of those points. If you enter in a point number to store that is the same as a point number in the control file, the point in the control file will remain unchanged. It will only modify the point in the current coordinate file. After storing a point, you are taken back to the Stakeout Coordinates dialog to select the next point. If the point being stored is the same as one in the current job file, the Point Protect dialog box appears stating that the point you chose is already used. The next available point number is listed with the option to overwrite the current point, or use the new number.

When you return to the Stakeout Line screen, after storing apoint, there is a new tab option “Next Alignment” that allows you to define a new alignment, without exiting the command.

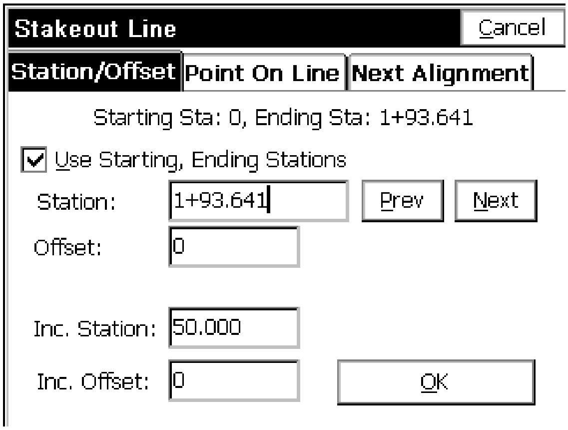


Figure 4-81

- **Next (N)**: This will take you to back to the Stakeout Line screen and auto-increment the station and offset (if applicable).
- **Menu (M)**: This will also take you back to the Stakeout Line screen but will not auto-increment any of the inputs.
- **Elevation Override (EL)**: This will first display the design elevation computed at that station along the defined line and second, will provide the option to override that elevation with a user-entered elevation. See Figure 4-82:

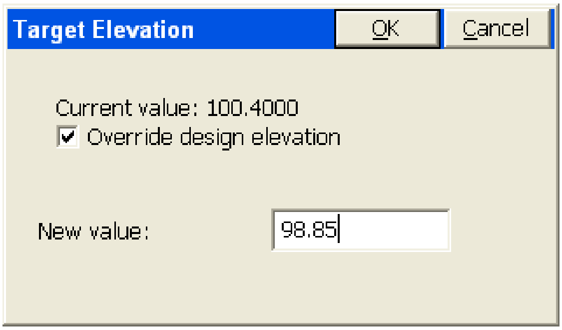


Figure 4-82

- **Setup**: This is the button in the lower right corner of the screen for total stations. It takes you to the Backsight screen which permits new inputs for instrument setup and benchmarking.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This brings up the Monitor/Skyplot dialog. See Monitor/Skyplot in Chapter 3 for information on this dialog.
- **Zoom**: The buttons along the left side of the dialog are for changing your view of the map. From the top down they are: zoom extents, zoom in, zoom out, zoom window, zoom previous and view point options. Notice that when zooming in or out, the bar scale at the top of the map changes in relation to the scale.

Point On Line tab in Stakeout Line

When configured for total stations, this option, which appears only in Stakeout Line, enables "line-of-sight" staking of lines, where the program prompts only for in-out distance to move. This is often used by surveyors who are setting line in tree lines, moving to gaps in the trees for readings, then moving in-out along the line-of-sight and driving stakes when perfectly on line. The "Offset to Line" option ghosts out when the "Find Intersect to Line" method is selected. The offset option is available when the Perpendicular option is chosen. See Figure 4-83.

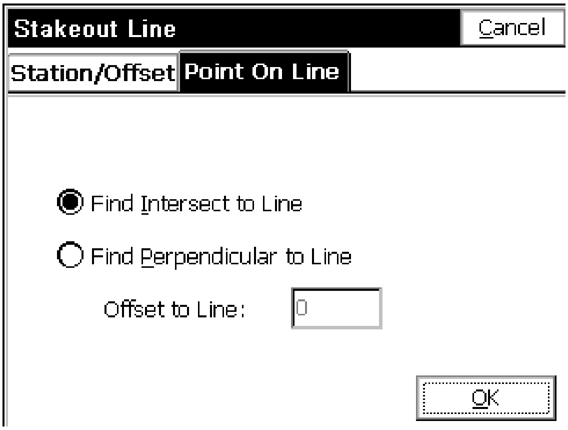


Figure 4-83

In the Intersect mode, the first screen always displays the target point on the line, (or the extension of the line), perpendicular to the setup or station point. When the first reading is taken, the program will then display the In-Out distance to the line along the line-of-sight, as shown below:

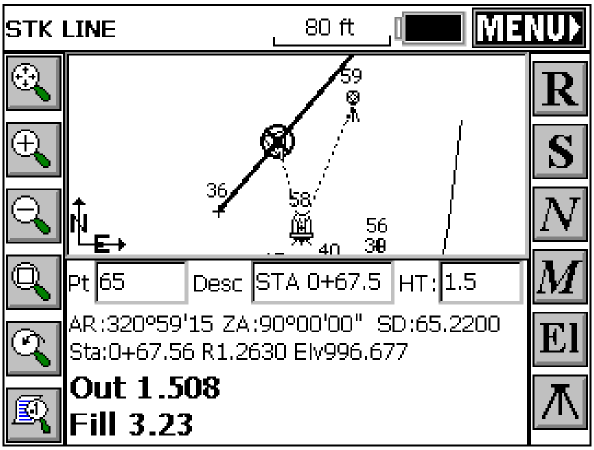


Figure 4-84

When configured for the Perpendicular to Line method, the program will show the direction and distance to move to find the nearest point on the line to the measured point.

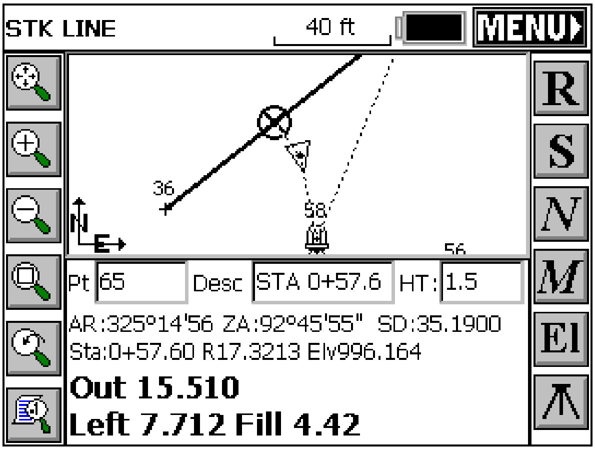


Figure 4-85

Point On Line, in Stakeout Line, offers the Perpendicular method when configured to GPS and both Perpendicular and Intersect methods when configured for total stations. It will default to the last method used (Perpendicular or Intersect) when set for total stations.

Features of Stakeout Centerline

When the routine is run in total station mode, you are immediately placed in a Confirm Orientation dialog. (See Features of Stakeout Line above) After orientation confirmation, you must choose a centerline file (.CL) from a standard file selection dialog. When this routine is run in GPS mode, you will immediately be prompted to select the centerline (.CL) file. Stakeout Centerline only requires a horizontal alignment, but you have the option to specify a vertical alignment which will lead to cut and fill results as well. See Figure 4-86.

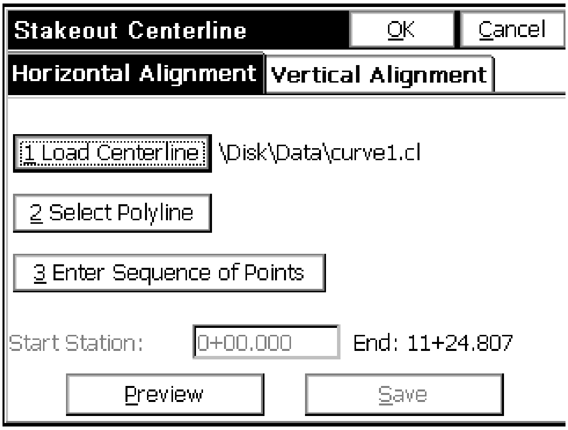


Figure 4-86

There are 3 methods of specifying a horizontal alignment: (1) by loading a centerline file defined in the Roads Menu or uploaded and converted to ".cl" format, (2) by selecting a polyline on the screen and (3) by entering a sequence of points. Defining the vertical alignment, which is optional, is similar, with the added option to toggle on applying the elevations. If your goal is to igrnore elevations and you are auto-recalling roading files, the Vertical Alignment will be used and cut/fill will appear unless you turn off "Apply Elevations". Pressing Preview will display the centerline, for verification. Shown in Figure 4-87 is a tight-curve centerline that might be used for an exit ramp. Notice that the centerline is shown along with any existing point numbers in the vicinity.

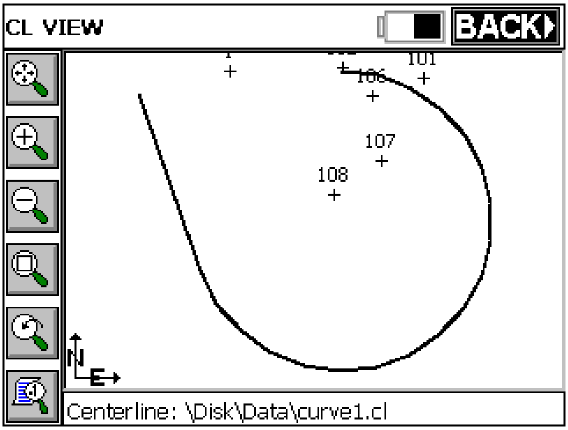


Figure 4-87

After you select the centerline file, the Stakeout Centerline dialog shown in Figure 4-88 appears. This screen illustrates the appearance if no Vertical Alignment is defined, or if defined, is toggled off. Elevations can be entered, leading to cut/fill reporting.

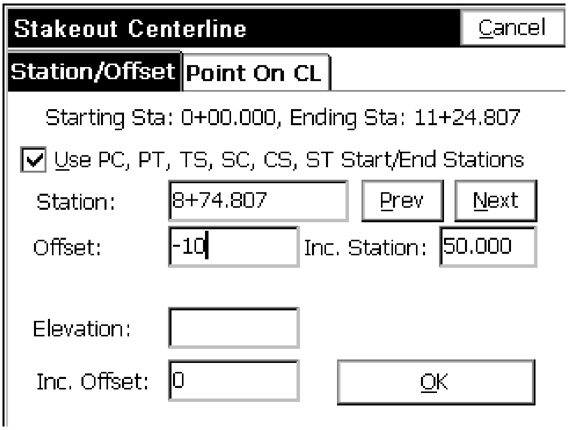


Figure 4-88

By contrast, if a Vertical Alignment is entered, and toggled on, you will see the dialog in Figure 4-89. Notice that the elevation is computed from the Vertical Alignment. If the "Override design elevation" box is clicked on, the computed Elevation can be changed. The Elevation is used for cut/fill reporting.

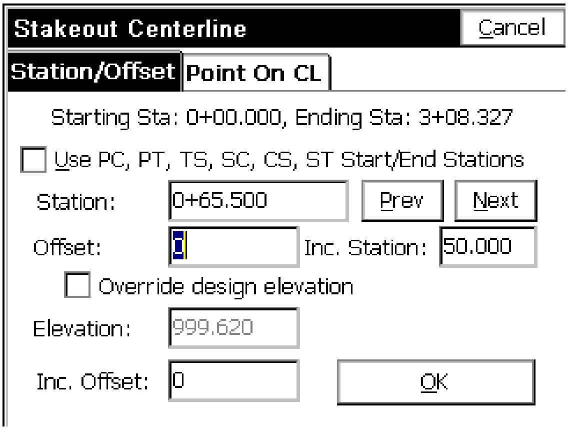


Figure 4-89

- **Use PC, PT, TS, SC, CS, ST, Start/End Stations**: With this toggle checked on, each PC, point of curve, PT, point of tangent, TS, tangent to spiral point, SC, spiral to curve point, and ST, spiral to tangent point will be staked. Start and End stations will also be used. When the N, next icon is pressed during stakeout, if one of the above curve elements is encountered, the station of the point will be displayed in the Station/Offset dialog. The option to skip this point is available by pressing the Next button.
- **Station**: This is where you enter the station to stake. The Prev and Next buttons allow for advancement to the Next station or to the Previous station. The default station advancement distance is defined by the Inc. Station defined below.
- **Offset**: This is where you enter in the offset distance from the line.
- **Inc. Station**: This is where you enter in the incremental stations to locate points and offsets along the line.
- **Inc. Offset**: This is for entering an optional incremental offset along the line.
- **Elevation**: This option enables reporting of cut and fill data on the staked point.

After you define the station to stake, the display will change to the map view. See Figure 4-90 for typical dialog while in GPS mode and Figure 4-91 for typical dialog while in TS mode. Note metric stationing.

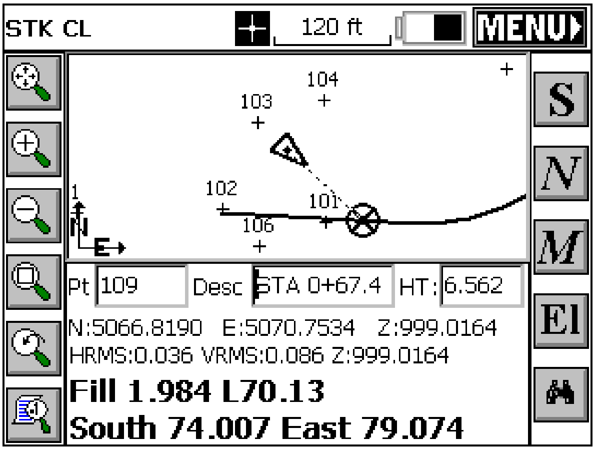


Figure 4-90

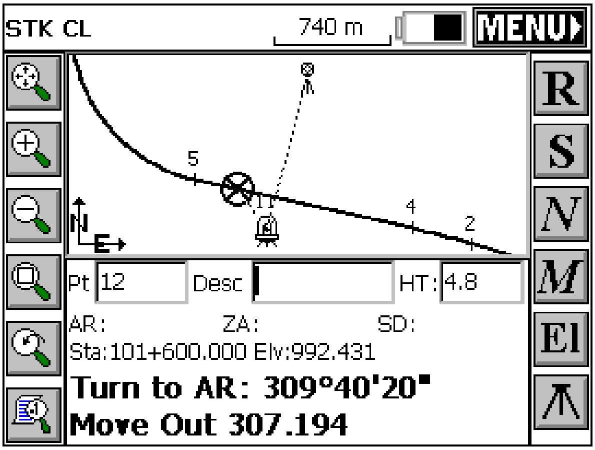


Figure 4-91

- **Read (R)**: This button takes a reading to the current position of the target when using a manual total station. After reading and taking the shot, the display will be updated with a distance and direction to stakeout. In GPS mode, your current position is read immediately with Enter or Store. The cut or fill is the elevation difference between the point read and the point being staked
- **Store (S)**: This will store your location to the point file. If the tolerance distance is exceeded for staking out, you will be notified and asked if you want to continue storing. Selecting OK will

display the Stakeout Report dialog. (see Figure 4-80 under Stakeout Line above). The coordinates for the Stake Point and the Target Point are displayed. The delta North, East and the elevation difference (Cut/Fill) is also displayed. The Vert Offset 1 and Vert Offset 2 allow for elevation calculations based on the input vertical offset values. If the Store Carlson Cutsheet Data in Noter File has been toggled, the vertical offset(s) specified will be recorded in the .not file for the job. If using GPS, the HRMS, VRMS, and PDOP values are also displayed. Fields for Point number and point description input are also displayed. After the point has been stored, you are taken back to the Stakeout Points dialog to select the next point for staking. For total stations, if the Use Control File option is set under the Job Settings, you have the option of staking one of those points. If you enter in a point number to store that is the same as a point number in the control file, the point in the control file will remain unchanged. It will only modify the point in the current coordinate file. After storing a point, you are taken back to the Stakeout Coordinates dialog to select the next point. In GPS mode, if the point being stored is the same as one in the current job file, the Point Protect dialog box appears stating that the point you chose is already used. The next available point number is listed with the option to overwrite the current point, or use the new number.

- **Setup**: This is the button in the lower right corner of the screen for total stations. It takes you to the Store Points screen for additional instrument setup and benchmarking.
- **GPS Start and Stop**: This button, available in some versions of GPS, alternates between an X and an arrow. While the GPS is running, the X appears, allowing you to stop the GPS from taking readings. When the button is hit, the GPS stops and the button switches to an arrow. Selecting the arrow will start the GPS again, taking more readings.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This brings up the Monitor/Skyplot dialog. See Monitor/Skyplot in Chapter 3 for information on this dialog.
- **Zoom**: The buttons along the left side of the dialog are for changing your view of the map. From the top down they are: zoom extents, zoom in, zoom out, zoom window, zoom previous and view point options. Notice that when zooming in or out the bar scale at the top of the map changes in relation to the scale.

Point On CL in Stakeout Centerline

This command is identical to the Perpendicular Offset option in Point. On Line within Stakeout Line.

Stakeout Arc (3 Points)

This defines the arc by three points that are user defined in the active screen. Choosing this option changes this screen to allow for selecting the points. (See Figure 4-92)

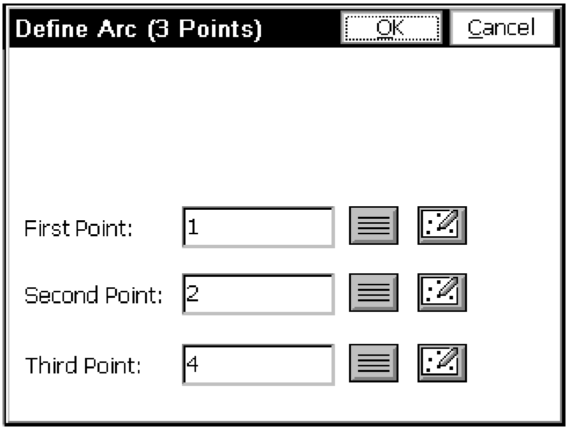


Figure 4-92

The points can be entered in, chosen from the list points button, or selected with the pick from the screen button. After selecting the three points, choose OK to go to the Stakeout Centerline dialog. Please refer to Stake Centerline above for Stakeout Centerline dialog definitions. After selecting OK, to the Stakeout Centerline dialog, the main stakeout window appears in map view (See Figure 4-93). In total station mode, an angle to turn to and a distance to go will be displayed at the bottom of the screen. Taking a reading to the current target position will update the display with a distance out/in and a right/left distance depending upon your job settings. You should see your points and centerline or curve in the map with an icon of the first point you need to stakeout to (the circle with the X inside). When using GPS, after selecting OK to the Stakeout Centerline dialog, you will be placed in the Map screen with your current position shown directional instructions to the first stakeout point continuously updated.

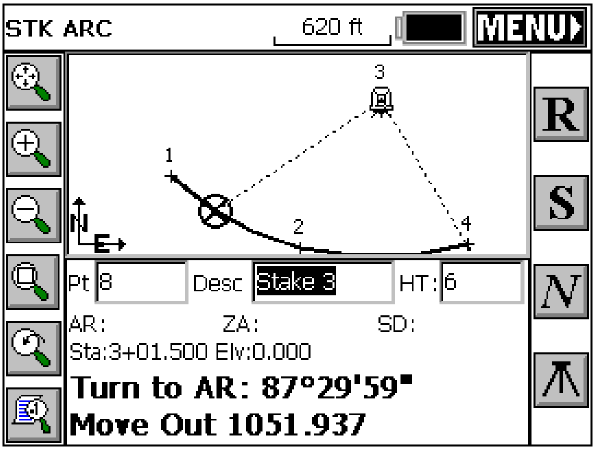


Figure 4-93

See Features of Stakeout Centerline above for information on the available commands while in the dialog shown above.

Stakeout Arc (3 Points)

This option for defining the arc requires four input parameters, the Start point, PC, (point of curve), the Radius Point, RPt, the End Point, PT, point of tangent, and the curve direction. See Figure 4-94.

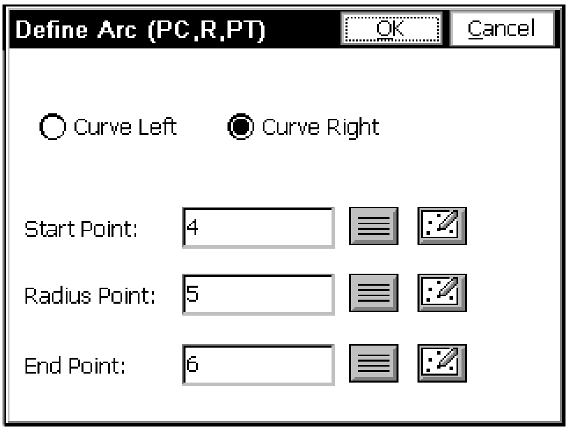


Figure 4-94

For selecting the PC, RPt and PT points, enter the point number, choose the point from the list points screen button, or pick the point from the map button. After selecting OK you will be placed in the Stakeout Centerline dialog, Please refer to the Stake Centerline above for Stakeout Centerline definitions. After selecting OK to the Stakeout Centerline dialog, the main stakeout window appears in map view. (See Figure 4-95) In total station mode, an angle to turn to and a distance to go will be displayed at the bottom of the screen. Taking a reading to the current target position will update the display with a distance out/in and a right/left distance depending upon your job settings. You should see your points and centerline or curve in the map with an icon of the first point you need to stakeout to (the circle with the X inside). When using GPS, after selecting OK to the Stakeout Centerline dialog, you will be placed in the Map screen with your current position shown directional instructions to the first stakeout point continuously updated.

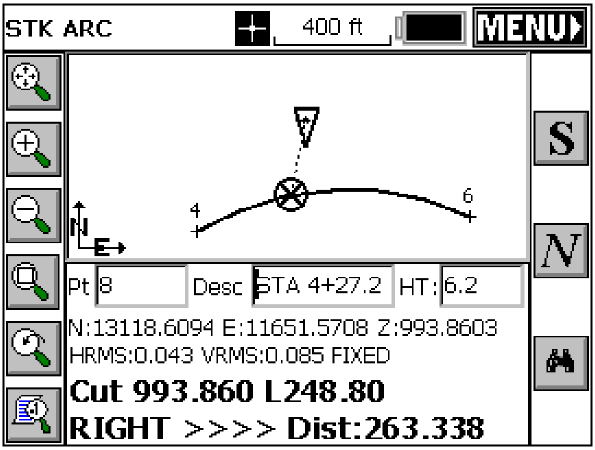


Figure 4-95

See Features of Stakeout Centerline above for information on the available commands while in the dialog shown above.

Stakeout Arc, Point on Arc

Both the Stake Arc (3 Points) and the Stake Arc (PC, R, PT) routines have a Point On Arc option similar to the Point On Line option. In the dialog below, we have chosen to calculate a left 25 offset from the arc. Any measured point will then be translated radially onto the arc that is 25 units left of the specified arc, in this case.

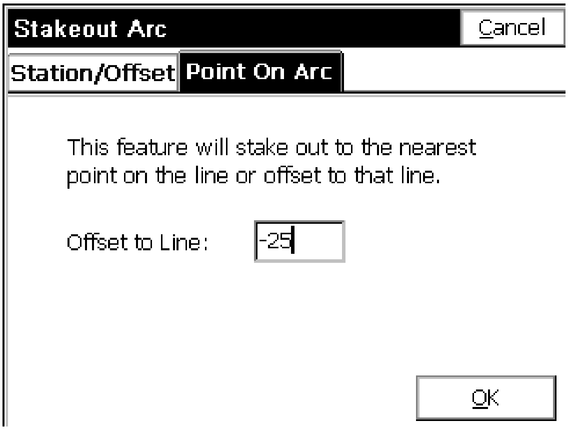


Figure 4-96

When a measurement or GPS reading is taken, the target point will be radial to the curve, at 25 units offset from the curve, as shown in Figure 4-97.

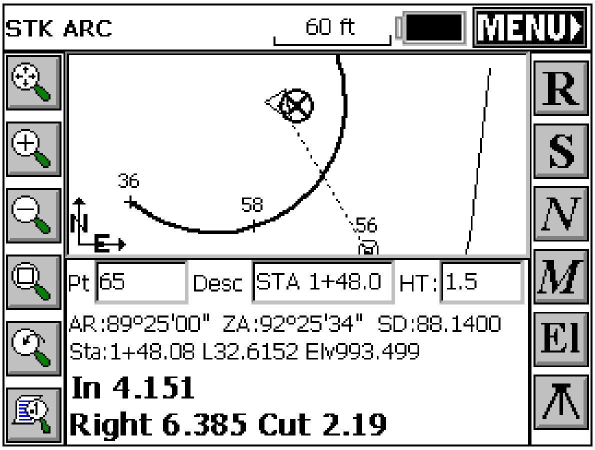


Figure 4-97

Offset Stakeout

Function

This command will stake out up to 2 user defined horizontal offsets to a centerline at any station as well as an unlimited number of offsets per station if you are using a predefined Cutsheet Station and Offset List. It will also stake out the centerline itself. Station intervals can be entered, and the program will auto-detect, at the user's option, special stations such as the TS, SC, PC, PT, CS, ST and vertical curve points (including high and low points). Because individual stations and offsets can be entered, and also because pre-made station and offset lists can be recalled in the field, Offset Stakeout can be applied to virtually any offset point along a centerline.

Pre-Requisites and Procedures

Offset Stakeout requires both a horizontal and vertical alignment. If total stations are involved, Offset Stakeout passes through the normal backsight confirmation screens that Sideshot/Traverse and other forms of Stakeout require. Offset Stakeout is a 3-screen program. The first screen identifies and loads in the alignment files. The second screen identifies the offset points to stake (slopes and distances) and the intervals or lists of stations/offsets to stake, and the final screen goes to the standard graphics, shows the target points, and guides the user to the destination, with N for Next continuing onto the next station in the interval or list.

Screen 1 - Identifying the Alignments

The first screen has tabs for selecting both the horizontal and vertical alignments. See Figure 4-98

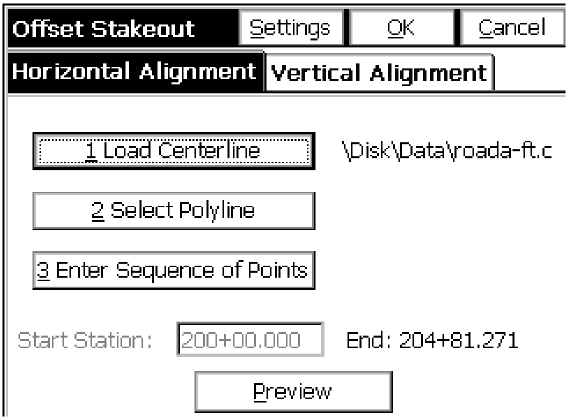


Figure 4-98

If alignments are selected from the screen in the form of a polyline or entered or picked as a sequence of points, then the Start Station edit box allows you to enter the starting station. Since our centerline (and profile) files are stored files on the field computer (CE box), the starting station is fixed. If you wish to "translate" the starting station to a new coordinate, the centerline file may be edited in the Roading menu (eg. Input/Edit Centerline). There is no requirement that the starting and ending stations of the centerline and profile match, only that they have some station range in common to work with.

The Preview button in the Horizontal Alignment tab gives you a plan view of the selected alignment in the Map screen, as shown in Figure 4-99.

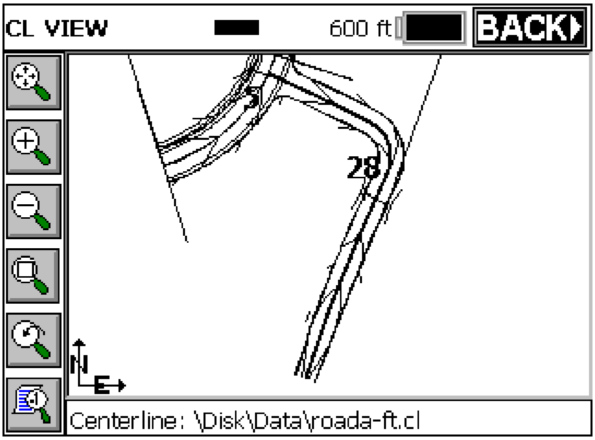


Figure 4-99

Similarly, the Preview button in the Vertical Alignment tab allows you to look at your vertical alignment in the MAP screen. The icon in the lower left corner of this MAP screen allows you to exaggerate the vertical scale as desired by increasing the value in the dialog. To return to the previous menu, simply press the "BACK" button at the upper right of the MAP screen.

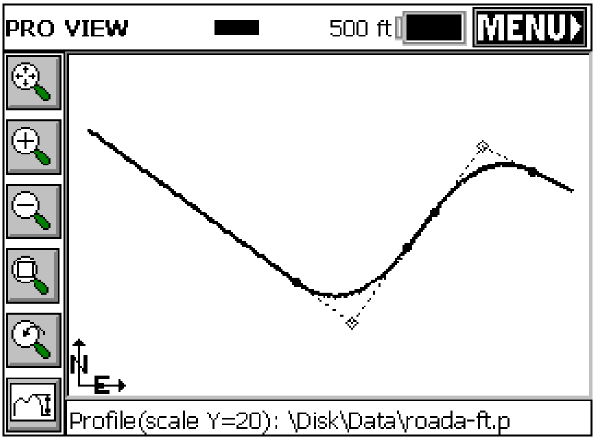


Figure 4-100

The "Settings" button at the top of this dialog gives the user additional options. The "Load Cutsheet Station and Offset List" allows the

Offset Stakeout routine to use a pre-defined list of station, offset, and elevation information as defined by the user. An ASCII file with a "*.cut" file extension is required. The file format is shown below:

Station, Offset, Elevation, Description, as in

20100, -11.5, 102.34,

20109.23, -11.5, 102.35, PC

"Select File" allows the user to load and use a cutsheet file that has already been transferred to the collector.

The "Edit File" button displays the contents of an existing file and allows the user to remove offsets, add offsets, edit existing offsets and save changes made to the file. See Figure 4-101.

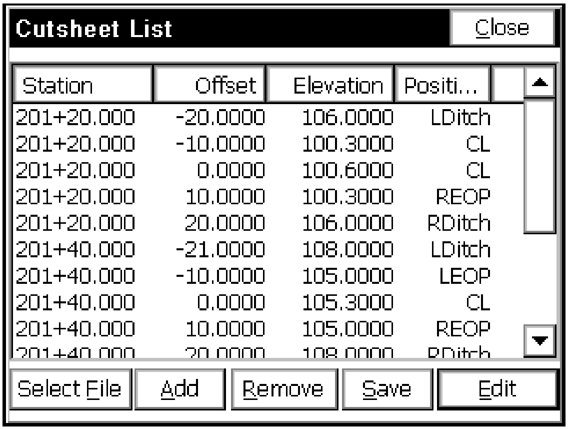


Figure 4-101

You can also create a new file by pressing "Select File" in the lower left hand corner of the Edit File dialog. Simply specify a new file name, press OK and begin adding offsets with the "Add" button. See Figure 4-102.

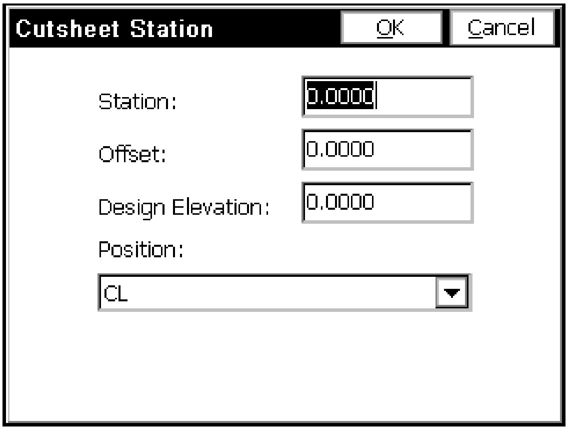


Figure 4-102

The “Additional Stake Stations” option allows the user to direct the routine to pick up additional “special” stations by toggling various options. These include PC’s (points of curvature), PT’s (points of tangency), PI’s (points of intersection, as in a sewer line) as well as spiral curve and vertical curve elements. This option is disabled when a cutsheet is being used.

The Settings screen appears in Figure 4-103.

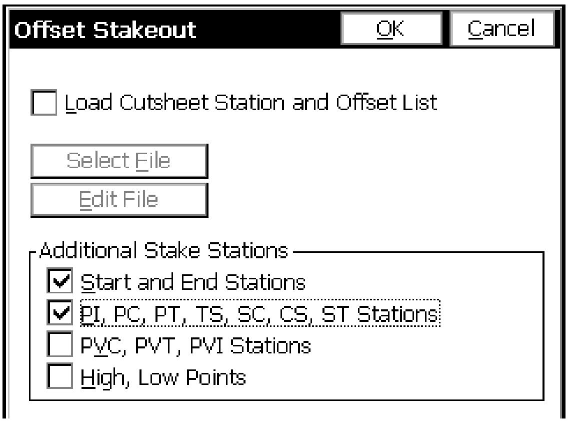


Figure 4-103

Screen 2 - Entering the Offset Points as Slopes and Distances

The second screen allows you to enter one or two offsets from the centerline. The first offset is prompted in a way that expects a slope in percent and a distance. The second offset if for a curb or ditch, and is prompted in the form of “distance over” and “elevation change up or down”. In this example, we have a metric-based road being surveyed in US feet. Figure 4-104 shows this screen.

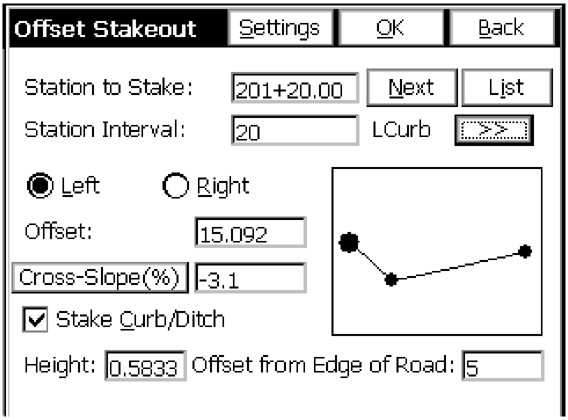


Figure 4-104

The Settings button returns to the Settings dialog, allowing you to load another cutsheet list or specify more or less “special” stations.

The OK button continues on to the third and final screen, for graphical stakeout.

The Back button returns to screen 1.

Station to Stake is your current station to stake. When you start into Offset Stakeout, this is typically the starting station.

The Station Interval to stake is specified by the user.

The Next button moves to the next station, which would typically be the station to stake plus the station interval (20120+20=20140), unless a “special” station like a PC or PT is encountered, in which case it would occur as the Next station.

The List option shows the order of stations, including all special stations. If a Cutsheet was loaded, the List option would show the stations in the Cutsheet. Figure 5-17 shows the Cutsheet List in this case.

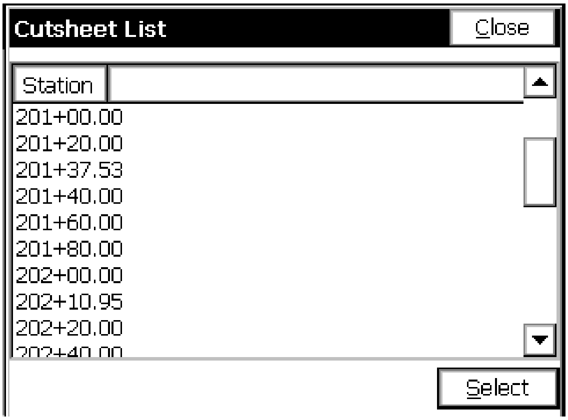


Figure 4-105

The double arrow button will move from the 3 key points on either the left side or the right side. Since our example has an upward slope to the outside point, the program interprets this as a curb. The other two points would be ditch and centerline. Pressing the arrow button will cycle through them.

You can specify whether to stake the left or right side of the road. The offsets are applied symmetrically. If you have a special case on the right side of the road, do the right and left separately, with separate slope and distance entries. In this case, the outside point represents 5 feet back of curb.

Offset is the first offset from centerline, in the units that are configured (feet or meters).

Cross slope is the first offset slope, with negative being downhill.

Stake curb ditch will allow user input and activate a "second" slope.

Height is the vertical difference from the first offset to the second offset. A positive entry is interpreted as a curb and a negative (downhill) entry is interpreted as a ditch.

Offset from Edge of Road is the distance from the first offset to the second (outer) offset.

When using a Cutsheet Station and Offset list, the user must select the List button, highlight the offset to start using, and press “Select”. The routine will stay on this offset as it progresses through the stations until the user selects List again and specifies a new offset.

Screen 3 - Stakeout

When OK is clicked in Screen 2, the program moves onto the graphic screen for stakeout, in both GPS and total station applications. For a total station project, the prompting would appear as shown in Figure 4-106.

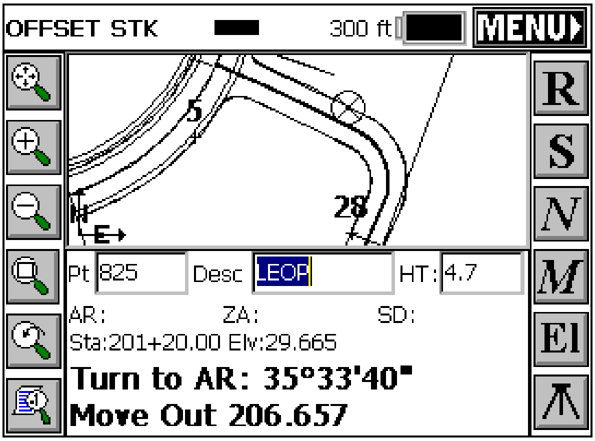


Figure 4-106

- **Read (R)**: This button takes a reading of the current position of the target when using a manual total station. After taking the shot, the display will zoom in and will be update the user with a new distance and direction to the target stakeout point as shown in Figure 4-107. This button is not present in GPS mode. In GPS or Robotic Total Station, with tracking on, your current position is read immediately. Depending on configuration in Job Settings, the direction to stake will either be right/left distance or North/South East/West in the Map screen. The cut or fill is the elevation difference between the point read and the point being staked.

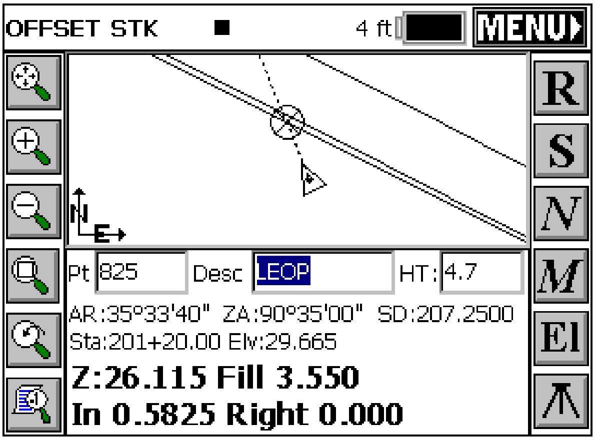


Figure 4-107

- **Store (S)**: This will store your location to the point file. If the distance between your current position to that of the exact location of the point being staked is greater than what is specified in stakeout tolerance in "Tolerances", you will be prompted with "Stakeout Tolerance is Exceeded! Continue Storing?" Selecting No will allow you to take another shot. Selecting Yes will store the point at your current position and display the Stakeout Report dialog.

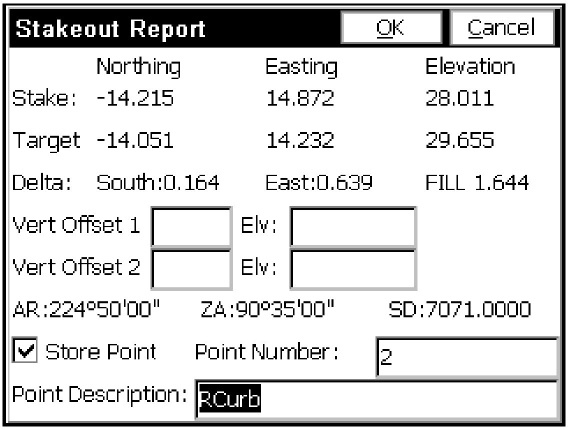


Figure 4-108

The coordinates for the Stake Point and the Target Point are displayed. The delta North, East and the elevation difference (Cut/Fill) is also displayed. The Vert Offset 1 and Vert Offset 2 allow for additional elevation calculations for the staked out point based on the input vertical offset values. If the Store Carlson Cutsheet Data in Note File has been toggled, the vertical offset(s) specified will be recorded in the .not file for the job. If using GPS, the HRMS, VRMS, and PDOP values are also displayed. Fields for Point number and point description input are also displayed. The toggle for “Store Point” determines whether or not the staked out point is written to the file. After the point has been stored, you are taken back to the screen three to select the next offset point for staking.

- **Next (N)**: This will take you to the next offset point for staking out.
- **Setup**: This is the button in the lower right corner of the screen for total stations. It takes you to the setup screen for additional instrument setup and benchmarking.
- **GPS Start and Stop**: This button, available in some versions of GPS, alternates between an X and an arrow. While the GPS is running, the X appears, allowing you to stop the GPS from taking readings. When the button is hit, the GPS stops and the button switches to an arrow. Selecting the arrow will start the GPS again, taking more readings.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This brings up the Monitor/Skyplot dialog. See Monitor/Skyplot in Chapter 3 for information on this dialog.

Elevation Difference

Function

This routine will report a cut/fill in comparison with your current location to a design surface at any location within a project. It has the capability of referencing the position of the shot to a project centerline for a report of station and offset and can also be used with a light bar.

Pre-Requisites and Procedures

There are five types of data that can be used to define the design surface.

- **Grid File**: .GRD file that can be created with various software packages such as SurvCADD, Carlson Survey, or Autodesk Field Survey. You must transfer this file to the collector via the File Transfer routine prior to running this command.
- **Triangulation File**: .FLT file that can be created with various software packages such as SurvCADD, Carlson Survey, or Autodesk Field Survey. You must transfer this file to the collector via the File Transfer routine prior to running this command.
- **Elevation**: Known elevation that you specify in the Set Elevation field.
- **Road Design**: Requires a Template, Centerline and Profile file at a minimum, and can utilize superelevation and template transition files.
- **Section**: Requires a Cross Section file and a Centerline file.

If total stations are involved, Offset Stakeout passes through the normal backsight confirmation screens that Traverse/Sideshot and other forms of Stakeout require. The Elevation Difference screen appears below:

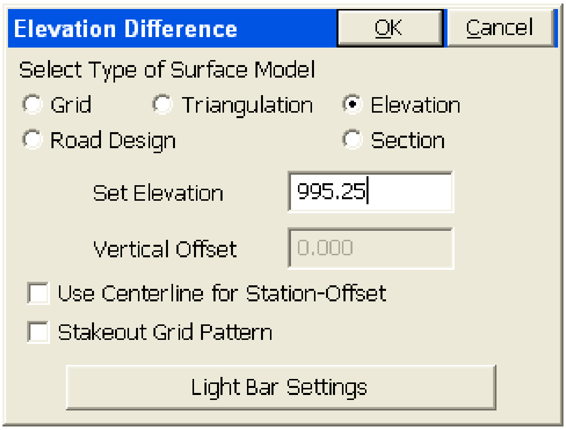


Figure 4-109

- **Select Type of Surface Model**: Allows the user to specify the type of surface to be used. See the reference paragraph above. To use a Grid or Triangulation file, select the appropriate button on the screen and press ok. In the file dialog box, select the desired file and press ok.

- **Set Elevation**: This option is available when the Elevation method is used for defining the surface model. Enter the desired elevation of your surface in this field.
- **Vertical Offset**: This is used in conjunction with grid and triangulation files as well as roading files. It allows the user to vertically offset the surface (as defined in the file) by the amount specified in the box.
- **Use Centerline for Station-Offset**: T his allows the user to specify a horizontal alignment file (.cl file) for reporting station and offset of your current location to the reference alignment. With total stations this is reported whenever a shot is taken. With GPS or Robotic Total Stations, with tracking on, your current position is updated in real time as the rover or prism is moved. This option is available with all three types of surface models.
- **Stakeout Grid Pattern**: The first prompt asks if you want to use the last stakeout pattern. To make a new pattern, you specify, in effect, the lower left corner ("left side" option) or the lower right corner ("right side" option) of a rectangle, and specify the starting point, direction point. Shown in Figure 4-110 is a 10x10 layout at 50' interval (400 points would be staked!). The number of cells in the grid ranges from 1x1 to 20x20, and are laid out in a grid beginning at the starting point going towards the direction point.

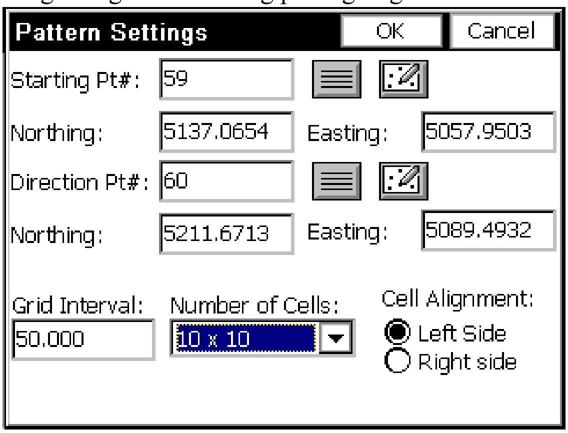


Figure 4-110

The program will then show the nearest grid point to your GPS or total station shot, as shown in Figure 4-111.

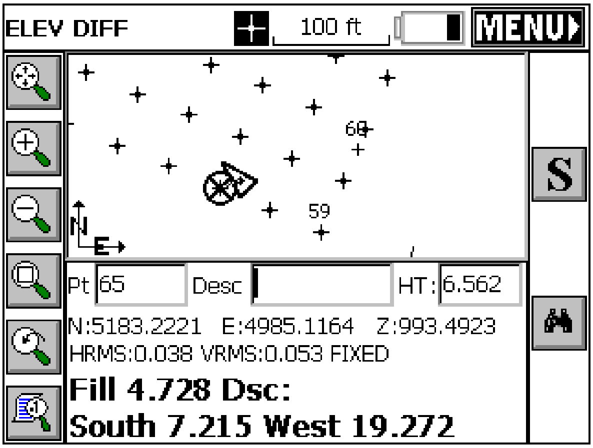


Figure 4-111

- **Light Bar Settings**: This button opens the dialog shown in Figure 4-112 and allows you to specify parameters for enabling the light bar, setting the grading tolerance and specifying the COM port. Two light bars are supported: Mikrofyn and Apache.

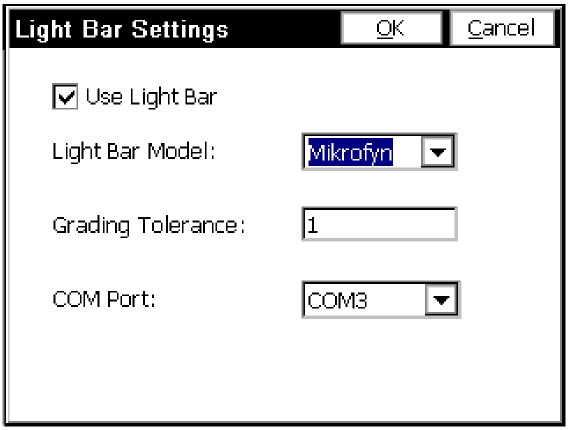


Figure 4-112

FAST Survey can actually drive the grading process, as shown below where an Apache light bar is used on a motor grader.

Figure 4-113

Figure 4-114

Pressing OK fromt the main Elevation Difference screen will first prompt the user to load the surface file if the grid or triangulation option has been specified. When the file is selected and ok is pressed, the following ELEV DIFF screen comes up. This screen provides the user with a plan view of the project. When a shot is taken, cut or fill from the current vertical location to the design surface is reported in the lower left portion of the screen. The computed design surface elevation for you current location is also reported. See Figure 4-115

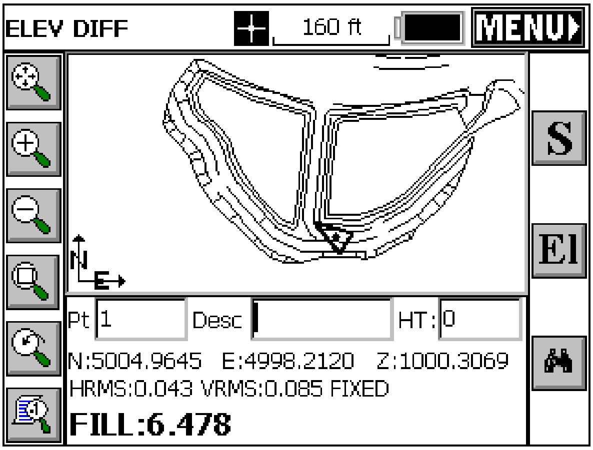


Figure 4-115

Options on the right side of the screen are shown below:

- **Read (R)**: This allows the user to take a shot without storing it to the job file. Cut or fill is immediately reported. This button is not present with GPS.
- **Store (S)**: This button immediately reports cut or fill and stores the current shot to the job file. Pressing the enter key will simultaneously read and store your current shot as well.
- **Configure (C)**: This takes the user to the Configure Reading dialog that is standard throughout the program. This button is not present in GPS.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This opens the Monitor/Skyplot dialog. See the Monitor/Skyplot command in Chapter 3 for information on this dialog box.

Building Face Survey

Function

This command enables points on both vertical and nonvertical planes to be coordinated by angle-only observations. This feature is most often used to pick up details of a building where the prism cannot be placed.

The building face is defined by observing three accessible points on the building or by entering their known coordinates. Angle-only observations are made, FAST Survey then calculates and stores coordinates of the angle intersection observation with the plane. You can use FAST Survey to survey the vertical face of a building or other vertical planes.

Vertical Plane Survey

1 Select the Building Face Survey option from the Survey menu. When the routine is selected, you are immediately placed in a Confirm Orientation dialog, where you are asked if this is correct. The opening or main dialog appears as shown in Figure 4-116

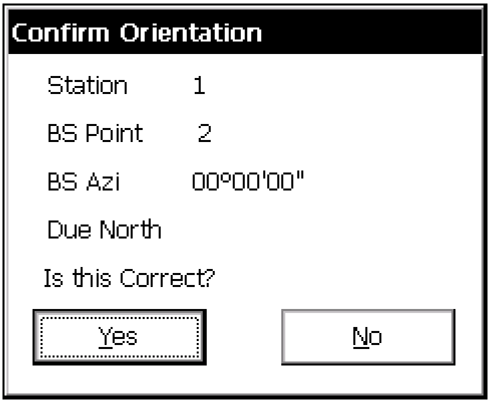


Figure 4-116

You are asked to view the Station, BS Point and BS Azi. If the three items are correct, select Yes to move on to Define Plane dialog box, or select No and you are taken to the Setup dialog to setup the instrument correctly. After the instrument is correctly configured, then you are taken to the Define Plane dialog.

2 FAST Survey will display the Define Plane dialog as shown in Figure 4-117

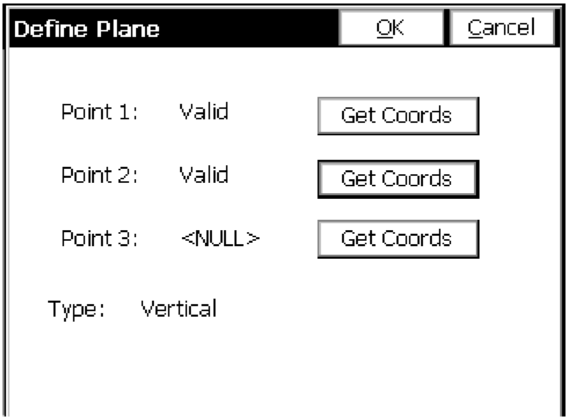


Figure 4-117

- **Point 1, Point 2, Point 3**: These fields indicate the points that define the building face plane. Both Point 1 and Point 2 must have horizontal coordinates to properly define the building face. For a vertical plane survey, point 3 is not required and can be left blank.
- **Get Coords**: This function allows for four methods to define the coordinates of a point as shown in Figure 4-118.

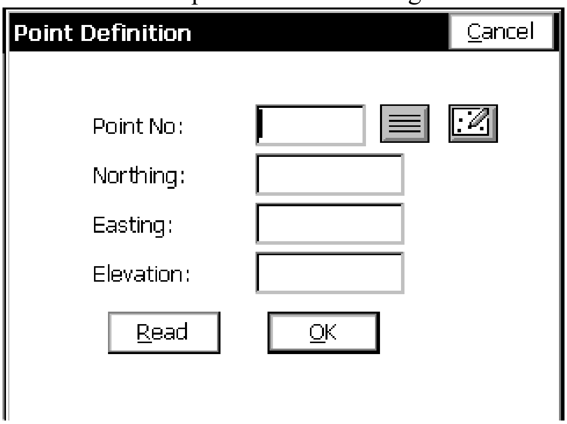


Figure 4-118

The coordinates of the points can be manually entered into the Northing, Easting and Elevation fields. Manually entered coordinates will not be stored in the coordinate file. Figure 4-119 shows an example of manually entering the coordinates.

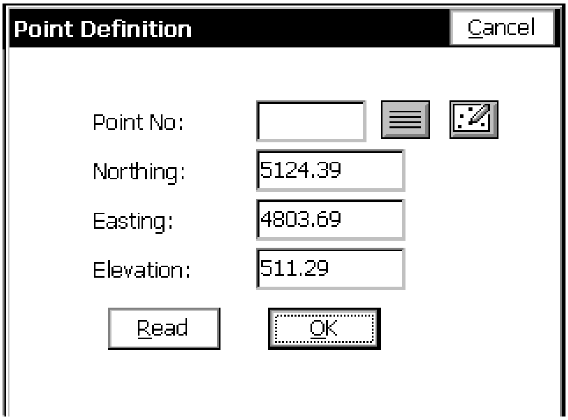


Figure 4-119

Existing point numbers can be entered into the Point No field. These point numbers must be defined by coordinate data. Figure 4-120 shows an example of entering a point number. As soon as you enter the point number, press enter and the coordinates will appear in the Northing, Easting, and Elevation fields.

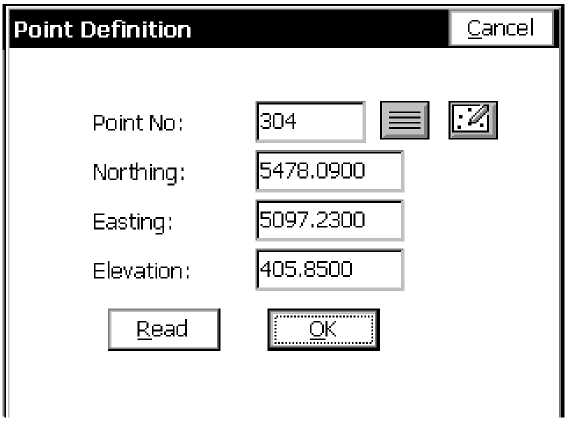
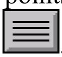
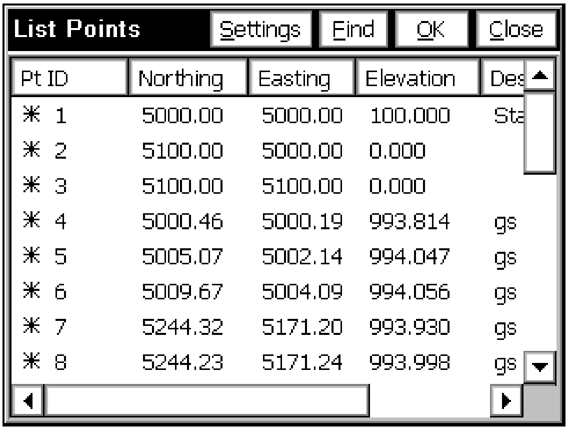


Figure 4-120

Existing points can be selected from a points list by selecting the point list icon . Figure 4-121 shows the point list, highlight the desired point and press enter or tap OK.



Pt ID	Northing	Easting	Elevation	Des
1	5000.00	5000.00	100.000	Sta
2	5100.00	5000.00	0.000	
3	5100.00	5100.00	0.000	
4	5000.46	5000.19	993.814	gs
5	5005.07	5002.14	994.047	gs
6	5009.67	5004.09	994.056	gs
7	5244.32	5171.20	993.930	gs
8	5244.23	5171.24	993.998	gs

Figure 4-121

Existing points can be selected from the map screen by selecting the map icon . Figure 4-122 shows the map screen. To select a point, tap it on the screen. If two or more points are close together on the screen, you will be asked to select the intended point from the point list as shown in Figure 4-121.

Lastly, the points can be "shot" with the total station by pressing Read.

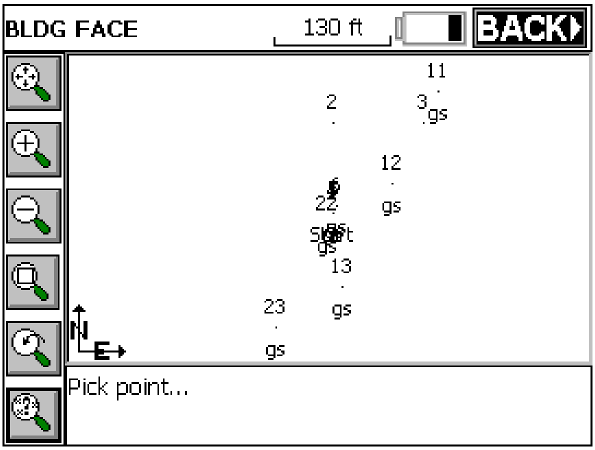


Figure 4-122

3 After you have specified the two defining points for the building face plane, FAST Survey will determine the available solution. One of the following messages will display:

See Figure 4-117 above.

Vertical - FAST Survey has enough data to fix a vertical plane.

3D - FAST Survey has enough information to fix an arbitrary plane.

Press OK, and the dialog shown in Figure 4-123 will appear.

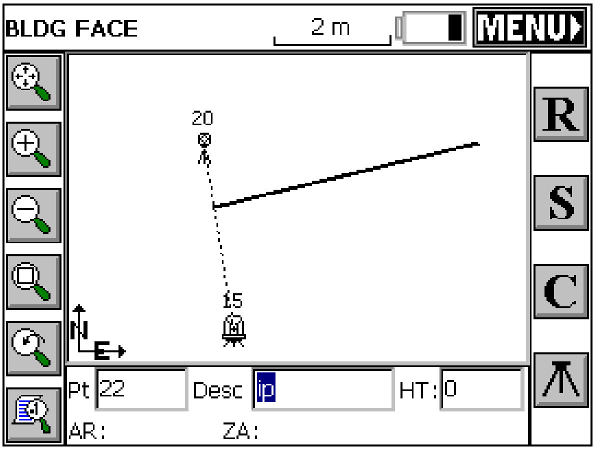


Figure 4-123

4 **Read (R)**: This button takes a reading to the current position of the target. It takes an angle reading only, but assigns a point to that position on the plane (this could be window or other inaccessible point). The points will appear as "?" symbols on the vertical plane (represented by the dark line) until S for store. They do not plot as point numbers on the screen to avoid clutter.

Store (S): This button will store the current position of the target. If the Hgt/Desc Prompt on Save toggle is turned on (See Configure Reading), you will be placed in the Store Point Dialog. FAST Survey will store the observed points on the building face using the angle only observations.

Configure (C): This button takes you to the configure Reading Dialog. Please refer to the Configure Reading section of this manual.

Setup: This button, bottom right of Map screen, takes you to the Setup dialog for additional instrument setup and benchmarking.

5 To exit the routine, press the ESC key or the MENU Icon at the top right of the screen.

Nonvertical Plane Survey:

Surveying a nonvertical plane is similar to surveying a vertical plane. Once the plane has been defined, picking up detailed observations follows the same general process detailed above. All three points must be defined for a nonvertical plane survey. When defining a nonvertical plane, the three points cannot be in a line.

Auto by Interval

Function

Auto by Interval allows you to acquire and store data at a set interval value of either distance or time. This function is available with GPS or Robotic Total Stations only. When the routine is selected using a robotic total station, you are immediately placed in a Confirm Orientation dialog, where you are asked if this is correct. The opening or main dialog appears as shown in Figure 4-124.

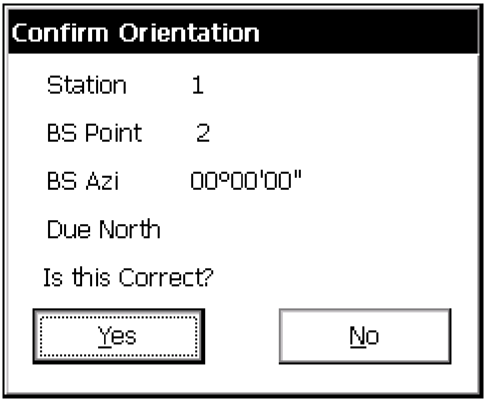


Figure 4-124

You are asked to view the Station, BS Point and BS Azi. If the three items are correct, select Yes to move on to the Auto Store by Interval dialog, or select No and you are taken to the Setup dialog to setup the instrument correctly. After the instrument is correctly configured, then you are taken to the Auto Store by Interval dialog, see Figure 4-125. In

GPS mode, you are taken to the Auto Store by Interval dialog immediately. In the Auto Store by Interval dialog box, you set the type of interval (distance or time) and the value of the interval. You also set the starting point number for the data set. You can assign a point description for all points acquired with this command. While data is collected, you can change the description.

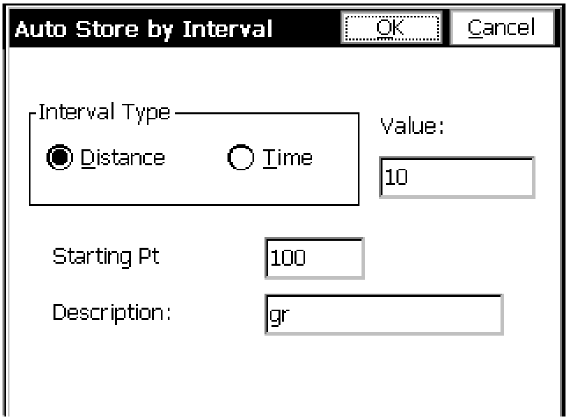


Figure 4-125

Data is acquired in the standard collection MAP view screen. The point number, description, and rod height field can all be changed while the command is active. For example, to change you point description from td (top of ditch) to gr (ground shot), simply type gr over the td in the Desc field without interrupting your collection.

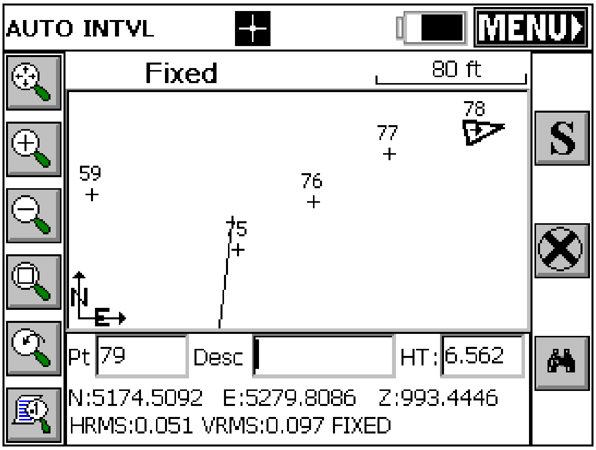


Figure 4-126

- **Store**: Pressing the "S" button immediately stores the point.
- **GPS Start and Stop**: This button, alternates between an X and an arrow. While the GPS is running or the Robotic Total Station is tracking, the X appears, allowing you to stop the surveying equipment from taking readings. When the button is hit, the GPS or Robotic TS stops and the button switches to an arrow. Selecting the arrow will start the GPS again, taking more readings.
- **Monitor/Skyplot**: If using GPS, this is the last button on the right side of the map screen from top to bottom. This opens the Monitor/Skyplot dialog. See the Monitor/Skyplot command in Chapter 3 for information on this dialog box.
- **Setup**: This is the button in the lower right corner of the screen for manual and robotic total stations. It takes you to the setup screen for additional instrument setup and benchmarking.

Remote Elevation

Function

This command allows you to observe a point that cannot be reached vertically, such as a power line, building top, etc. The routine uses two observations - one for the base point and one for the vertical angle to the target object. The routine then calculates the target point's elevation.

By placing the prism below or above the desired point, FAST Survey stores information about the base point. Then you can take a second reading, observing only the zenith/vertical angle to the target object point. Using these two observations, FAST Survey calculates the intersection of the extended zenith/vertical angle with a vertical line from the base point to determine the elevation. Reporting includes the elevation difference between the prism and the target object and the elevation of the target object.

Steps to take a remote elevation reading are as follows:

1 Select Remote Elevation from the Surv menu.

2 FAST Survey prompts to confirm your orientation, station and backsight as shown in Figure 4-127.

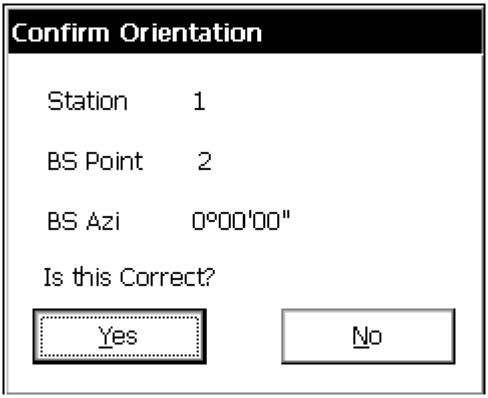


Figure 4-127

3 FAST Survey prompts to press enter to observe base point (see Figure 4-128). Point the instrument toward the target and press enter.

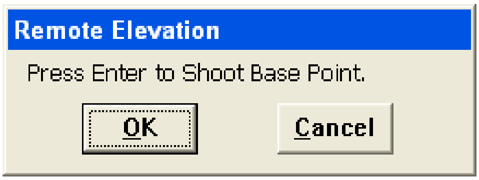


Figure 4-128

4 FAST Survey prompts to press enter to shoot target elevation (see Figure 4-129). Sight instrument on the desired point (such as a wire or top of pole or point on a building) and press Enter.

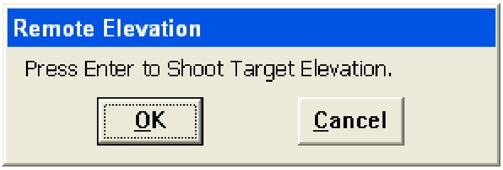


Figure 4-129

Back in the REM ELEV screen shown in Figure 4-130, your angle, zenith, and slope distance are shown along with the remote height and remote elevation. Press S to store this point.

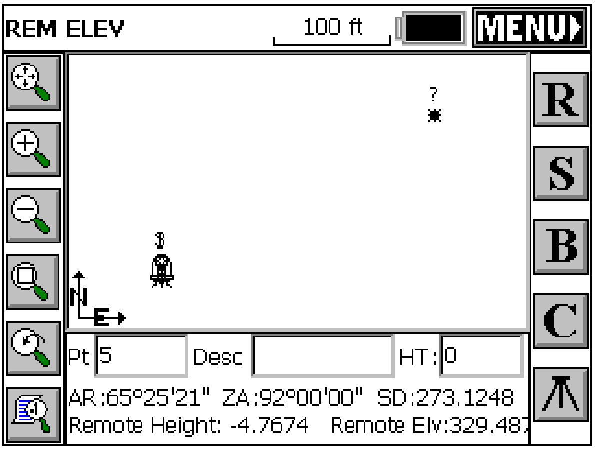


Figure 4-130

Options at the right of the screen are shown below:

Read (R) – This allows the user to take additional shots above or below the previously defined base point. Pressing the enter key will also repeat this command.

Store (S) – This button stores the current target offset point to the job file

Base (B) – This re-initializes the Remote Elevation command, allowing the user to define another base point. The prompting sequence described above will follow.

Configure (C) - This takes the user to the Configure Reading dialog that is standard throughout the program.

Instrument Icon - This takes the user to the Instrument Setup dialog that is standard throughout the program.

Log Static Data

Function

This command allows you to log static data to the receiver or a data card (depending on instrument type) for use with Post Processing software.

Post Processing (Logging Static Data) for Novatel/Sokkia Radian/Sokkia Radian IS

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 3 buttons (See Figure 4-131), or an error message stating that the data collector could not connect to the receiver. If you receive an error message, check connections and the data card.

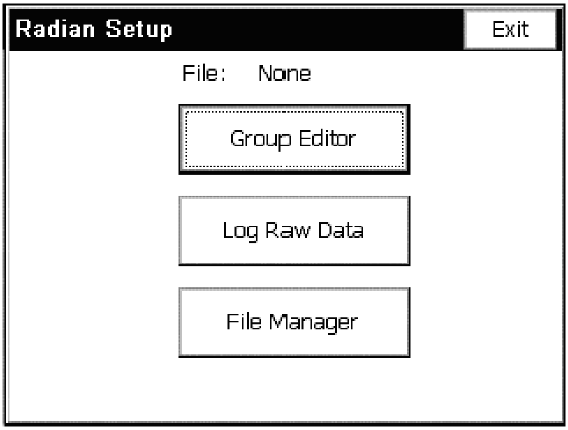


Figure 4-131

If you want to change the groups you already have on the device, click Group Editor. It will take anywhere from 1-5 seconds to pop up a dialog with group information. This dialog box will be covered later, as it is only necessary for post processing if you have no groups.

Click on the Log Raw Data button to start logging raw data. The documentation continues, assuming you had clicked on this one.

Click on the File Manager button to see what files are on the receiver's card. Through the dialog box, you see a list of files. If memory is low, you can delete them from this dialog box. This dialog will be covered later.

The Log Raw Data dialog box contains a list of groups (or a message that no groups were found), three buttons, and a place to enter a file name. In order to continue, select a group, enter a file name, and click Use Selected Group For File. If you have no groups (or wish to see/change the groups you already have), you will need to click Edit Groups, and add a group (see Figure 4-132).

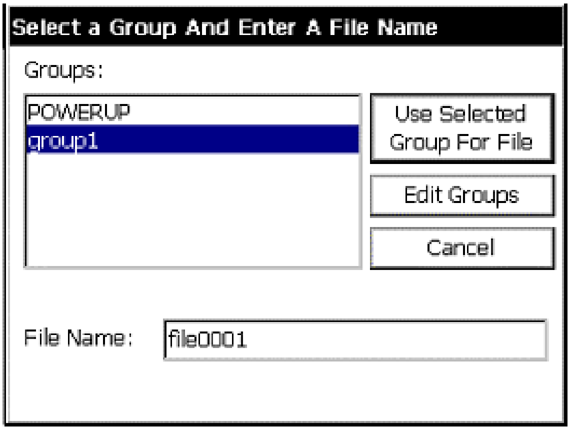


Figure 4-132

Next is the Tagging Site dialog. To start tagging a site, enter the information requested (site name, site code, optionally change the antenna height (see Changing the Antenna), and whether you want the site to stop automatically (after a duration of your choice) or when End Site is clicked. Click Start Site and all the information entered will be grayed out until the site is ended. Stop the site at any time by clicking End Site. Before ending the site, you will have the option to change the antenna information (in case you made a mistake). View the satellite status at any time by clicking the View Status button. This will not affect the tagging of the site.

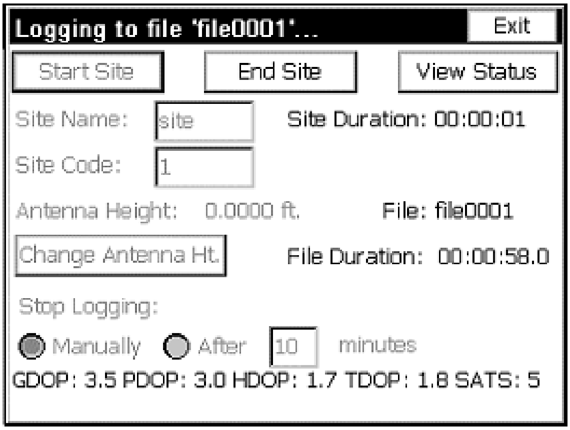


Figure 4-133

You can tag as many sites as you wish. When you are done, click the Exit button. FAST Survey will ask you if you want to continue logging the file. If you do, click yes, and the next time you click Log Raw Data, you will go directly to the dialog box above. The file name will appear in the main Post Process screen if it is being logged. If you wish to leave the receiver logging, you can exit the setup, and the next time you come back to post processing, it will know you are still logging a file.

File Manager

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 3 buttons, or an error message stating that the data collector could not connect to the receiver. If you receive an error message, check connections and the data card.

Click on the File Manager button to see what files are on the receiver's card. Through the dialog box, you see a list of files. (see Figure 4-134).

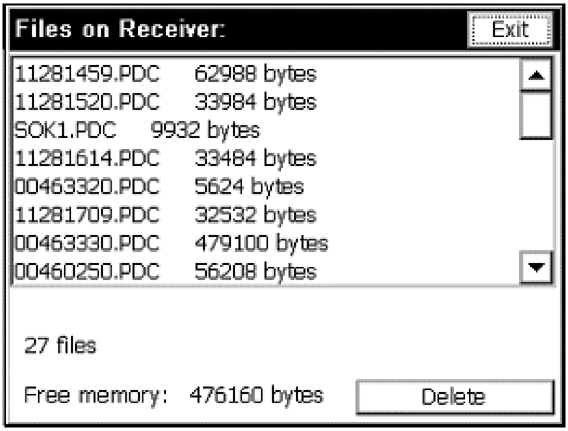


Figure 4-134

The files are shown with their size. At the bottom of the dialog, the free memory is shown, along with a cancel and a delete button. If you find memory short, you can delete files using this dialog box. To delete a file, click on the file from the list and the delete button. You will be asked if you are sure that you want to delete the file. To exit this dialog, click Exit.

Group Editor

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 3 buttons, or an error message stating that the data collector could not connect to the receiver. If you receive an error message, check connections and the data card.

If you want to change the groups you already have on the device, click Group Editor. It will take from 1-5 seconds to pop up a dialog with group information. (See Figure 4-135)

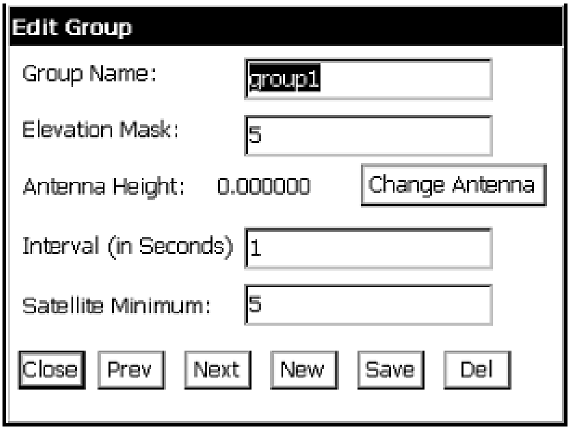


Figure 4-135

If the Group Name is "NewGroup," there are currently no groups on the receiver. To add one, fill out the information and click the Save button. If there are already groups, to add a new one, click New, fill out the information, and click Save.

To see other groups, click Prev or Next.

To delete a group, click on the Del button.

To change a group, make changes, and click the Save button. If a group name is changed, it may take slightly longer to make the change. In order to change the antenna, click the Change Antenna button (see Changing the Antenna).

When you are satisfied with the groups, click Close. You will be asked if you wish to start logging data. If you click yes, you will go into the Log Raw Data dialogs.

Post Processing (Logging Static Data) for Topcon

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 4 buttons. (See Figure 4-136).

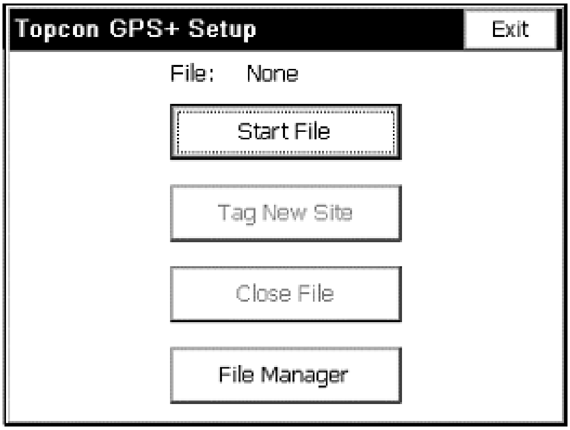


Figure 4-136

If you want to manage the files (to see how much memory they are using and to delete files) on the receiver, click the File Manager button. Use of the file manager will be covered later. If a file was open, you can now tag sites. Otherwise, open a file by clicking the Start File button.

The file name can be chosen from a list of existing file names, using the suggested file name, or a file name of your choice. The antenna height can be changed, as well as the antenna type by clicking the Change Antenna button (see Changing the Antenna). The interval can be selected from the list, or you can enter another one in seconds.

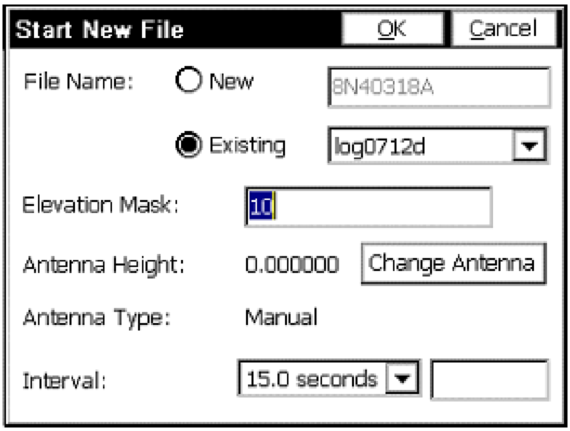


Figure 4-137

After starting a file, you will be returned to the main screen. From here you can leave the file recording, manage files, exit, or start tagging sites. To tag a site, click the Tag Site button.

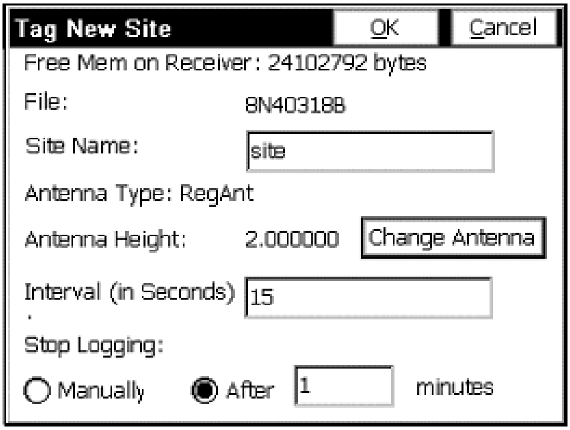


Figure 4-138

The Tag New Site dialog shows the available space on the receiver, and gives you the ability to enter site name, change the interval, and change the antenna. You can choose to have FAST Survey stop logging the site automatically after a certain number of minutes, or stop it manually. Even if you choose to stop it automatically, you will still be able to stop it manually. You will see a screen like the one below when you press OK.

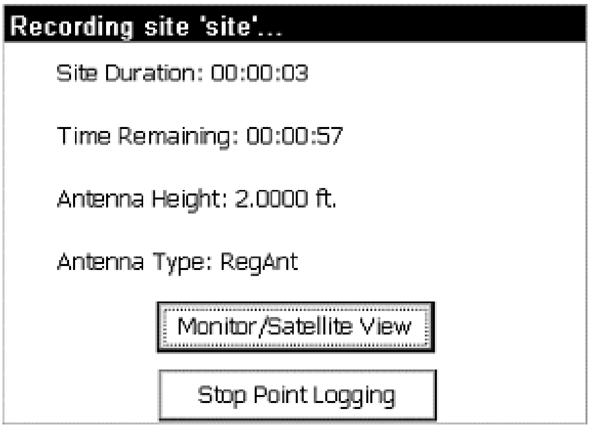


Figure 4-139

After you exit this screen (automatically or manually), you will be returned to the main post processing screen. From here, you may tag more sites, close the file, or manage your files.

When you are ready to close the file, hit the Close File button.

File Manager

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 4 buttons.

Click on the File Manager button to see what files are on the receiver's card. Through the dialog box, you see a list of files.

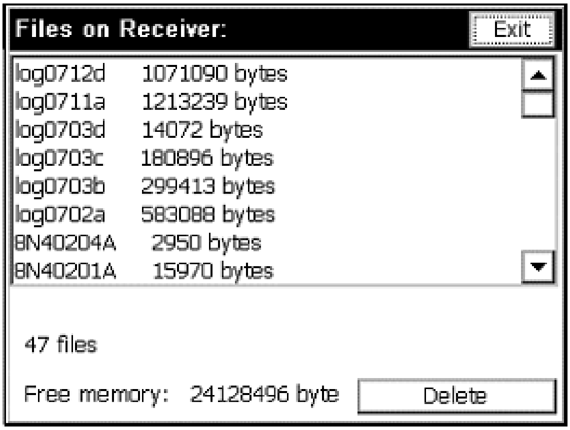


Figure 4-140

The files are shown with their size. At the bottom of the dialog, the free memory is shown, along with a cancel and a delete button. If you find memory short, you can delete files using this dialog box. To delete a file, click on the file from the list and the delete button. You will be asked if you are sure that you want to delete the file. To exit this dialog, choose Exit.

Post Processing (Logging Static Data) for Leica System 500 GPS

Setting Up Post Processing as a Base

In order to do Post Processing as a base, you must start it when you configure the base. From the Equip Menu select Configure Base, and check the Log Static Data to PC Card checkbox.

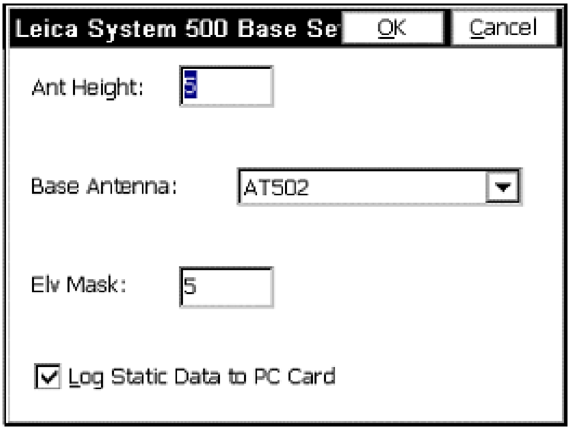


Figure 4-141

Then go through the Configure Base screens the way you would normally, until reaching a dialog asking for a job name and interval. After entering these, the job will start recording. To end the job, just turn off the receiver. Your next job should start up fine.

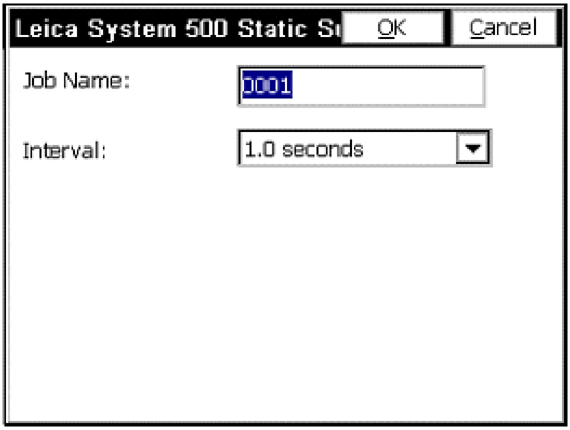


Figure 4-142

Setting Up Post Processing as a Rover

From the Surv Menu choose Log Static Data. The data collector will check to see that the receiver is connected and has satellites (if the receiver doesn't have satellites, no post processing is possible). If successful, a menu with 4 buttons will pop up.

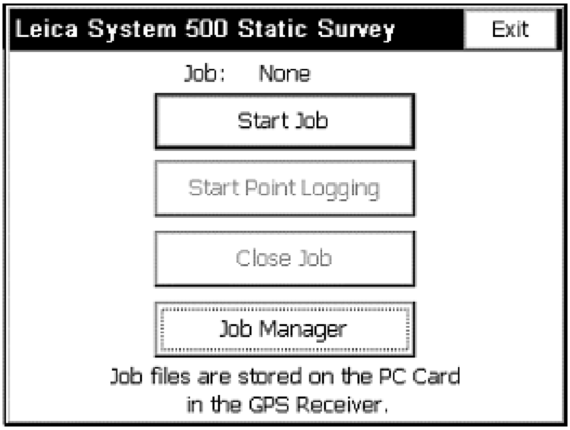


Figure 4-143

To manage jobs, click the Job Manager button. This will be covered later in the documentation. To start a post processing job, click the Start Job button. Select a job name from the existing jobs, or create a new one. To change the antenna settings, click the Change Antenna button (the functionality of this button will be covered later).

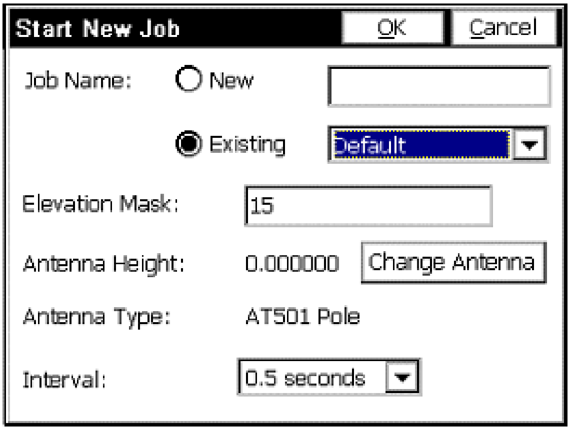


Figure 4-144

After starting a job, you will be back in the Post Processing menu. Now, you will be able to log points, close the job, or manage jobs.

To start logging a point, click the Start Point Logging button. The current job, the available memory, the interval, and the antenna height (which can be changed by clicking the Change Antenna button) are shown. Also, enter a site name, and choose whether to stop logging the point automatically.

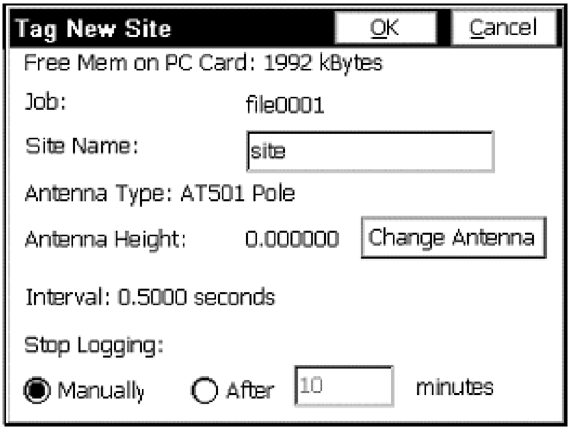


Figure 4-145

You will enter this screen. This screen shows some information about the point being logged. It can be exited without stopping the point.

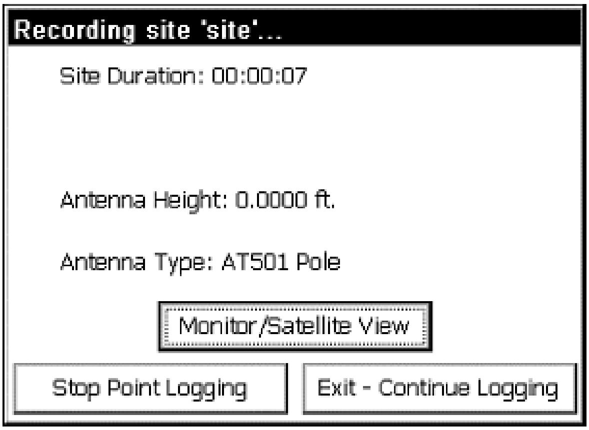


Figure 4-146

After exiting the screen, you will come back to the menu. You can choose to end the job, log more points, or just leave it running while you do other things. To end the job, click the Close Job button.

File Manager

Go to the Surv Menu, and click the Log Static Data button. You will see a screen with 4 buttons.

Click on the File Manager button to see what files are on the receiver's card. Through the dialog box, you see a list of files.

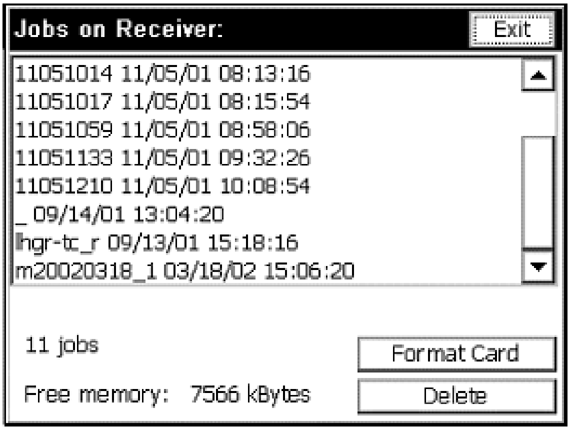


Figure 4-147

The files are shown with their size. At the bottom of the dialog, the free memory is shown, along with a cancel and a delete button. If you find memory short, you can delete files using this dialog box. To delete a file, click on the file from the list and the Delete button. Also, you can format the card with the Format Card button. This will destroy all the data on the card! Make sure you don't need any of the data on the card before formatting it. You will be asked if you are sure that you want to delete the file. To exit this dialog, choose Exit.

Changing the Antenna for Post Processing

Clicking on "Change Antenna" from various FAST Survey Post Processing dialogs leads you to this dialog. Here, if the antenna height needs to be changes, choose either Vertical Height or Slant Height.

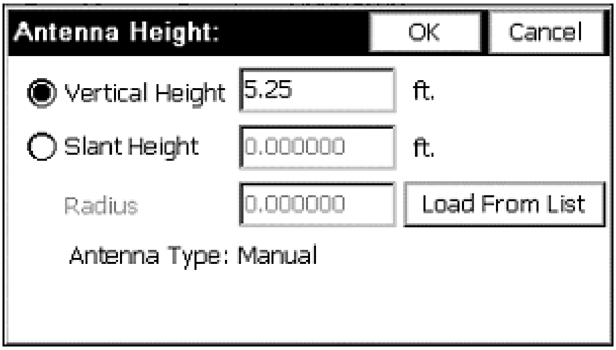


Figure 4-148

For Vertical Height, click on the radio button for Vertical Height, enter a height, and choose OK.

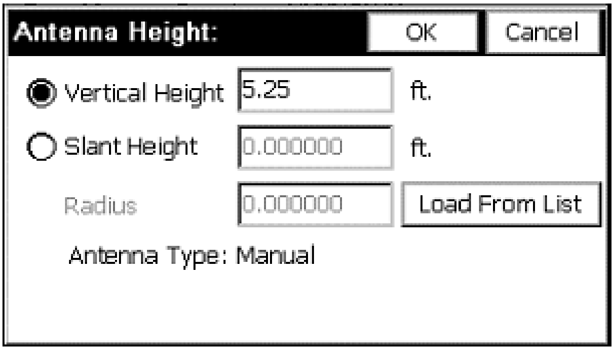


Figure 4-149

For Slant Height, click on the radio button for Slant Height and enter the slant height. Then, click on Load From List. Choose the antenna and click OK. The radius should be filled in for the antenna. If your antenna is not listed, choose Manual, click OK, and enter the radius in the edit box on the main Antenna Height dialog.

When you are done, click OK. The program will calculate an antenna height if you chose slant height. Antenna height is displayed in the original dialog.

Post Processing (Logging Static Data) for Thales/Ashtech in FAST Survey

There are two methods to log static data with a Thales/Ashtech receiver. The first is from the Log Static Data button under the SURV tab of the main menu. The second is using Configure Rover and Configure Base, as described below.

Logging Static Data from the SURV Menu

Go to the SURV Menu, and click the Log Static Data button. The result is a dialog with 6 buttons, as shown in Figure 4-150, or an error message stating that the data collector could not connect to the receiver. If there is an error message, check connections and the data card. From here one can start a file, leave the file recording (exit), manage files, pause recording (stop processing), resume recording (start processing), or start tagging sites. To manage files, see below. If a file is open, but paused, one can resume it.

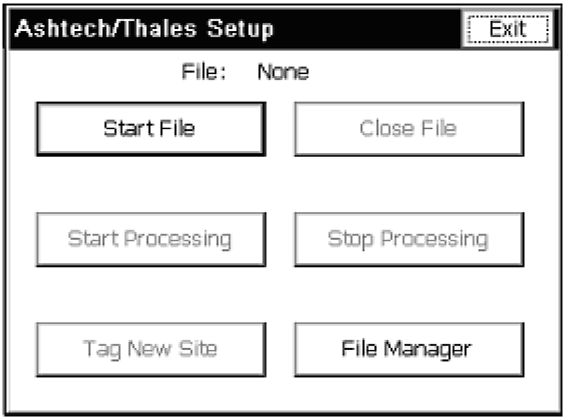


Figure 4-150

If a file was open, one can now tag sites. Otherwise, open a file by clicking the Start File button. The receiver, based on the names of the last site in the file, chooses the file name. The antenna height can be changed, as well as the antenna type by clicking the Change Antenna button (see Changing the Antenna). The interval can be selected from the list, or one can be entered in seconds in the edit field as shown in Figure 4-151.

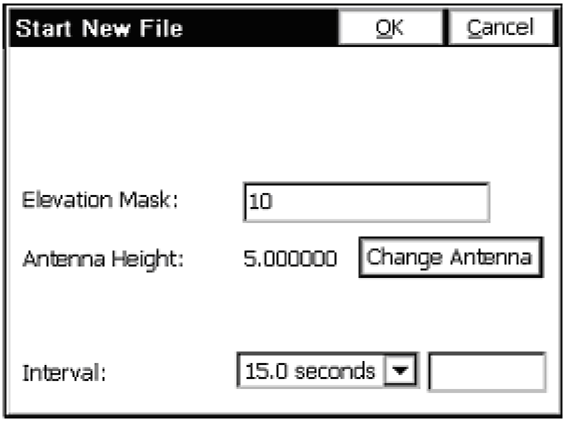


Figure 4-151

After starting a file, the software returns to the main screen (Figure 4-150). From here one can leave the file recording (exit), manage files, or start tagging sites. To tag a site, click the Tag Site button.

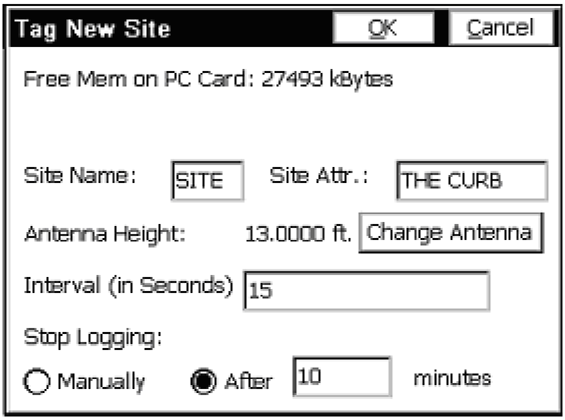


Figure 4-152

The Tag New Site dialog (Figure 4-152) shows the available space on the receiver, and gives one the ability to enter site name (which must be 4 characters), site attribute, change the interval, and change the antenna height. One can choose to have FAST Survey stop logging the site automatically after a certain number of minutes, or stop it manually. Even if automatic is chosen, one will still be able to stop it manually. Press OK, and the program will show a screen similar to the one in Figure 4-153.

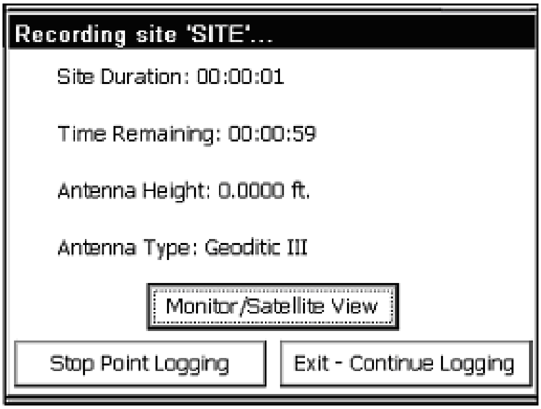


Figure 4-153

This screen can be exited automatically, by clicking the Stop Point Logging button, or by clicking the Exit-Continue Logging button (which leaves the site running but exits the dialog), returning to the main post processing screen. From here one may exit, tag more sites, manage files, or close the file by clicking the Close File button.

Start Processing/Stop Processing

These buttons pause and resume recording to the file. If the file is recording, **Stop Processing** will pause the recording. If the file is not recording, **Start Processing** will resume the file. When the file first starts, it is recording.

File Manger

Go to the SURV Menu, and click the Log Static Data button. There is a screen with 6 buttons (Figure 4-150), or an error message stating that the data collector could not connect to the receiver. If there is an error message, check connections and the data card.

Click on the File Manager button to see what files are on the receiver's card. The next screen (Figure 4-154) contains a list of files and buttons to delete files or format the data card. The files are shown with their size. At the bottom of the dialog, the free memory is shown, along with a format and a delete button. If memory is short, delete files using this dialog, or format the card. To exit this dialog, click Exit.

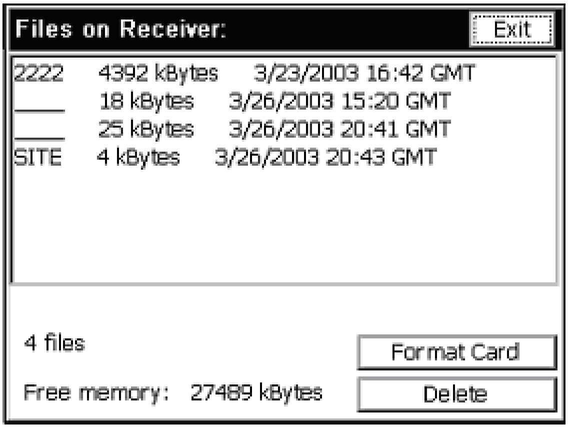


Figure 4-154

To delete a file, click on a file, then on Delete to delete a file. You will be asked if you are sure that you want to delete the file.

Click on Format Card to format the data card. This will erase all the files you have on the card, so be careful.

Thales/Ashtech File Types & Logging Static for RTK Points

The Thales/Ashtech receivers log data into various files on the receiver during Log Static Data. These files are all contained in a **U**-file, which is what the **File Manager** will list from the PC Card. When these files are decompressed on the computer intended to do post processing (using the Ashtech Download program), they are split into the following files: an almanac file, a **B**-file (raw data), a **D**-file (description and antenna information), an **E**-file (ephemeris data), and an **S**-file (session information). D-files are created automatically from the antenna and site information.

FAST Survey creates **O**-files automatically on the data collector from receiver information. The O-file is named the same as the coordinate file name, with an .obn extension, and placed in the data directory. This file is needed for GNSS Studio, as it contains vector information.

However, this information can only be added if the point stored has a GPS fixed position.

To store an RTK point into the O-file, go into Store Points with the GPS position fixed. Enter information for point (site id), description (site attribute), and antenna height, and click the A button to store an OBEN average. For every reading taken by GPS Average, an OBEN measurement will be taken to be averaged into the final measurement. The final measurement is stored in the crd file and the o file on the data collector, as well as the static data files on the receiver.

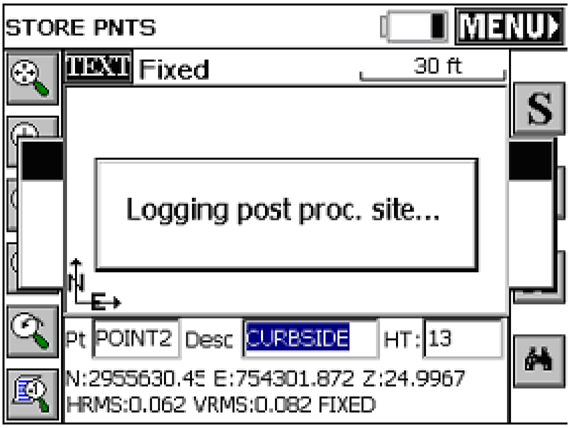


Figure 4-155

Remember, the file must be recording in order to log static data from Store Points. If a point is stored, and no site is logged, to log one, go to the Log Static Data Menu, select Start Processing, and return to Store Points. It is now possible to log a point from Store Points.

Note: In one reported instance, a damaged "PC card" caused the equipment to display a "Card Full" message. Use the File Manager within Log Static Data to review data on the PCMCIA card in the receiver and use File Manager to re-format the PCMCIA card on the receiver if the card appears to be causing errors. Remove any useful information from the PC card before re-formatting, or install a new PC card.

Resection

Function

This command allows you to calculate coordinates of an unknown point given the angles and distance from up to 10 distinct reference points. You can flip the scope and turn face 2, to the same point number within resection. If you do, then the 10 potential shots (5 F1, 5 F2) equate to 5 distinct reference points maximum. Doing Face 2 in Resection is a process independent from configuring for F1/F2 in Configure Reading. The key is simply to plunge the scope and use the same point number for the second reading. The elevation is calculated as an option, in addition to the northing and easting coordinates. After entering the routine, the first screen appears as follows:

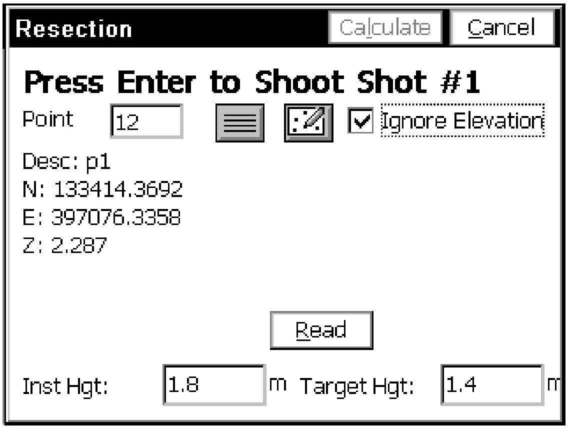


Figure 4-156

The points can also be selected from the point list or directly from the map screen by pressing either the list or map icons. You are also prompted for the Instrument Height and a target height. Press Read when you are ready to take a measurement. The results screen is shown below:

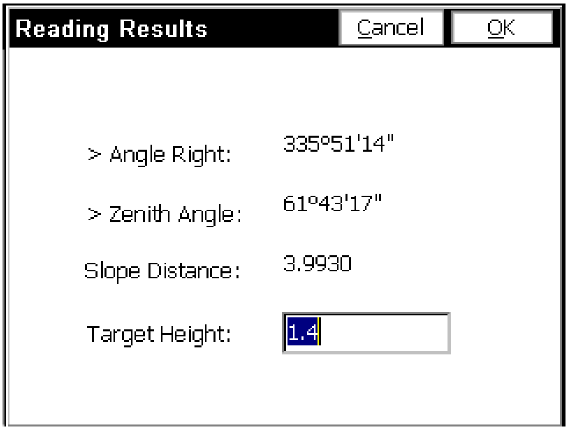


Figure 4-157

The angle right, zenith angle and slope distance are recorded.

Repeat this process for all measurements of the resection. The prompting for the second shot appears as follows:

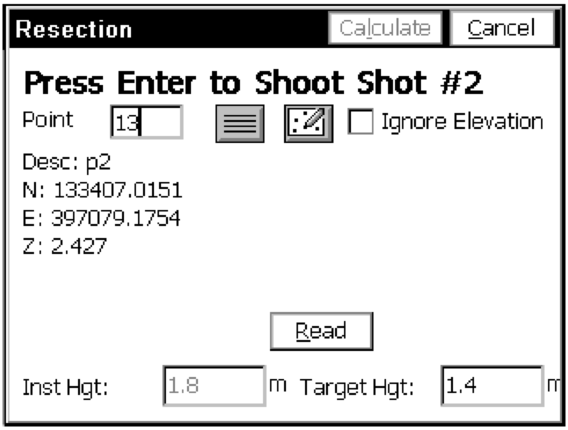


Figure 4-158

In the Store this Point? dialog box shown in Figure 4-159, you are prompted for the point number and description of the calculated point. Anytime after the second resection point is shot, "Calculate" in the upper part of the screen will "unghost" and you can calculate the occupied station (setup) point. With 3 or more resection points, residuals are presented showing the accuracy of the calculation.

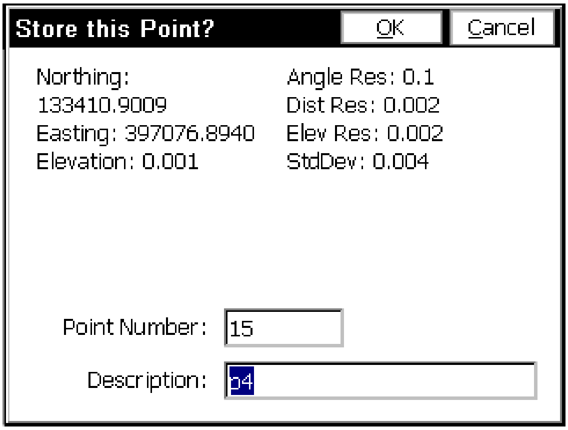


Figure 4-159

Since there is redundant data, the final calculated coordinate differs slightly from the individual measurements. The command reports the calculated coordinate values northing, easting, and elevation and the difference between the calculated coordinate and the individual solutions as the residuals, which indicate the quality of the data. High residuals suggest a problem with the input data. When your press OK from the Store this Point? screen, you will be setup on the calculated point backsighting the first point shot in the resection.

Set Collection

Function

The Set Collection routine allows you to collect and average sets of angles to multiple foresights.

Setup

The opening dialog is the standard setup dialog shown below that allows the user to specify the instrument and backsight information.

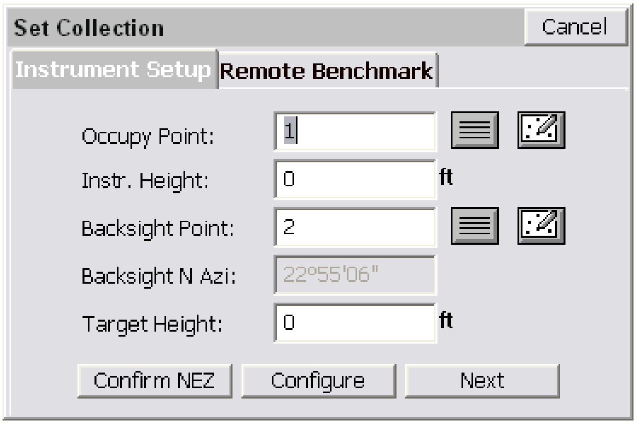


Figure 4-160

- **Confirm NEZ:** This button allows you to quickly verify the instrument and backsight coordinate values.
- **Configure**: This button displays the dialog shown below and allows the user to specify options available for the way the angle sets are to be collected.

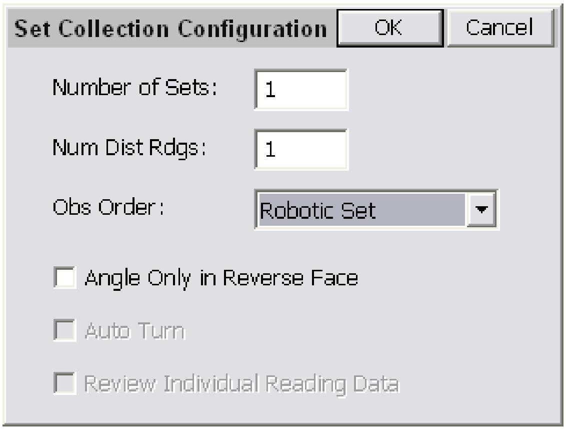


Figure 4-161

- ☐ **Number of Sets:** This input box allows you to definte the number of angle sets that are to be collected to each point. An angle set is defined as a direct and revers reading to the backsight and the foresight (i.e. BD-FD/FR-BR). If multiple foresights are defined, only a single backsight direct and backsight reverse set of readings will be collected for all foresight points.

- □ **Num Dist Rdgs:** This input box allows the user to specify the number of distance measurements that are to be taken during each sighting.
- □ **Obs Order:** This drop list allows the user to specify the order the angles are to be completed. The definition for the abbreviations are *Backsight Direct (BD), Backsight Reverse (BR), Foresight Direct (FD) and Foresight Reverse (FR).* Since the backsight dialog is the first reading in all cases, only the following options are available:
  - ✓ **Robotic Set:** Only available for motorized, auto targeting instruments. This option will turn all reverse sightings without any assistance from the user. The order will be the same as BD-FD/FR-BR.
  - ✓ **BD-FD/FR-BR**
  - ✓ **BD-BR/FD-FR**
  - ✓ **BD-FD/BR-FR**
  - ✓ **BD-BR/FR-FD**
- □ **Angle Only in Reverse Face:** This toggle in intended for use with non-coaxial instruments. Only direct face readings will be measured and all reverse face readings will be for angles only.
- □ **Auto-Turn:** This toggle will allow the motorized instrument to automatically advance to the next position if it was previously measured. The software will pause at the next location and wait for the user to initiate the reading.
- □ **Review Individual Reading Data:** This toggle will pause the software after every reading and display the measured data.

■ **Backsight:** This button is required to initiate the first reading and backsight orientation for the set collection process. The following dialog will be displayed. The user must measure either an angle only or an angle and distance to the backsight in order to proceed with the OK button. It is recommended that the *Set Angle* or *Set Angle and Read* buttons be used to record the initial backsight reading.

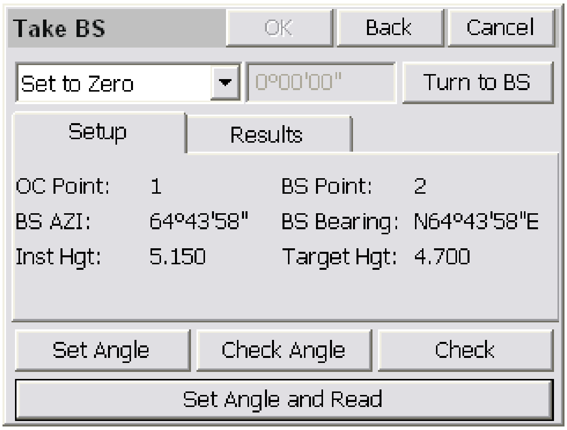


Figure 4-162

Define Foresight Points

After the backsight dialog is accepted, the next step in the process is to enter in the point ID's for all of the foresight points that you intend to sight. The dialog shown below is intended to receive pre0defined point ID's beginning in the top left input box then work your way down to the bottom of the left column, then start at the top of the right column and work down to the end.

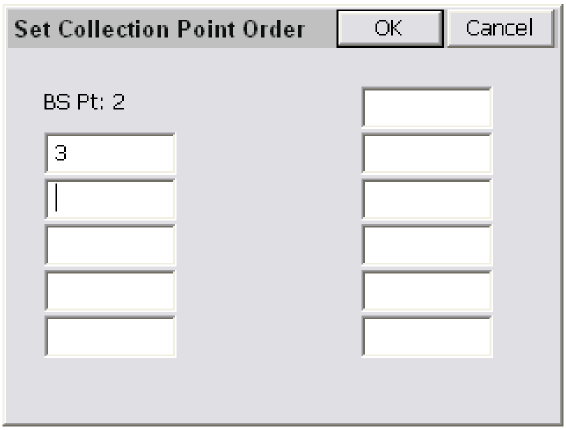


Figure 4-163

Take Readings

Once the foresight points have been specified, the next dialog will be determined by the set order. If the next reading was to be FD since the BD was already recorded, then the dialog will prompt as shown below. Pay attention to the prompts in these dialogs as they inform you as to which point and which face is expected based on your configured set order. Press the enter button or select the OK button to record the reading.

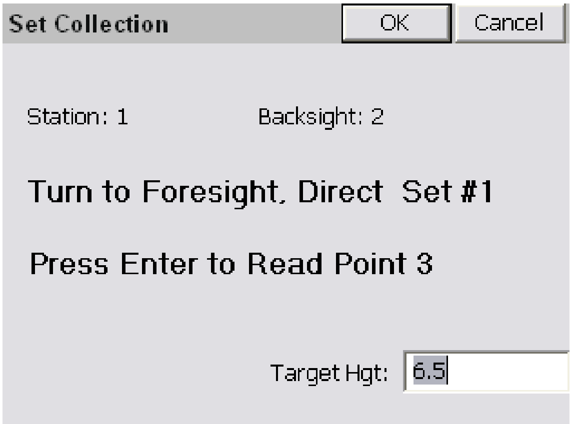


Figure 4-164

Completed Set

At the end of the set collection process is the dialog displayed below. This will be presented after all of the reciprocal calculation and store point dialogs have been dismissed.

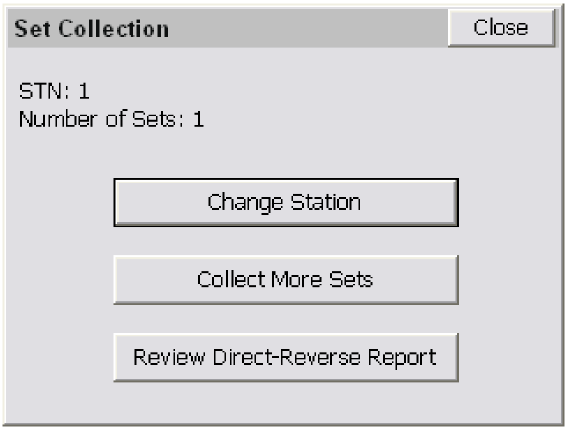


Figure 4-165

- **Change Station**: This button will take the user to the instrument setup dialog and advance the point numbers so that the originally occupied point is the backsight and the last foresight point is now the occupied point.
- **Collect More Sets**: This button will take the user to the backsight dialog and maintain all of the previous setup information.
- **Review Direct-Reverse Report**: This button will allow the user to select the occupied point ID from a list of points that were used with set collection. The software will then generate a report of all of the sets measure from the specified occupation point as shown in the graphics below.

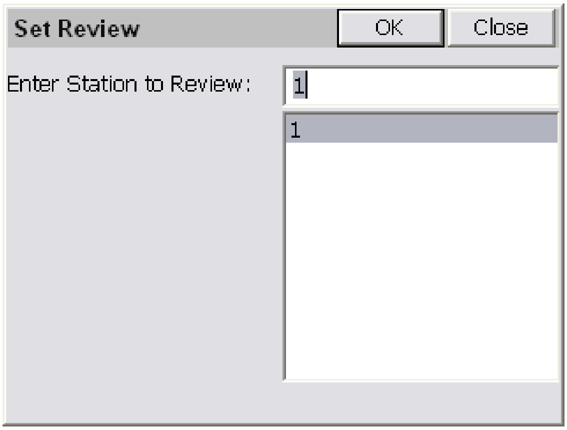


Figure 4-166

In Figure 4-166, select a point number and tap OK to view the report. The report is shown in Figure 4-167.

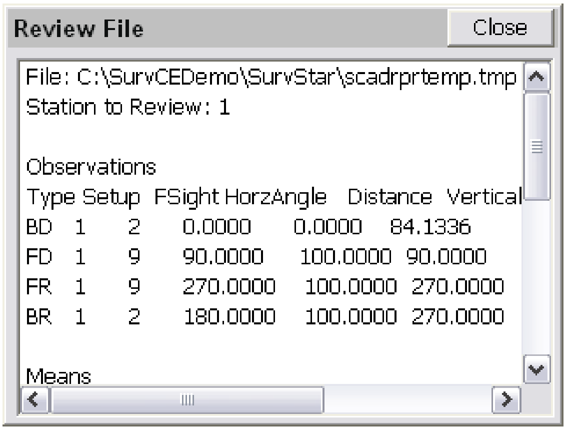


Figure 4-167

Set Review

Function

See the Completed Set section under Set Collection.

5

COGO Menu

This chapter describes the commands found
in the COGO menu.

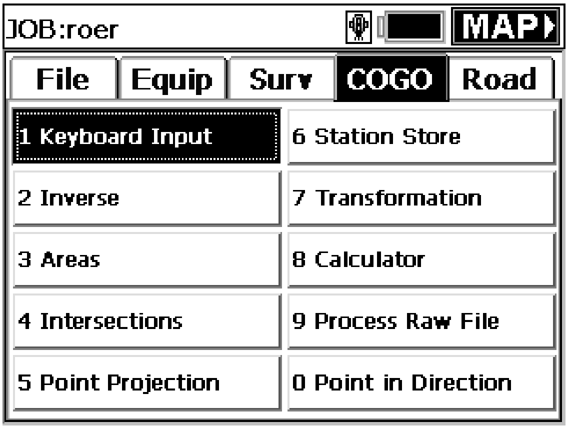


Figure 5-1

Keyboard Input

Function

This feature allows you to manually enter or edit coordinates in the current job file or the current control file. Figure 5-2 shows the Enter and Edit Coordinates dialog box. The option to specify the control file only appears if Use Control File is clicked on, and a named control file exists, in Job Settings. There are fields for Point Number, Northing, Easting, Elevation and Description. If adding a point to an existing job, FAST Survey displays a point number one greater than the highest in the file. If starting with a new job, the point number will default to 1. The Previous and Next buttons move up and back throught the coordinate file, skipping points with zero coordinates. Store writes the entered data to the file and advances the display to the next point. The Next button will not store the current data to the file. The Delete button allows the user to delete a point or range of points from the file.

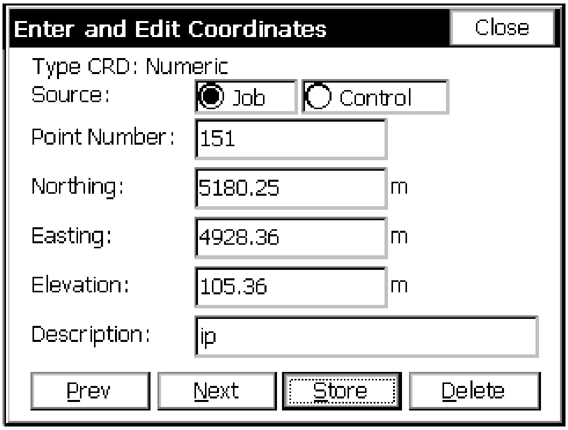


Figure 5-2

If you are editing an existing point number as shown in Figure 5-2, when you press Store, FAST Survey will warn you that this point number has already been used. You then have a choice to Overwrite this point number or Use a New Number.

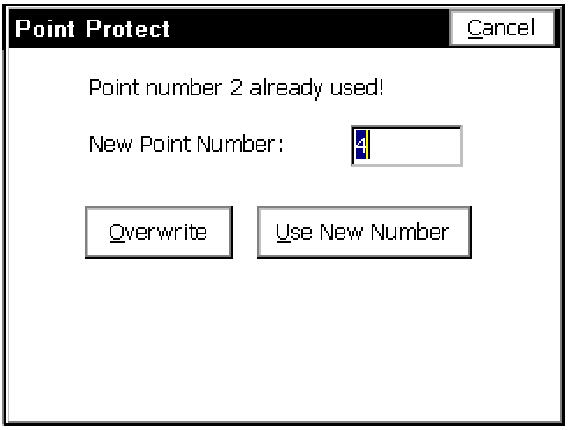


Figure 5-3

If you want to create a duplicate point, simply change the point number and press enter. You can also edit one or more attributes of a point and then change the point number to do this. For example, consider point number 2 shown in Figure 5-4.

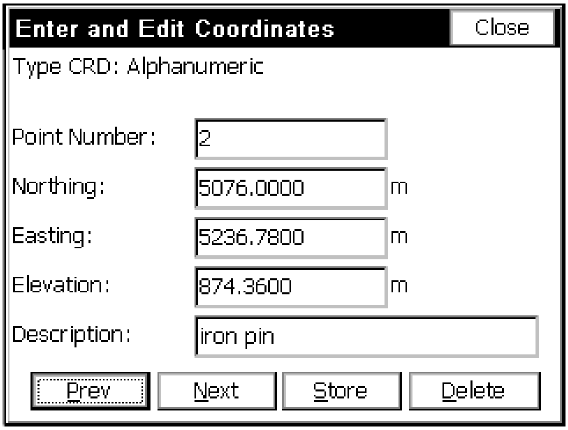


Figure 5-4

If you want a duplicate point with a **different** elevation, click in the elevation field and change it. We will change this one to 880.00. Then **without** pressing enter, click in the point number field and change it to 2A. Now when you press Store, point 2A is saved using the northing and easting of point 2 and the new elevation. See Figure 5-5.

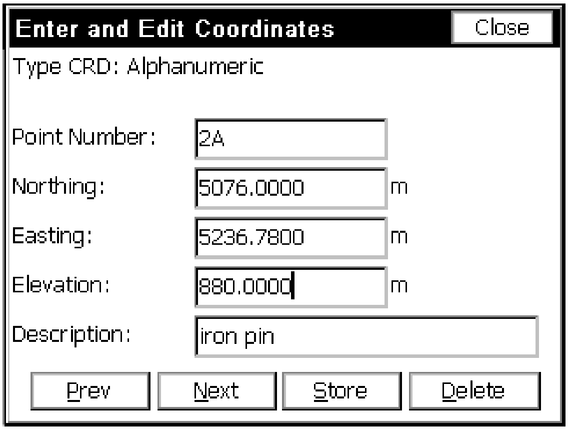


Figure 5-5

Note: As shown in this example, alphanumeric characters are acceptable for numbering points.

Inverse

Function

This command reports the bearing and horizontal distance between any two user specified points that are contained within the current job. If Units, within Job Settings, is set to Angle: Azimuth, then Inverse will display azimuths instead of bearings. You can override the display settings from within Job Settings by choosing between Bearing, North Azimuth and South Azimuth at the bottom right of the Inverse screen. There is a “2D” and “3D” mode for inverse, set at the top of the screen. In 2D mode, the program displays only the bearing and distance between the 2 points. As many as four inverses can be viewed at once, as shown below. In 3D mode, the report also displays the slope distance, elevation difference, slope in percent and slope as a ratio, between each point. The Northing, Easting, Elevation and description of the specified points are also shown. Start the command, enter the first point number at the bottom (you may also select from a point list or select from the map screen). Press Enter, and then enter the second point.

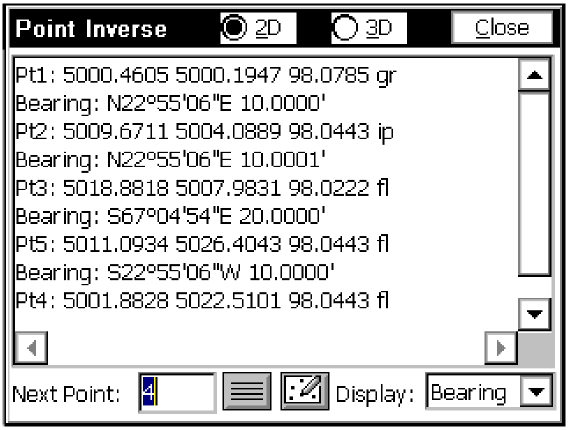


Figure 5-6

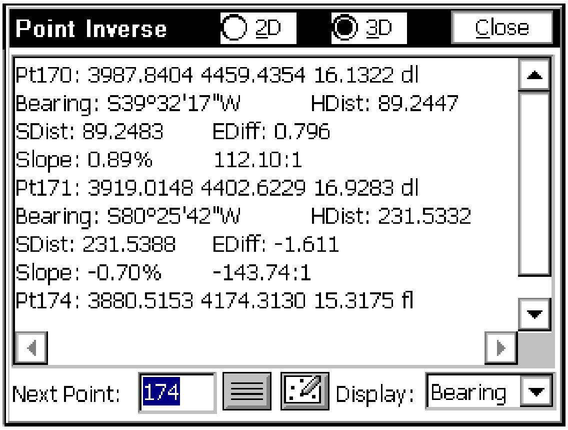
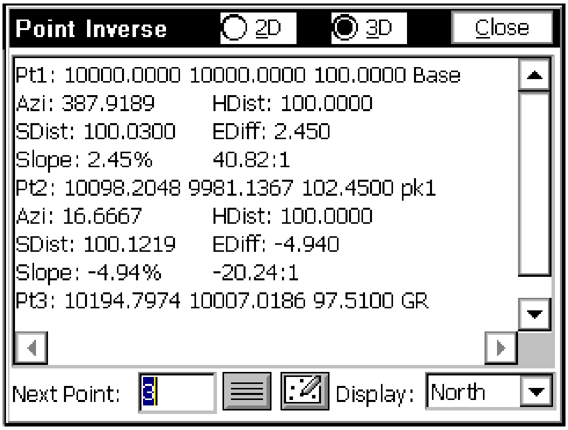
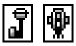


Figure 5-7

If a control file is specified in Job Settings, then when you Inverse, you can choose the “List” icon at the bottom center of the screen and then select points from the control file. In this way, you can inverse between points in your current file and your control file as needed.

If under Job Settings, Units tab, the Angle Unit is set to Grads/Gons, then the Inverse command will default to the 400 circle and will display North azimuths. Here is an example:



Areas 

Function

This command calculates the area of a closed figure that is defined internally by user entered point numbers contained within the current job or by a polyline picked from the screen.

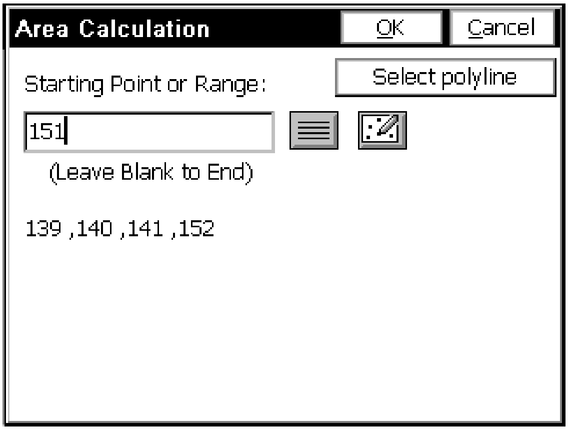


Figure 5-8

You may specify individual point numbers or type in a range of point numbers to define the area. Notice the example of using individual point numbers. This could also be entered as 139-141,152,151. This will calculate the area from point 139 to 140 to 141 to 152 to 151 back to 139. Leave the field blank to end your input. Figure 5-9 shows that the area is reported at the bottom of the map screen. A temporary polyline is also drawn between the points. Results are reported in square feet and acres when units are set to feet, and square meters when units are set to metric.

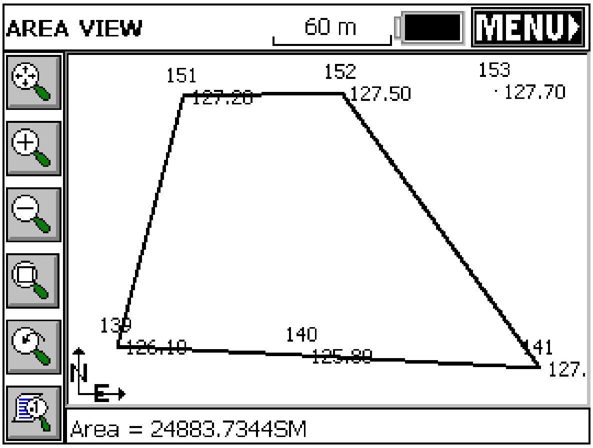


Figure 5-9

If the polyline is used to solve the area, the program will bring up the Map screen after you pick a polyline. It will highlight as shown in Figure 5-10

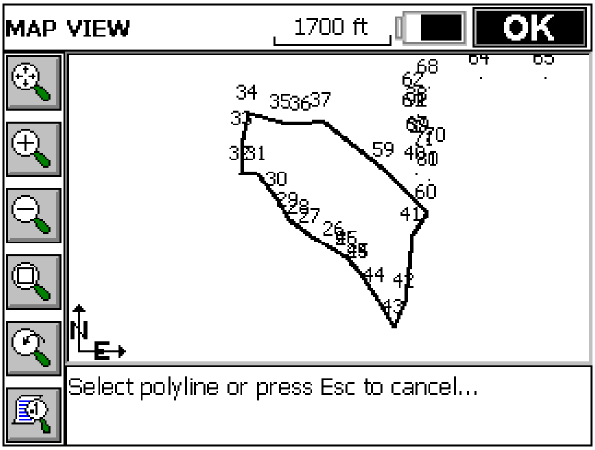


Figure 5-10

When you are certain you have selected the desired polyline, press OK, and the graphic screen (shown below) presents the area (here, 96.1279 acres). Since the point-defined area is a straight point inverse, the advantage of the pick polyline approach is that the polyline may contain arcs.

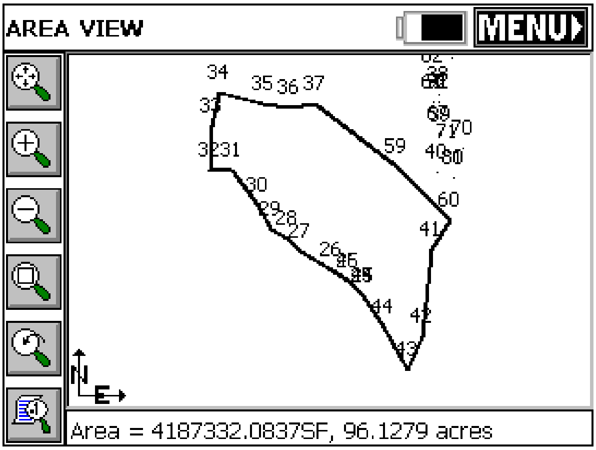


Figure 5-11

At the end of each Area calculation, you are asked if you would like to "Write result to raw file?" This will write a line in the raw file such as:

"Calculate area of polyline: Area = 4187332.0837 SF, 96.1279 acres" and for point-defined figures in metric, you would obtain:

"Calculate area of polyline 139, 140, 141, 142, 152, 151, 139: Area = 24883.7344 SM"

Intersections

Function

This command allows for the calculation and storing of points based upon standard surveying practices of Bearing-Bearing, Bearing-Distance, or Distance-Distance Intersection calculations. Data can be entered manually, or defined by selecting points from a point list or selecting points from the screen. The kind of intersection calculation to be performed determines the number of possible solutions. With a Bearing-Bearing calculation, there will be only one possible solution. Bearing-Distance, and Distance-Distance calculations will have two possible solutions prompting the user to pick the desired solution. Note that in intersection calculations of Bearing-Distance and Distance-Distance there may be no solution for the input data. In these cases, FAST Survey will display the message, "No Valid Solution".

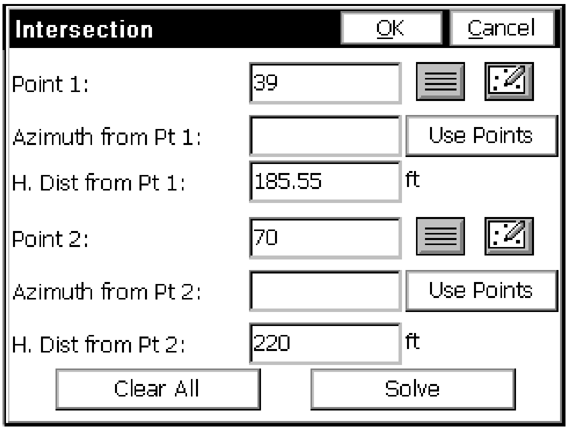


Figure 5-12

From the COGO Menu select Intersections. Using the dialog shown above, fill out the appropriate data fields to perform the desired calculation. The Enter key moves forward through the edit boxes. The current Angle setting in Job Settings, Units, dictates whether angles are prompted as azimuth as shown in Figure 5-5 or bearings as shown in Figure 5-8

Bearing-Bearing

This method locates a point at the intersection of two lines. Select Point 1 by entering directly the desired point number, or pressing the point list icon and selecting the desired point. Pressing the map icon will allow for selection of the desired point directly from the screen. Note that when picking from the screen, if the desired point cannot be determined from the picked point on the screen, a listing of the nearest points to the picked location will appear allowing for verification of the desired point. If the list appears, select the desired point from the list by clicking on it.

Define the bearing from point 1 by typing in the bearing, or by selecting Use Points, and defining the bearing by specifying two point numbers or select the map icon and selecting two points from the screen. Repeat the above procedures for selecting point 2 and defining the azimuth from point 2. Bearings can be entered in 3 forms:

- SE40.5945 becomes S40d59'45"E
- S40.5945E becomes S40d59'45"E
- 240.5945 becomes S40d59'45"E

Once data entry is complete, press solve button. The calculated point will appear on the screen with the input data detailed at the bottom of the screen. Store, Modify (review and revise) and RESULTS Options are located on the right side of the Map screen. Press S to store the calculated point, press M to verify/revise calculation input data, or RESULTS to review the calculation results. The results screen will display the coordinates of the base points, the inverse bearing and distance from the base points to the calculated INT1 point (and INT2 for distance intersections) and the coordinate data for the calculated points. Note that calculated points are labeled as Int1 and Int2 until the points are stored. These Option Buttons are present on all Map screens displayed while in the Intersections routine. Once store is selected or the enter key pressed the stored point will inherit the specified point number, description and optionally the elevation displayed at the bottom of the screen. There can be only one solution for a bearing-bearing intersection. Figure 5-13 shows the two original points. Figure

5-14 shows the intersection dialog with values filled in and Figure 5-15 shows the results after pressing the Solve button.

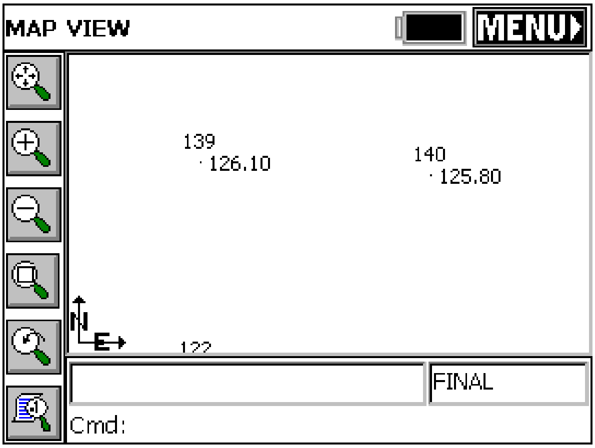


Figure 5-13

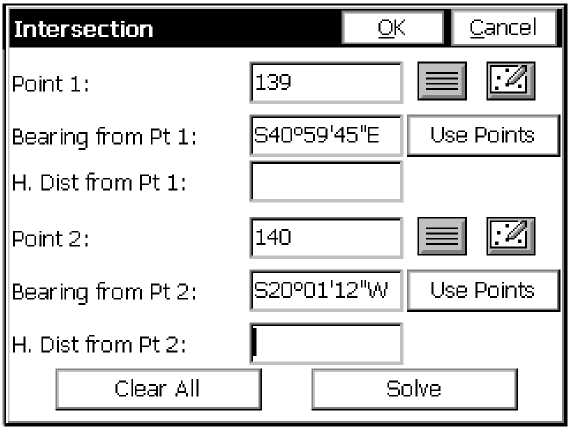


Figure 5-14

All Intersect routines handle the 400 circle, if configured to grads/gons within Job Settings, Units. Shown below is the intersection of a 100 gons (due East) azimuth from point 151 and a 50 gons (northeast) azimuth from point 3.

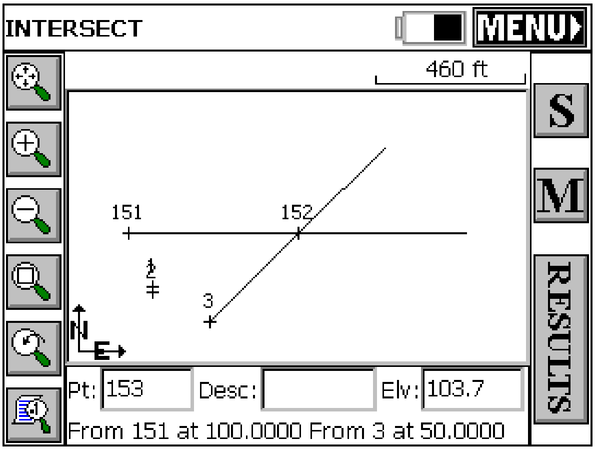


Figure 5-15

Bearing-Distance

This example uses the same two base points as shown in Figure 5-13. In Figure 5-16, select Point 1 by entering directly the desired point number or press the point list icon and select the point by clicking on the desired point. Pressing the map icon will allow selection of the desired point directly from the screen. Define the Bearing from point 1 by typing in the bearing, or by selecting Use Points, and defining the bearing by specifying two point numbers or select the map icon and select two points from the screen. Select Point 2 using the same methods as Point 1. Enter the known horizontal distance from the selected point 2.

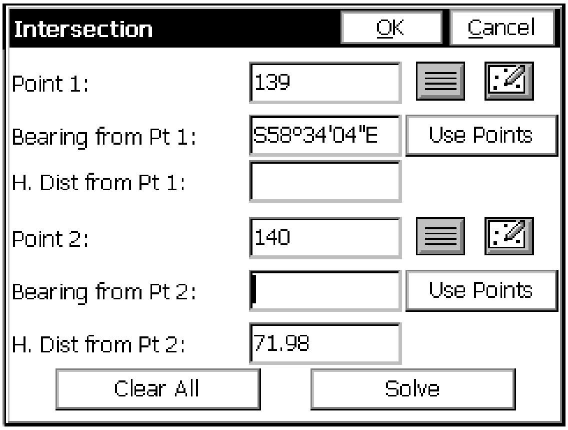


Figure 5-16

Press enter or tap the solve button and the map screen will display showing a circle radiating from the selected distance base point, and a line defined by the bearing is extended to intersect the circle at the two possible calculated solutions. See Figure 5-17. Pressing enter will display the prompt "Pick a Solution". Select desired calculated solution. To select the point simply pick it from the screen. Picking near the desired solution is sufficient. The program will select the nearest solution position. Pressing enter again will accept the the second possible solution for the intersection. To accept only one of the possible two solutions, select the desired point and then press the menu button at the top left of the screen. If there was no solution for the input data, FAST Survey will display "No Valid Solution". Pressing OK will display the map screen showing the circle radiating from the distance base point and the line defined by the bearing input. The map screen displays the options of S (Store), M (Modify) and Results. Press M to do a new calculation. If there is no valid solution, pressing the results button will display only the base point coordinates.

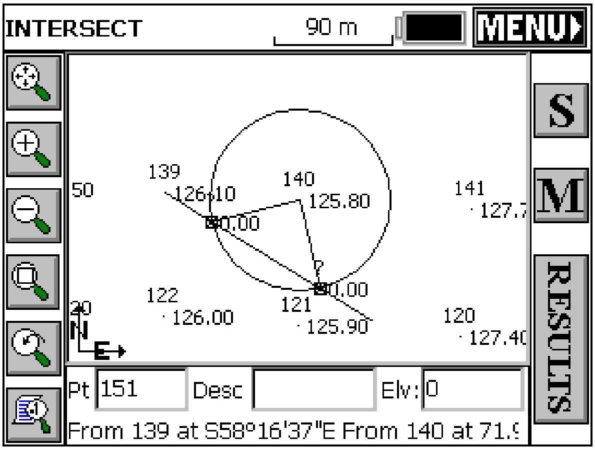


Figure 5-17

Distance-Distance

This example uses the same two base points as shown in Figure 5-13. In Figure 5-18, select point 1 by entering directly the desired point number or press the point list icon and select the point by clicking on the desired point. Pressing the map icon will allow for selection of the desired point directly from the screen. Enter the known horizontal distance from point 1. Select Point 2 using the same methods as Point 1. Enter the known horizontal distance from the selected point 2.

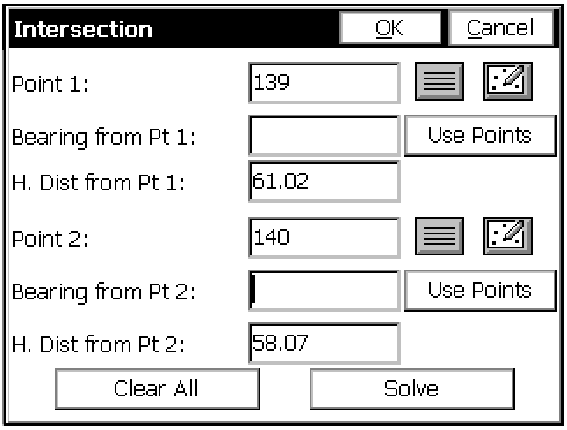


Figure 5-18

Press enter or tap the solve button and the map screen will display showing circles radiating from the first and second selected base points. See Figure 5-19. Lines leading from both base points to the two possible intersections of the circles are also shown. Pressing enter will display the prompt "Pick a Solution". Select desired calculated solution. To select the point simply pick it from the screen. Picking near the desired solution is sufficient. The program will select the nearest solution position. Pressing Enter again will accept the second possible solution for the intersection. To accept only one of the possible two solutions, select the desired point and then press the menu button at the top left of the screen. If there was no solution for the input data, FAST Survey will display "No Valid Solution". Pressing OK will display the map screen showing the circle radiating from the distance base point and the line defined by the bearing input. On the map screen display the options of S (Store), M (Modify) and Results are present. The M option can be used to revise the existing data or enter new data for the intersection calculations. If there is no valid solution, pressing the results button will display only the base point coordinates.

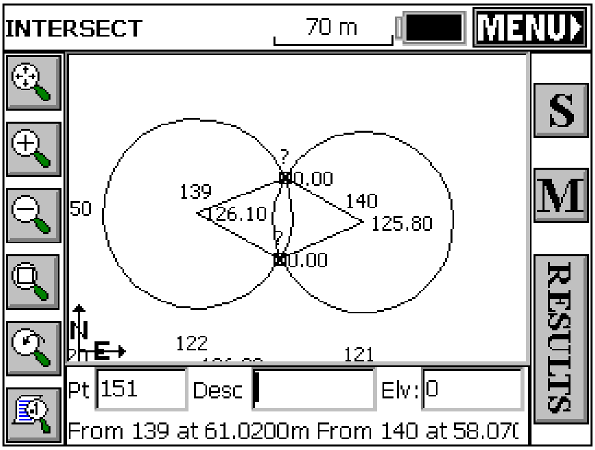


Figure 5-19

All Intersect routines create SP records in the raw file, storing the calculated coordinates for each new point. This SP record is identical to records created by Keyboard Input, for example.

Point Projection

Function

This command allows you to calculate the station and offset of any entered or surveyed point relative to a known centerline or baseline. You can then calculate the the "Intersect", or the projection of that offset point on the baseline. This baseline "intersect" or perpendicular projection point can be staked out and stored. The application of the routine is shown in Figure 5-20:

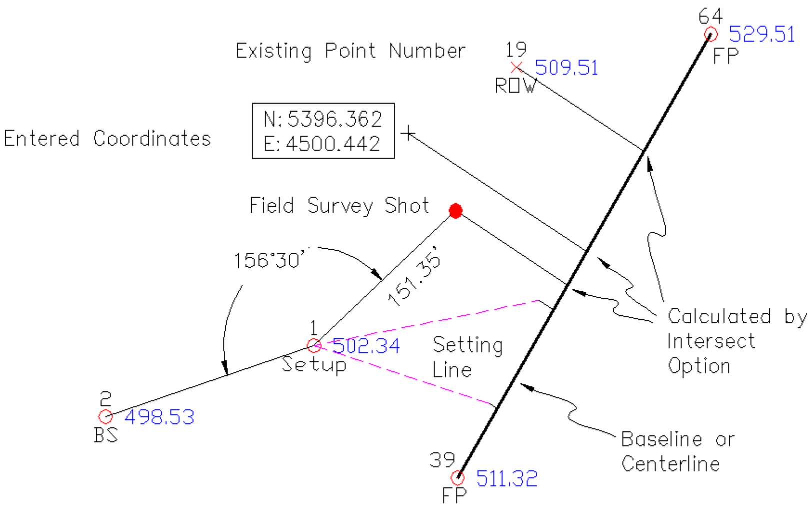


Figure 5-20

The coordinates to project from are entered one of 3 ways:

- By Point Number
- By Entering the Coordinates Values
- By Taking a GPS or Total Station Reading

The Station and Offset of the point is then calculated, and the Intersect button (see Figure Figure 5-20) will calculate the projected perpendicular offset. This Intersect can be staked out. Point Projection can be used, crudely, to set line, where you sight a manual total station in a gap in a tree line or row of bushes, and note the station and offset. However, since the offset is perpendicular, the "out" or "in" distance to the desired line will not be along the line of sight, as shown above.

Procedure: You must first define the baseline as shown in Figure 5-21. You can designate the baseline by picking two points on a line or by choosing a predefined centerline file (.cl file).

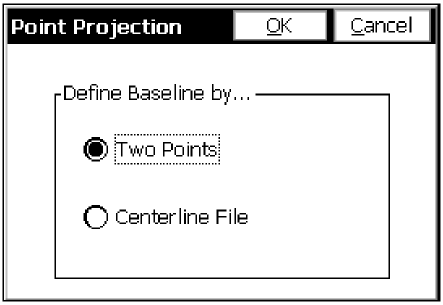


Figure 5-21

Choosing Two Points, you must define the line in the Point Projection dialog box as shown in Figure 5-22

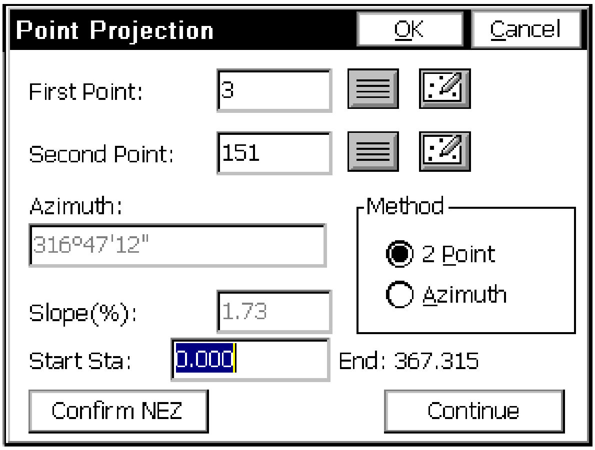


Figure 5-22

With the 2 Point method you simply enter two point numbers, or choose them from the point list or MAP. The azimuth and slope between them is calculated, along with the ending station, based on the entered start station. With the Azimuth method you define the line by entering a first point and then entering an azimuth and slope.

You can confirm the coordinate values of the points by choosing Confirm NEZ.

When the line is defined, choose Continue. You must now define, or designate the point that is offset from the line in the Point Definition dialog box as shown in Figure 5-23.

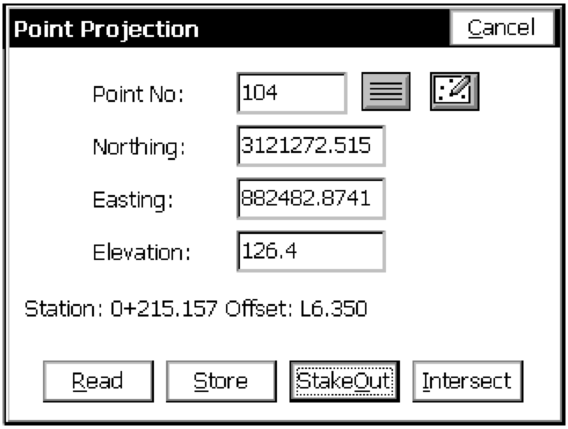


Figure 5-23

You can enter a point number, select one from the list, or select one from the map. You can also enter coordinates to define a new point, or read values for a new point. As soon as enough information is entered, the Station/Offset is displayed or the message OFF CENTERLINE is displayed to let you know that a station/offset cannot be computed for the coordinates entered.

- **Read**: This command will read the instrument to gather coordinates for point projection.
- **Store**: Store after Read stores the offset coordinate. Store after Intersect is selected stores the coordinates for the intersect point on the centerline (perpendicular from the offset point). Store after entering coordinates or a point number for the offset point, without selecting Intersect, would simply store the offset point coordinates again as a new point number. Store is most often used to save the calculated intersect points to the coordinate file. Pressing Store will save an SP (store point) record in the raw file and a note record will indicate tha the point was calculated within Point Projection.

- **StakeOut**: This command will allow you to stakeout the displayed coordinates (typically used to stakeout the intersect points).
- **Intersect**: This command will project the coordinates entered perpendicular, back to the centerline and enter these new coordinates into the Point Projection dialog box. From there you can store or stakeout the intersect points.

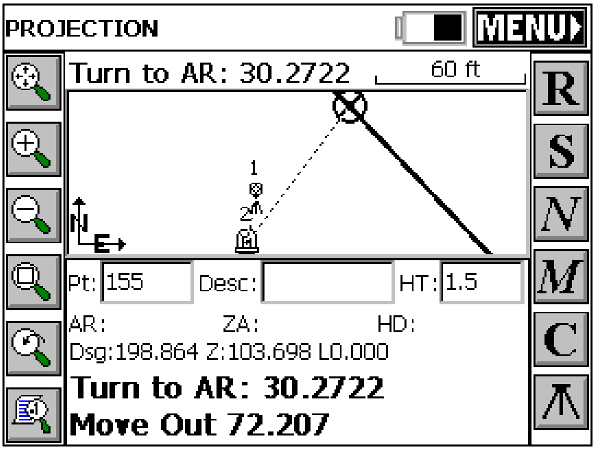


Figure 5-24

This stakeout screen represents a metric, grads/gons display (400 circle). The target point is 198.864 meters along the baseline, 30.2722 gons angle right from the backsight point 1, a distance of 72.207 meters from the instrument. Point 1 itself was also the offset point used in this example.

During stakeout, you will obtain the standard stakeout screen, where option M returns to the previous coordinate screen in Figure 5-24 with the same data shown, and option N returns to the same previous screen with the data cleared, ready for entry of the next offset point.

Station Store

Function

Station Store is a pure calculation routine that will create point numbers based on a station and offset from an alignment. The alignment may be defined as a centerline, a 3-point arc, an arc defined by a PC, Radius and PT, a sequence of points or even a picked polyline. The user may also assign an elevation to the calculated point. Station Store is often used to enter elevations of culverts, for example, where inlets and outlets are located at distinct stations, offsets and elevations. Then the 2 calculated points at the inlet and outlet can be used within Stakeout Line to stake any point along the culvert, with the cut/fill calculated. Although the command Stake Centerline, found within Stakeout Line/Arc, will directly stakeout a particular station and offset to a centerline, some users prefer to pre-calculate the station and offset and assign a point number, then stake by point number. Station Store permits this pre-calculation of point numbers at any station and offset.

The very first screen within Station Store offers several methods of defining an alignment. The routine defaults to the most automatic of the methods—use of a pre-defined centerline file. To review, centerline files can be made by use of the command Input-Edit Centerline File (item 1 within the Road menu). Alternately, centerlines can be uploaded to the FAST Survey program from a PC in forms including LandXML, SDR, TDS, ASCII LDD, TM (Terramodel) and Carlson/AutoDesk Field Survey. Unless the file format is Carlson/AutoDesk Field Survey, the command Centerline Conversion within Road Utilities should be used to convert the "foreign" centerline format to the ".cl" form used by FAST Survey.

You can follow along by loading the file demo.cl within the command Station Store. Then, on the data entry screen, enter a station of 101.25, offset of -35.5, and elevation of 996.04, as shown below (any unused point number will do). See Figure 5-25.

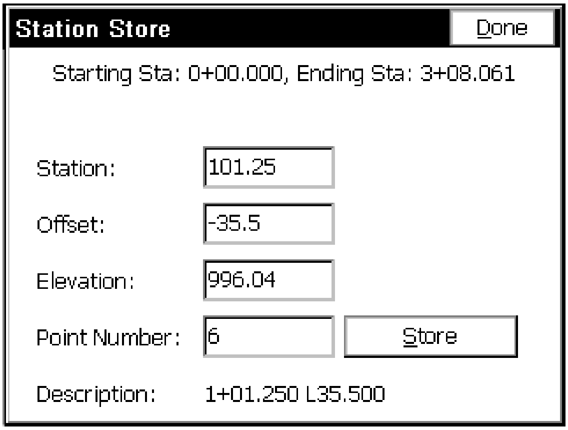


Figure 5-25

Pressing Enter will move through the dialog and store the point, leaving the screen up for more entries, while defaulting to the previous data and the next point number. The description is fixed as the station and offset, but could be edited using the command Keyboard Input. You could continue by entering a right-side station and offset, such as station 117.25, offset 29.71, elevation 1003.67 for point number 7. Then the 2 calculated points might define a "skewed" culvert, ready for stakeout using the command Stakeout Line/Arc. You could also choose to stakeout the endpoints of the culvert by point number using the command Stakeout Points. Figure 5-26 shows the resulting plan view, as seen in the Map view. You can view the demo.cl by doing the command CL2P at the "command" line in the Map view. It is also found under the "Tools" pulldown in the Map view.

The line representing the culvert is drawn by the command 2DP, which stands for "2D polyline".

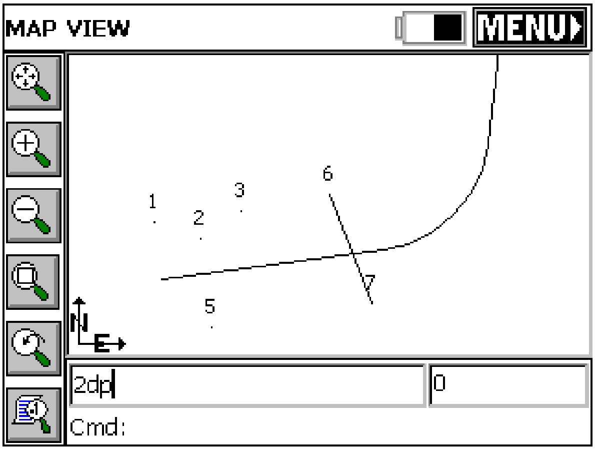


Figure 5-26

Transformation

Function

This command allows you to translate, rotate, and/or scale points in the current job. Any point drawn on the map screen will be updated automatically in addition to updating the coordinates.

Translate

On the translate dialog shown in Figure 5-27, below, enter in the Delta North, Delta East, and the Delta Elevation. These values represent the change in the original coordinate values and the desired coordinate values. When complete, select the ok button on the dialog, or press the Rotate or Scale Tabs for further data input.

The lower portion of the screen, in Figure 5-27, is an alternate method of defining a translation, by comparing an original point to a destination point. Data entered there, as point number or directly entered northing, easting and elevation, will lead to computation and display of the delta N, delta E and delta Z in the upper portion of the screen.

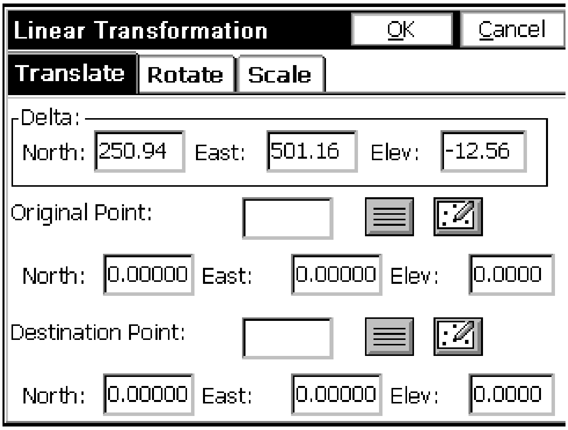


Figure 5-27

When OK is pressed, a second screen appears which controls then range of points to be translated. This is shown in Figure 5-28:

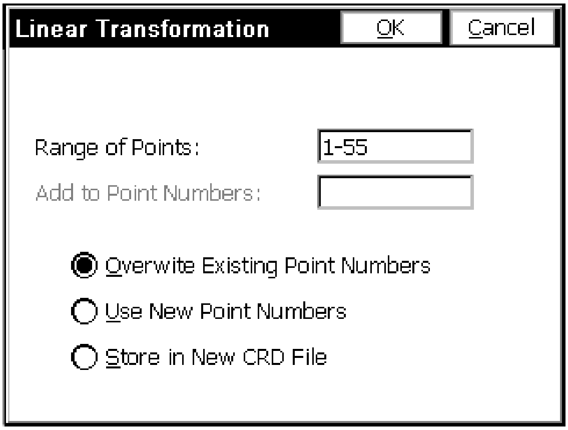


Figure 5-28

Assuming you have 55 points in your file, you could "preserve" these 55 points by adding 100 to the point numbers, and saving the transformed points as 101 through 155. If you choose "Overwrite", the Add to Point Numbers option is not available. If you choose "Use New Point Numbers", then you will be prompted to enter a new point number for each existing point to be overwritten (recommended only when you are overwriting a few points). You can even store the "transformed" points in a completely new CRD file by selecting "Store in New CRD File".

Raising and Lowering Elevations: Users often ask, "How do I raise or lower elevations on a range of points?" The answer is, Transformation, option Translate, enter only the delta elevation (leave Northing and Easting at 0 translation). Rather than have a special command for raising or lowering elevations, it is just a subset of the Translate option within Transformation.

Rotate

The rotate tab is used to rotate points in a coordinate file, see Figure 5-29. Enter the desired degree of rotation into the degree of rotation data field. Specify the rotation base point. This can be accomplished by either entering the point number of the desired point manually, or by selecting the point list icon and selecting the point from the list, or using the map icon and selecting the point from the screen. You may also enter in coordinates for the rotation point if the point is not present in the coordinate file. You can also define the rotation by referencing 2 points (such as "From" 1, "To" 2 as shown in Figure 5-29), then specifying the desired new bearing for these points. Even the new bearing itself can be computed from 2 points used a reference. If we "talk through" the rotation in Figure 5-29, we "made points 1 to 2 go in the direction N 75 degrees, 15 minutes, pivoting around point 1."

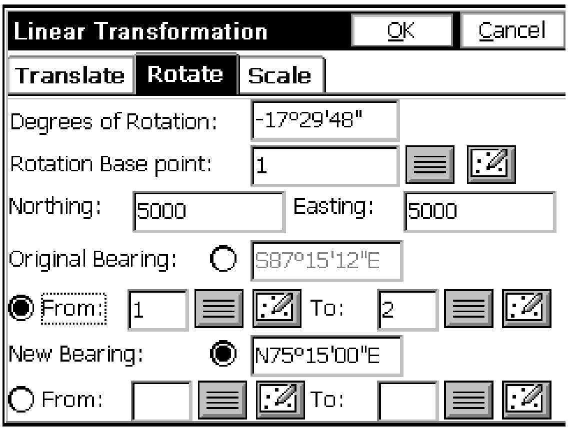


Figure 5-29

The same "second" screen appears as in Figure 5-29 above, which allows you to set the range of points to transform and how to store the newly calculated points.

Scale

The scale tab is used to scale the points in a coordinate file, see Figure 5-30. The northing, easting and optionally the elevation are multiplied by the specified scale factor. Enter the desired scale factor in the scale factor field. Select the base point by entering the point number of the desired point manually, or by selecting the point list icon and selecting the point from the list, or by using the map icon and selecting the point from the screen. You may also enter in coordinates for the scale base point if the base point for scaling is not present in the coordinate file. The coordinate of the base point will remain unchanged. All other points will scale. If the Ignore Elevations toggle is checked ON, then only the Northing and Easting values are scaled.

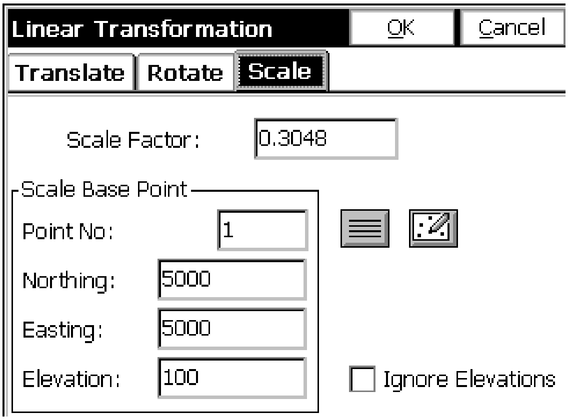


Figure 5-30

All three transformations can be performed individually or all at once if desired. When the OK button is selected at the top of the transformation dialog, the following dialog shown in Figure 5-31 is displayed.

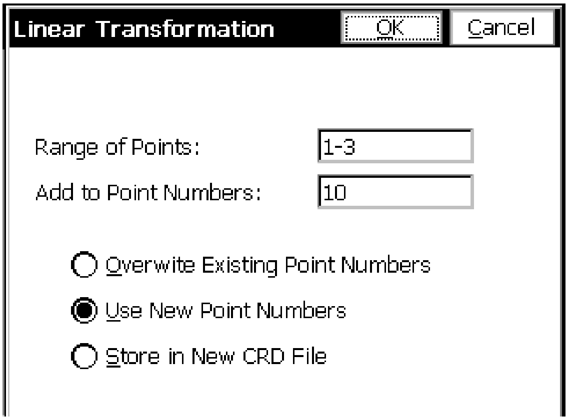


Figure 5-31

On this dialog, you must complete the following fields:

- **Range of Points**: Enter the range of points to translate. Ranges can be entered in the following format: 1-20,32,40-45 etc.
- **Add to Point Numbers**: Enter a number to add to existing point numbers when creating new point numbers. This option is not available when overwriting your existing point numbers. See example below under Use New Point Numbers.
- **Overwrite Existing Point Numbers**: Overwrites the existing point coordinate data with the new coordinate data.
- **Use New Point Numbers**: Uses new point numbers for the new coordinate positions while keeping the existing point numbers and coordinate data. Each time a point is to be overwritten, you will be prompted whether to overwrite or use a new point number. This method is only recommended when you are transforming very few points, and wish to give them specific point number assignments.
- **Store in New CRD File**: This option writes the transformed points to a new CRD file while keeping the existing point numbers and coordinate data. You may also choose to input a number for Add to Point Numbers, but this is not required.

Calculator

Function

This command eliminates the need to carry a separate calculator in the field. The calculator can be used to do scientific computations, standard calculations, conversions, triangle calculations including angles, and curve calculations.

Standard Calculator

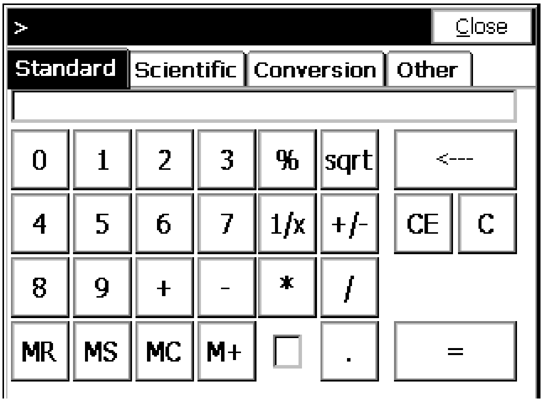


Figure 5-32

Figure 5-32 shows the FAST Survey standard calculator. Most basic calculations can be done with this tool. Memory functions are also available.

Scientific Calculator

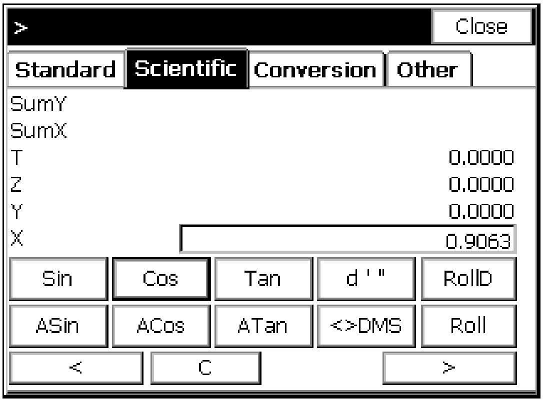


Figure 5-33

Figure 5-33 shows the scientific calculator. Values can be entered on the X register by typing on the keypad. The values can be rolled up and down with the up and down arrow keys and the Roll and RollD buttons on the screen. The Enter key finishes the entry of a number and pushes the stack. The C on the touch screen clears an entry. Additional functions on the screen can be obtained through touching the scroll [<] and [>] area of the screen.

Conversion Calculator

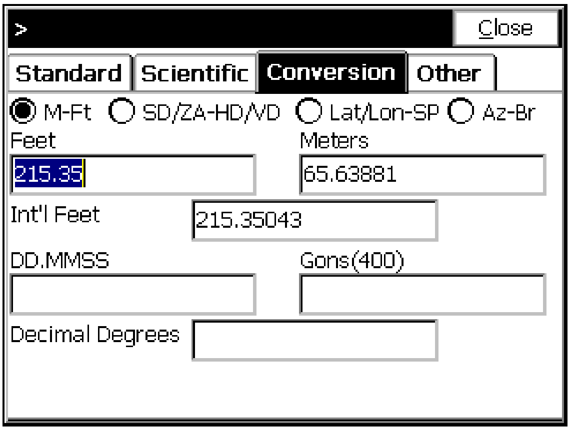


Figure 5-34

Figure 5-34 shows the **M-> Ft.** conversion calculator for converting between the following units.

- Feet, Meters and International Feet
- Degrees, Minutes, Seconds and Gons and Decimal Degrees

Enter a value in any field and press enter to find the conversion value

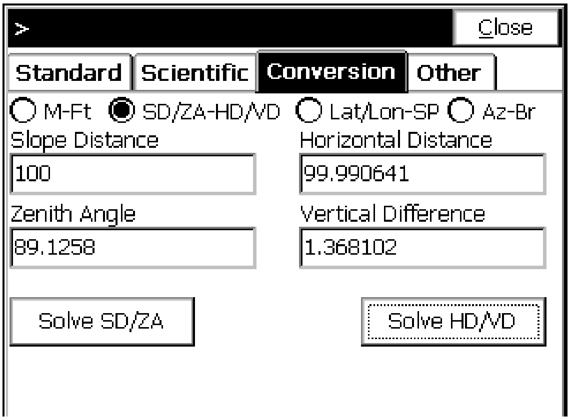


Figure 5-35

Figure 5-35 shows the **SD/ZA -> HD/VD** conversion calculator. This option allows you to solve for slope distance and zenith angle or for horizontal distance and vertical difference. To find horizontal distance and vertical difference, enter a slope distance and zenith angle, and then press Solve HD/VD. To find slope distance and zenith angle, enter a horizontal distance and vertical difference and then press Solve SD/ZA.

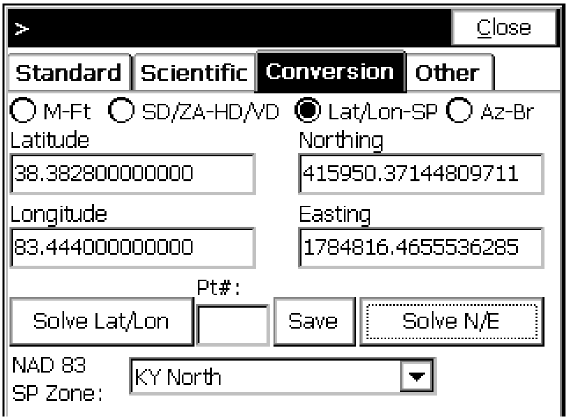


Figure 5-36

Figure 5-36 shows the **Lat/Lon-SP** conversion calculator. This option allows you to convert from Latitude/Longitude to State Plane Coordinates and visa versa. To solve for northing and easting, fill in the latitude and longitude and press Solve N/E. To solve for latitude and longitude, fill in the northing and easting and press Solve Lat/Long. You can set the state plane zone at the bottom of this dialog. After completing a conversion, you may enter a point number and press Save to save the coordinates to the current job.

You can also change the type of transformation or zone system used. If you don’t want NAD 83 (primarily used in the U.S.) you can go to Job Settings, GPS and change the Transformation type. For example, you could change the Transformation to UTM or NTF-France. Then back in Calculator, your coordinate to Lat/Long calculation would be based on the configured transformation.

The Az-Br tab option, within Conversion, does a straight, simple calculation converting azimuths to bearings. A prime example would be converting an azimuth of 119.2547 as shown in Figure 5-37 .

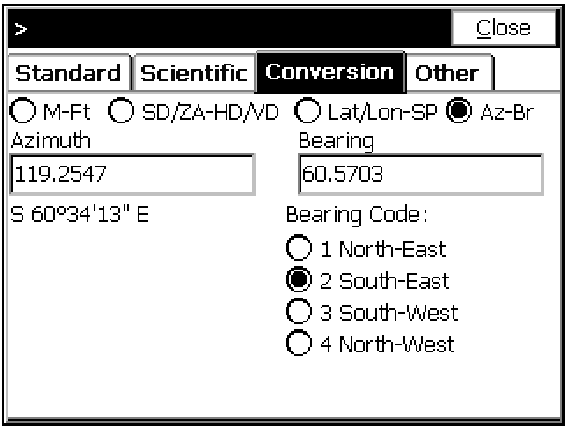


Figure 5-37

Other Calculations

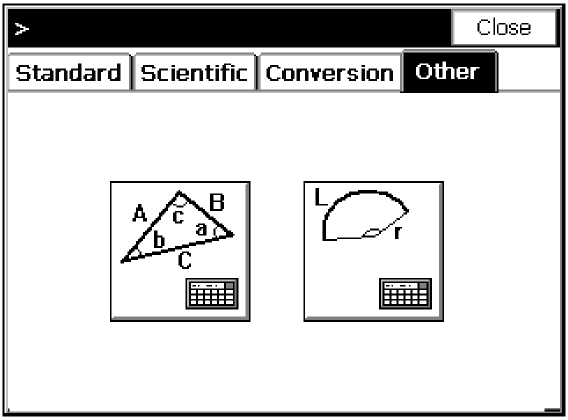


Figure 5-38

There are two types of calculations that can be done from the Other tab. Click the large, square icons to go to the triangle or curve calculator.

- **Triangle Calculator**: Figure 5-39 shows the Triangle calculator. The top of the dialog box indicates the mode of calculation. To change the mode, simply use the pull-down and pick on the desired mode.
  - Side-Side-Side

- Angle-Side-Angle
- Side-Angle-Angle
- Side-Angle-Side
- Side-Side-Angle

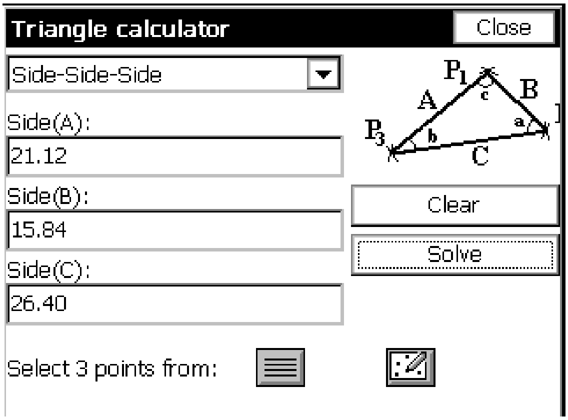


Figure 5-39

After choosing a mode, simply apply the values to the appropriate blank and hit solve. Points from your current job can be selected to fill out the blanks as well. The points can be selected from the screen or from the point list by picking the appropriate button icon. After the calculations have been performed, there are choices of: Clear, Results, and View Triangle. Clear will clear the entry fields. Results will show the results dialog again. View Triangle will draw the triangle on the screen connecting the points chosen for the calculation.

- **Curve Calculator**: Figure 5-40 shows the Curve calculator. The top of the dialog box indicates the mode of calculation. To change the mode, simply use the pull-down and pick on the desired mode.
  - Radius-Delta Angle
  - Radius-Chord Length
  - Radius-Arc Length
  - Deg. of Crv.-Delta Angle
  - Deg. of Crv.-Chord Length
  - Deg. of Crv.-Arc Length
  - Delta Angle-Chord Length

- Delta Angle-Arc Length
- Chord Length-Arc Length

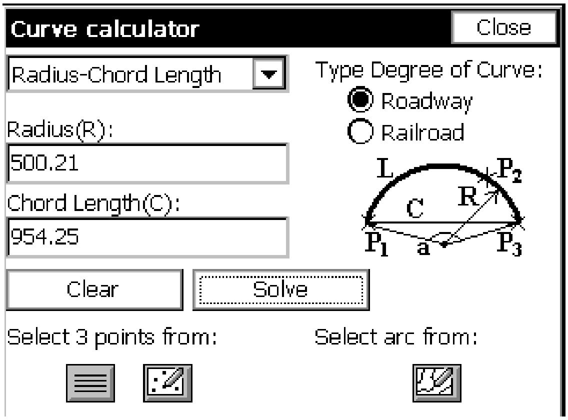


Figure 5-40

The type of curve can be toggled between roadway and railroad. Values can be entered into the blanks by keyboard entry, by selecting points from the current job from a point list or from the screen, or by selecting an arc drawn on the screen. Once the values are entered, the results show on the screen. The results can be visualized by selecting the results button. The curve can be viewed on the screen by selecting the view curve button.

Process Raw File

Function

FAST Survey creates a raw file (.RW5) that contains various lines of survey data similar to a surveyors' field book. This data contained in the RW5 file will vary depending upon whether Total Stations, Robotics or GPS is used during the survey. The name of the RW5 file will default to the specified job name. This command enables viewing of the raw survey data, traverse closure and adjustment computations for the survey. A graphical representation of the traverse can also be viewed using this program.

Total Station and GPS use

After selecting the .RW5 file, the dialog shown in Figure 5-41 will appear.

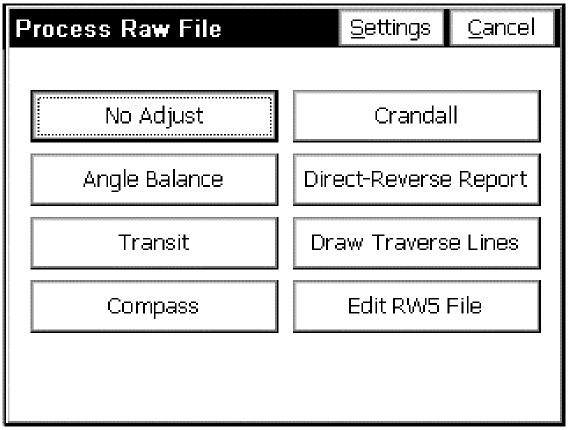


Figure 5-41

Settings

This presents you with the direct-reverse and foresight-backsight (reciprocal) processing options dialog shown here.

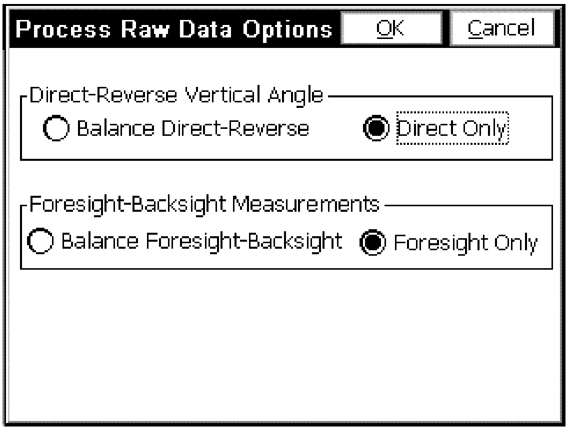


Figure 5-42

The first setting concerns adjusting Set Collection data. You can choose not to use the vertical angles of the reverse reading (face 2) when computing coordinates. The second option covers the so-called "reciprocal" calculation. If you foresight from point 2 to point 3, you calculate point 3 based on a direction, and a delta distance and delta elevation from point 2. But if you set up on 3 and backsight 2 and take a measurement, you can use that backsight measurement to re-calculate point 3, by considering the extra delta distance and delta elevation computed from point 3 to point 2. The azimuth from point 2 to 3 will be unchanged, but you can average the two delta distance and delta elevation measurements to re-compute point 3. So with the Balance Foresight-Backsight option clicked on, the actual northing, easting and elevation of all foresights that include a backsight to the former setup will be re-calculated.

No Adjust

This command processes the RW5 file and computes coordinate values for the surveyed data. No angle balance or traverse adjustment is applied. The Process Raw Data Options dialog shown below appears after selecting No Adjust.

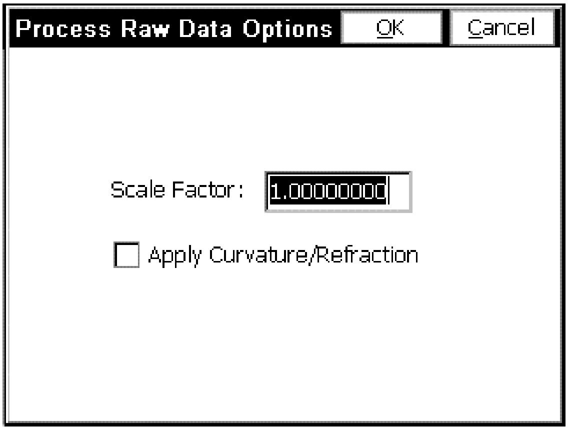


Figure 5-43

■ **Apply Curvature/Refraction**: Applies curvature and refraction adjustments to the distances.

■ **Scale Factor**: Applies the input scale factor to each distance measurement.

Now, the Traverse Points dialog shown in appears:

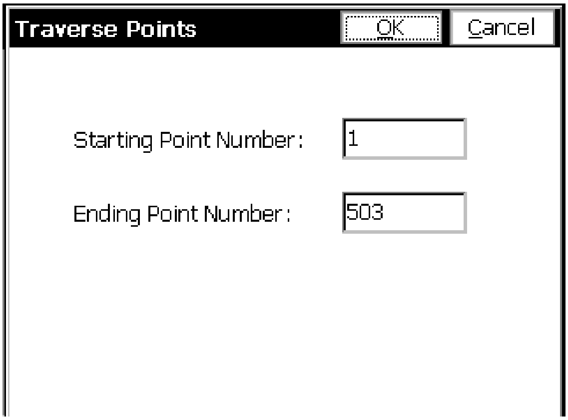


Figure 5-44

Enter the Starting and Ending points of the traverse in the appropriate fields. If the RW5 file contains GPS readings, you will be prompted for a localization file to use for GPS processing. Choose None if no localization is used.

If the file contains both GPS and Total Station readings, the GPS readings are applied first, and are treated as control points during Total Station raw processing.

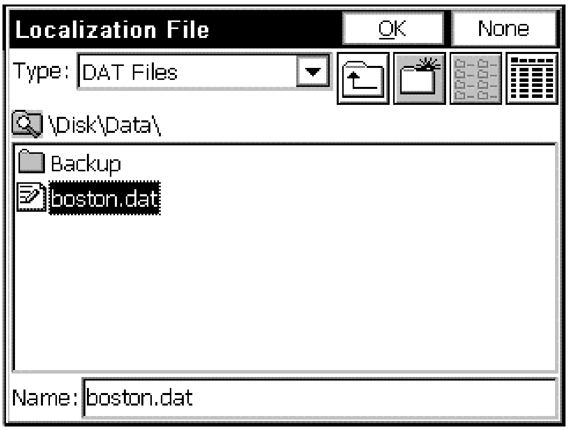


Figure 5-45

After selecting localization, the file will be processed, and the results displayed on the screen as shown in Figure 5-46. This screen displays the raw data for each traverse and/or sideshot point and the unadjusted coordinate values for the traverse.

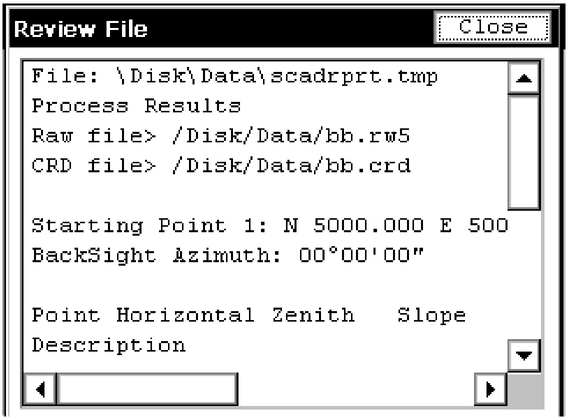


Figure 5-46

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 the calculated amount. The angular error is the difference between the angle balance shot and a reference angle. The program will prompt for the traverse shot to use as the angle balance shot. The measured direction between the occupied point and the foresight point in the specified angle balance shot is then compared to a reference angle. The reference angle is specified as a bearing, azimuth or by a traverse line defined by entering a "from point" and a "to point". The angle balance process is initiated by selecting the angle balance option from the process raw file menu. The Process Raw Data Options dialog shown below appears after selecting No Adjust.

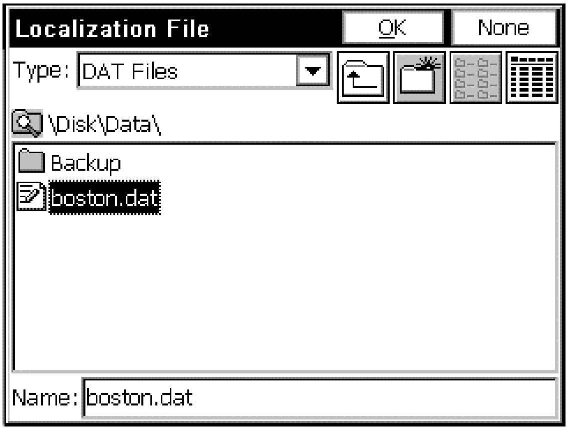


Figure 5-47

- **Apply Curvature/Refraction**: Applies curvature and refraction adjustments to the distances.
- **Scale Factor**: Applies the input scale factor to each distance measurement.

Then, enter the starting and ending point numbers of the traverse in the appropriate fields on the Traverse Points dialog box as shown in Figure 5-48.

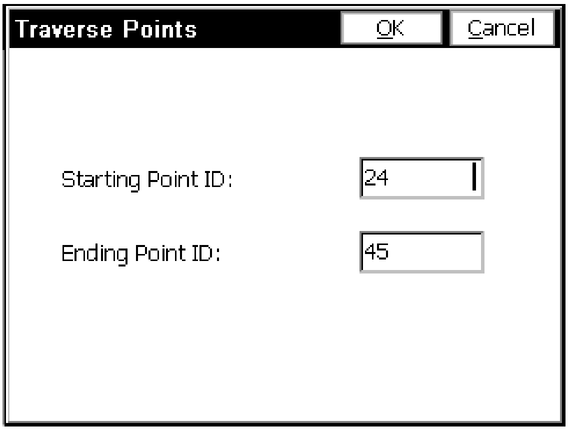


Figure 5-48

If the RW5 file contains GPS readings, you will be prompted for a localization file to use for GPS processing. Choose None if no localization is used. If the file contains both GPS and Total Station readings, the GPS readings are applied first, and are treated as control points during Total Station raw processing.

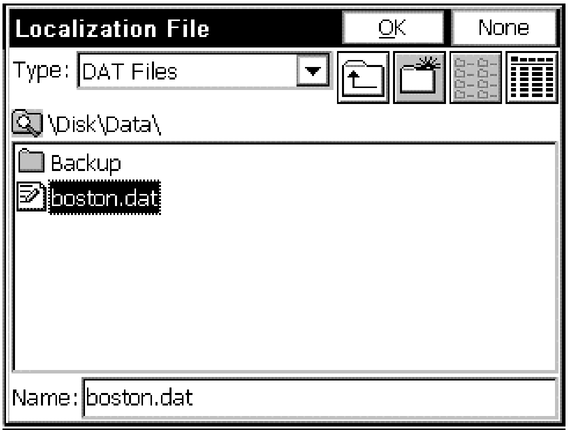


Figure 5-49

The Angle Balance Measurement dialog shown in Figure 5-50 appears. Say our traverse started at 24, traversed up to 25, then around a loop and back to 24 (point 45). If point 45 was the end point or closing shot, the traverse leg from 45 to 46 could be the angle balance shot in this case. It is very common, for example, in closed-loop traversing to take a closing angle shot from the closing point (45) by measuring the angle along the first traverse leg (24 to 25). That is what occurred in the case of this sample traverse.

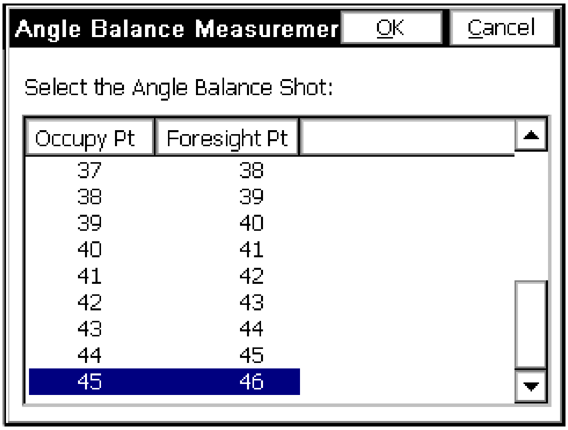


Figure 5-50

Next, the Reference Closing Angle dialog, shown in Figure 5-51 Appears. Enter the bearing or azimuth of the reference angle, or by defining the reference angle with points by entering in the desired point numbers in the From Point and To Point fields. If using bearing or azimuth, enter in the bearing in DD.MMSS format and then selecting the correct quadrant from the format field located at the bottom of the dialog. Once the reference angle has been defined, then the angular error display will update with the calculated angular error. The measured closing bearing and measured closing azimuth is displayed at the top of the dialog box. If the reference angle has been defined by point numbers, then the reference closing angle field will update and display the defined angle. There is no need to select a format from the format field if point numbers are used.

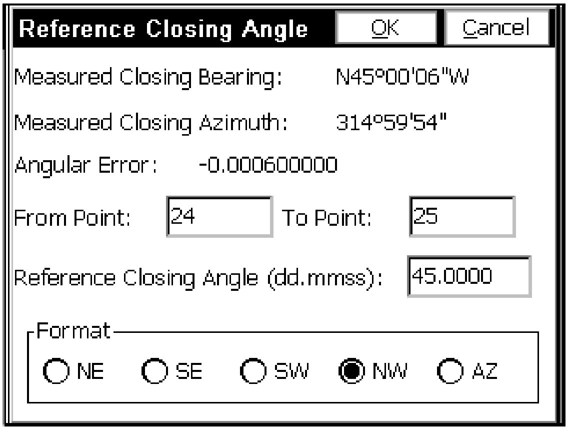


Figure 5-51

Pressing the OK button or the enter key will execute the angle balance process and the process results will be displayed. The results display shows the closure results before angle balance (Figure 5-52) and after angle balance (Figure 5-53).

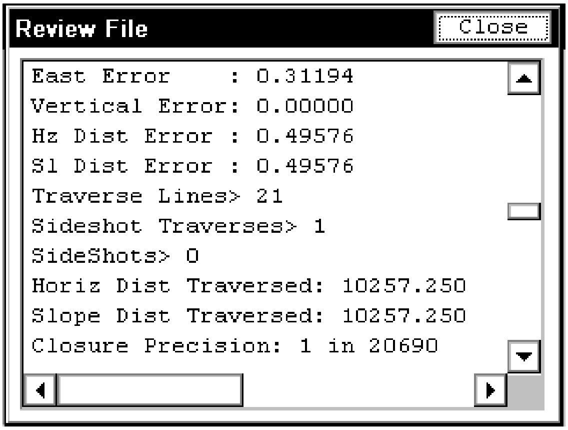


Figure 5-52

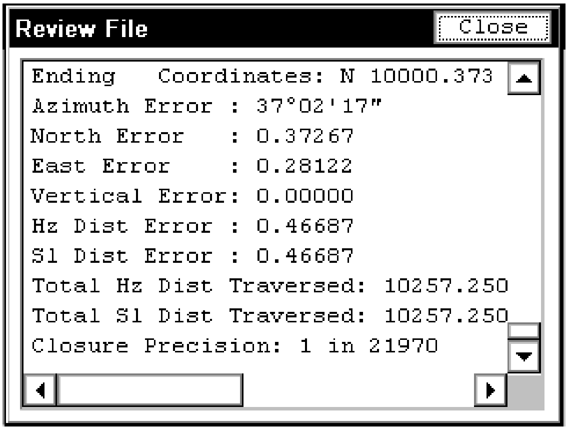


Figure 5-53

The angular adjustment applied to each traverse leg is also displayed along with unadjusted angles and adjusted angles for each traverse leg. The adjusted coordinates are written to the coordinate file replacing the unadjusted coordinate values.

Note: Though the program will accomplish the angle balance in all cases, the closure precision that is presented will apply to closed traverses only, where the "end traverse" shot closes to the starting point in the traverse. Since you are not prompted for a "reference closing shot", the closure precision number will not be valid in “open” traverses, or those that tie to a point different than the starting occupied point.

Transit, Compass, Crandall Adjustments

These methods apply the selected rule to the traverse lines when calculating the coordinates. After adjusting the traverse points, the sideshots are also recalculated. The closure error is calculated as the difference between the specified ending point and a reference point. The reference point is specified by point number or by entering the northing, easting and elevation of the reference point. The process results show varying information depending on selected options from the Process Raw Data Options dialog box.

Upon execution of the transit adjustment, the Process Raw Data Options dialog box will appear as shown in Figure 5-54.

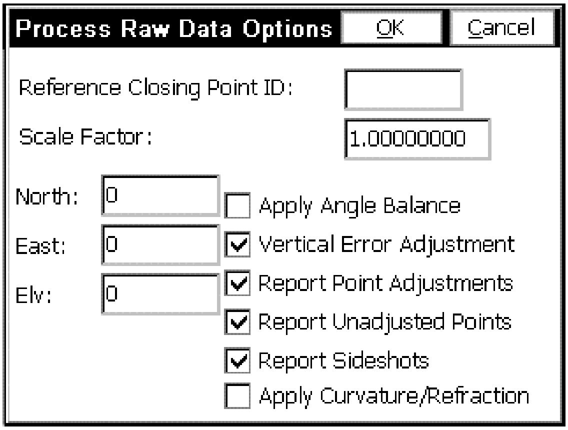


Figure 5-54

- **Reference Closing Point ID**: The desired closing point number must be entered into this field. If the closing point does not exist in the coordinate file, the known coordinates can be entered into the North, East and Elevation fields on the dialog box.
- **Apply Angle Balance**: This option performs an angle balance on the traverse lines before the selected adjustment routine is processed. With this option checked, the Angle Balance Shot must

be chosen from the Angle Balance Measurement Dialog box. The adjustment method is applied without angle balance computations.

- **Vertical Error Adjustment**: The vertical error between the starting and ending points will be calculated and displayed in the results screen. An adjustment value is determined and applied to the traverse points proportional to their measured distance.
- **Report Point Adjustment**: The adjusted point coordinates and the original point coordinates will be displayed in the results display under the adjusted point comparison section.
- **Report Unadjusted Points:** Displays the unadjusted points in the results screen.
- **Report Sideshots:** Displays sideshot data, original and adjusted, in the results screen.
- **Apply Curvature/Refraction:** Applies curvature and refraction adjustments to the distances.
- **Scale Factor:** Applies the input scale factor to each distance measurement.

After the "reference closing point" is entered (e.g., point 2) the next screen, in effect, asks which "ending point" in the traverse closed to that reference point. If point 11 was the shot that closed back to point 2, then it is critical to name point 11 correctly in the following screen, Figure 5-54:

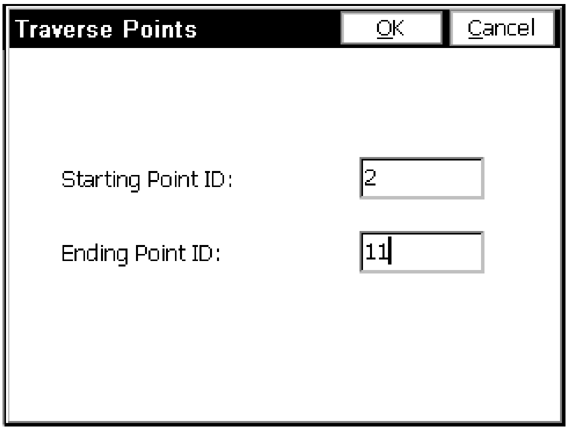


Figure 5-55

If Angle Balance is clicked on, you will be asked for the "closing angle" shot and the reference closing angle screen will appear, which you complete as described in the Angle Balance section above. The closure method will be applied to the coordinates before or after angle balance, depending if angle balance is clicked on. If the RW5 file contains GPS readings, you will be prompted for a localization file to use for GPS processing. Choose None if no localization is used. If the file contains both GPS and Total Station readings, the GPS readings are applied first, and are treated as control points during Total Station raw processing.

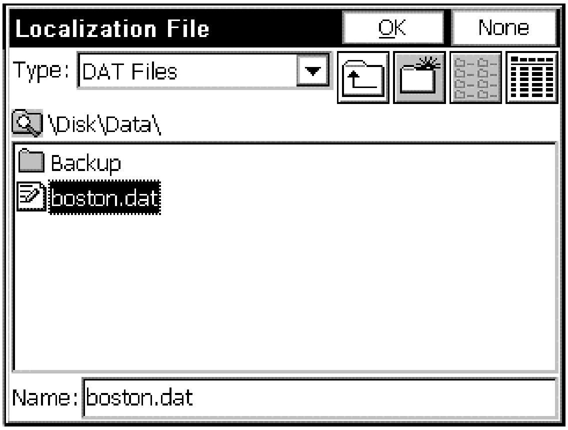


Figure 5-56

The routine will conclude, for all 3 closure methods, by displaying the final, adjusted angles, distances and coordinates.

Direct-Reverse Report

This command creates a report of direct and reverse shots along with the resulting averaged shots. The residuals are the difference between the measurement and the final average. Shown below is a direct and reverse report for a shot taken from point 1, backsighting point 4 and foresighting point 100.

Direct-Reverse Report
Observations

Type	Setup	FSight	HorzAngle	Distance	Vertical
BD	1	4	359.5958	279.8760	89.4827

BR	1	4	179.5945	279.9490	270.1114
FD	1	100	336.1603	211.2160	75.0056
FR	1	100	156.1601	211.2150	284.5848
BD	1	4	359.5948	279.9500	89.4824
BR	1	4	179.5942	279.9500	270.1111
FD	1	100	336.1608	211.2150	75.0052
FR	1	100	156.1601	211.2170	284.5850

Reduced Sets

HorzAngle	Residual	FS Diff.	BK Diff.
336.1610	0.0004	0.0002	0.0013
336.1619	0.0005	0.0007	0.0006

Vertical	Residual	Diff.
75.0104	0.0004	0.0016
75.0101	0.0004	0.0018

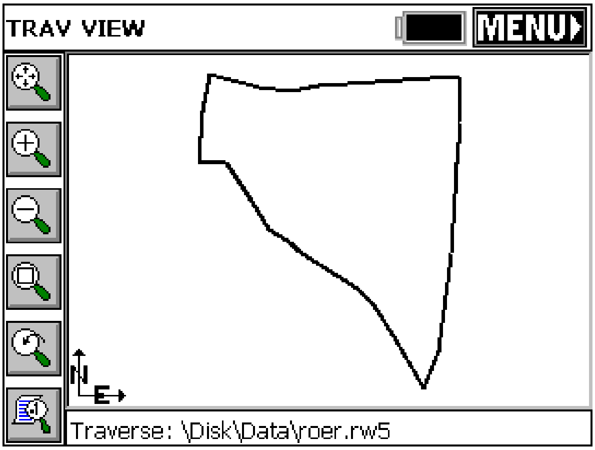
Distance	Residual	Diff.
211.2155	0.0002	0.0010
211.2160	0.0002	0.0020

Means

HorzAngle	SD	Distance	SD	Vertical	SD
336.1615	0.0004	211.2158	0.0002	75.0103	0.0001

Draw Traverse Lines

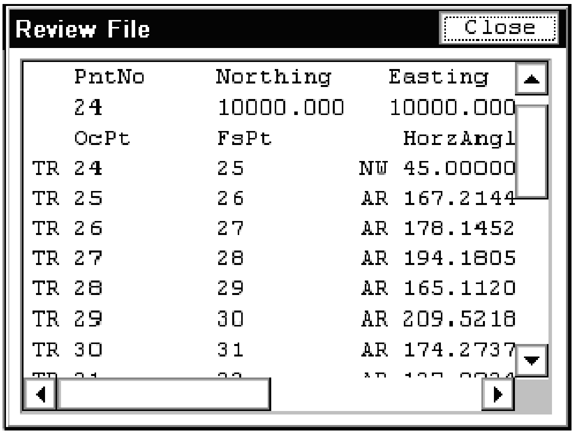
This command displays a preview of the traverse configuration by drawing lines between the traverse points. To start the command select Draw Traverse Lines from the Process Raw Menu. Enter in the beginning and ending points to draw on dialog and press enter. An example of the results is shown in Figure 5-57. To exit the preview screen, select the menu button at the top right of the screen.



<u>**Figure 5-57**</u>

Review RW5 File

This command displays the RW5 file, allowing for review and inspection of the raw data. The report will appear as shown below. No editing of the raw file is currently permitted.



<u>**Figure 5-58**</u>

Point in Direction

Function

This command allows for manual entry of angles and distances and calculates sideshots or traverses from a known occupied point. If the direction is defined by a bearing or azimuth, a backsight point is not required. If the direction is defined by angle left or right or a deflection angle left or right, then a backsight point is required.

Point in Direction is one of 3 options for manual traverse and sideshot entry. A second option is to go to the Map screen, and at the command line (Cmd:) enter I for inverse to inverse to an occupied point, or from backsight point to occupied point, then T for traverse or S for Sideshot, using angle codes 1-NE, 2-SE, 3-SW, 4-NW, 5-AZ, 6-AL, 7-AR, following the prompting for angle and distance entry. This "style" works strictly off the keyboard and does not require any screen tapping to switch from traverse to sideshot to inverse. The points plot on the screen as you go. A third option for traverse and sideshot entry is to set the equipment type to Manual Total Station, and enter the traverse and sideshot data within the command Sideshot/Traverse, found under the Surv Menu. Of the 3 methods, Map Screen traversing and the SideShot/Traverse command under Surv will store data to the raw survey file for re-processing, and will allow entry of instrument heights and target heights. In the Map screen Traverse Defaults (TD) will turn instrument and target height prompting on and off. All 3 methods allow for zenith angle prompting as an option.

The command centers around one main entry screen, as shown in Figure 5-59

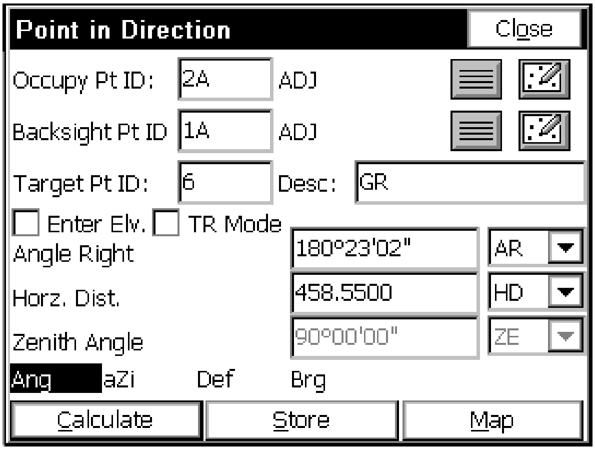


Figure 5-59

You must enter an occupied point for traversing. You must also enter a target point number to calculate.

■ **Horizontal Angle**: You must select a horizontal angle method, with options from AR (angle right) shown here to NE, SE, SW, NW, AZ, SAZ (south azimuth), angle left, deflection left and deflection right. If a bearing or azimuth is selected for traversing, the backsight point number will "ghost". Only an occupied point is required to traverse forward by bearing or azimuth. All other "turned angle" methods will require a backsight point number. The stored descriptions for the occupied point and backsight point will display as shown above (TRV MAG and TRV N in this case). Occupied points and backsight points can be selected "from List" or "from Map" using the buttons in the upper right.

■ **Distance Method**: There are 3 methods of distance entry: horizontal distance (in which case the elevation line "ghosts"), Slope Distance and Slope Distance, No Elevation. Both Slope Distance methods will prompt for vertical angle/zenith angle, etc., but Slope Distance, No Elevation, will calculate a zero elevation for the target point number and but will reduce the slope distance by the effect of the vertical angle/zenith angle.

■ **Elevation/Vertical Angle Method**: There are many ways to calculate a vertical differential between the occupied point and target point. The most common method is, of course, zenith angle (ZA). But Point in Direction also offers vertical angle, delta Z (elevation difference), slope by percent (SP), slope by ratio (SR) and known elevation (Z).

When you are entering in the horizontal angle, distance or elevation/vertical angle information, the program displays the "mode" you are in, for extra confirmation, at the bottom of the screen. For example, if we are entering a delta Z (elevation difference), this is confirmed on the screen as shown in Figure 5-60

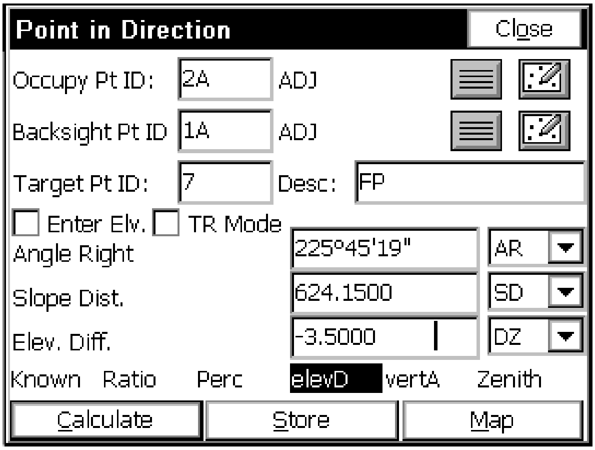


Figure 5-60

Hitting Enter from the last entry line, or tapping Calculate, or entering a "C" for calculate, will solve for the coordinates and display them at the bottom of the screen. Then Enter again, tapping Store, or entering S will store the points. Before storing, you can also tap Map and see the location of the calculated point, in reference to the occupied point and backsight point, as shown in Figure 5-61

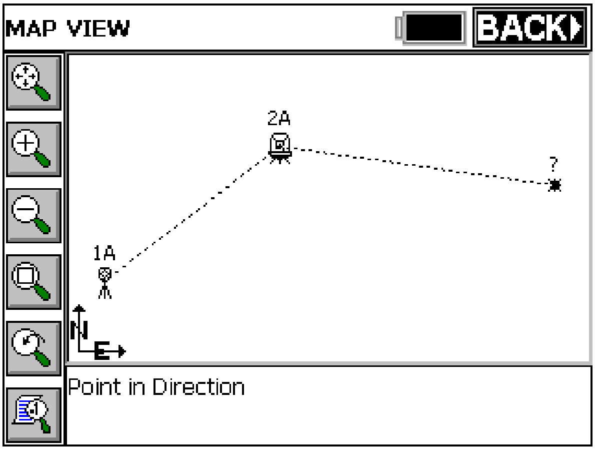


Figure 5-61

Click Back to return. You always have the option to enter new angle and distance information, Calculate, check the Map, then Store, as desired. Point in Direction offers the flexibility to check point locations graphically prior to storing.

■ **Enter Elevation:** If Enter Elevation is clicked on, this activates a "check screen" that displays the calculated elevation, and let's you override that elevation with a new elevation as shown in Figure 5-62. This option is useful in combination with Horizontal Distance for calculating points at a known distance and fixed elevation.

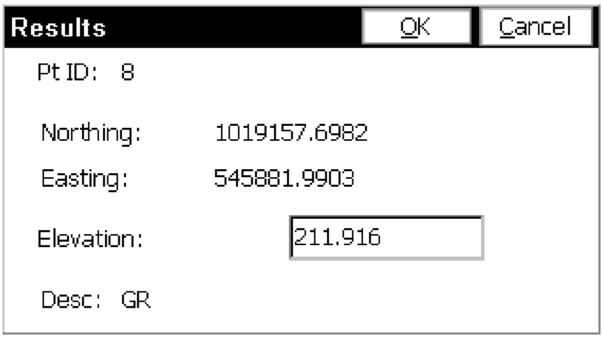


Figure 5-62

■ **TR Mode**: Clicking Traverse Mode will cause the routine to "traverse up" to the target point number, so that the new occupied point number will automatically change to the last target point number, and the new backsight will change to the last occupied point. You can always manually change the fields for occupied point and backsight point and "force" a traverse, but clicking Traverse Mode on will update these fields automatically and to an immediate "move up", awaiting the next angle and distance entries. With TR Mode clicked off, Point in Direction defaults to sideshot mode.

6

Road Menu

This chapter describes the commands found in the Road menu. Centerlines and profiles can be created, edited, imported and drawn on the screen with all versions of FAST Survey. With the Roads add-on, other commands are available such as creating templates, template staking and slope staking.

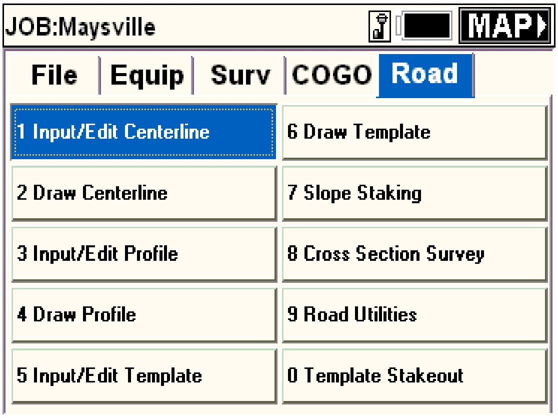


Figure 6-1

Input-Edit Centerline

Function

This command allows you to enter new centerlines, as well as recall and edit existing centerline files. Centerline files in FAST Survey are

ASCII files with a .CL extension. When the routine is selected, you are immediately placed in a dialog, where you can Load existing centerlines or begin entry of new centerline information. This dialog box appears as shown in Figure 6-1.

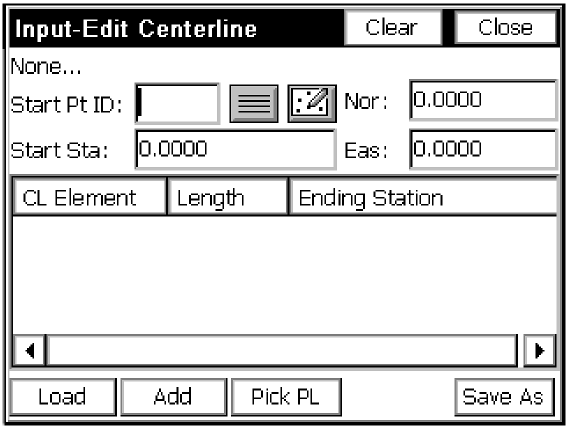


Figure 6-62

- **Clear**: This button at the top of the screen clears out all information in the dialog, in preparation for entering a new centerline. With no centerline file loaded or saved yet, the file name in the upper left is displayed as "None."
- **Start Pt ID**: If the centerline starts on a point number that exists in your current coordinate (.crd) file, you can enter the point number here, and it will recall and display the starting coordinates. The point can also be recalled "From List" or "From Map" with the icons.

Note: You can create new points with Input-Edit Centerline. When you enter and save a centerline, it will prompt "Do you want to save centerline points?" You may answer Yes and save point ID's for the start, end, PI, PC, radius point and any key spiral points found in the file. In the same way, a centerline that you load can be re-saved with new coordinate ID's assigned to all key points, as long as you make some change, like adding a point number to one of the Pt ID fields. If you answer Yes to Save Centerline Points, the dialog box below appears. If you anve entered point ID's of your own choosing in the Input-Edit dialogs, use the upper option. The lower option will auto-number from the starting point ID without regard to any numbers you've entered, but will respect and not overwrite used points in the file.

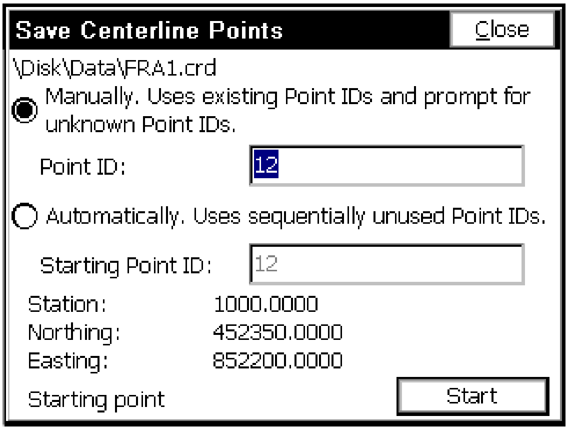


Figure 6-3

- **Start Station**: You must enter the starting station for the centerline. ("Station" is the same as the European term "Chainage.") Many surveyors and engineers prefer not to start centerlines at station 0. If the job backs up or needs to start further back along the centerline, you end up with negative stationing. There are 3 centerline "forms" as set in Job Settings, Units. A starting station of 1500 can be displayed 1+500 (metric, US-style, showing whole kilometers left of the "+"), as 1500.000 (pure decimal chainage, common to Europe) and 15+00 (feet, US-style, sometimes also used on metric roads in Canada), often referred to as "station 15 plus 00". In all cases, you would enter it as 1500, but it would display as 1+500.0000 after you press Enter if configured to the kilometer form, for example. The program will also accept use of the "+" in the entry of the station, and will convert to the configured form after you press Enter.
- **Northing, Easting**: If the Northing and Easting are not recalled from a starting point number, you will need to enter the northing and easting for the start of the centerline. It is not necessary to enter the Northing and Easting if you use the Pick PL (pick polyline) option for defining a centerline, since the starting coordinates of the

selected polyline are automatically used, and would overwrite anything previously entered.

- **Load**: This command allows you to load an existing centerline for review or edit. When you select Load, you will see a directory of all previously stored centerline files, as shown in Figure 6-4. When you select a file, such as 141b by tapping it or typing it in beside Name, you will see the centerline elements displayed in a new dialog, as shown in Figure 6-5.

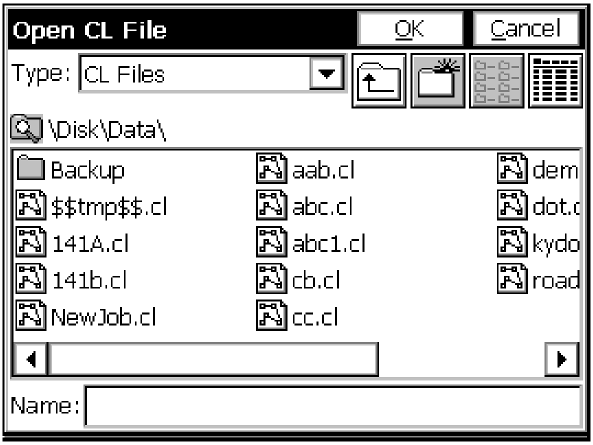


Figure 6-4

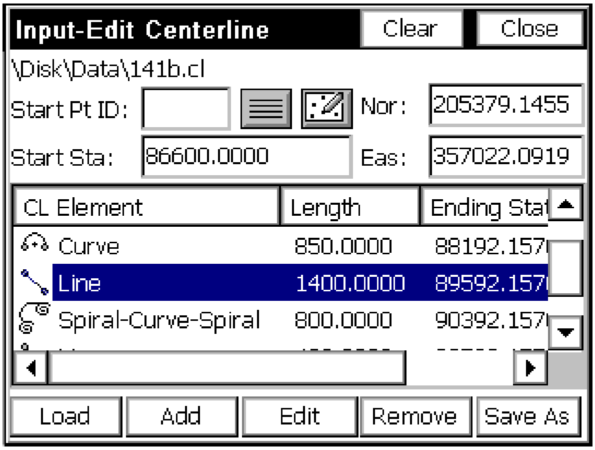


Figure 6-5

Points are not stored to the centerline file itself, so after loading a stored centerline, no point ID's will appear.

- **Add**: Returning to the starting dialog, you can add elements to get a centerline started. Typically, you would start with a line or tangent segment, but you can also start on a curve or spiral curve element. When you select Add, you get to choose which element to use, (see Figure 6-6). These options will be discussed in detail below.

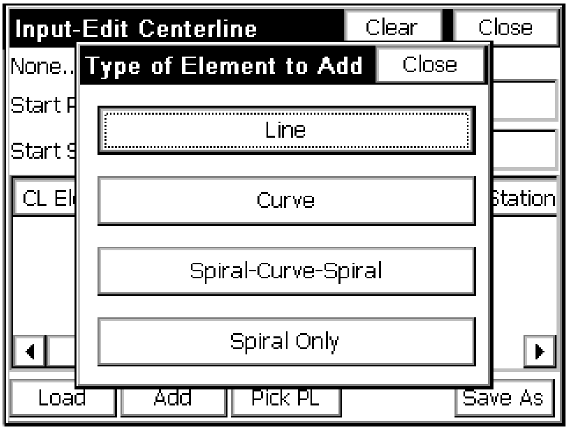


Figure 6-6

- **Pick PL**: With this option, you can pick a centerline from any screen polyline, including polylines with arcs. When you choose Pick PL, you are immediately presented with the graphic screen (see Figure 6-7), where you can pan by dragging your finger across the screen, or zoom using the many zoom options. You can choose not to select a polyline (maybe there were none to select!) by pressing OK or Enter. When you select a polyline, it will highlight as a darkened polyline. After selecting a polyline and pressing OK or Enter, you will see the polyline elements. (see Figure 6-8). Note that if you change the start station to 500, all the stationing for the polyline elements will change accordingly (see Figure 6-9). This is also true regarding the starting Northing and Easting. If these are changed, all element coordinates will change accordingly, as can be verified using the Edit option.

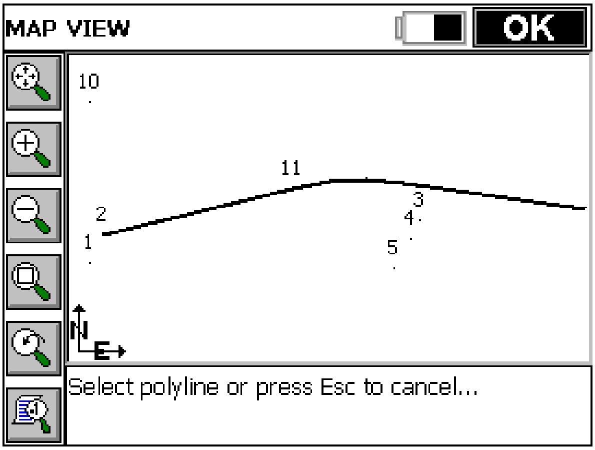


Figure 6-7

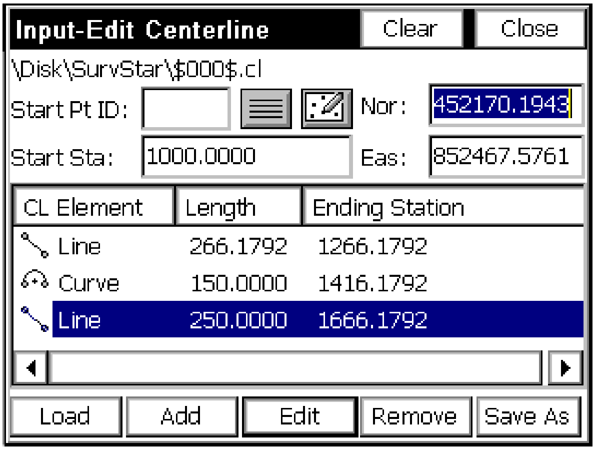


Figure 6-8

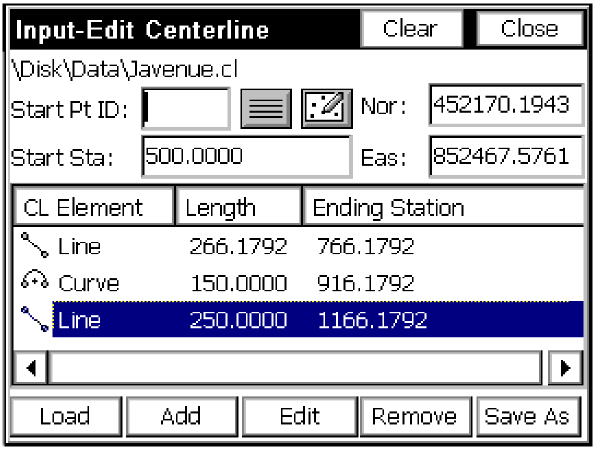


Figure 6-9

- **Save As**: This saves the file. Enter a name (as in Javenue, above).

A Simple Sewer Line Example, by Point Number

Centerlines can be very complex or very simple. Perhaps the simplest form is a point-to-point sewer line, without any curves or spiral curves. Such a centerline, if it exists on the map screen, could be picked using the Pick PL option. But if you only have point numbers, you can enter them. Referring to Figure 6-9, we could create a centerline representing manholes at points 10, 1 and 5. Begin by entering point 10 as the Start Pt ID in the Input-Edit Centerline dialog. Enter a Start Station of 100. Then select Add and choose Line (the default option, so you can press Enter). You will see the "Line" dialog (see Figure 6-10). Fill out the End Pt: as point 1.

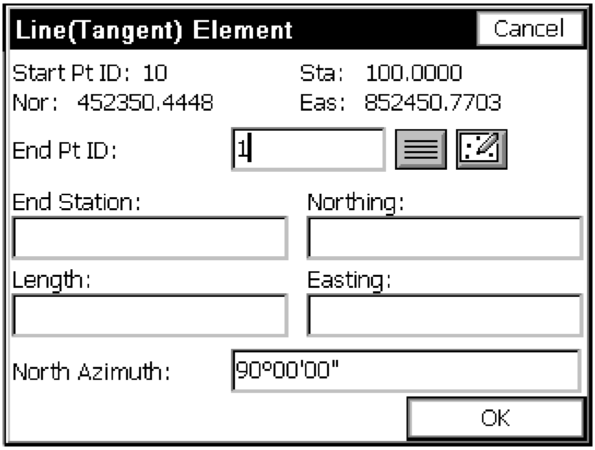


Figure 6-10

When you press Enter to accept 1, it recalls the coordinate of 1, computes the length of the line element and then also computes the bearing of the line element (see Figure 6-11). Note that if you don't have point numbers for a line segment, you can enter the Bearing and Length (or Bearing and End Station) to define the starting line segment.

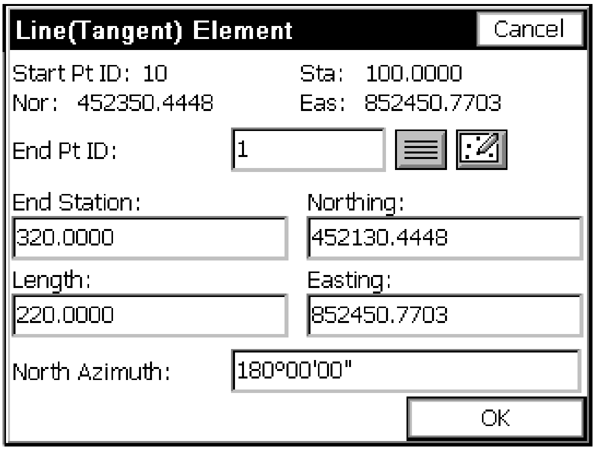


Figure 6-11

When the first segment is entered, you can click OK or enter your way through the dialog items and back to the main menu (see Figure 6-12).

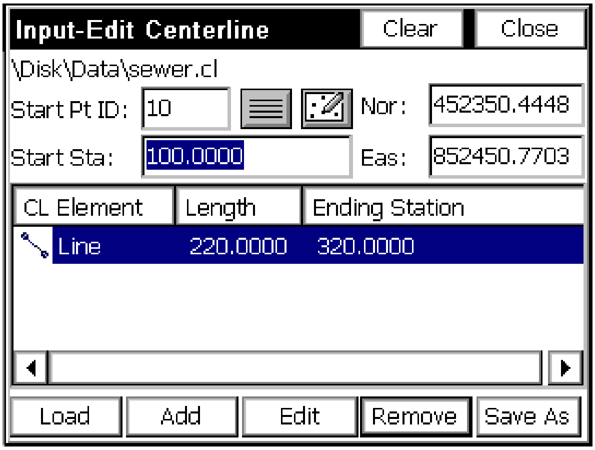


Figure 6-12

The procedure is then repeated for point 5, the second and last line segment. The fastest approach is to select Add, press Enter (for Line), enter the point number, tap OK and repeat. It is a total of 3 keystrokes, not counting entry of the point number. The final screen is shown in Figure 6-13.

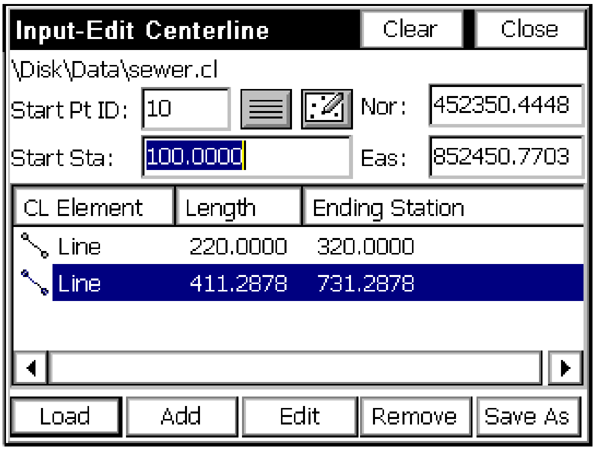


Figure 6-13

A Highway Centerline Example—From Plans

Highway Centerlines are the most complex form of centerline, because they can include curves and spiral curves. Though centerlines and profiles can be entered using office software and downloaded to FAST Survey as LandXML files or as native files in SDR33 format and converted to FAST Survey format, it is often necessary to enter these files in the field. Sometimes this entry process is based on a concise printout of centerline and profile information, and sometimes it must be read from actual paper plans of the road project. We will examine the procedure for centerline entry direct from paper plans (e.g., what to look for, what to enter). The first thing to look for is the starting station. See Figure 6-14.

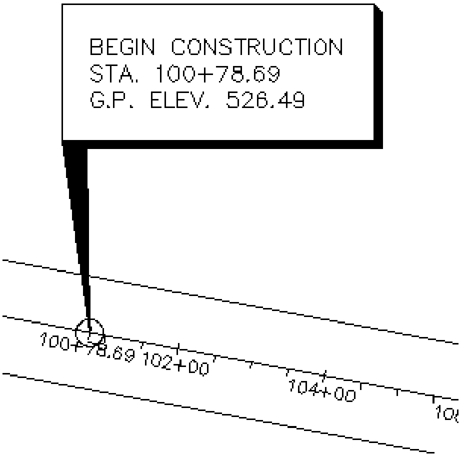


Figure 6-14

The starting station is 100+78.69. We can now proceed to Input-Edit Centerline, found as menu item 1 in the Road menu of FAST Survey.

With this item selected, the first dialog appears and is filled out as shown in Figure 6-15.

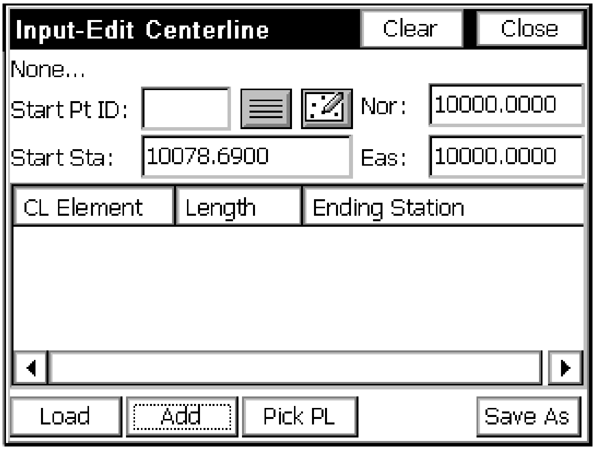


Figure 6-15

If the starting coordinates are known, these should be entered. It should be noted that all coordinates in a centerline will automatically translate if the starting coordinates are later revised.

Once the starting coordinates are entered, you select Add to add each element of the centerline. Supported elements include lines/tangents, simple curves, spiral-curve-spiral and spiral only, as shown in Figure 6-16.

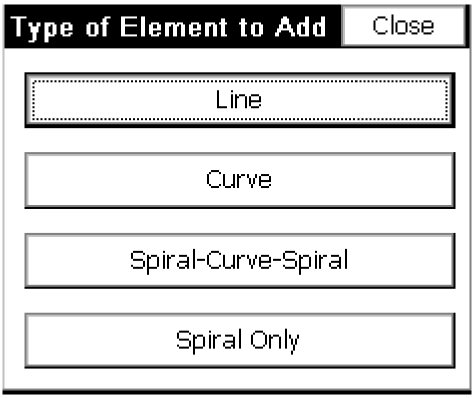


Figure 6-16

Note: The Spiral Only element will handle a spiral between any line and arc segment (eg. line-spiral-arc or arc-spiral-arc). For that reason, the Spiral-Curve-Spiral element is really just 2 implementations of Spiral Only (line-spiral-curve and curve-spiral-line). The advantage of Spiral-Curve-Spiral is that it completes 3 elements at once and is a fairly common application on high-speed highways.

The first element or segment of the centerline is a tangent section up to the first PC. The paper plans show the station of the first PC and the bearing into the first PC (see Figure 6-17), which will be entered next within the Line Element dialog.

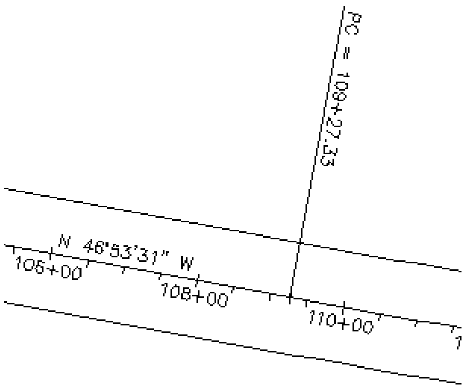


Figure 6-17

The PC of the simple curve is 109+27.33. This is also the end of the tangent section, (or the line element). The bearing into the PC can be read as N 46°53’31”W. After you select Line, fill out the dialog as shown in Figure 6-18.

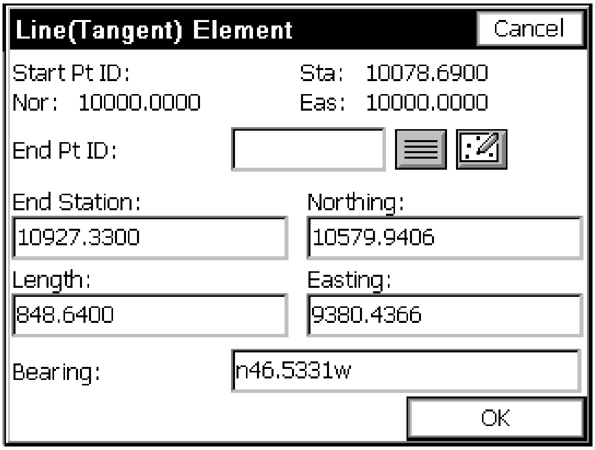


Figure 6-18

Note that all other tangent sections, assuming they are tangent to the previous curve or spiral elements, can be entered simply by filling out the end station dialog box (one entry). On the very first tangent section, the bearing must be entered. When Enter is pressed after entering the bearing as n46.5331w (or nw46.5331), it converts to a degree, minutes and seconds presentation. If configured grads/gons, 46.5331 remains in decimal form. When Enter is presses after typing in the End Station, the program calculates the Northing, Easting of the End Pt. and the Length of the tangent section. If the length was known (and the PC station was not known), then length could be entered, and that would calculate the End Station of the tangent. Click OK to move onto the next element. Returning now to the Input-Edit Centerline dialog, we now have an element entered, as shown in Figure 6-19.

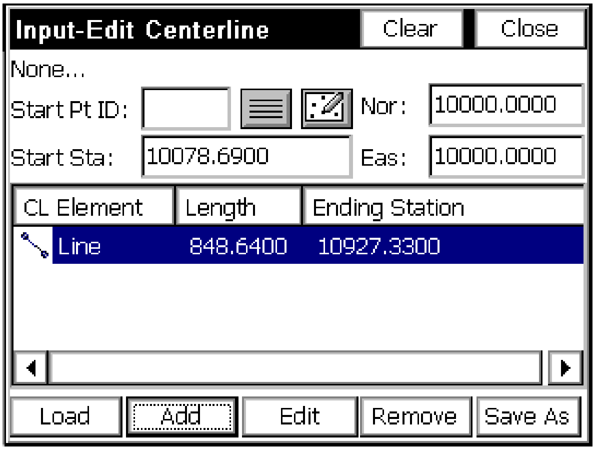


Figure 6-19

Now you select Add for the next element, which is a Curve (simple curve). Select the Curve option, as shown in Figure 6-20.

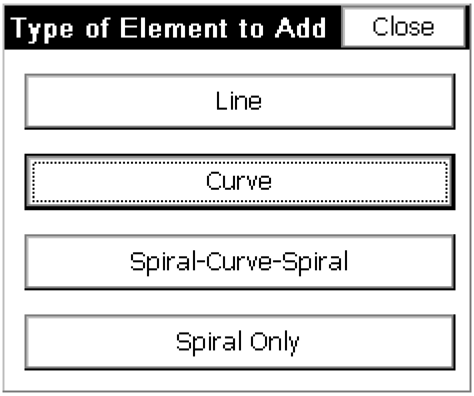


Figure 6-20

This opens the Curve Element dialog. Simple curves can be defined several ways, but the easiest is to enter the direction (left or right), the arc length and the radius length (3 items total). All the other curve elements are then calculated. Referring to the curve data in the upper right of Figure 6-21, the arc length (or L) is 1917.23 and the radius is 11459.16. It is a curve to the left, so we choose Left in the Curve Element dialog as shown in Figure 6-21. Pressing Enter, after the entry of the second element (arc length if radius was entered first, or radius length is arc length was entered first), calculates all items as shown in Figure 6-21.

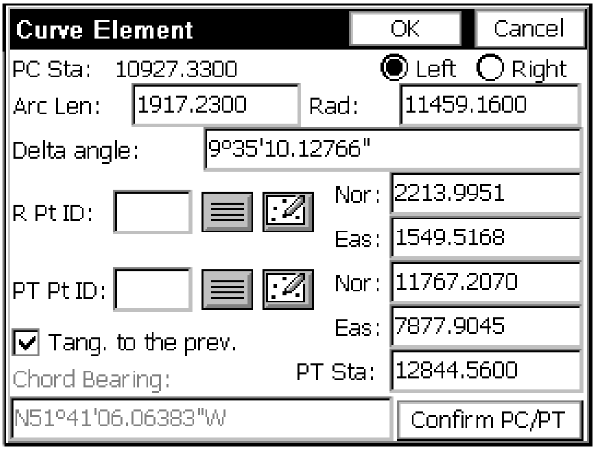


Figure 6-21

In terms of keystrokes, you can fill out the Arc Length immediately, because the cursor defaults to that position when the dialog is entered. Then Enter through the Delta angle to the Radius dialog box, and fill that out. If you do not know the radius but do know the dregree of curve, enter ? in the Rad dialog box, go to the Curve Calculator, enter the arc length and degree of curve. It will calculate the radius. Highlight and select the radius, then Copy and then Paste (top of the dialog). If you press Confirm PC/PT you can verify the Tangent Out bearing, as shown in Figure 6-22.

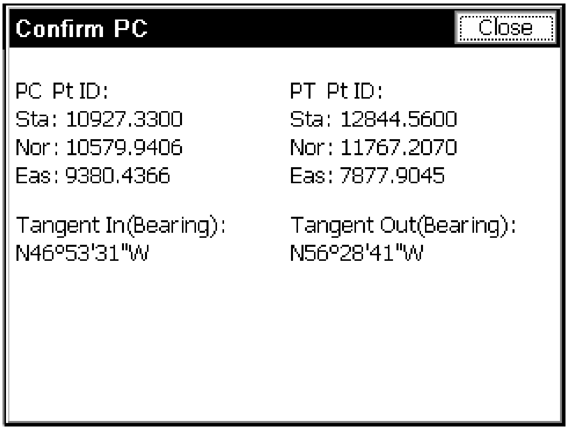


Figure 6-22

Pressing OK reveals that we now have 2 elements, a line and a curve (see Figure 6-23). Press Add to enter the 2nd line or tangent section leading up to our second curve.

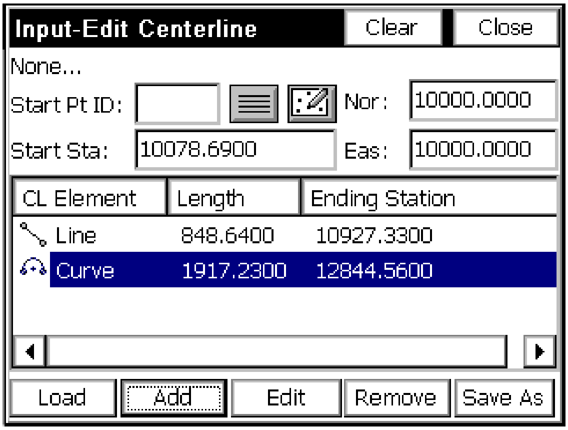


Figure 6-23

On the plans, we can check ourselves by looking for the Point of Tangency (PT) and verifying the stationing. That checks, as shown below in Figure 6-24 (12844.56). Next we click Add and select a Line segment.

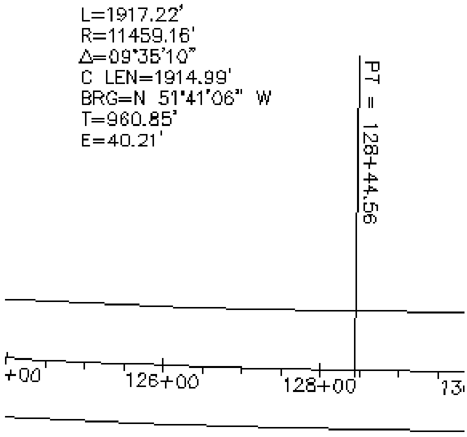


Figure 6-24

Now we look for the next PC station, which equals the end of the next tangent. Tangent sections can also end at TS (tangent to spiral) stations as well. Figure 6-25 reveals that the next PC is at station 147+92.27.

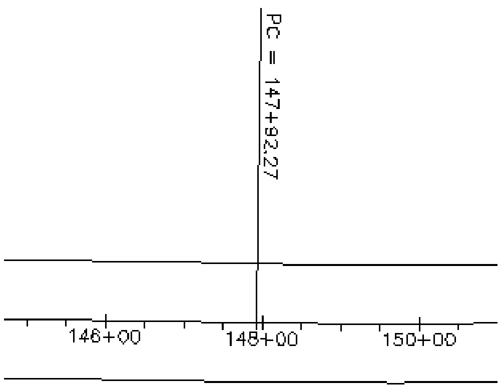


Figure 6-25

Entry for this tangent segment is one line, the end (or PC) station. Pressing Enter leads to the calculation of northing and easting and length, as shown in Figure 6-26. Note that because the program defaults to tangential line segments coming off curves and spiral curves, the Bearing quadrant is grayed out and fixed. If the tangent segment is non-tangential, then you must check on the Non-Tangential toggle in the Line (Tangent) Element dialog.

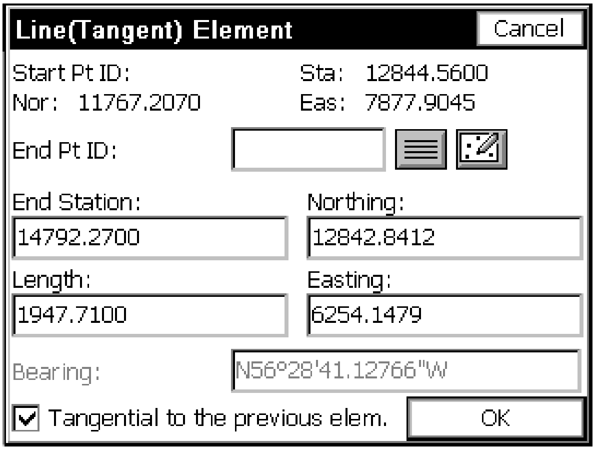


Figure 6-26

Press OK to complete the entry for this line element. Next, click Add (or press Enter for Add) to enter the next simple curve. The curve data for this curve appears in Figure 6-27.

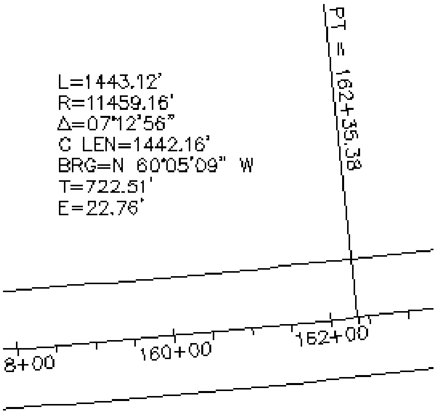


Figure 6-27

The key entry items again are, curve direction (left), the arc length (1443.12) and the radius length (11459.16). These are entered as shown in Figure 6-28.

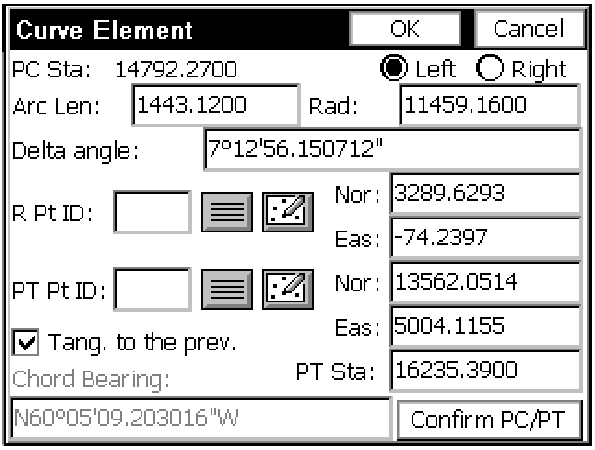


Figure 6-28

Pressing OK leads to still another element added to the centerline (see Figure 6-29).

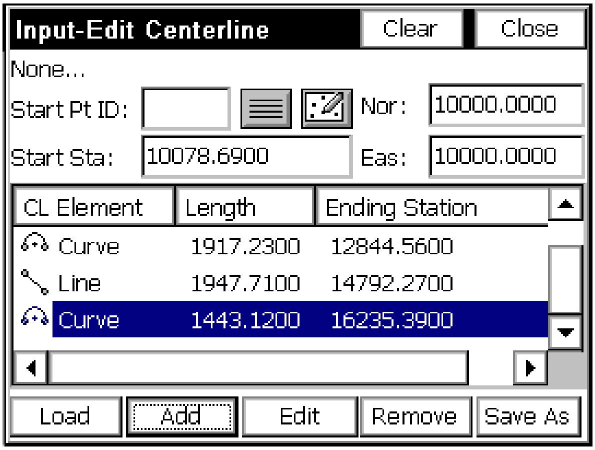


Figure 6-29

Notice that in Figure 6-28, the PT Station is 162+35.38. Yet we are calculating 162+35.39. This is because we entered the given arc length of 1443.12 from the PC at 14792.27. That adds up! But when you start to vary from the plans, you need to make a decision. Maybe the delta angle of 7 degrees, 12 minutes and 56 seconds (7.1256) is what governs the length of the curve. So if we click Edit and return to the last Curve element, we can change the Delta angle to 7.1256 (see Figure 6-30). Note how this computes the PT Station at 16235.38 (rounded). But also note that the Arc length becomes 1443.1116, implying that the 1443.12 displayed on the plans may be incorrect or rounded improperly. These are the kinds of decisions you must make as you enter data from paper plans and make things work. If your biggest problem is a one hundredth error, you are doing fine!

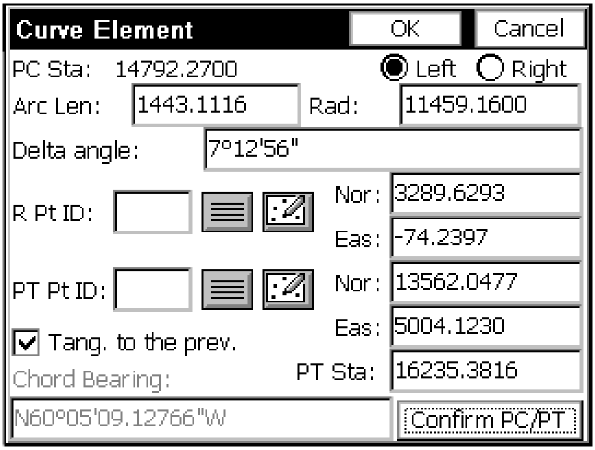


Figure 6-30

The other issue with highway plans is the precedence of Degree of Curve data over Radius Length data. A degree of curve of 0 degrees, 30 minutes (as in curves 1 and 2) actually computes to an 11459.1559 radius. This lesser radius would create less distance through the arc, at a fixed delta angle. To calculate the radius from a Degree of Curve, use the Curve Calculator, which is accessible from the Radius dialog box by pressing **?** (the question mark key).

We will use the last entries to complete curve 2. The next element is a line (or tangent) segment leading up to a spiral curve. The end of the line is therefore the TS or Tangent to Spiral station. This station is 246+41.89, as seen in Figure 6-31.

Figure 6-31

The line (tangent) segment is entered as shown in Figure 6-32.

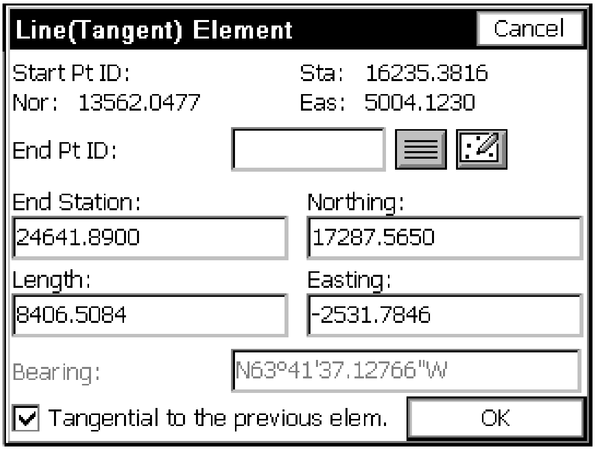


Figure 6-32

Note that the computed bearing of NW 63.4137 should be compared with the plans as a crosscheck. After clicking OK, we are now ready to enter a spiral curve to the right. Click Add at the main dialog and choose Spiral-Curve-Spiral, as shown in Figure 6-33.

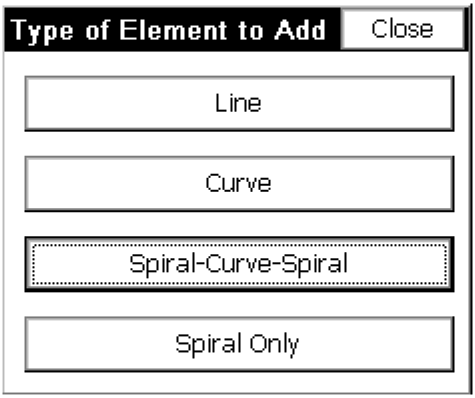


Figure 6-33

The easiest way to enter a symmetrical spiral into and out of a circular curve is to specify direction (left or right), enter the Spiral In Length and Spiral Out Length (one of which can be zero for non-symmetrical spirals), radius of the simple curve and arc length of the simple curve.

Another option is to enter the Central PI Station and Bearing Out as a substitute for the arc length. Figure 6-34 shows the result of the entry.

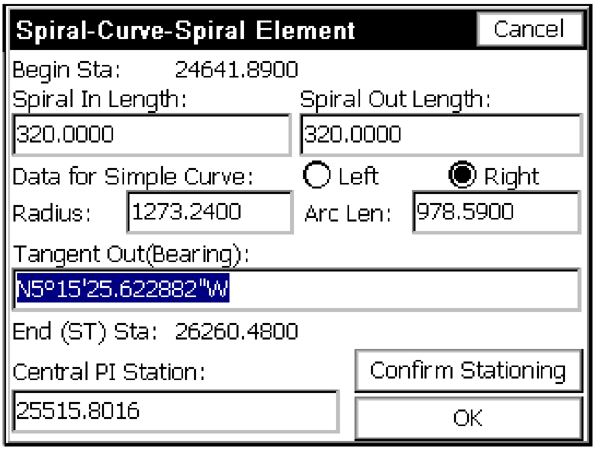


Figure 6-34

For spirals, if you remember to fill out the upper 3 lines, everything else is calculated, including the Central PI Station. If you press

Confirm Stationing, you can verify the TS, SC, CS and ST stations and coordinates as shown in Figure 6-35.

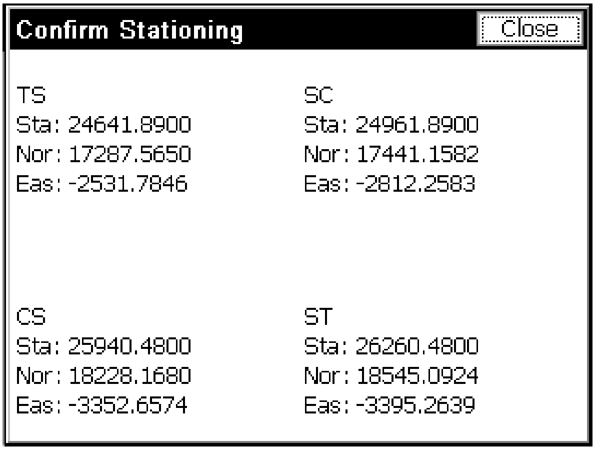


Figure 6-35

Note that we have got into negative coordinates for the Eastings. Press Close to return, and then press OK. See the spiral-curve-spiral element added to the list (see Figure 6-36).

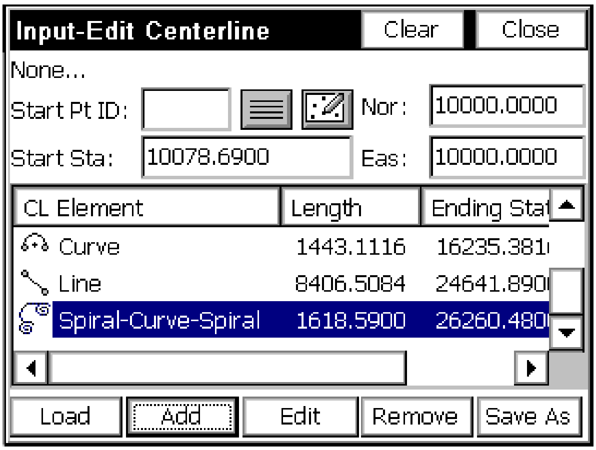


Figure 6-36

Lastly, we will finish our centerline by adding a short 100-foot segment. In this case we fill out the Length dialog box within the Line (Tangent) Element dialog, as shown in Figure 6-37.

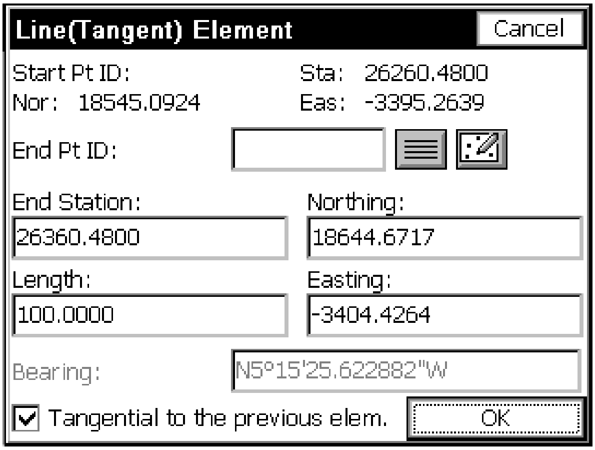


Figure 6-37

The final 3 elements appear in Figure 6-38. Click Save As to store.

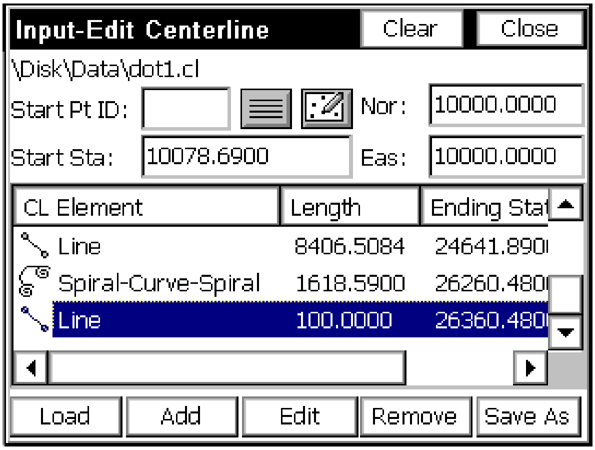


Figure 6-38

Starting on a Curve, and Compound and Reverse Curves

Highway Centerlines will sometimes start on a curve. They can be entered if you know the coordinates for the beginning point, radius and point of tangency of the first curve. Otherwise, you must enter a short tangent segment to precede the curve. Consider the following centerline data for 3 elements.

	Station	Northing	Easting
Start Pt.	20000	69179.6111	306316.6870
Radius		69165.0111	306316.6870
PT		69165.5660	306331.2765

	Arc Length	Delta Angle	Radius	Direction
Curve 1	22.3785	87.4918	14.600	Right
Curve 2	82.3931	6.4821	693.637	Left

	Length	Bearing
Line	11.22	SE 8.5903

Choose Input-Edit Centerline and fill out the starting information as shown in Figure 6-39.

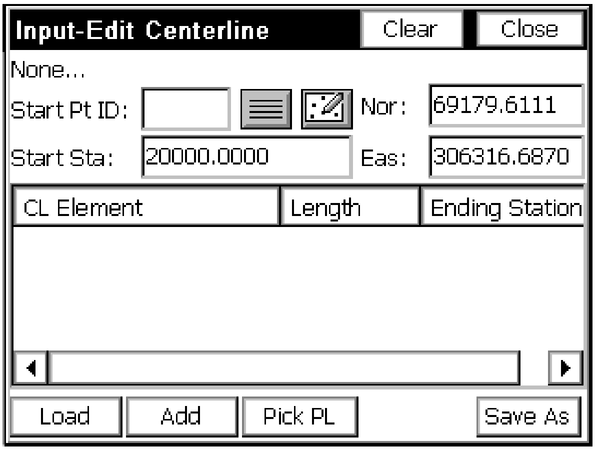


Figure 6-39

Next press Add, and go directly to the Curve option. Fill out the dialog, as shown in Figure 6-40. Go directly to the coordinate entry dialog boxes and fill out the coordinates for the PT Pt# and the Radius Pt#. This defines the curve. Press OK.

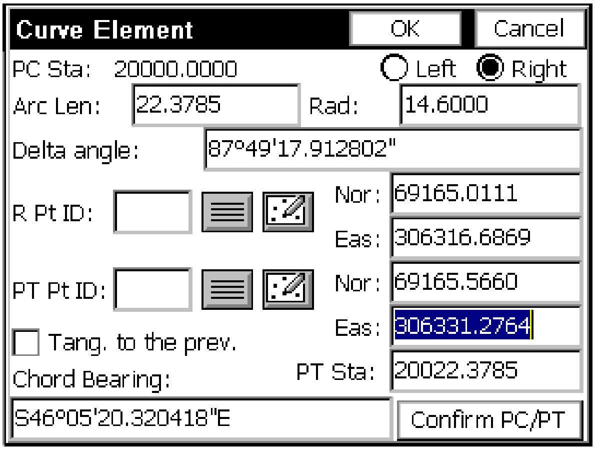


Figure 6-40

If the Curve then proceeds into another curve (e.g., for compound or reverse curves), just click Add and choose another Curve element. Since we are working on a curve that is preceded with another element, we can go directly to the arc length and radius dialog boxes, and enter 82.3931 for the arc length and 693.6370 for the radius length (see Figure 6-41).

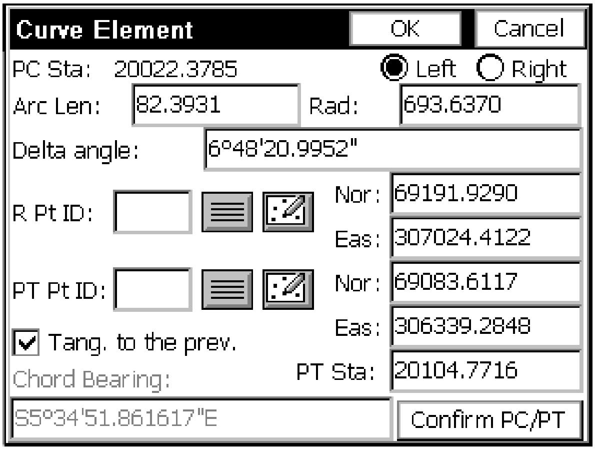


Figure 6-41

If we choose Confirm PC/PT, we can verify our tangent out bearing in advance (see Figure 6-42).

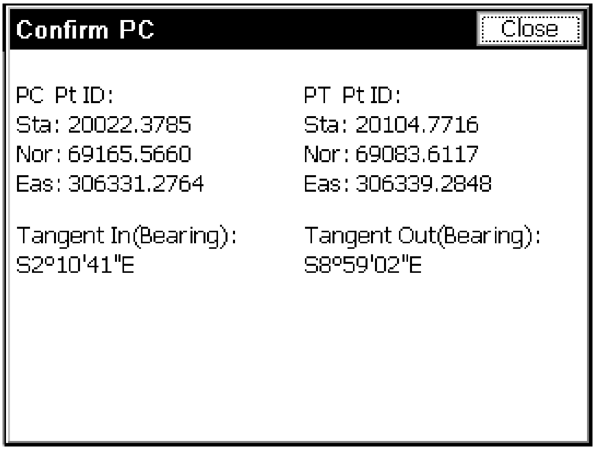


Figure 6-42

Finally, we complete the centerline by adding a Line element with a length of just 11.22. The result is shown in Figure 6-43.

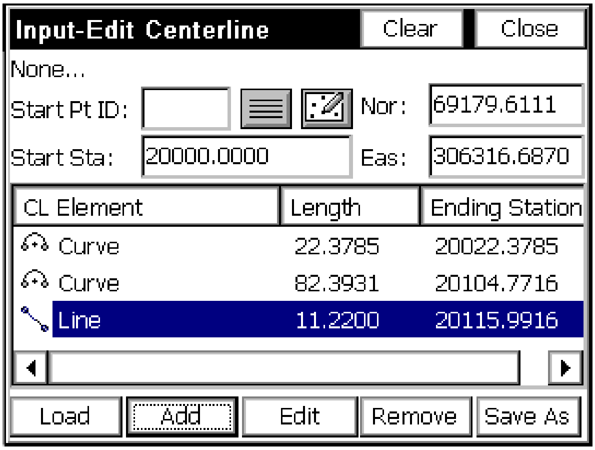


Figure 6-43

The centerline file can be saved and drawn using the command Draw Centerline. Shown below in Figure 6-44 is the centerline entered above, including the spiral curve.

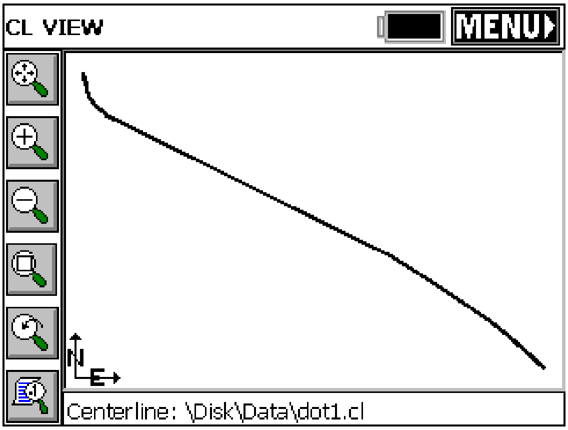


Figure 6-44

Draw Centerline

Function

Draw Centerline will draw the selected centerline on the screen. All the zooming commands [Zoom In, Zoom Out, Zoom Window, Zoom Previous and Pan] are available to you in the Draw Centerline command. The program will automatically zoom to the extents of the centerline when drawn. If there are point numbers and polylines on the screen in that area, they will appear as well. Tap the Menu button to exit this command.

Example 1

Shown in Figure 6-45 is a plot of the Curve-Curve-Line centerline example entered above in the Input-Edit Centerline instructions.

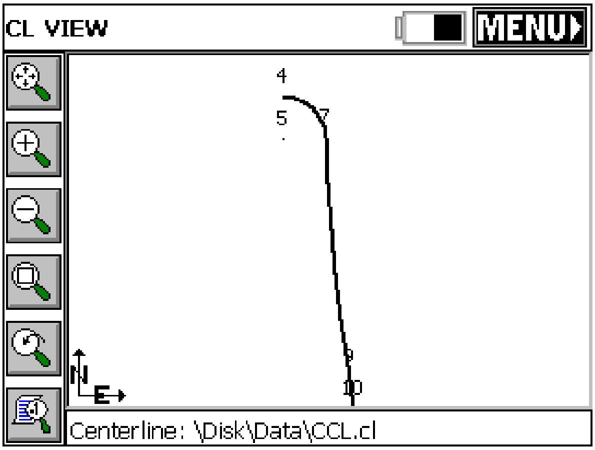


Figure 6-45

Example 2

Figure 6-46 shows a plot of Demo.cl, provided with FAST Survey. In this case, however, it is shown plotting on top of existing contours. The centerline plot will not remain part of the Map picture when the routine is exited. It is a temporary plot. To see the centerline permanently, choose the command CL2P (CL to polyline), found under the Tools pulldown menu in the Map View.

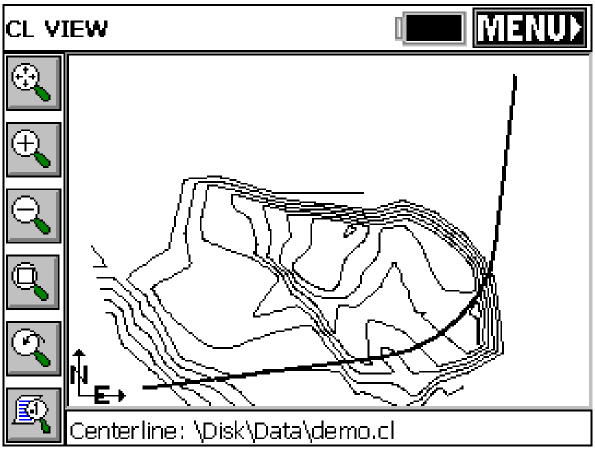


Figure 6-46

Input-Edit Profile

Function

This routine allows field entry of vertical alignment files for roads, sewers and other types of alignments. Vertical alignments can also be loaded and edited. In addition, high and low points can be calculated and the elevations of individual stations can be calculated. Vertical alignments are stored as files with a .PRO extension. Vertical alignments are typically referred to as profiles. In FAST Survey, the station ranges of the profile and centerline do not need to match. As long as they have station ranges in common, any profile can be used with any centerline for all advanced Roading commands, and for Surv menu routines such as Offset Stakeout and Elevation Difference by Road Design files.

Profile Entry

Profiles are extremely easy to enter. When the command is selected, if no prior profile has been entered, you will encounter the blank Input-Edit Profile dialog as shown in Figure 6-47. You can also obtain a blank screen and start a new profile by tapping Clear.

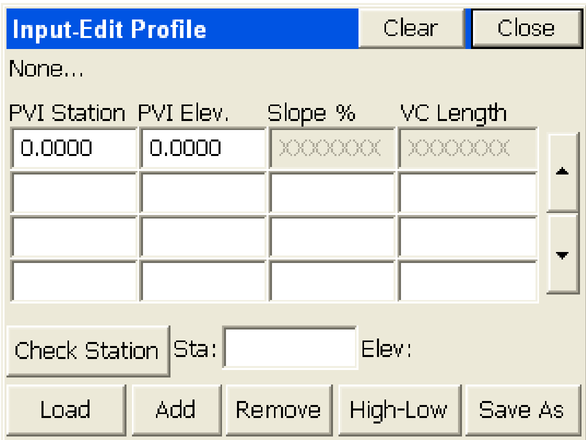


Figure 6-47

- **PVI Station**: PVI stands for point of vertical intersection, similar to a PI (point of intersection) for the horizontal alignment. In some locations, the term VPI is used (vertical point of intersection). You can start immediately by typing in the starting station under the PVI column. For our highway example, the starting station is 10078.69.

- **PVI Elevation**: The starting elevation is 526.49. So simply press Enter and move from the PVI column to the PVI Elev. column and enter 526.49. Pressing Enter again moves onto the next PVI field, where you can enter 10600 for the next station, then 529.10 for the next PVI elevation.
- **Slope %**: Once a second station and elevation are entered, the program will calculate the percent slope. Alternately, if you enter under the Slope % before entering the PVI elevation, then the program will calculate the PVI elevation. The slope column is a nice check against bad entries in the PVI elevation column. In other words, you often expect even slopes, and you can check the computed slopes against the plans.
- **VertCurve**: For Road jobs, you can enter the vertical curve length under the VertCurve column. This is the total length of the vertical curve. If the length entered is 600, this means that the vertical alignment transitions through a curve (parabola) beginning 300 units (feet or meters) before the PVI and ending 300 units after the PVI. If a vertical curve is uneven, that is, it transitions from, say, 400 feet before the PVI to 200 feet after the PVI, then the curve must be entered using the form 400-200 (the before and after distances separated by a dash). FAST Survey assumes all vertical curves are parabolas (industry standard). For sewer and water line alignments, there is typically no vertical curve transition, so this column can be left blank, or 0's can be entered for vertical curve lengths.
- **Check Station**: The profile for the highway job shown above has been entered and appears in Figure 6-48.

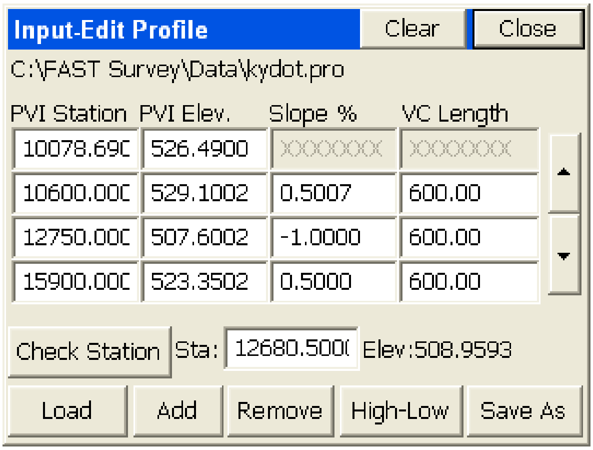


Figure 6-48

You can also enter check stations below and check the grades at any desired station. When entering stations, you may include the "+" that is often used, as in 12+680.5 (English) and 126+80.5 (metric).

- **Load**: The Load command presents a list of all previously stored profiles, and when one is selected, then displays the profile information in the dialog. To load a stored file, you can type a name in (like Demo), and no extension is necessary. Or you can pick a name from the screen. To accept it, either press OK or press Enter.
- **Add**: Based on which row of the dialog the blinking cursor is located, the Add button will create a new line in that position with 0 entries (with the exception of slope, which will compute based on the 0 entries). If for example, if you touch line 1 (get the blinking cursor on line 1--the first line), the Insert command will allow you to insert a new line in the front of your profile. This would be necessary if you needed to start the profile at an earlier station. To add to the end of your profile, just arrow key down to the first blank line and make your new entries (see Figure 6-49).

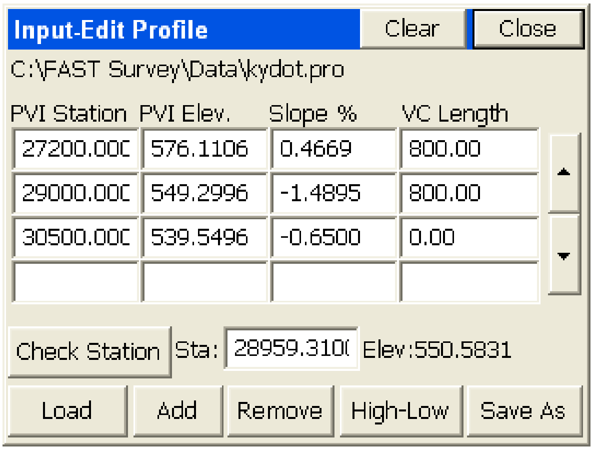
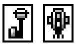


Figure 6-49

- **Remove**: This button deletes the current line.
- **High-Low**: You can calculate high and low points as well (allow a few seconds for this calculation).
- **Save As**: This command will save your profile to any entered file name. There is no need to enter a file extension. If you want to save the file as Baker.pro, just enter Baker. The Save As command will default to the current profile name. If you are entering a new profile, it will default to the current coordinate file name.

Draw Profile 

Function

The Draw Profile command will draw the selected profile on the screen. The profile will be exaggerated (typically 10:1 or 20:1) for a more dramatic appearance. You can control the vertical exaggeration by selecting the vertical scale icon, located at the lower left of the Draw Profile screen. All the zooming commands [Zoom In, Zoom Out, Zoom Window, Zoom Previous and Pan] are available to you in the Draw Profile command. Tap the Menu button to exit this command.

Example

The file Demo.pro is provided with FAST Survey. The PVI information is shown in Figure 6-50. The plot generated by Draw Profile, set to a 20:1 vertical exaggeration is shown in Figure 6-51.

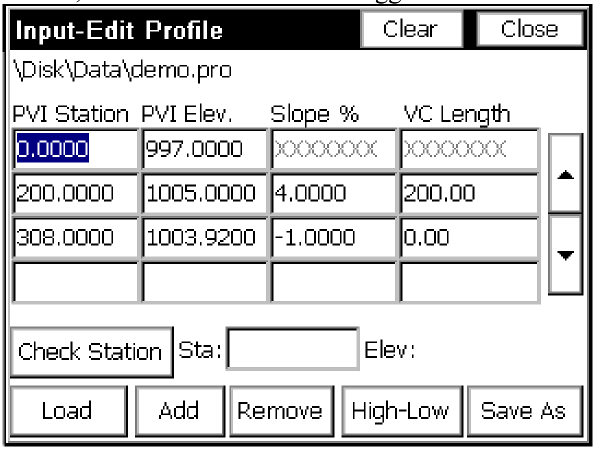


Figure 6-50

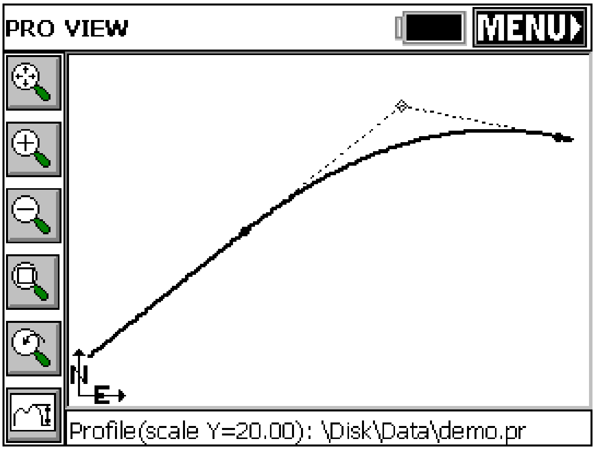
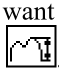


Figure 6-51

If you want to change the display scale, click the icon in the lower left corner . The dialog shown in Figure 6-52 will appear, change the scale and tap OK.

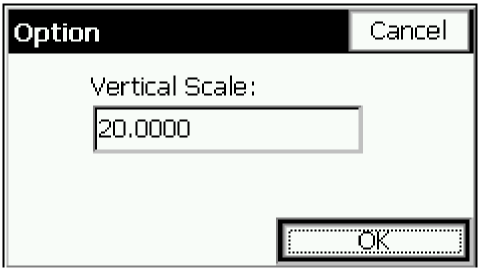


Figure 6-52

Input-Edit Template

Function

Templates, for roads, levees, ditches and other such earthwork can be created in Carlson Software products such as SurvCADD or Carlson Roads, or alternately they can be entered in the field using Input/Edit Template. They are used in FAST Survey in the command Slope Staking where the template is one of the design files for slope staking, along with the centerline and the profile. Templates are also used in Template Stakeout (for staking those portions of the road from left shoulder to right shoulder) and for Elevation Difference by Road Design Files. Templates can be reviewed graphically using the command Draw Template. Templates are not necessary for the command Offset Stakeout, found in the Surv menu. In Offset Stakeout, road or other cross slopes from centerline are entered within the command itself.

When selecting Input/Edit Template, you are presented immediately with the input dialog, as shown in Figure 6-53.

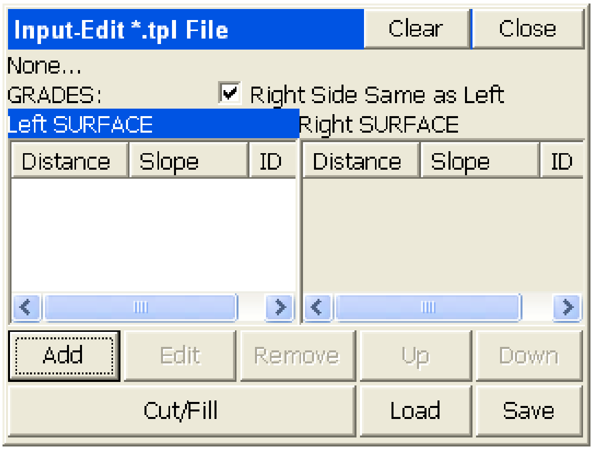


Figure 6-53

If you are dealing with a symmetrical template, keep the "Right Side Same as Left" clicked on. This will reduce entries by half. Otherwise, you must click into the side you are working on and use Add to add entries, or Edit to revise. One "trick", if you have non-symmetrical grades, is to keep "Right Side Same as Left" on and enter the symmetrical portion (perhaps the pavement lanes and first shoulder lane), then when you get to the outside shoulder or other "lane" where one side is different than the other, click off "Right Side Same as Left" and complete the non-symmetrical portion of the template.

In the curb-and-gutter template shown below, the Add option is used to enter the grade breaks from centerline out to the back of shoulder.

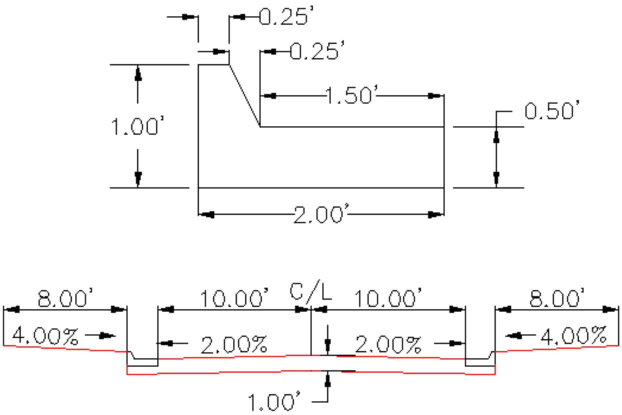


Figure 6-54

Since templates used in Slope Staking help define all grades into the centerline from the slope stake, it makes sense to focus on the subgrades that are built by the dozer, motor grader or trimmer. Thus, despite all the surface grades involved, there are only three distinct grades in this example curb and gutter template between centerline and the "pivot point" of the cut and fill slopes: 12.00 at -2% (subgrade at back of curb), 0.01 horizontal and 1 vertical, and 8.00 at 4%. For the "vertical" method, some positive horizontal distances must be entered, such as 0.01 or 0.001. By pressing Add in the dialog, we can enter the first 2 grades as show n in Figure 6-55.

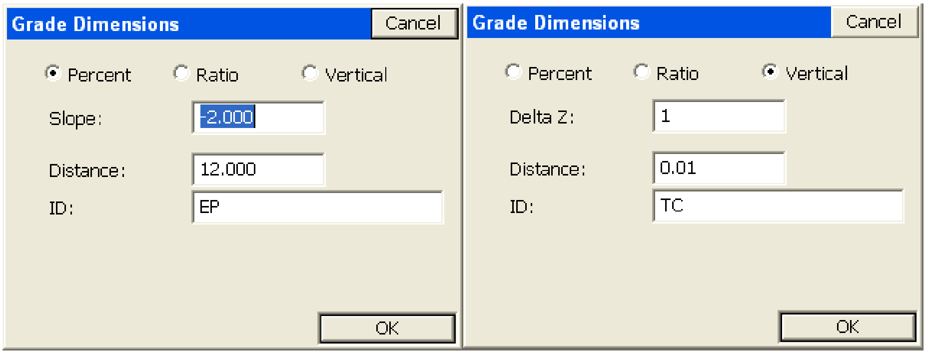


Figure 6-55

Downhill slopes, going out from the middle of the template, are entered as negatives. Note that it is necessary to enter an "ID" for each break point in the template. This helps identify the description of the grade on the progressive slope stake report (e.g. from the outside going in, 8' at -4% to TC, 0.01' at -1 vertical to EP, 12' at 2% to CL). The shoulder slope going out (8' at 4%) is entered similarly, as above. The Input-Edit Template dialog now appears as shown in Figure 6-56.

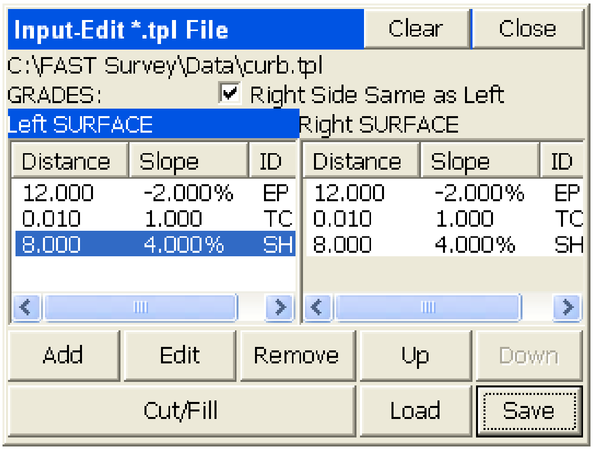


Figure 6-56

You can press Save any time to save your work. Here we've saved and named the template "curb." Now it is time to enter the Cut and Fill slopes, which are used in slope staking. If the cut slope is 3:1, but the fill slope is 4:1, you would select Cut/Fill above and enter as shown. Distinct left side and right side cut and fill slopes can be defined. After entry of the cut and fill slopes, press OK or Enter to return to the main Input-Edit Template dialog, and press Save. Templates can be drawn using the command Draw Template.

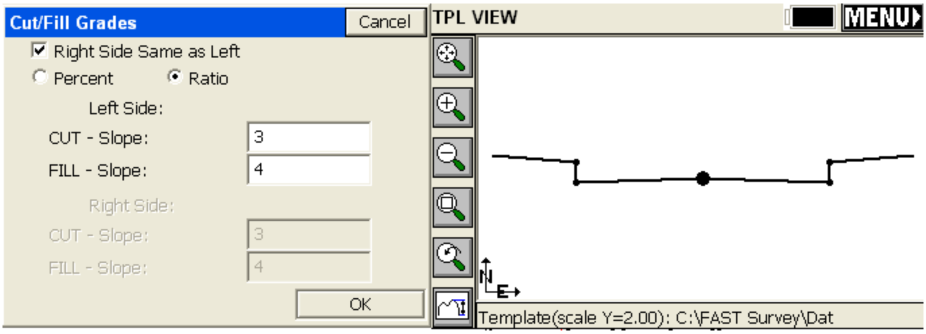


Figure 6-57

For highway projects or subdivision roads with cut slopes down to a ditch line, 4 template definitions may be necessary for slope staking: (1) Cut Left, Fill Right, (2) Cut Left, Cut Right, (3) Fill Left, Cut Right, (4) Fill Left, Fill Right. Then the appropriate template could be used for any condition. Here is the Cut Left, Fill Right for a 2-slope (pavement and shoulder) road. We will set the fill slope at 4:1 and the cut slope at 3:1.

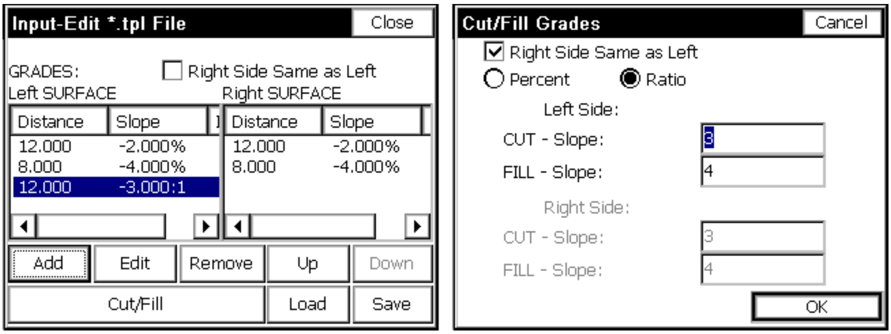


Figure 6-58

Using this template, cut slopes on the left side of the road will find the pivot at the base of ditch, while fill slopes on the right side of the road will pivot from the edge of shoulder. The template would draw as shown in Figure 6-59, using Draw Template

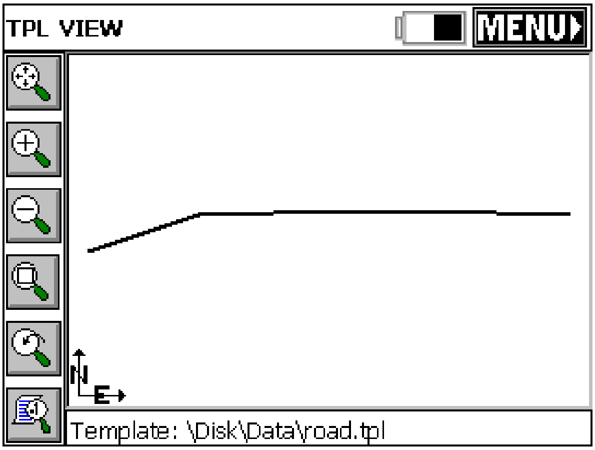


Figure 6-59

Draw Template

Function

The Draw Template command will draw the selected template on the screen. All the zooming commands [Zoom In, Zoom Out, Zoom Window, Zoom Previous and Pan] are available to you in the Draw Template command. Tap the Menu button to exit this command. Figure 6-60 illustrates this command using the "demo.tpl" template.

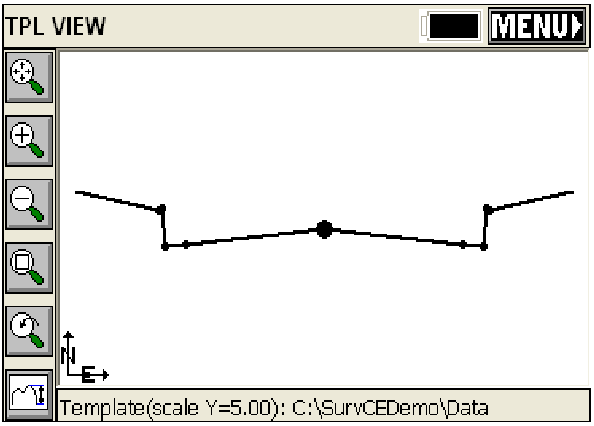


Figure 6-60

Slope Staking

Function

The slope staking command calculates and stakes out the location of the "catch point" where fill slopes or cut slopes contact the original ground. The slope staking command will also set offset stakes to the catch point and will produce a report of the slope stake information. The location of the slope stake is dependent on the position of the "pivot" point where the slope begins and on the slope itself (eg. 2:1, 3:1, 4:1, etc.). Slope stakes are typically used in highway work, to locate the toe of slope or top of cut. If design file information is available for the road template and profile, then the slope stake routine will calculate distance and offset information for all "break points" on the template from the slope stake itself back to the centerline. This also applies to slope staking conducted by section files, and descriptions associated with the break points on templates and/or sections are identified by name in the slope stake report.

There are "rules" for slope staking. The slope stake is measured from a pivot point, which is user-entered, or starts at the centerline itself in "point-defined" alignments, or starts at the last template point before the cut or fills when templates are involved, or starts at the left and right end-points of sections when using section files. Note that in the command Template Stakeout (which works with both sections and templates), slope staking can be initiated from any desired point. This allows for slope staking of interior, central median catch points and slope staking of any side of an eventual divided highway, being built in stages. Slope staking can be interval based, or accomplished based on where you are standing right now, independent of station interval.

Although office plans may predict the position of the catch points, slope staking is necessary to accurately determine the catch points based on actual field conditions. Slope stakes are often set at an offset to the actual catch points, since stakes at the precise top of slope or bottom of fill are likely to be knocked out by earthmoving activity. Furthermore, slope stakes are often marked with information on the slopes and distance in toward centerline or in towards the building pad or other feature. The information on the slope stake is often written in "progressive" form: distance and slope from offset stake to slope stake, distance and slope from slope stake to outside shoulder, distance and slope from outside shoulder to edge of pavement, on into centerline. Thus, the slope stake, placed safely beyond the area of construction, tells the story of the cuts and fills in towards centerline or towards the center of the work.

Catch points for both cut and fill are shown in the typical section graphics below in Figure 6-61 and Figure 6-62.

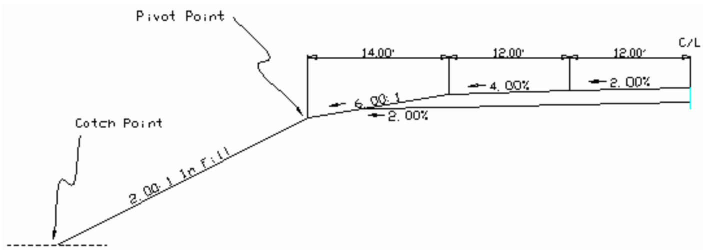


Figure 6-61

Figure 6-62

Note in the "cut" example (Figure 6-62) how the catch point may be closer or farther from the pivot point based on the slope of the original ground. With flat ground at virtually the same elevation as the centerline of the road, the catch is found approximately 15 feet from the pivot point in the base of the ditch. But with ground sloping slightly uphill, it takes a full 30 feet or so to find the catch point. The program helps find the catch quickly by modeling the surface of the ground with each shot taken. Thus, by projecting the ground slope outward, the program advises the user how far to go to find the anticipated catch point. Unless the ground slope changes dramatically, the catch point is usually staked within just a few tries. With GPS, the process is even more automatic, since the ground elevation is being computed continuously as you walk toward the catch point. No "shot" has to be taken until you are positioned right on the catch point itself. Figure 6-63 shows a cut condition slope stake in 3D. The "catch" is located at the top of the cut.

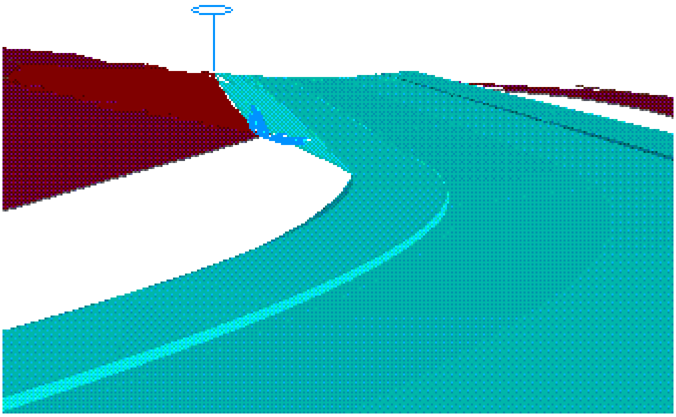


Figure 6-63

Four Methods of Slope Staking

1 **User-Defined**: This is the most commonly used method of slope staking. Here, you simply enter the station, offset and elevation of the pivot point. Do not enter a minus sign for a left offset as in –25, since the program detects whether you are left or right of centerline. The only prerequisite is the selection of a centerline file. Cut and fill slopes are entered in the field.

2 **Point-Defined Alignments:** This method is often used for staking the top of cut for a ditch, particularly a V-ditch. You can select the

centerline by any of the three classic methods of centerline file, a picked polyline on the screen, or a sequence of points. The vertical alignment can be derived from any picked 3D polyline or from the elevations on the sequence of points, or you can separately enter a profile. This method is useful for slop staking existing flow lines, where you simply take two shots at either end, create an alignment by point number, then set the slop stakes at the user-entered slope ratio.

3 **Design Files**: This is the most "formal" way of slope staking, but typically only applies to uniform, simple road, drainage ditch or levee projects where the pivot offset positions do not vary from station to station. While all methods require that a centerline be selected, the design file method additionally requires, at a minimum, a template file and a profile. For more complex roads, superelevation files and template lane width transition files may also be entered. With the exception of the centerline, profiles and simple templates, the other files are usually created at the office using SurvCADD, Carlson Roads or TakeOff, and then downloaded onto the field computer.

Note: Whenever the Road Design File options is selected, templates can be selected as a single "TPL" file, or as a series of templates organized as a "TSF" file (Template Series File). The TSF file can be entered within Road Utilities. If the left pavement lane of a road expanded from 10' – 20' for a passing lane, from station 1100 to 1200, you can create two templates, Road1 with the 10' lane and Road2 with the 20' lane. Then if you create the Template Series File shown below, the program will auto-calculate a 15' left pavement width at station 1150. This same feature can be accomplished by using one template and applying a Template Transition File, which instructs on the changing dimensions of portions of a single template. Unlike the Template Series File, the alternate Template Transition File can only be created at the office using SurvCAD, Carlson Roads or TakeOff.

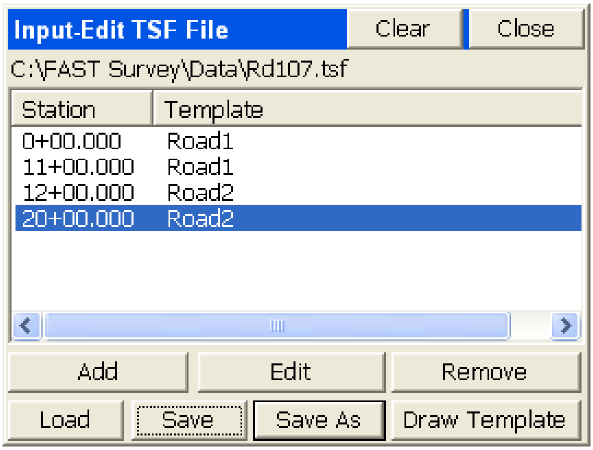


Figure 6-64

One advantage of the design files method is that the slope stake report will include information to locate all breaks in grade from the slope stake back in to the centerline. In this way, the entire road can be built from the information marked on the slope stake, which is placed outside the construction area at a user-specified (eg. 5') offset to the actual catch point.

This report might appear as follows, using our example fill graphic above:

	Station	Offset	Elevation
Offset Pt:	25.00	-38.00	5756.58

	HDIST	VDIST	SLOPE
OFFSET to CATCH	5.02	-0.17	CUT 3.4%, 29.5:1
CATCH to PIVOT	32.20	16.10	FILL 50.0%, 2.0:1
PIVOT to SHLDR	14.00	33	FILL 16.7%, 6.0:1
SHLDR to EOP	12.00	0.48	FILL 4.0%, 25:1
EOP to CL	12.00	0.24	FILL 2.0%, 50:1

This is sometimes referred to as a "progressive" report, since it lists the incremental information from each break point to the next, going in towards the centerline. In some areas, the stake is referred to as a "story stake" or "progressive story stake", because it tells the whole story of the gradework. The program is able to identify the names of the break points (eg. “SHLDR” and “EOP”) because the templates used by the program must have pre-defined IDs for all break points. Specifically with office-defined templates where cut conditions can have downslopes for ditches followed by upslopes, the program will auto-detect whether to pivot into fill or to create a cut condition, and pivot from the ditch line.

4 **Section Files**: Section files can be used to identify the pivot points left and right and minimize fieldwork. Consider the sections shown below

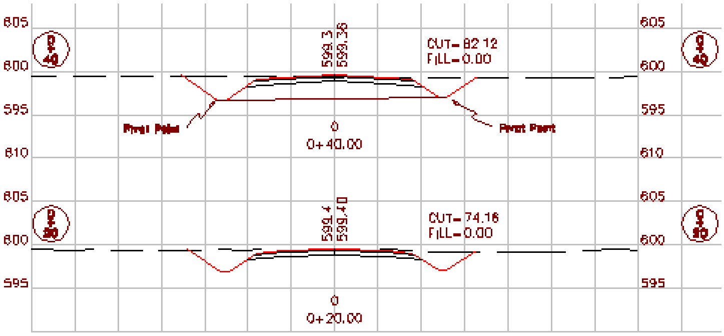


Figure 6-65

Shown are stations 0+20 and 0+40, with the pivot points for slope staking identified on station 0+40. For the section approach to work, the left-most point in the cross section must be the left pivot, and similarly, the right-most point in the cross section must be the right pivot point. The section should only be entered from pivot left to pivot right (the “designed” catch points should be dropped). But since the interior section points have no bearing on the slope staking, they can be omitted, too. So in the case of station 0+40, a 2-point cross section could be entered, consisting of pivot left and pivot right. That 2-point section is also shown in the graphic above. It is just as effective for slope staking as a section containing all the break points between pivots. The one exception is if you have entered descriptions for your section points, you can obtain a progressive slope stake report, just as with the templates, as shown below (metric distances). Note that if descriptions do not exist, the report leaves them out. Section-based slope staking requires selection of a centerline file and field-entry of the cut and fill slopes.

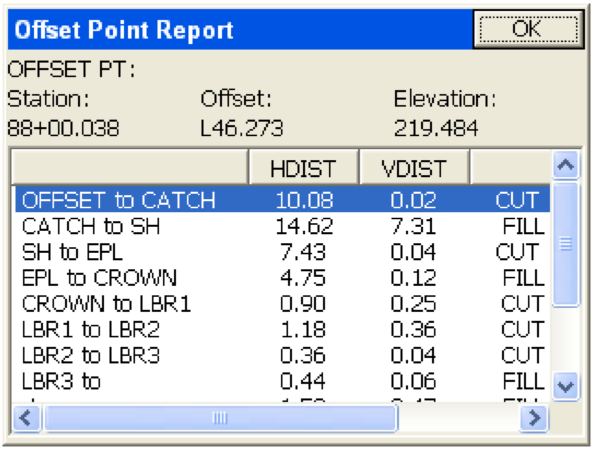


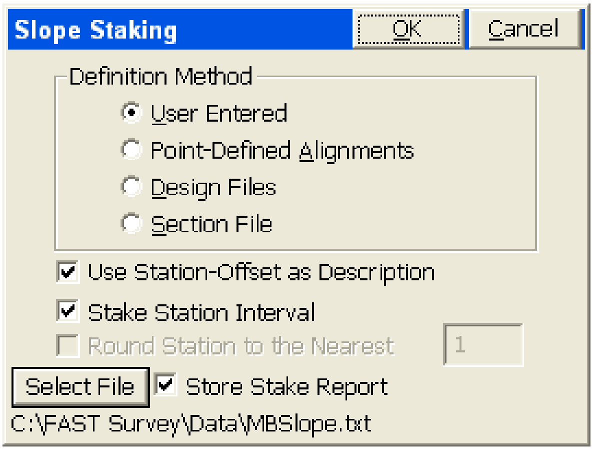
Figure 6-66

Section-based slope staking is useful when the pivot points for stakeout vary unpredictably and don't conform to a fixed template. Section-based slope staking has 2 advantages. First, all sections can be entered in the office as 2-point sections (left and right pivot), minimizing field paperwork and reference material. Secondly, odd stations can be staked out (eg. station 0+27.5), since the pivot points can be straight-line interpolated by the program.

Section files may be entered in an Road Utilities, or in an external program such as Carlson SurvCADD, Roads or TakeOff.

Choosing the Slope Staking Method

When Slope Staking is selected, you are presented with a Definition Method screen, where you choose among the 4 methods of Slope Staking: User-Defined, Point-Defined Alignments, Design Files or Section Files. The application of these methods is discussed above.



■ **Use Station-Offset as Description:** As many as 3 points can be stored for each slope staking position: the slope stake point at the "tie" to the ground, the first offset point and the second offset point. The staking of the offset points is optional. Even storing any of the points at all is an option. (After all, the main goal is to drive a stake and write information on it.) But if you do store any of these 3 possible points, clicking of this option will store the actual, staked station and offset as the default description. You can append or overwrite it, however. If this is clicked off, the default description for the catch point is "CATCH OFFSET" and there is no default for either of the offset points.

■ **Stake Station Interval:** When clicked on, your slope stake target is always a fixed point. It is the slope stake at the specified station in the input dialog in all 4 methods. But if clicked off, the slope stake target point moves up/down station as you move. In User-Defined, the pivot offset and elevation is used regardless of station position. In the other methods, the pivot elevation is recalculated dynamically as you move from the known information (3D points, profile, sections).

■ **Round Station:** This option applies only if you turn off "Stake Station Interval" and move to "fluid" slope staking. If you "round" to an interval, such as 5, then the elevation to stake from is calculated to the rounded station value, as is the up-down station position for the offset. Rounding only applies to the stored report—the target still moves fluidly was you walk forward or back parallel to the alignment.

■ **Store Stake Report:** You have the option to make a special report of the slope staking. This stores a file containing the station, offset and elevation of both the slope stake point and the first and second offset stake points, as requested by the user. The columns in the report are "dual purpose". If you stake the catch point, your first elevation column is the pivot elevation and the second is the catch point elevation. If you stake the first offset point, that same first elevation field now is the catch point and the second elevation field is the offset point. So the field headers for the columns (which will port to Excel in comma separated form) are Elev PP/CP and then Elev CP/OS, representing PP for Pivot Point, CP for Catch Point and OS for Offset Stake. Same conventions apply to the offset distances.

When you click out of the opening dialog that offers the 4 methods of Slope Staking, you obtain additional input screens.

User-Defined Dialog: If the User-Defined method is selected, you are first prompted for a centerline, then the dialog shown in Figure 6-72 appears.

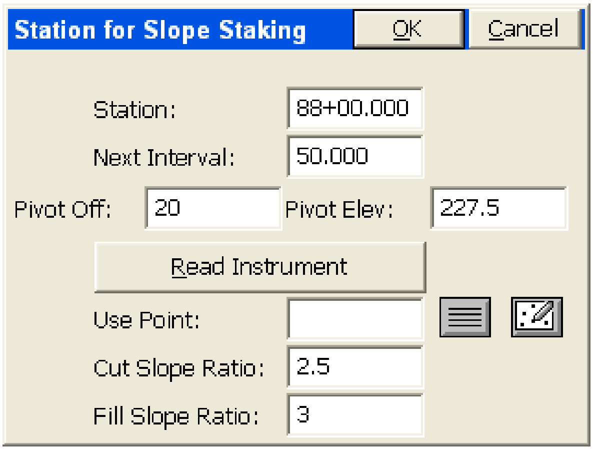


Figure 6-67

At each station, you can enter a specific pivot offset, pivot elevation and the cut and fill slope ratio that governs. Pivot offsets should be entered as positive numbers even left of centerline, since the program will detect which side of centerline you are on from the first total station or GPS reading. The program will take the absolute value of the pivot offset entry, in any case.

You can obtain the position to stake from “Read Instrument”, which calculates the station, offset and pivot elevation from a measured position. Or you can enter a point number to obtain a station, offset and pivot elevation.

Point-Defined Alignment Dialog: The selection of the Point-Defined method leads to the classic alignment selection screen shown below, familiar to users of Offset Stakeout and Stake Centerline.

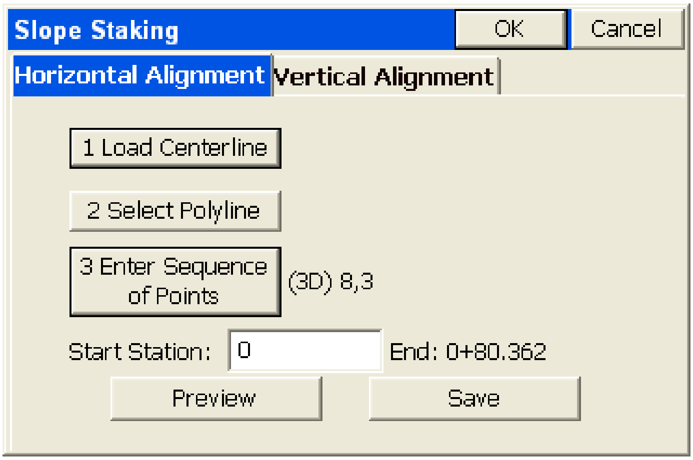


Figure 6-68

Though this is the classic use of the Point-Defined option (using points), slope staking can be conducted from a single centerline and single profile or from a picked 3D polyline. Points can be selected by number or picked directly off the screen, as shown below:

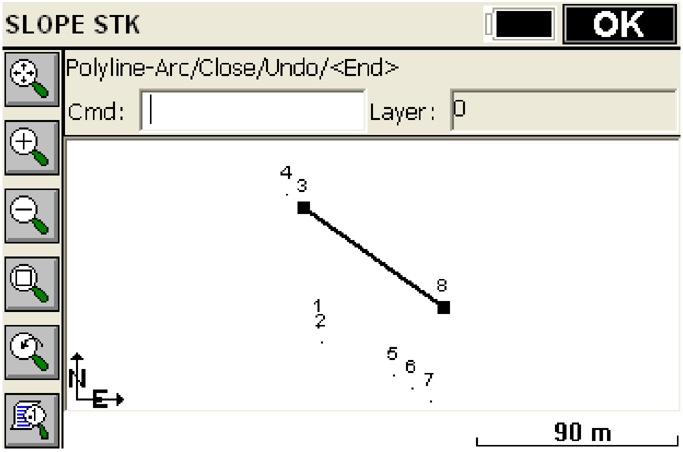


Figure 6-69

When a new horizontal alignment is selected by 3D polyline or point method, the program will ask if you wish to overwrite any existing vertical alignment selection. The typical answer is yes—you want it for both, and you are ready to stake any station at any interval based on user-entered slopes. Think of points 8 to 3 as the flow line of a ditch with steep side slopes, and the goal is to lay the slopes back at 4:1—a perfect application for Point-Defined Slope Staking.

Design File Dialog: If you select Design Files, the dialog shown in Figure 6-70 appears.

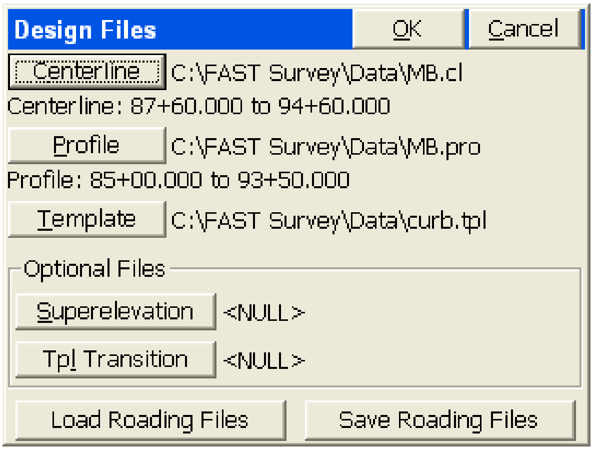


Figure 6-70

Centerlines, profiles and templates can be made using FAST Survey. Note that templates can be either single template ".tpl" files or multiple templates with transitions in a Template Series ".tsf" file. If the roads have superelevation, the "super" files can be made in Road Utilities. If template transition files are to be used for lane changes, then this file type must be made using external software such as SurvCADD or Carlson Roads. Note that "sets" of Roading Files can be saved and loaded using the buttons at the bottom of the screen.

Section File Dialog: If Section Files are selected, the dialog shown in Figure 6-71 will appear.

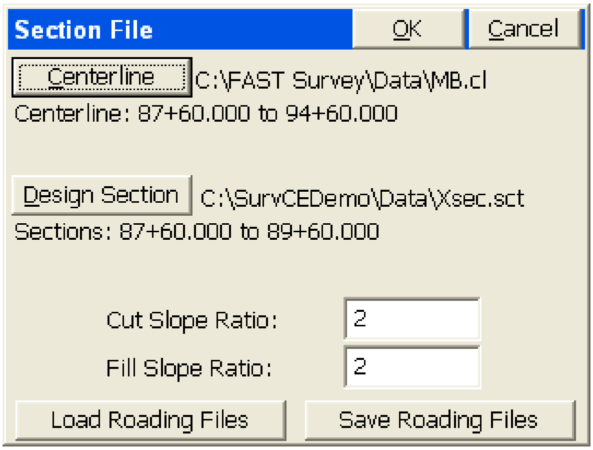


Figure 6-71

The centerline can be made using FAST Survey—in fact centerlines can be imported from a variety of file formats using the command Road Utilities, Centerline Conversion. The Section file (which has an “sct” file extension) can be entered in Road Utilities or impored from the LandXML format using Section File Conversion, also in Road Utilities. Roading File sets (as in the above MB.cl and Xsec.sct files) can also be saved to a named set and then re-loaded later for convenience.

Setting the Station and Interval for Stakeout

The next screen sets the station to stakeout and the interval. This screen’s options are slightly different depending on your method and whether you have turned off the Station Interval option. In effect, there are 8 ways of going into Slope Staking: 4 methods times 2 interval options (on=fixed station/off=fluid, real-time). The User-Defined station interval dialog has already been discussed. But if you click off the “Stake Station Interval” option, the User-Defined dialog is simplified as shown here:

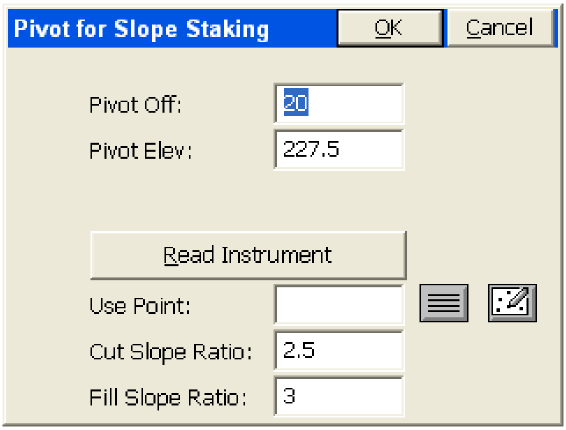


Figure 6-72

Note there is no "Station" and "Next Interval" option—it will just use the same offset and elevation at all points along the centerline as you move. This non-interval method could be called "real-time" slope staking. You are freed of the constraints of staking a fixed point at a specified station.

The Pivot Offset should be entered as a positive number—the program will automatically detect whether you are on the left or right side of the centerline. The screen is exited by pressing OK.

The Alignment Point method has its own pair of "follow-up" screens for the location to stake. Shown below are the "by interval" and "no interval" screens, side-by-side.

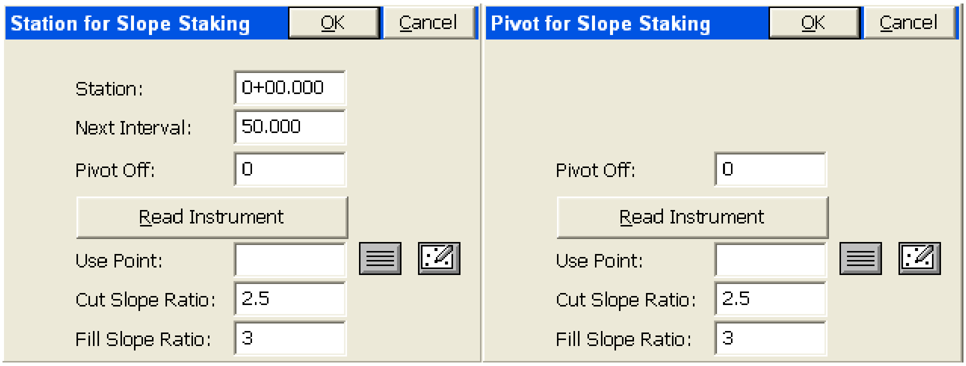


Figure 6-73

For flow line or V-ditch staking, a 0 pivot offset would be entered from the point-defined alignment. If the ditch were a trapezoidal ditch with a 2 meter bottom width, and the alignment was the centerline, each side of the ditch could be slope staked using a pivot offset of 1 (1/2 of the ditch width from center to pivot point).

Both the Road Design Files and Section Files methods go straight to the navigation (stakeout) screens if no interval is selected (Stake Station Interval turned off). The pivot offset is built into these methods based on the "rules" outlined earlier: you stake from the pivot to cut or fill in templates, and from the extreme left and right points of cross sections. But if station interval is turned on, this is the interval input screen:

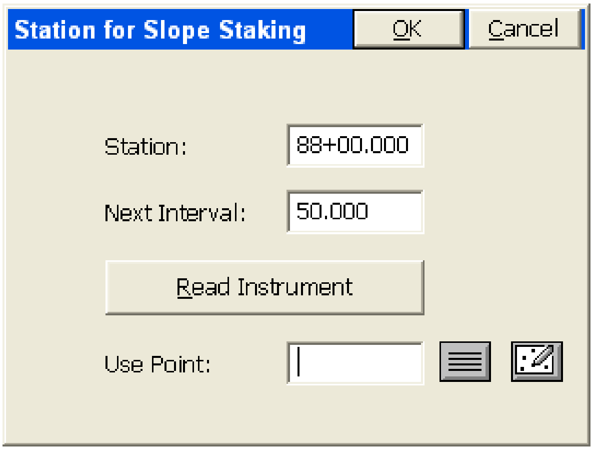
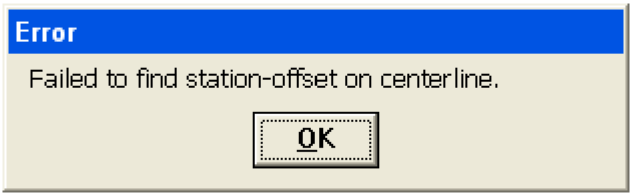


Figure 6-74

Slope staking cannot occur outside the station range of the horizontal alignment. If your horizontal alignment runs from station 0 to 308, you can't stake station -10, either by interval method (naming the station) or by the non-interval, fluid "where-you-are" method. You will get this dialog in response to out-of-range slope staking by interval:



In live stakeout mode, you will get "Off Centerline" when beyond the range of the horizontal alignment.

All paths lead on to the navigation or stakeout (some call it "set out") screen.

The Navigation (Stakeout) Screen

When configured for GPS, the navigation screen then appears as shown in Figure 6-74.

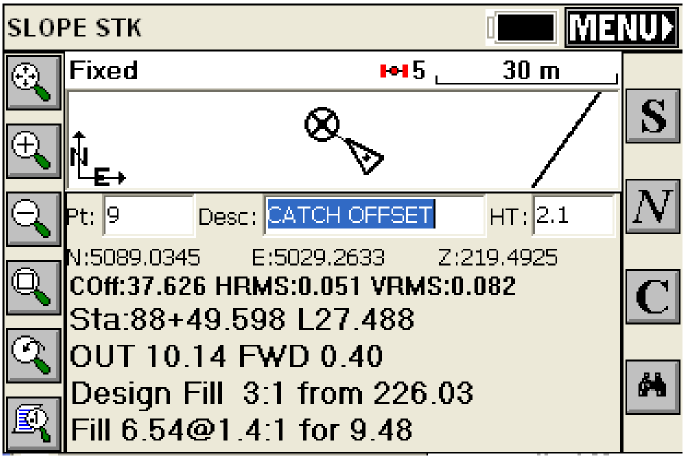


Figure 6-75

Note that because the GPS reads continuously and models the ground surface, the program calculates immediately where the catch point (the circle with the X) is located. You simply walk right to it. If the ground goes uphill or downhill as you approach the point, then the X will move closer or move away, until you are right on it.

As you get closer to the point (within 1 unit distance), the program will present a bullseye screen, as shown in Figure 6-75.

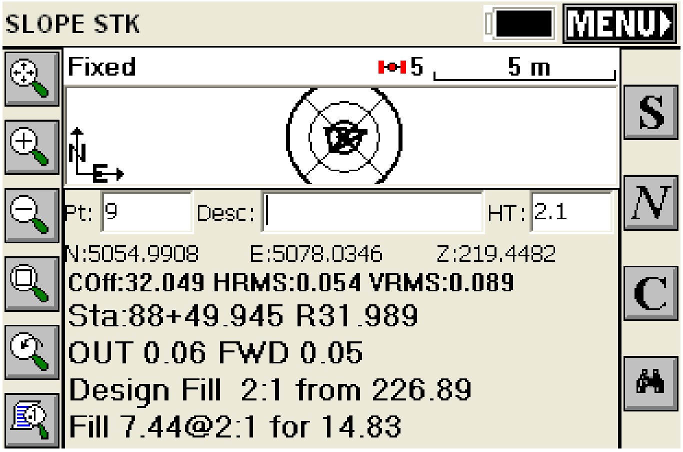


Figure 6-76

When you are satisfied with the accuracy of the slope stake position, you then touch S for Store (or press Enter to take the shot). In this case, the fill rounds to 2:1 so its time to drive the stake.

Interval and Non-Interval Methods Impact Stakeout Screen

The stakeout screens above are for the interval method. In the non-interval, "fluid" slope staking, where you can drive the stake anywhere, the "Forward-Back" portion of the screen becomes vertical "Up-Down". This is **not** referring to up-down station but up-down vertically. In this fluid stake-out mode, you simply move in or out from the centerline to set the slope stake—there is no correct or incorrect forward or back station. So the program instead reports the vertical up to the fill slope above you or down to the cut below you. Consider the diagram in Figure 6-77:

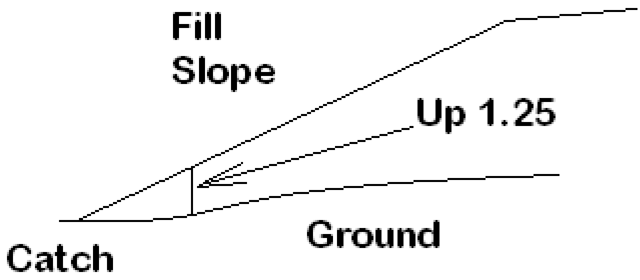


Figure 6-77

If you are moving out to the catch point along the ground, you would get a report of “Up 1.25” or some such number, and the “Up” amount to the ground would decrease as you approach the catch. The actual stakeout screen would appear as shown below. Note that some surveyors will watch the lower line (1.6:1 for 11.59) and just keep moving out until they see 2:1 (or the desired slope) and drive the stake. This is fast, but slightly less accurate. Because of rounding, you may be setting 2.04:1 or 1.96:1 (good enough for many types of work). Others will watch the “UP” value decrease to 0 and drive the stake, which is the most accurate method along with watching “OUT” decrease to 0.

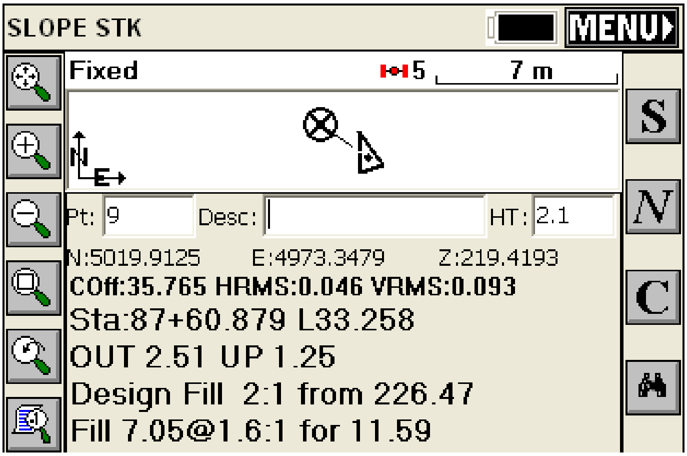


Figure 6-78

Storing the Slope Stake and Offset Stake Points

When S for Store is pressed, you may store the actual slope stake point (points 14 and 18 in the graphic below). You can also store a first offset point (since the slope stake itself can be removed by construction). The slope stake information is typically written on the first offset stake. Then you can also stake a second offset point, to obtain "line" to reset the slope stake if it is knocked out. The first and second offset stakes provide a direction back to the slope stake. When the slope stake is set, the program prompts for setting the first offset stake. When the first offset stake is set, the program prompts for setting the second offset stake. Both offset stakes are optional.

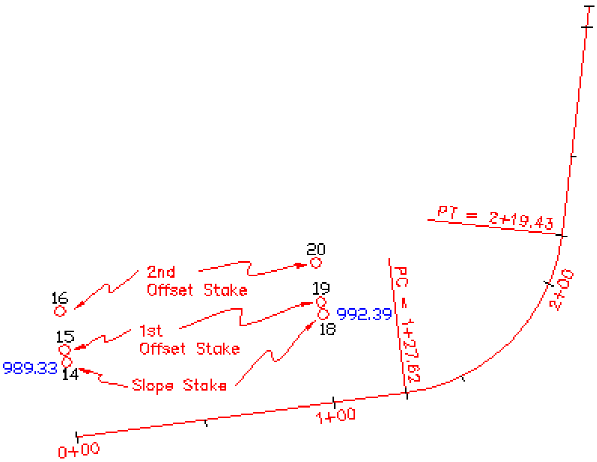


Figure 6-79

The storage of the slope stake points is an option turned on by clicking "Store Point to CRD File". With this clicked off, you can simply slope stake and avoid storing any points. The Description for the point will default to the station and offset, if Use Station Offset as Description is turned on within the initial screen. Otherwise, the description will be blank as shown below, or will default to the previous description. Slope Staking will not respond to settings in Configure Reading for the Height/Description prompt screen. If you are using a named "Report File" (set in first slope stake screen), you can still control at the point of staking whether you choose to append data to the file by clicking on or off "Store Data to Report File".

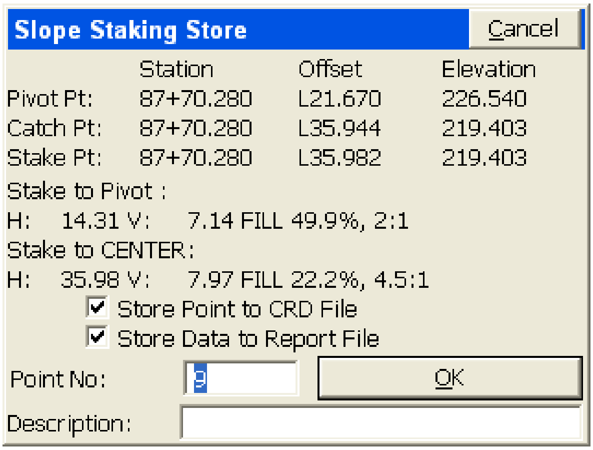


Figure 6-80

When Enter or OK is pressed, you are prompted for whether to stake the first offset stake.

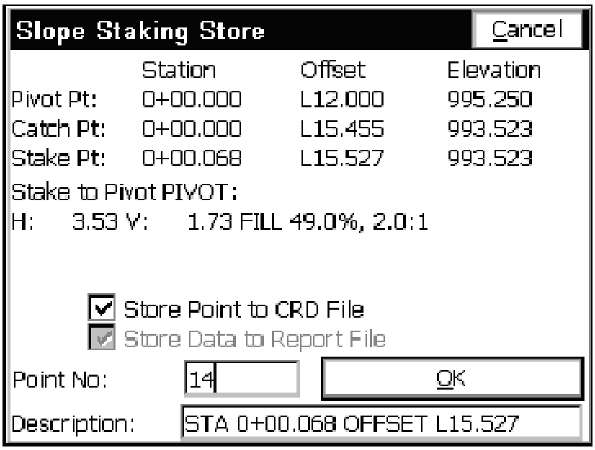


Figure 6-81

If you are doing "User-Defined" or "Point-Defined Alignment" methods, you are shown the horizontal distance and vertical difference to the pivot point, which can be written on the Slope Stake. Additional break-point information appears if you are using the "Design File" or

"Section File" method. If you trust that the Slope Stake will not be knocked out, then you are done—no need to set an offset stake.

Pressing OK leads to the prompt to set the first offset stake. If you choose to set the first offset stake, then you can set the offset distance, as shown in Figure 6-82.

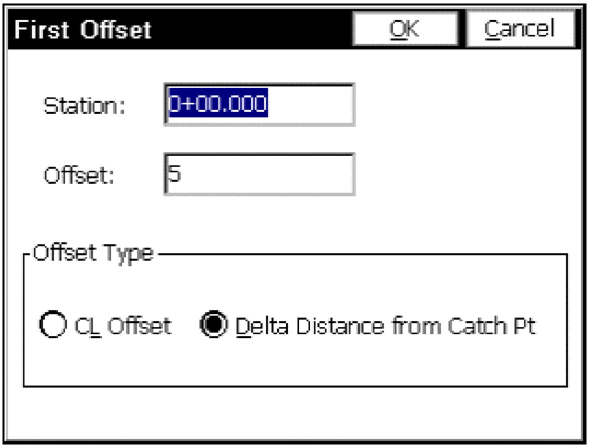


Figure 6-82

Press OK and then you are in a standard stakeout screen. The offset point is a fixed location and the stakeout procedure is similar to point stakeout. This leads to a report of information that can be written on the Slope Stake. Finally, you will be prompted for staking out a second Slope Stake, to establish "line." After the first offset stake is set, and before the prompt for the optional second offset stake, a summary screen will appear. If you have used the Road Design File or Section File methods, you will be presented with every break point into centerline:

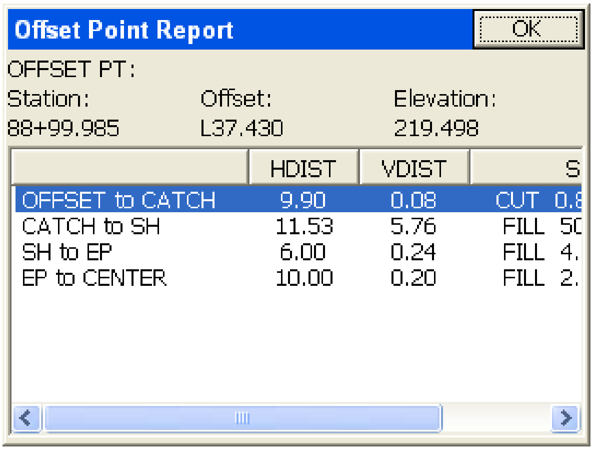


Figure 6-83

Finally, you will be prompted for staking out a second Slope Stake, a more rarely used option whose purpose is to establish "line" (the direction) from the first offset stake to the slope stake itself. This permits accurate replacement of the slope stake when it is knocked out by construction activity.

Note: When using Road Design or Section Files in Slope Staking, setting the first offset point is the recommended procedure, as it produces the full report, referenced and cross section IDs, for all break points all the way into the centerline point.

Procedure for Slope Staking with Total Stations

The procedure is nearly identical for Manual Total Stations, except that you must press R for Read (or Enter) to take shots and allow the program to begin calculating the Slope Stake position. Unlike the GPS, FAST Survey cannot predict the location of the target slop stake poin until at least one measurement is taken. After any measurement, the following screen appears:

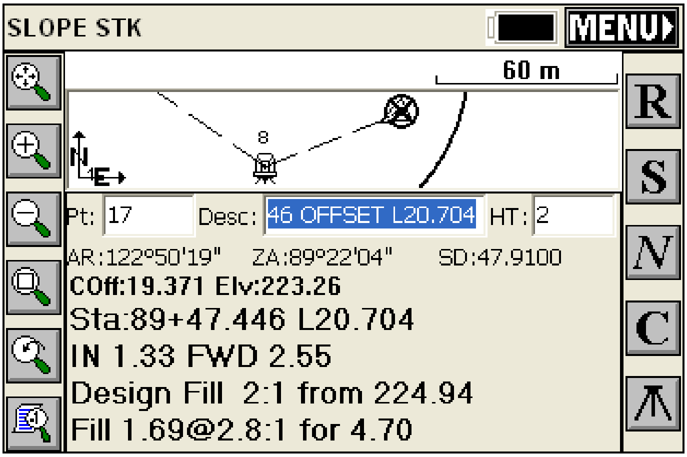


Figure 6-84

Note: When using either GPS or total stations for slope staking, you can obtain more graphics and less screen information by pressing the down arrow key. It literally has the effect of bringing the graphic screen down (see below). Pressing the up arrow key will pull the screen back up and show the full text. This works in all modes except GPS Simulation, where the up arrow moves the cursor faster, down arrow slower.

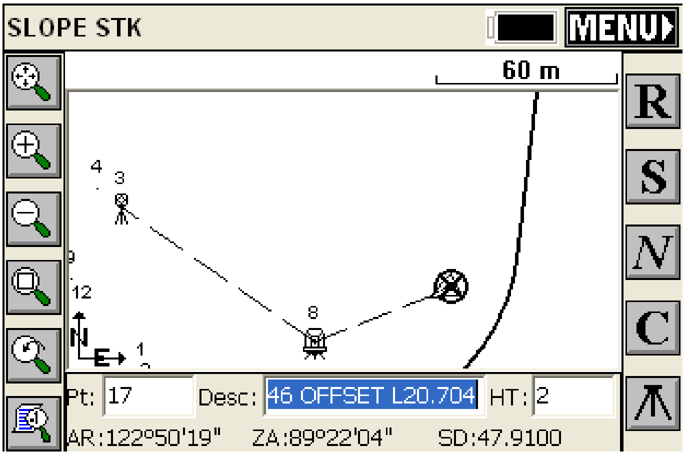


Figure 6-85

The Slope Stake Report and Writing on the Slope Stake

Surveyors doing slope staking have the option to write the information on the stake as each is surveyed, or to come back at a later time, refer to the slope stake report, and write on all the stakes after the surveying is complete. The slope stake report file is a comma-separated ".txt" file, configured in Job Settings, Stakeout, Set Cutsheet Format, which might appear as follows if formatted in Excel or another spreadsheet form:

#Des Sta	Des Off	Des Elv	Staked Sta	Staked Off	Staked Elv	Desc
1+00.000	L33.849	998.075	0+99.966	L33.453	998.075	Catch Point
1+00.000	L38.849	------	1+00.019	L38.866	998.15	First Offset Point

OFFSET to CATCH, 5.01, -0.07, CUT 71.6:1, 1.39%

CATCH to PIVOT, 23.849, 11.925, FILL 2:1, 50.0%

Armed with this information, the user could write out the slope stake. A typical slope stake might appear as shown in Figure 6-86.

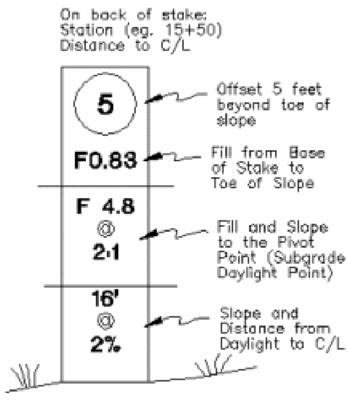


Figure 6-86

Cross Section Survey

Function

This function collects as-built cross sections of roads or other alignments and stores them as points. The descriptions of the points will store the station and offset. The station itself can be set to automatically round to the nearest 5, 10 or other station interval (eg. a shot at 179+98.23 would round to 180+00 if a rounding of 5 or 10 is used). The information can be stored into a ".not" ASCII file in addition to the points themselves, if store to Note file is turned on. You can save the cross section data to a cross section file in .SCT or RAW/Geodimeter format and you can output a cutsheet file which compares existing grade to a design grade. Cross Section Survey can also be used simply to verify your current station and offset as you move along a centerline using GPS or taking total station shots.

This routine is often combined with office software to check as-built road cross sections against desired grade and to calculate quantities for payment. The field crew begins by taking shots along each desired cross section, as shown in Figure 6-87.

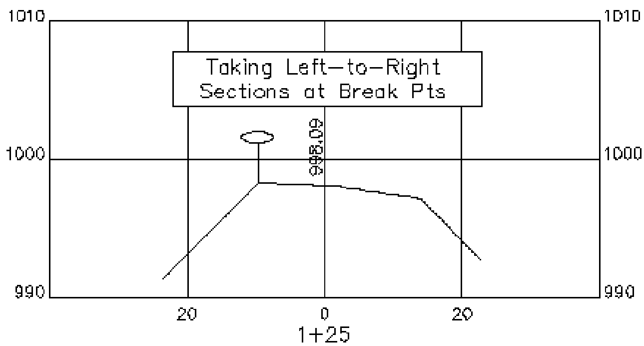


Figure 6-87

If, for example, 4 sets of cross sections were taken from station 0+75 to 1+50, the points would appear as shown in Figure 6-88 (plan view) and Figure 6-89 (3D view). There is an option to turn off point number storing, in which case the shots can still be stored to a cross section (.sct) file and report file (.txt).

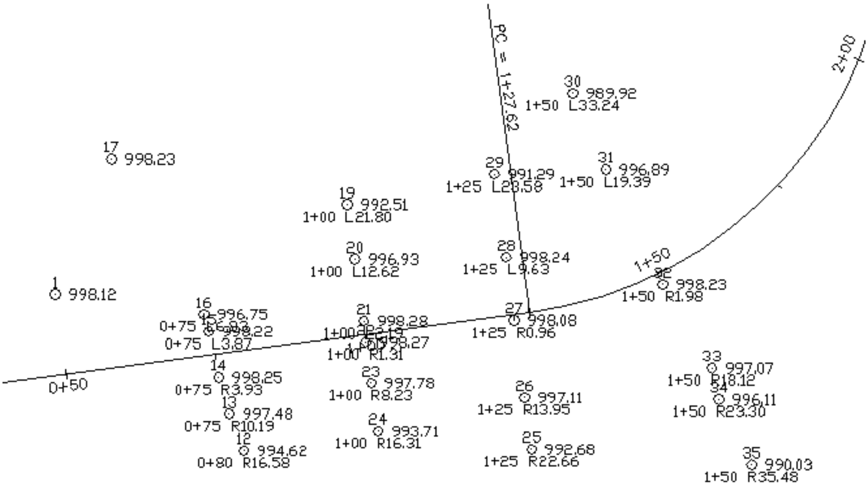


Figure 6-88

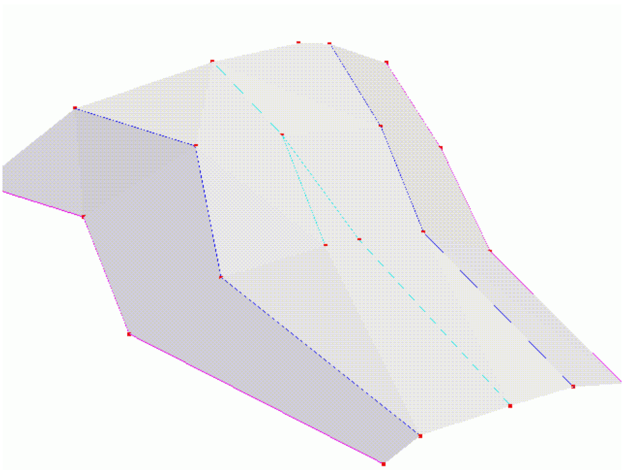


Figure 6-89

The command begins with a screen where you select the method for defining a centerline. The options are shown here:

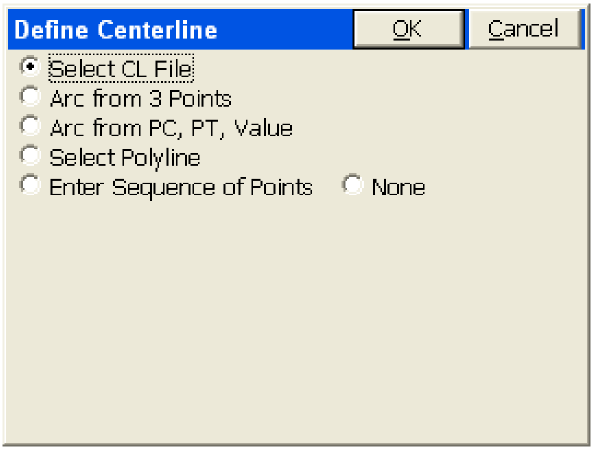


Figure 6-90

The next screen allows you to choose whether or not to store a file summarizing cross section data (See Figure 6-92). Because the SCT method requires that you choose an alignment, the option for no alignment ("None") only applies to the Raw/Geodimeter method, in which case a named file is required. Except for this case of option "None", the Section output file is optional because the information will be stored with the points. When you click Select File, you have two file type options when using a horizontal alignment:

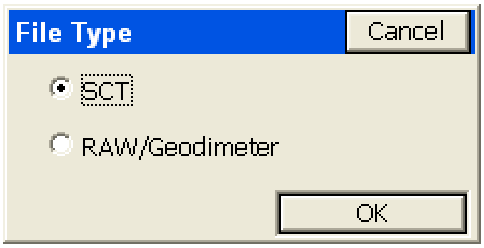


Figure 6-91

The Raw file format is a design that is compatible with the old Geodimeter section file format, and includes special prompting for job type. It is discussed in detail below (see discussion of "None" as centerline option). It leads to a different set of screen options than the SCT format.

Unless you are looking for Geodimeter file format compatibility, you should consider storing a section output file in the ".SCT" format, since it can be converted, using Road Utilities, to LandXML form and then imported to several different roading software packages for plotting and computation of volumes. The ".SCT" section files can also be used directly for volume calculations with Carlson Roads, Leica Site Manager, Topcon Topsite and SurvCadd. You can also set the rounding—here, a rounding of 10 units (feet or meters) has been selected. The station and offset can also be stored as the point description and as a note file, if the lower options are clicked on.

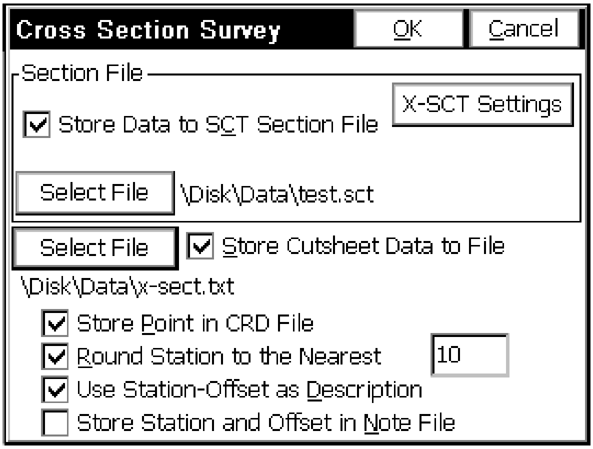


Figure 6-92

Note that the rounding is fully automatic. If you choose a 5-unit rounding, and are targeting station 0+75, but take a shot at 0+77.93, it will round up to 0+80 (see point 12 in the above point plot).

Before collecting the cross sections, it is important to click X-SCT Settings in the upper right, and set the stations you wish to capture. This way, if the station rounds, per the above screen, to a station that doesn't exist in your list, you are warned before proceeding with storing. This list also includes the left and right "tolerances" for the offsets, which will lead to warnings if you exceed that distance from centerline. If you set a tighter "Station Tolerance" in X-SCT Settings (option Edit) than the "Rounding" Tolerance, you will be warned even though the rounding is correct. These tolerances should match, for consistency. In the screen shown below, station 0+60 has been added as a special station. Clicking the first line (0+00.000-3+08.327) allows you to set the standard interval, and the additional stations in the list would be for special stations in addition to the standard interval.

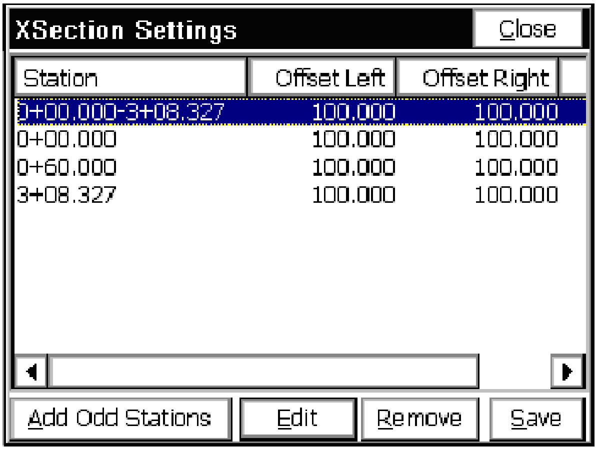


Figure 6-93

With the first line highlighted, as shown above in Figure 6-93

Selecting Edit leads to the settings options for the full range of stations shown in Figure 6-94.

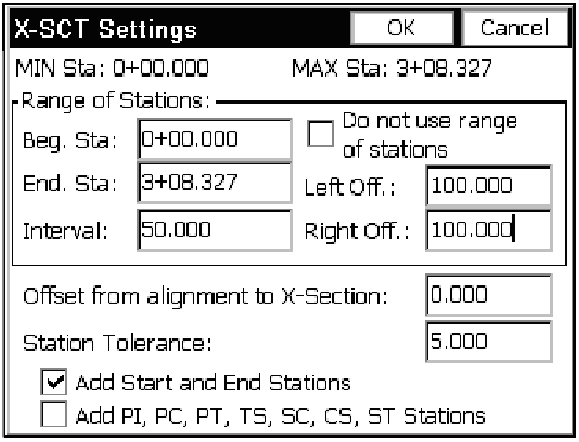


Figure 6-94

With an interval set of 50, and Start/End Stations turned on, and the special station 0+60 added, the program will only expect you to capture stations 0, 50, 60, 100, 150, 200, 250, 300 and 308.327. The Offset from alignment to X-Section option let's you, in effect, use an alternate, parallel centerline at a left (negative) or right offset from the main centerline. Unless the Raw/Geodimeter method is used, a station "warning" screen is used if the rounded station is not in the list or pre-selected stations. The "Station Tolerance" option will let a capture of station 75 round to 80, but since 80 is not in "the list", you will be warned before storing. A station of 55 would round to 60, which is in the list, leading to no warning screen. Since the rounding was set to 10 in this example, data collected at 45 to 55 would round to 50 (station 53 would not round up to 55), and therefore only "even 10" stations will be collected to begin with. So the additional "Station Tolerance", which rounds the collected station data to the listed stations, will not activate. Had we permitted rounding to the nearest 5 station, then 55 would round up to 60 and store without warning.

When OK is clicked from the Cross Section Survey dialog, the program immediately proceeds to a point collection mode, with continuous presentation of station and offset (if running GPS or robotic total stations). Using GPS, the screen appears as shown in Figure 6-95 in all cases except the Raw/Geodimeter format style.

.

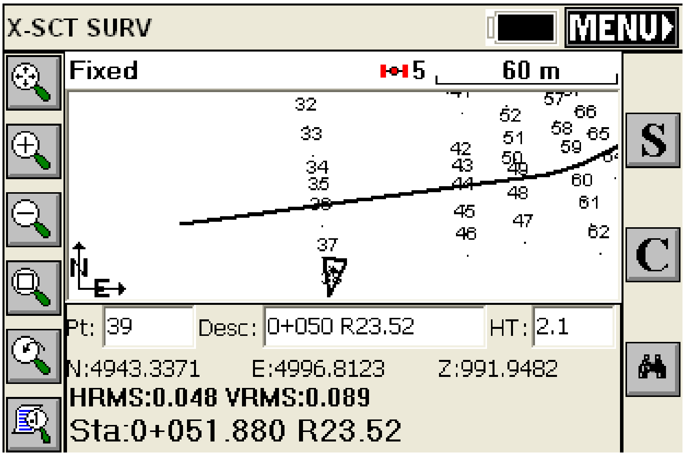


Figure 6-95

Storing Points using GPS: There are two methods for storing points in real-time GPS mode: Press the S icon at right (or pick Alt S) or simply press Enter. The "binoculars" icon will bring up the Monitor/Skyplot dialog. You can survey as many cross sections as desired within the command. Unlike in Slope Staking, Cross Section Survey will respond to the setting for Hgt/Description prompt on save, found in Configure Reading, allowing you to arrow key to desired descriptions or change your rod height after taking the shot. Option C goes to the Configure Reading directly from the data gathering screen. When done, simply select the Menu button, and you are returned to the Road menu. When exiting by pressing Menu, if you have opted to store to an SCT file, you will be prompted to store the cross section information in SCT form.

Storing Points using Total Stations: After confirming the occupied station and backsight, as with all total station work, proceed through the same options above until you reach the store point dialog (as shown in Figure 6-96).

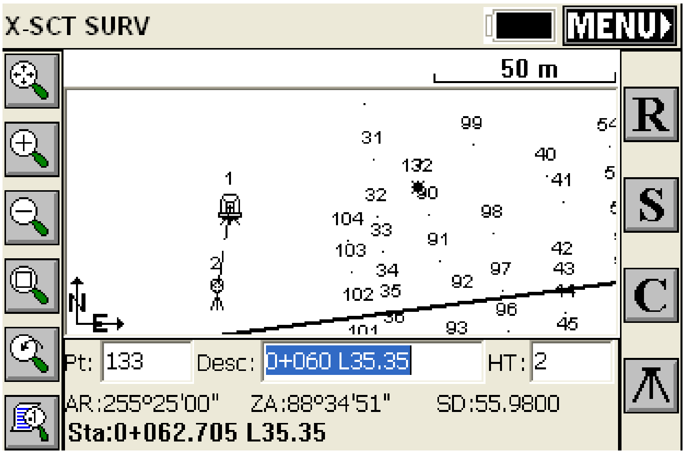


Figure 6-96

Here your options are R for read followed by S for Store, or simply Enter to Read and Store. The backsight icon can be pressed to set a new occupied point or backsight point. Note that we have a very "busy" screen of points. If you just want to see your setup, backsight and last point that was measured, press Alt F. This produces the screen below. You will stay in this mode until you press Alt F again and toggle back to the presentation of all points.

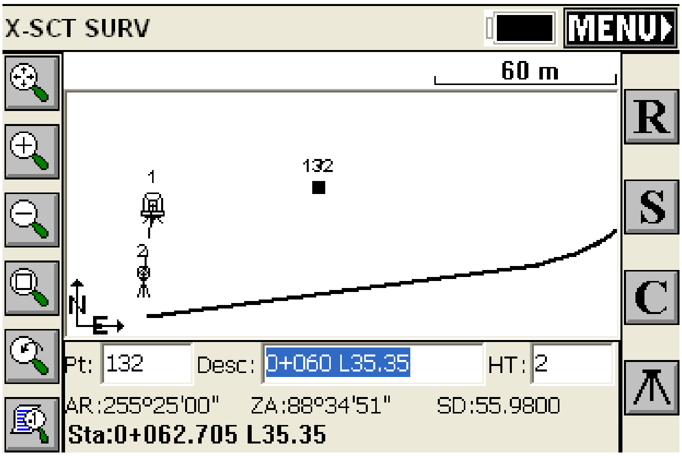


Figure 6-97

If a shot is taken that doesn't round to a station in the list of "approved" cross section stations (X-SCT Settings), then a warning screen appears.

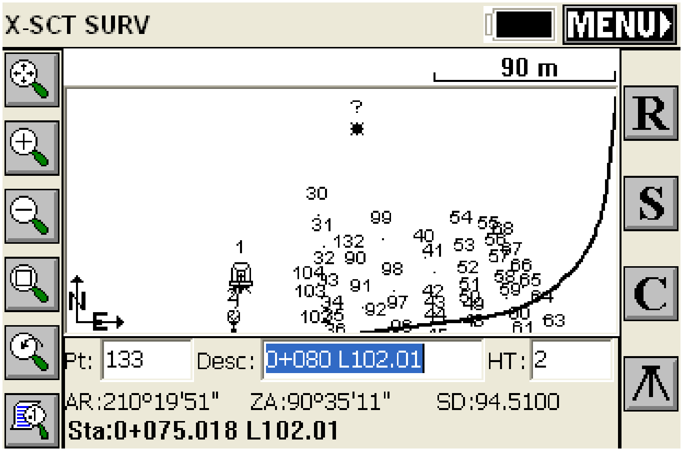


Figure 6-98

In this warning screen, we have exceeded the tolerance on 2 accounts: we round to 0+800, which is not in the list, and our offset is 102.011 left, which exceeds our anticipated maximum offsets of 100 left and right.

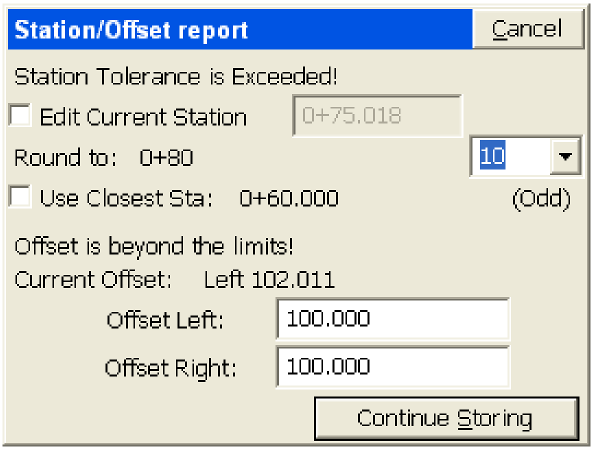


Figure 6-99

Points Store with Station/Offset Descriptions, as shown below:

29	1+25	L23.58
30	1+50	L33.24
31	1+50	L19.39
32	1+50	R1.98
33	1+50	R18.12

The "cutsheet" file, which is comma-separated, would appear as follows if presented in a tab-delimited form:

#Point ID	Station	Offset	Elevation	Description
29	1+25	Left 23.5759	991.2901	1+25 L23.58
30	1+50	Left 33.2363	989.9193	1+50 L33.24
31	1+50	Left 19.3923	996.8921	1+50 L19.39
32	1+50	Right 1.9816	998.2340	1+50 R1.98
33	1+50	Right 18.1201	997.0731	1+50 R18.12

etc.

When you exit the routine by clicking Menu from the data gathering screen, and have Store SCT file turned on, you will be asked if you want to "process" or add the last shots you collected to the named SCT file. You have the choice to "Process" (use the data) or "Discard" shown in Figure 6-100.

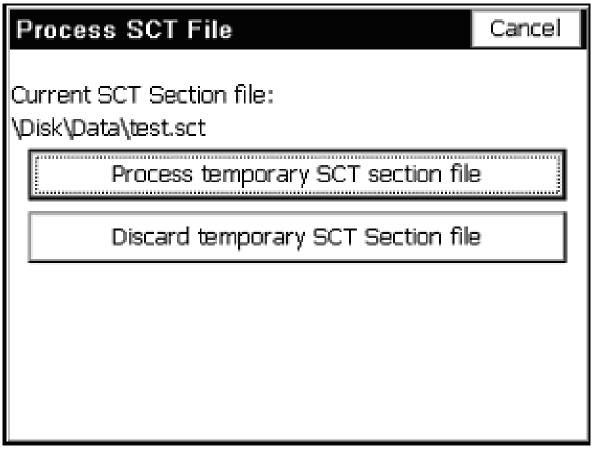


Figure 6-100

The program will even keep the section data "on file", so that if you Cancel the above screen, and re-enter Cross Section Survey, you will be prompted again whether to save (process) or discard the cross section data collected earlier.

Options When Storing in Raw/Geodimeter Format

When the Raw/Geodimeter Format is selected, a distinct set of screens are obtained. This particular format was adapted for highway departments and survey companies that had built cross sectioning practices around the Geodimeter format. This method requires that you enter the station (chainage) being surveyed, and only uses the centerline position to advise you on your station and offset. A horizontal alignment is not required. The program detects the selection of this format, and before proceeding, opens with a starting screen where job-based information is entered:

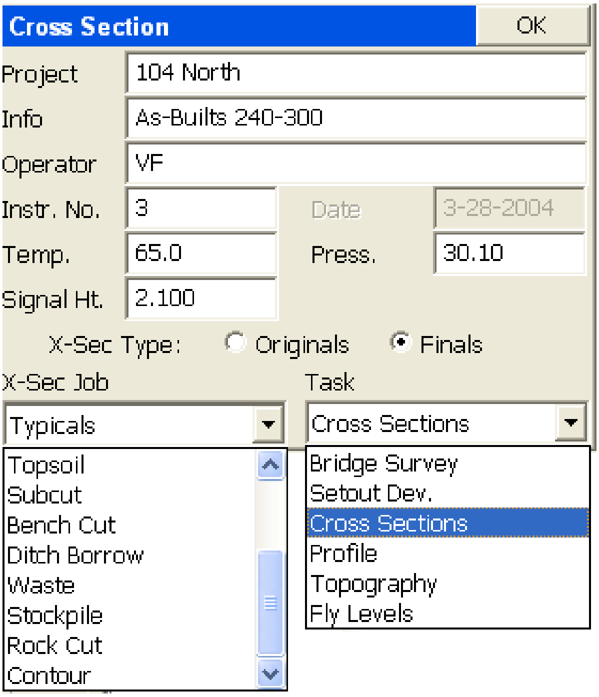


Figure 6-101

There are pre-set job categories and tasks, which save into defined number categories in the old Geodimeter raw file format. Whereas the SCT method recognizes the station you are on and automatically rounds to it when you are within tolerance, the Raw/Geodimeter method requires that you click the Station button, shown below, and set your target station for collection of cross section data:

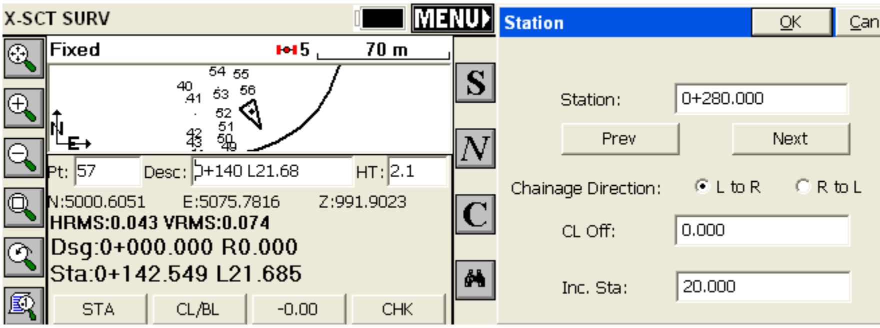


Figure 6-102

Then you proceed from the current location (station 0+142 above) to the target station, 280 (shown here in kilometer form, as in 0+280, as configured in Job Settings, Units). In fact, although the points that are stored may contain station and offset descriptions, the data stored to the raw file pays no attention to the centerline information. The station and offset on the screen (0+142 in this case) act only as a check on your current location. The direction of taking the sections, (L to R or R to L), is important and is set by specifying "Chainage Direction". Unlike with the SCT format method, pressing Menu to exit does not store the data, but instead the data is automatically stored as you go, as a series of 37 (N), 38 (E) and 39 (Z) record types (Geodimeter format), with header line records, as shown below:

50=XSEC1
54=104 North
0=As-Builts 240-300
53=VF
90=2
97=0
51=3-28-2004
56=65.0
74=30.10
55=3
96=2
6=2.100
80=280.000
91=1
37=5105.857
38=5069.091
39=991.905

37=5104.091
38=5074.931
39=990.724

Starting left to right, the data points begin with a 91=1 record. A right to left section would begin with 91=2. When you "cross 0" or are on the centerline or baseline, you click the CL/BL button which sets a 92=1 record for centerline and 92=2 for baseline, and the next shot is the centerline/baseline shot. If you select the "-0.00" button, this indicates whether the next shot is a tie-in (catch) or extension beyond the tie-in. This sets a 93=1 record for the catch and 93=2 for the extension prior to the subsequent coordinate record. In effect, you tell the program where the centerline or baseline is by shooting that point. Then the station and offsets of the shots for that cross section are determined relative to that center-of-alignment shot. It does not use a horizontal alignment combined with rounding to determine the station and offset of the shots (like the SCT method does). You tell it the station, the direction of measurement (left to right or vice versa) and you tell it which one is the center shot. This is why the Raw/Geodimeter method is the only method that works with no centerline (the "None" option). For each section, you tell it the station and center shot, and all other measurements are used to determine the left and right offsets relative to the center shot. If the L to R method was used, shots before the center shot are on the left, for example, and their offset is determined by the inversed distance to the center shot. The centerline file or other form of horizontal alignment, if selected, is academic and only used to advise you on your current station and offset. The CHK button will allow checking into known points to be sure that tight coordinate control is maintained. N moves onto the next station as defined by the interval set using the Sta button.

Note: The .SCT file method is the standard Cross Section Survey method. The RAW/Geodimeter method is a flexible routine designed to adapt to customers who have built their cross section processing systems around the Geodimeter raw file format.

Road Utilities

Function

Function: Road Utilities include necessary routines to convert centerlines, profiles and cross sections from other formats to the formats used by FAST Survey. FAST Survey uses ASCII file formats for centerlines (".cl" files), profiles (".pro" files) and cross sections (".sct" files). These same formats are used by other Carlson products such as SurvCADD, Carlson Survey and Carlson Roads. Road Utilities will also scale up or down centerlines and profiles, usually to convert between metric and English units. In addition, Road Utilities includes a command for entering a superelevation file (".sup"), which can serve as an optional input file and react with templates in commands such as Template Stakeout, Slope Staking and Elevation Difference. Finally, Road Utilities has an option for a Template Series file, which will transition from one template to another automatically, as long as the templates share identical "IDs". The Template Series file can be substituted for a standard template file in Slope Staking and Template Stakeout, wherever "design files" are applied. The options for Road Utilities are shown in Figure 6-103.

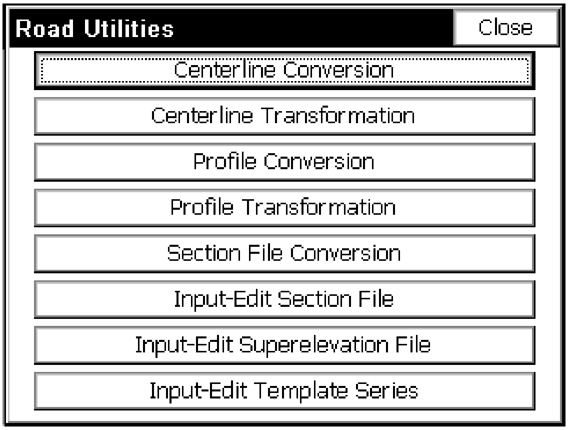


Figure 6-103

File Conversion and LandXML: The LandXML file format is becoming a standard encouraged by many DOTs, by AutoDesk, by MicroStation and by several software companies such as Carlson, Infrasoft (Moss) and Geopak. LandXML files have a ".xml" extension and may contain various road design files from centerlines to profiles to cross sections. The "header" lines within the ".xml" file will indicate what design files are included, and sometimes several files of the same type, such as 3 or 4 centerlines or profiles, may appear in the same LandXML file. As more and more software companies offer LandXML file output, this file type may be the preferred form for data exchange. Be aware that each company tends to implement the LandXML format in slightly different ways, much like DXF files for drawing data exchange were sometimes slightly different in format between AutoDesk and MicroStation, or from release to release. Therefore, if a LandXML file containing centerlines, profiles or cross section files fails to convert, it is recommended that they be emailed to Carlson Software so changes can be made in FAST Survey to enable conversion. LandXML is an evolving format that is likely to solidify in the near future.

Centerline Conversion

Centerline Conversion: Centerlines are used in numerous commands in the Surv, Cogo and Roads menus. Centerlines can be made "from scratch" within FAST Survey using Input-Edit Centerline, but they can also be converted from the following file formats:

- ASCII Inroads (.ASC extension)
- ASCII LDD (.TXT)
- Geopak (.OSD)
- LandXML (.XML)
- Leica (.GSI)
- SDR (.SDR)
- TDS (.RD5)
- Terramodel/Geodimeter (.RLN, .ALN and .ARE formats)

Note that for Terramodel/Geodimeter RLN to CL conversion, beginning with FAST Survey 1.5, spiral-only elements will be successfully read and imported. The FAST Survey format has a ".CL" extension. These source files can be loaded into FAST Survey using Data Transfer, located in the File menu options. When doing the conversion, and selecting a particular format, the program automatically looks for the corresponding file extension, as in the case below, where the goal is to input a Leica ".gsi" centerline shown in Figure 6-104

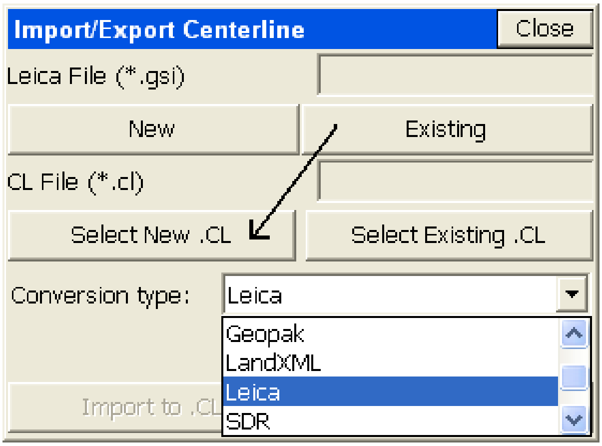


Figure 6-104

Clicking "Existing" in the upper right will load the ".gsi" file and clicking "Select New .CL" (Figure 6-104) will save the centerline file in the correct format for use in FAST Survey. Reversing the direction, clicking "Select Existing .CL" would recall a FAST Survey centerline file and then clicking "New" in the upper left would save it back to a Leica ".gsi" file in this case, for use in other software. For file types where both Import and Export options are available, the conversion procedure forms a "criss-cross": You bring the files into FAST Survey by going upper right ("Existing") to lower left ("Select New"). You send the files back to the "non-FAST Survey" format by going lower right ("Select Existing") to upper left "New" as shown in Figure 6-105.

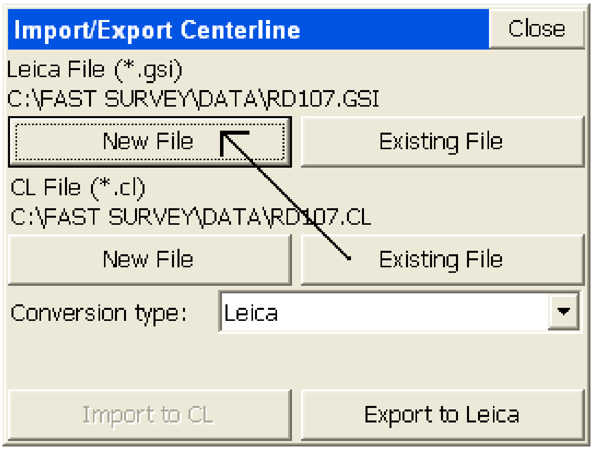


Figure 6-105

When the files have been selected, the appropriate action is highlighted below. In the case above, we are converting "Demo.cl" from FAST Survey to a Leica ".gsi" format, so the "Export to Leica" button highlights in the lower right. For the Leica ".gsi" format, 2 export options are available (8 and 16 character), leading to one more selection dialog shown in Figure 6-106.

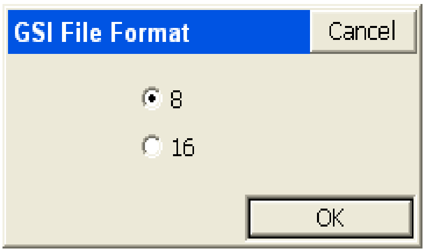


Figure 6-106

If the SDR format is selected, the dialog automatically changes as shown in Figure 6-107.

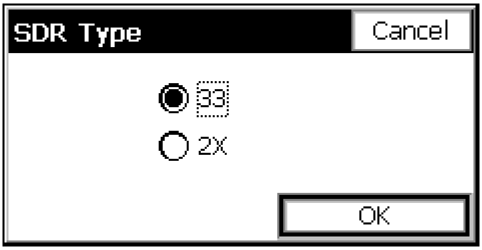


Figure 6-107

When the process is completed, the program announces "Process Done," and you are free to move on to the next command. Most formats only convert to FAST Survey and not back again, and therefore only have "one-way" dialogs. These include ASCII-Inroads, ASCII-LDD, Geopak, Moss, TDS and Terramodel/Geodimeter. When only 1-way conversion (to FAST Survey) is available, the dialog appears as shown in Figure 6-108

.

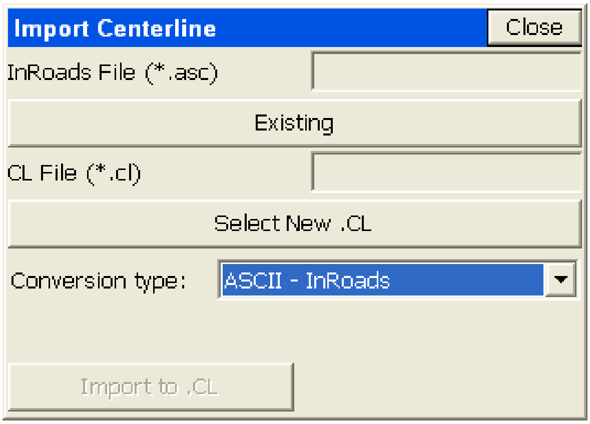


Figure 6-108

Importing TDS RD5 Files

Importing TDS RD5 Files: If TDS is selected, centerlines can be converted "1-way" to FAST Survey centerlines. It is important to note that the TDS RD5 file is a dual centerline and profile file. Because the TDS RD5 file does not display the starting station, an extra dialog will appear requesting starting coordinates and a starting station, as shown in Figure 6-109.

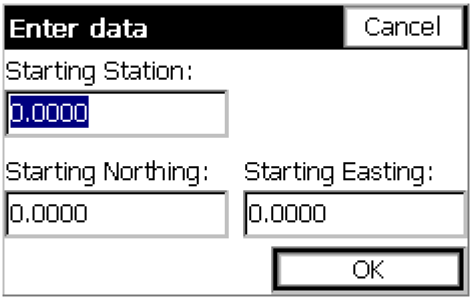


Figure 6-109

Verify the Conversion

It is recommended that after converting centerlines, profiles or cross section files to FAST Survey format, that you go to the Input-Edit options for these file types, and review the data to verify that the correct file was converted and that the conversion was successful. So, for example, after converting a centerline from, say, Inroads format to FAST Survey ".cl" format, go directly to Input-Edit Centerline in the Roads menu and verify that data.

Recognizing File Formats

For reference, portions of 4 of the file types are shown below, as they might display in a Text Editor. The LandXML, FAST Survey and SDR examples all reference the file DOT1.CL. These displays may help you recognize these file types in the future. The new LandXML format, endorsed by many Departments of Transportation in the United States, may soon become the standard in the future for internet transfer of roading and other types of design files.

LandXML	<CoordGeom> <Line length="848.64000000" dir="2.38921515" > <Start>10000.00000000 10000.00000000</Start> <End>10579.94056914 9380.43661675</End> </Line> <Curve rot="ccw" chord="1914.99460706" crvType= <Start>10579.94056914 9380.43661675</Start> <Center>2213.99512832 1549.51682467</Center> <End>11767.20701020 7877.90450628</End> </Curve> <Line length="1947.71000000" dir="2.55652497" >

FAST Survey	0,10078.69000,L,10000.00000000,10000.00000000 0,10927.33000,L,10579.94056914,9380.43661675 0,10927.33000,PC,10579.94056914,9380.43661675 0,9.351012766,R,2213.99512832,1549.51682467 0,12844.56000,PT,11767.20701020,7877.90450628 0,14792.27000,L,12842.84117284,6254.14793824 0,14792.27000,PC,12842.84117284,6254.14793824 0,7.125600000,R,3289.62929108,-74.23974329 0,16235.38163,PT,13562.04766716,5004.12304528 0,24641.89003,L,17287.56502100,-2531.78459252 0,24641.89003,TS,17287.56502100,-2531.7845925
SDR	00NMSDR33 V04-04.24 Jul-29-99 14:49 122211 28KIDOT1 1 06NM1.00000000 29NM10078.6900 313.108056 10000.0000 30NM10579.9406 9380.4366 32NM1917.2300 -11459.1600 30NM11767.2070 7877.9045 30NM12842.8412 6254.1479 32NM1443.1116 -11459.1600 30NM13562.0477 5004.1230 30NM17287.5650 -2531.7846
TDS	HR+++++++++++++++++++++++++++++++++++ HL,77.0204,151.834 HC,-1.0,300.0,114.436,L HL,-1.0,128.892 HC,-1.0,800.0,846.144,R VR+++++++++++++++++++++++++++++++++++ VG,47.02,0.000000 VG,215.48,5.000000 VC,75.0,5.000000,8.000000 VG,25.0,8.000000 VC,75.0,8.000000,9.430000

Centerline Transformation

This routine is designed primarily to convert centerline data from Metric to Survey Feet or from Survey Feet to Metric. Here is the dialog, and scale factor, when converting from Metric to Survey Feet. The main dialog is shown in Figure 6-110.

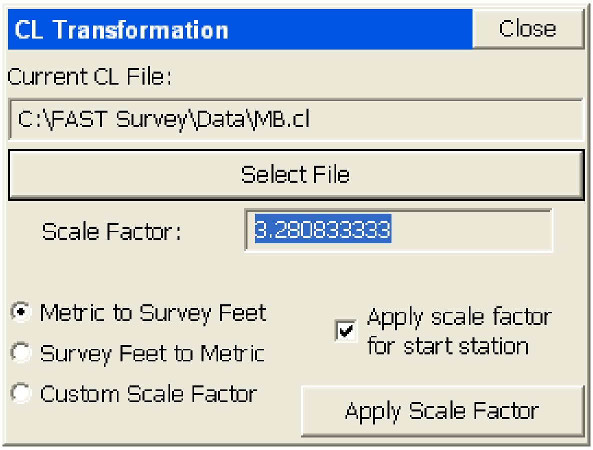


Figure 6-110

Apply scale factor for start station: If this option is clicked on, as shown, then a starting station of 1000, for example, would become a start station of 3280.833. If clicked off, the start station would remain at 1000. If the goal is to change the starting station by a certain amount unrelated to the scale factor, then you must use Input-Edit Centerline and enter a new start station in the initial dialog. This will automatically translate all stations in the centerline by the appropriate amount.

When "Apply Scale Factor" is selected, the centerline is adjusted by the scale factor, after a confirming "warning" screen.

Profile Conversion

This command converts profiles to and from FAST Survey format and other formats including

- ASCII-LDD (.TXT)
- Caice (.KCP)
- LandXML (.XML)
- Leica (.GSI)
- SDR (.SDR)
- TDS (.RD5)
- Terramodel/Geodimeter (.RLN, .ALN and .ARE)

The FAST Survey format has a .PRO extension. These source files can be loaded into FAST Survey using Data Transfer, located in the File menu options. The conversion screen is similar to Centerline Conversion, with the characteristic "criss-cross" logic for 2-way conversion (LandXML and Leica) and one-way conversion for the other options. Here is the dialog for a 1-way Caice to FAST Survey profile conversion shown below.

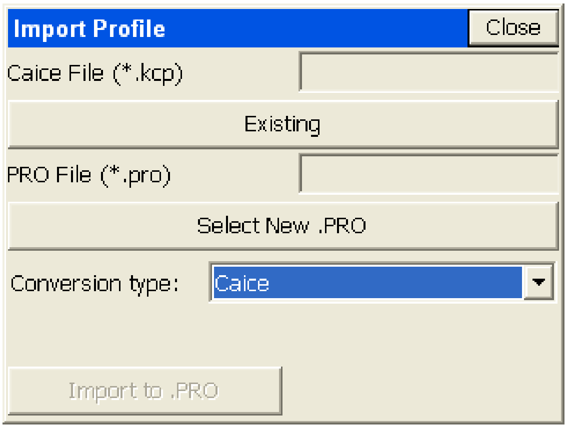


Figure 6-111

The FAST Survey Profile "file format": It should be noted that of all the FAST Survey file types that are ASCII and therefore viewable in text editors, the profile ".pro" file has the simplest format. The format is station, elevation, length of vertical curve, description for road profiles. For example, the Demo.pro file that is typically provided with the software has the following 4 lines (which can be viewed in Notepad):

0.0000, 997.0000 , 0.0000,

200.0000, 1005.0000 , 200.0000,

308.0000, 1003.9200 , 0.0000,

0.0, 0.0, 0.0 (this is an "end-profile" line)

A profile, therefore, can be hand-entered within a text editor as well as officially made within FAST Survey. Other ASCII file types such as centerlines can be deciphered, but are generally of a more complicated design and are best entered using the editors provided within FAST Survey.

Profile Transformation

Like Centerline Transformation, this routine is primarily used to scale a profile up or down to go from Survey Feet to Metric or from Metric to Survey Feet. The main dialog is shown in Figure 6-112

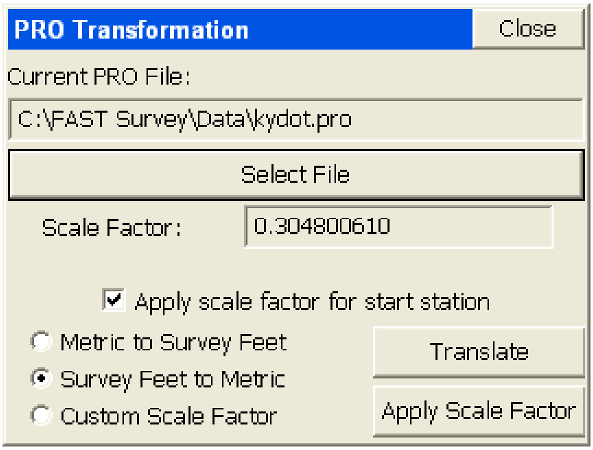


Figure 6-112

Unlike with Centerline Transformation, you can directly "translate" the profile up or down, in addition to scaling the profile stationing and elevations. The "Translate" option leads to its own dialog of entries, which allows you to translate both the stationing and the elevations, as shown below. In this way, you could make the starting station 1000 or raise the entire profile 15 feet or meters.

If you want to apply a translation to selected stations, tap the Translate button and the dialog shown in Figure 6-113 will appear.

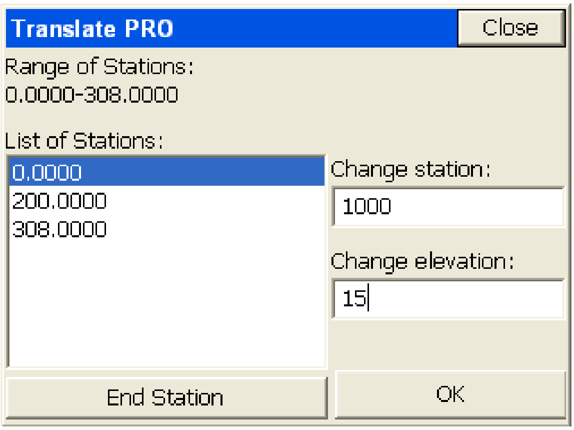


Figure 6-113

By default, the entire range of stations is selected as shown at the top [0-308]. If you wish to only translate a range, highlight the beginning station, then highlight the end station and tap the End Station button. Next enter the amount to translate in the Change Station box and optionally the amount of elevation to change. Tap OK when you are finished.

Section File Conversion

FAST Survey can import and export 2 types of section files: Caice (".fff") and Landxml. The FAST Survey format is ".SCT". Section files are used for both Slope Staking and Template Staking. Furthermore, Cross Section Survey will output section files. The standard, 2-way format, dialog for Section File Conversion is shown in Figure 6-114

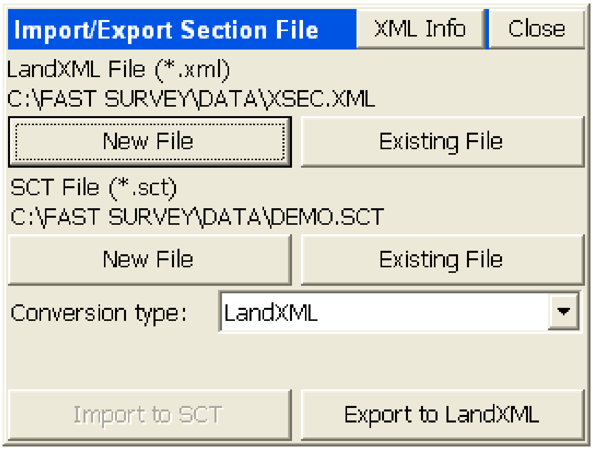


Figure 6-114

Note that if you click "XML Info" at the top of the screen, you'll see some of the "header" information associated with the XML file to be exported or imported:

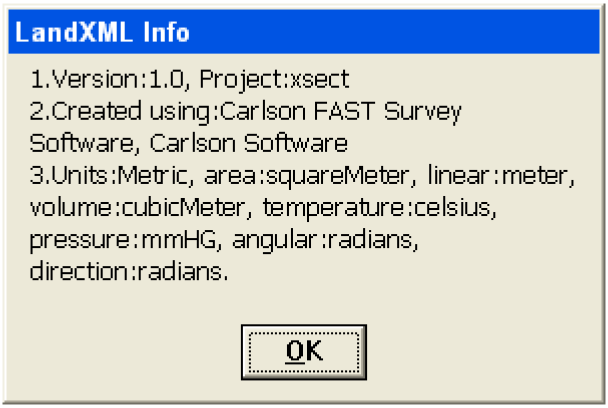


Figure 6-115

To export to LandXML, you need to load a LandXML file that already contains a centerline covering all or part of the station range in the SCT cross section file. Otherwise, you will obtain the following error message:

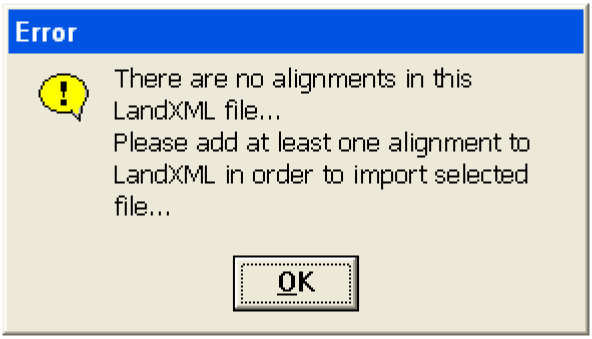


Figure 6-116

Despite the message, you can add the horizontal alignment portion to the LandXML file after creating the file with sections only. However, if you first create a LandXML file containing one or more alignments, then choose that existing LandXML file to export to, you can select among those centerline alignments when making the cross section file. A LandXML file with 3 centerlines would present the following screen if used to append cross section data:

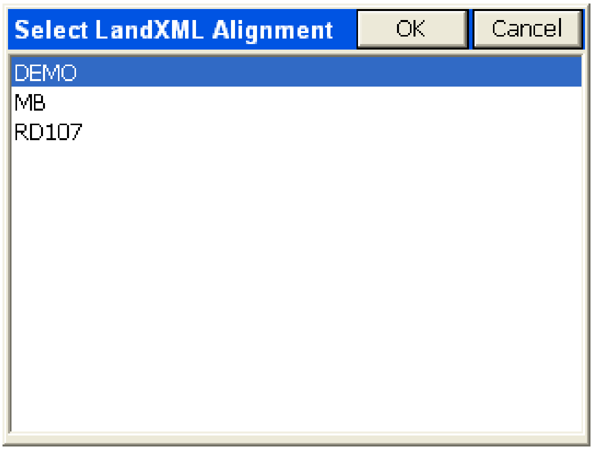


Figure 6-117

Input-Edit Section File

This routine is a convenient cross section editor. It can be used for entering new sets of cross sections or simply for editing and reviewing an existing set of cross sections. One nice application is for Slope Staking. If you know the left and right "pivot points" on stations to be slope staked, you can enter very simple, 2-point cross sections consisting of the left pivot offset and elevation and the right pivot offset and elevation. Then, without taking a "cheat sheet" into the field, you can slope stake by cross section method, and the program will seek these pivot point, and even interpolate the correct pivot points between entered cross sections. A better approach would be to include all break points in the sections from pivot left to pivot right, along with descriptions. Then Slope Staking would report the progressive information to grade each point from the catch all the way into centerline. This "section-based slope staking" is a cross between user-defined (where you need the "cheat sheet"!) and design files, where the pivot offsets and elevations are taken from the pivot points in the template as they react with the profile and superelevation files. Sections used in Template Stakeout should be complete cross section files, with all offsets, to enable precise, interpolated stakeout within the left-to-right range of the sections, on station, or at interpolated stations.

The Input-Edit Section File routine begins by prompting for a cross section file name. If you wish to start a new cross section file, just enter a new name, as shown below in Figure 6-118

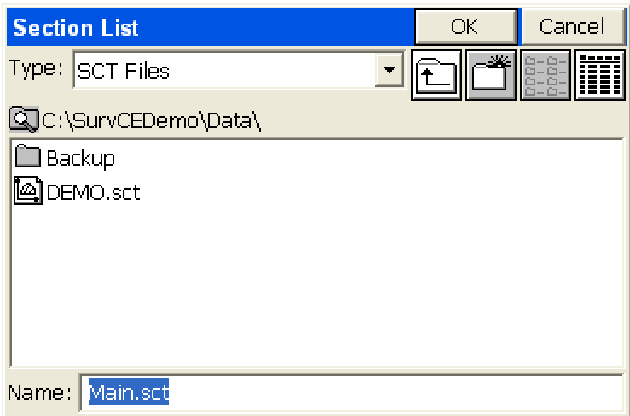


Figure 6-118

If you choose to select an existing cross section file such as DEMO.sct, after selecting the file, you will see the "Section List" dialog, as shown in Figure 6-119

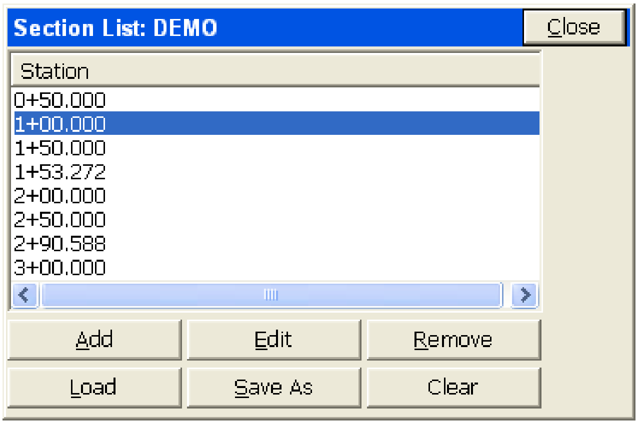


Figure 6-119

From this dialog, you can Add stations, Edit existing stations, Remove stations, Load entire new cross section files, Save As (to save your changes to the current loaded file or to a new cross section file) and lastly, you can Clear the list of stations (not recommended unless you want to start from scratch). Let's select Edit and review the highlighted station 1+00.

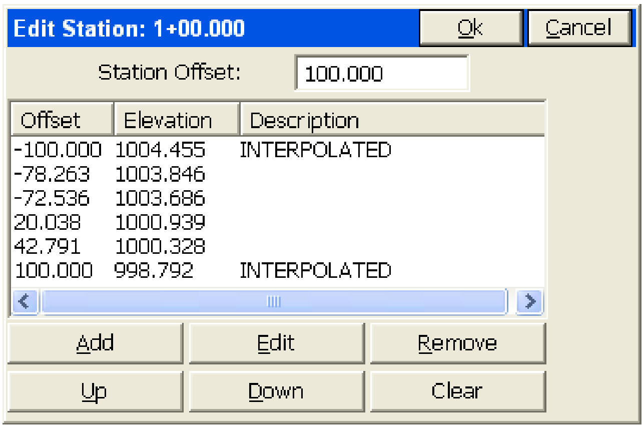


Figure 6-120

In this dialog, you can add offsets and elevations, edit existing offsets and elevations, remove them, move them up and down for sorting, and clear the list. Note also that cross section offsets are negative for left of centerline and positive for right of centerline, and can have descriptions such as SH, EOP, CL, Ditch, etc. These descriptions, where they exist, are potentially useful for description-based interpolation between stations, as applied in Template Stakeout. If you want to add an offset at -20.038 called EOP, click "Add". You don't have to highlight the correct offset to add above—it will sort out and place the new entry appropriately. Fill out the dialog as shown in Figure 6-121

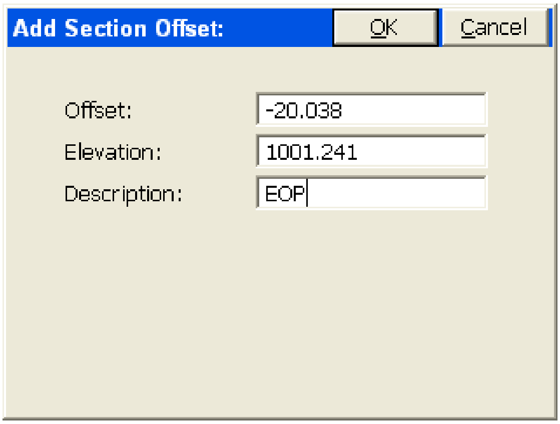


Figure 6-121

When you click OK, it will be in the list, as seen here in Figure 6-122

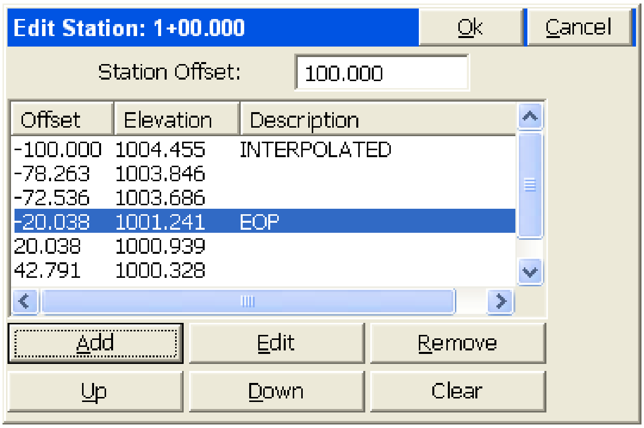


Figure 6-122

The Edit box leads to the same entry dialog as Add. Remove will provide a warning and then delete the highlighted offset and elevation. Up and Down should not be used unless a file conversion led to out-of-order listing of offsets and elevations. When you click OK from the station edit dialog, you can save the revised cross section file back in the section list dialog.

Input-Edit Superelevation

Roads can contain 1 or more curves, and each curve can have its own superelevation data: start station for super transition, station for full super, percent of full super, station for end full super and station for ending the super transition back to normal crown. In FAST Survey, each superelevation data set for each curve would be entered as a "line" of superelevation data in the ".sup" file. Shown below is the dialog for entering superelevation.

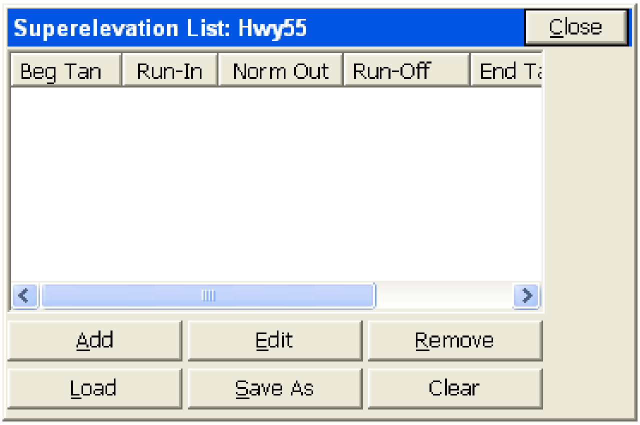


Figure 6-123

If we had 2 curves, both with superelevation, then we would do 2 "Adds" off this dialog. Let's say, for simplicity we have a road with a 2% "normal crown" which has 1 curve to the left followed by 1 curve to the right, with the following information:

	Curve 1	Curve 2
Start Super Pivot	Sta: 100	Sta: 2200
Full Super	Sta: 600	Sta: 2500
Full Super %:	3% Left	4% Right
End Super:	Sta: 1400	Sta: 3500
End Super Pivot:	Sta: 1900	Sta: 3800

The first curve to the left goes through 3 stages as it pivots into full super: (1) the right side pivots to "flat", (2) the right side pivots to "reverse crown", where the slope is the same across the template and (3) where both the right and left side pivot from the hinge point (centerline) into full super. All these key pivot points are entered in the superelevation dialog. This is represented graphically below.

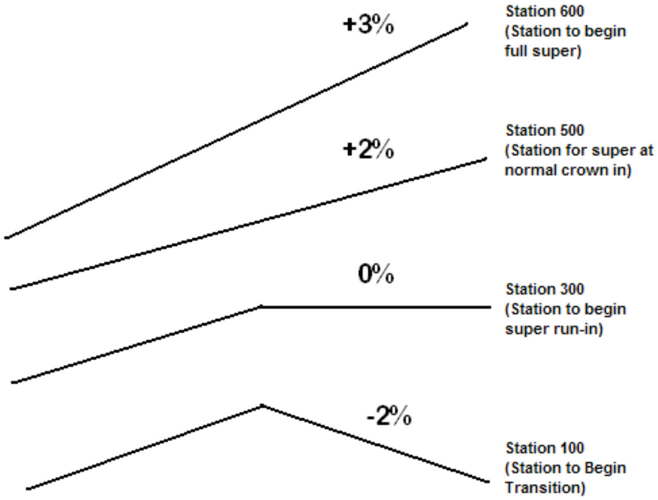


Figure 6-124

You enter all these key stations (begin, flat outside lane, reverse crown, full super) both going up to full super and transitioning back down to normal crown. Recognizing that the normal crown of -2% transitions from station 100 through a slope of 5%, the transition is 1% per 100 feet, assuming an even rate of transition. Therefore, a "flat" outside slope occurs at station 300, reverse crown at station 500 and full super at station 600, as shown. You will need to compute these stations in advance. These intermediate stations are entered in the superelevation dialog to allow for different rates of transition from normal crown to flat to reverse crown to full super. Normally, the rates of transition are consistent. Note that super left or right is always entered as a positive percent slope—the road centerline curve direction will control the direction of pivot. You are now ready to click add and enter in Curve 1, as seen below.

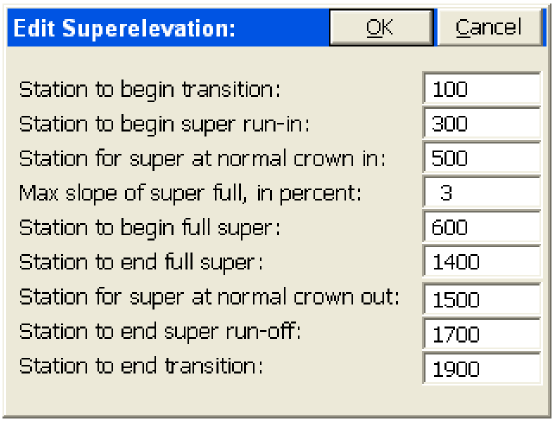


Figure 6-125

When we click OK, the first line of the superelevation dialog is filled in. Curve 1 is complete. Next we enter Curve 2 as follows, using similar logic as shown below.

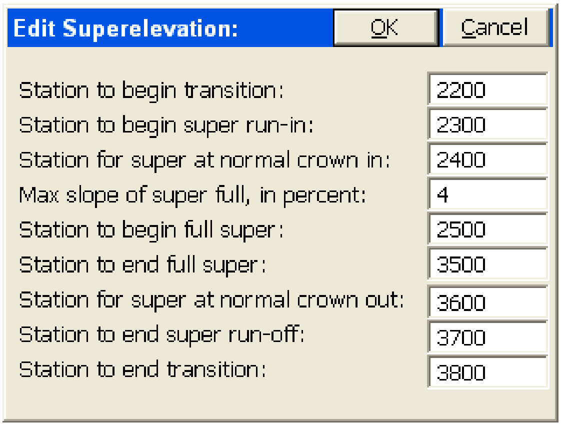


Figure 6-126

When OK is clicked, this leads to the completed 2 curves, and the summary dialog shown below (1 line per curve).

Note: If any of the columns are too narrow to display all the text, you can "grip" the vertical line separating columns, much like in programs such as Excel, and make the column wider.

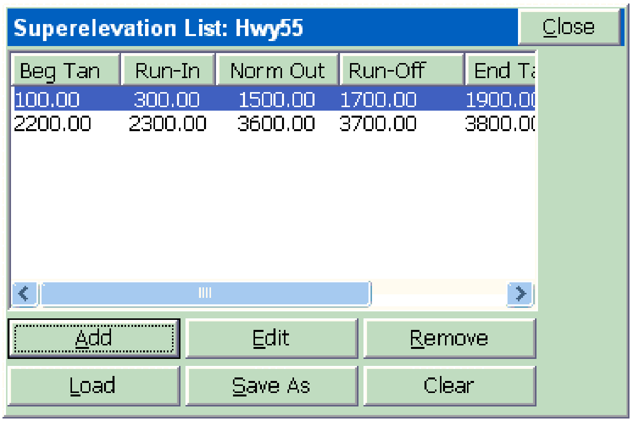


Figure 6-127

The superelevation file is one of the optional "roading" or "design" files in Slope Staking, Template Stakeout and Elevation Difference. After a superelevation file has been entered and saved, it will appear as the default superelevation file in both these commands, unless removed from the design file list by the user.

Input-Edit Template Series

FAST Survey allows for 2 types of transitioning: (1) A single template can transition by being "acted upon" by template transition files (made in Carlson Roads, Topsite, Leica Site Manager or SurvCADD) and superelevation files or (2) A template series file can transition between several templates sharing identical IDs but having different slopes and widths between ID points within the templates. The Template Series approach can even be used to transition from normal crown to superelevation, avoiding the need to use superelevation files. The Template Series approach is commonly used to expand the width of a lane to accommodate, for example, a passing lane. Since template ID's must match, if a "special slope" lane "appears" for a certain station range, then the Template Series approach can still be used as long as you add the extra ID point (e.g. EP2) to the normal template, perhaps making that point 0.001 units in dimension initially. In the second, transitional template, the EP2 lane can have the full width of 3.5 meters or 12 feet or whatever applies. If the transition starts at station 500 and ends at station 600, EP2, will be 1.75 meters or 6 feet or exactly half the full dimension at station 550.

Starting with the demo.tpl file, with a 10' lane to ID "EP" followed by a 6' shoulder lane to ID "SH", you can make another template called Road.tpl, with a 12' lane to "EP" and an 8' shoulder to "SH". This second template is shown below as seen in Input-Edit Template. Note how we have made sure to use the same ID for the road lane ("EP") and the shoulder lane ("SH").

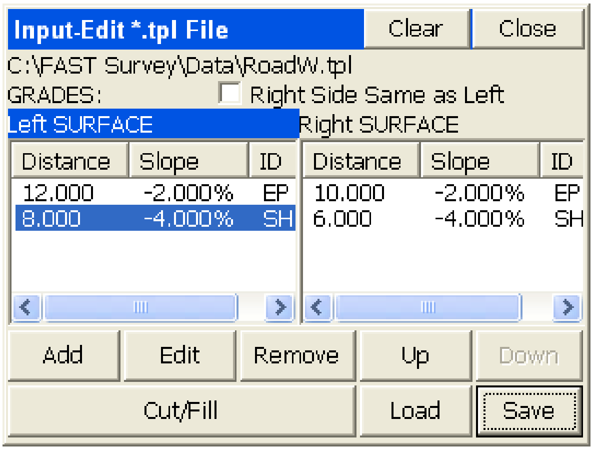


Figure 6-128

If the demo.tpl is used from station 0 to 500, and the RoadW.tpl is used from 600 to the end of the project at station 1000, then the entry process for a Template Series is as follows:

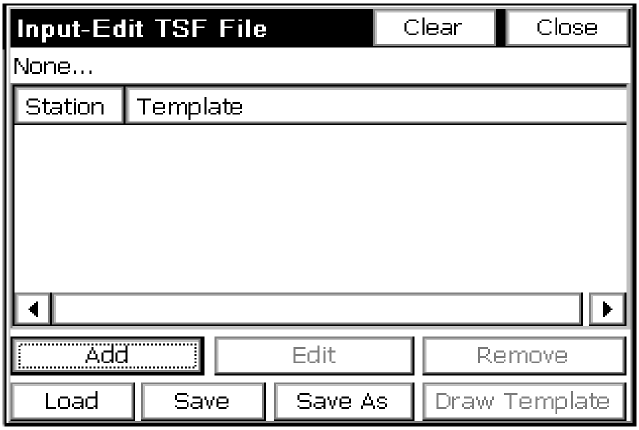


Figure 6-129

Click Add. You obtain the next dialog:

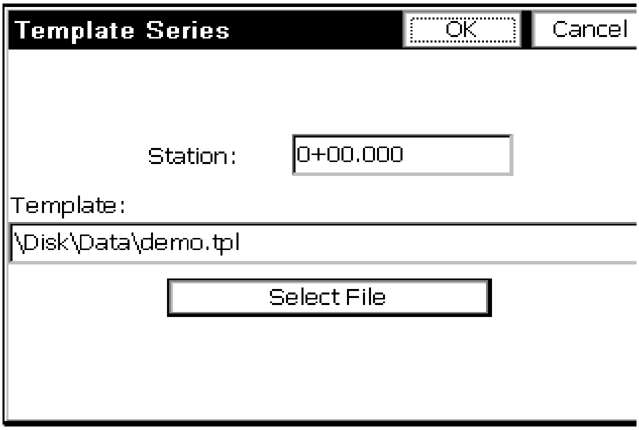


Figure 6-130

Choose Select File and pick the first template (demo.tpl). Click OK. Back in the main dialog, click Add again and specify the ending station for demo.tpl as station 500. Then click Add again and specify the first station for RoadW.tpl as station 600. You do not need to specify an end station, as RoadW.tpl will be used for the remainder of the project. The final summary dialog is shown below:

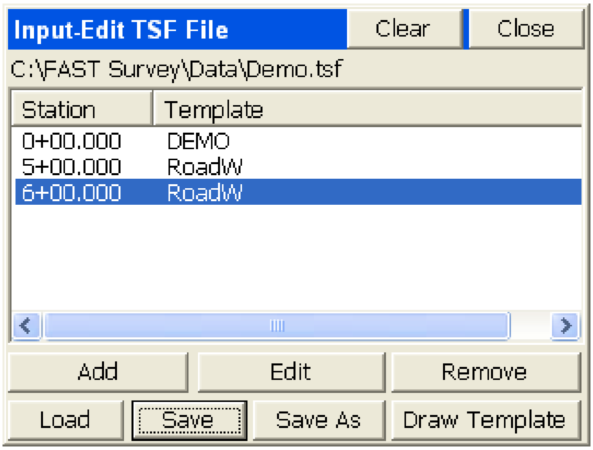


Figure 6-131

You then Save the Template Series File. When running Template Stakeout or Slope Staking and recalling a template file, you now have the option to recall a Template Series File and process a set of transitioning templates, as shown in Figure 6-132:

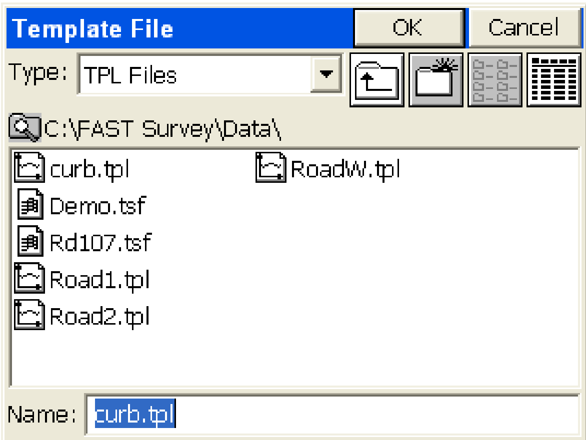


Figure 6-132

Template Stakeout

Function

Template Stakeout is one of 4 major commands used in highway work. This command is designed to stakeout specific stations and offsets along a centerline. For example, if your goal is to stakeout the break points at station 87+80 on a given road centerline, you would use Template Stakeout. Template Stakeout, therefore, is used primarily to lay out road surfaces for construction. Template Stakeout is typically used to set cut and fill stakes or "blue tops" at specific stations and offsets. The elevation used to determine the cut or fill at each offset is derived from either design files (the template interacting with the profile and centerline) or from cross sections. At any specific station, you will be guided to the desired offset and will get a cut or fill. By contrast, if the goal were to simply set random cut and fill stakes along an alignment, at no particular station or offset, then the command Elevation Difference would be used. If the goal is to stake out the "catch" in cut and fill, where cut slopes and fill slopes meet existing ground, then Slope Staking would be used. The fourth, major highway-oriented feature is Cross Section Survey, which is used to gather "as-built" information on a road. In this command, you take cross sections of data points along the road, at random or specific stations. In summary, Slope Staking starts the cut and fill work, Template Staking directs the precise roadbed work and fine grading, Elevation Difference acts as a quick grade check, and Cross Section Survey produces the final confirmation of the as-built road for payment and certification.

Defining a Road: Design Files versus Cross Sections

Most highways are defined by a typical template that strings along a centerline and rides vertically along a profile, all the while responding to lane width changes and tilting into superelevation through curves. All files that impact the road are called design files. In FAST Survey, design files include the "basic 3": template, centerline and profile and an "optional 2": superelevation and variable width files. Even though roads are defined by design files, often so much subtle transitioning is occurring, with special profiles for central medians, roadside ditches and all manner of pavement edges and shoulders, that it can become a monumental task to define the road by design files. In fact, design files may fail to describe all conditions at every station. Because of this, most stakeout is based on the cross sections, which constitute the "record" plans. Most contractors will build to the cross sections. In Template Stakeout, you can stake by design files or by cross sections. Design files are recommended for subdivision streets, access roads and simpler highway designs. For complex designs, with non-conforming intersections, transition lanes, special ditches, etc., it is recommended to use cross section data if available. Cross sections can be made in SurvCADD or converted from Caice or LandXML formats.

FAST Survey is provided with sample files of the "basic 3" design files in the form of demo.tpl, demo.cl and demo.pro. They are shown graphically below in Figure 6-133.

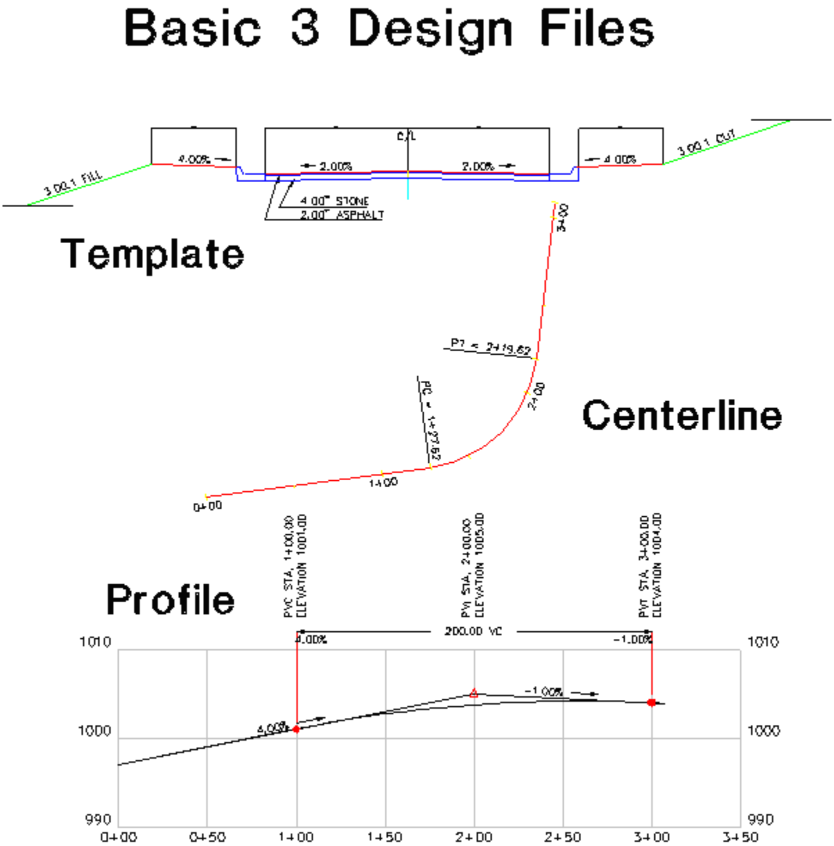


Figure 6-133

Centerlines and Profiles can be converted from many types of source files using Road Utilities in FAST Survey. Centerline source files that can be converted include LandXML, Leica GSI, SDR, TDS, Terramodel/Geodimeter, LDD/ASCII, Inroads/ASCII and Geopak. For Profiles, FAST Survey converts LandXML, Leica GSI, SDR, TDS, Terramodel/Geodimeter, LDD/ASCII and Caice. Currently, FAST Survey uses only templates made in SurvCADD or entered directly within FAST Survey using the command Input/Edit Template. Every point on a template has an "ID" such as "EP" and "SH" or "CB1". Templates made in FAST Survey have only one surface—the surface you are staking. To stake out subgrades, you would enter the surface grade information, then use a vertical offset in Template Stakeout. Subgrades that are part of templates entered in SurvCADD are not used for stakeout within FAST Survey, so subgrades would be staked using the vertical offset from the surface grade in this case, too. Alternately, the subgrade surface can be entered directly as a template for stakeout.

There are 2 "optional" design files: superelevation and variable width files. The road template shown in Figure 6-134 might appear as follows in a 6% superelevation.

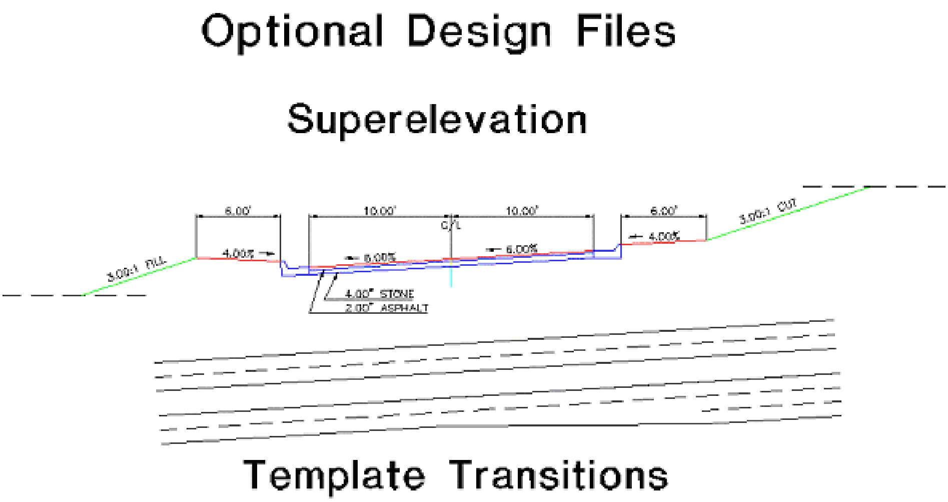


Figure 6-134

Superelevation files can be entered in SurvCADD or in FAST Survey itself. The superelevation file specifies at what station the road begins to tilt into superelevation, when the pivoting side is flat, when it reaches "reverse crown" and finally, at what station it achieves full superelevation. Then it asks for the station where full superelevation ends and the transition stations back down to normal crown. The superelevation will apply from the left pivot of the template to the right pivot of the template (outside shoulder to outside shoulder in the example above) if defined in FAST Survey. If the template is defined in SurvCADD, there are additional options to specify which template ID points "follow" superelevation and which do not. Some users prefer to enter a normal template and a superelevated template as an alternative to entering a superelevation file. Using the Template Series option in Road Utilities, a station is entered for the "end" of template 1 (normal crown), another station is entered for the end of template 2 (full superelevation), and the template will transition in between, automatically. In this way, the normal crown road portion and the "full super" road portion can be staked without use of a superelevation file.

Template Transition files can only be defined in SurvCADD, Carlson Roads, TopSite or Leice Site Manager at present. These files will allow a pavement lane, shoulder or ditch bottom to widen or contract from one station to another. FAST Survey currently does not convert template transition or superelevation files from other formats. FAST Survey uses Template Transition files that act on a template and cause it to transition. Using Template Series files, FAST Survey also enables the approach of entering multiple templates and conducting straight-line transitioning between these templates.

In the same way that design files "define" a road, section files also fully define a road. One set of sections might define the subgrade surface and another set of sections might define the final grade surface. Sections are made up of simple offsets and elevations that can have descriptions such as "EOP", "DL" or "SH". Here are 2 sets of cross sections that define all road surface points at or in-between these stations shown in Figure 6-135.

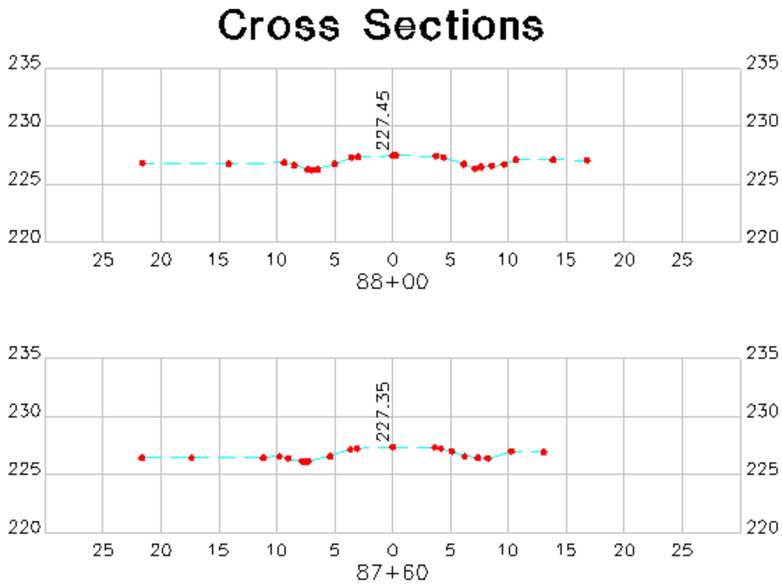


Figure 6-135

One of the challenges of cross sections is to control how intermediate stations are interpolated. In these metric stations, an offset such as 5.14 right might be a pivot point at station 87+60, but that same pivot might be at 4.4 right on station 88+00. So how should offset 5 right be interpolated at 87+80? Lacking descriptions on the offsets, the program can only straight-line interpolate. This is what is done now. However, if descriptions are provided, "intelligent" interpolation is possible between similar descriptions on slope transitioning or widening lanes. Although FAST Survey 1.21 conducts straight-line interpolation at fixed offsets, the goal will be to permit "intelligent" interpolation in future releases, provided the offsets have a consistent and discernible "pattern" of descriptions.

Template Stakeout Procedure

When Template Stakeout is entered and a total station is the configured instrument, the standard backsight "Confirm Orientation" screen appears. Otherwise, if GPS is configured, and after the Confirm Orientation is addressed, the program continues on to the "Definition Method" screen, which appears as shown in Figure 6-136.

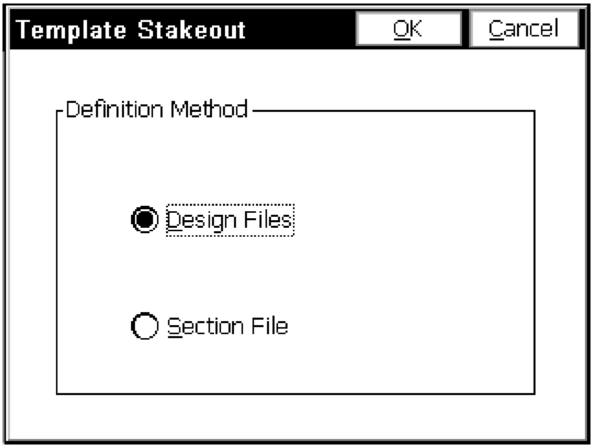


Figure 6-136

Template Stakeout by Design Files

If Design Files is selected, the "basic 3" and "optional 2" files can be chosen in Figure 6-137.

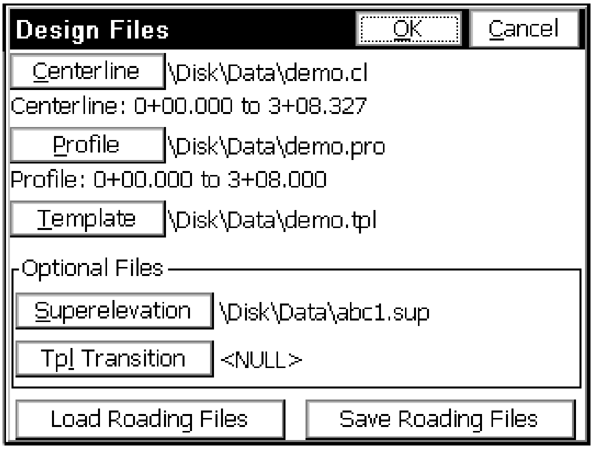


Figure 6-137

Note that the station ranges of the centerline and profile are presented for verification. The start and end stations of the centerline and profile do not need to be the same. As long as there are stations in common, any profile and centerline file can be used for Template Stakeout. The Template can be a ".tpl" file or a template series ".tsf" file. If you wish to "clear" a file such as a superelevation file, just click it and choose Cancel. The **Save Roading Files** option will save sets of roading files, which can be recalled later using **Load Roading Files**.

The next screen (Figure 6-138) is the heart of the program. Here is where you select the station and offset to stake out. You can even launch into a slope stake and then return to stake out other template points.

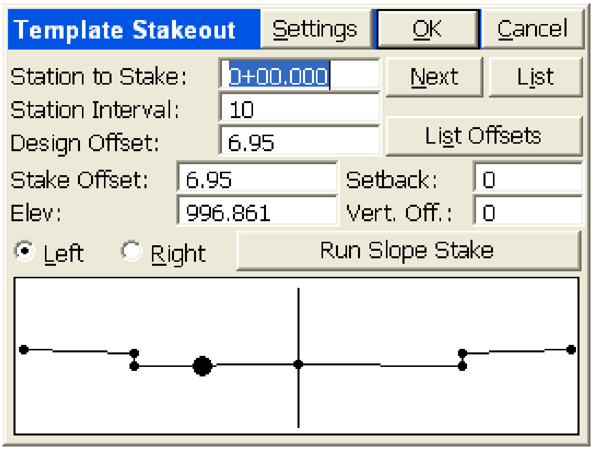


Figure 6-138

Choosing the Station to Stake: You can enter any station to stake out. However, when using Design Files, if you enter a station that is either before or after that centerline or profile, you will obtain this warning screen, as shown in Figure 6-139.

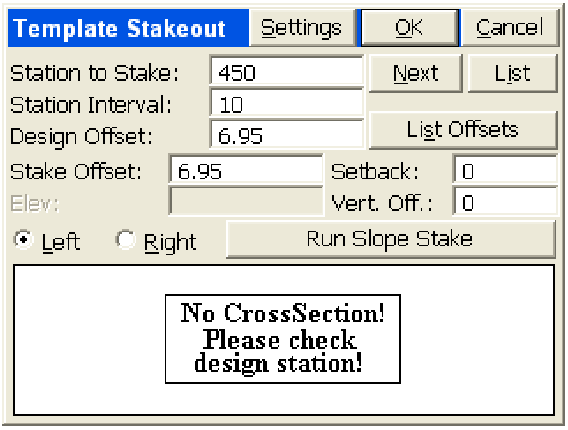


Figure 6-139

When choosing a Station to Stake, you can select from the List, or press Next and the program will increment the current station by the station interval. The "List" option will show all stations in a list, at the given interval. In addition, it will show any "special" stations identified in the "Settings" option at the top of the screen. For example, in "Settings", you can select to show PC and PT stations in the List.

The "Settings" Option: Clicking "Settings" brings up the following dialog as shown in Figure 6-140.

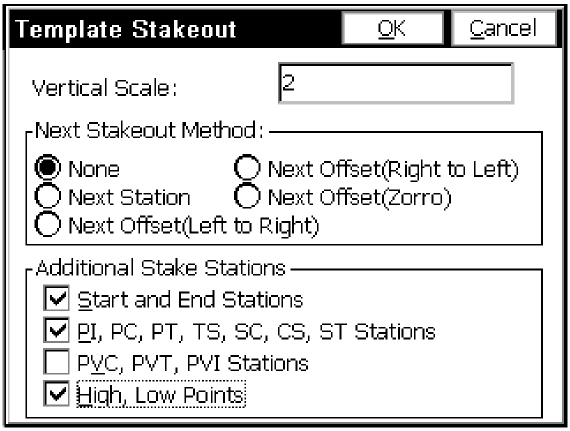


Figure 6-140

The "Additional Stake Stations" that appear in the List are set in the lower portion of the dialog. Here, in Figure 6-141, we've called for the PC and PT of the curves, as well as high and low points on the profile. The Vertical Scale option will allow for "exaggeration" of the vertical on the template graphic. Though defaulting to 1, we can double the exaggeration by setting this to 2. In fact, an exaggeration of 5 works fine for the "demo.tpl" template file. The "Next Station Method" governs how "N" for next, from the stakeout graphic screen, moves you up. When set to "None", N for Next will stay put until you change your entries. But if set to "Next Offset (Left to Right)", Next will stay on the current station and move to the next offset. The "Next" in the dialog below, however, always increments the current station by the next station in the List. Don't confuse the Next button on this screen, with the N button on the graphic screen to follow, which is influenced by "Settings", and moves you along after you complete each point stakeout.

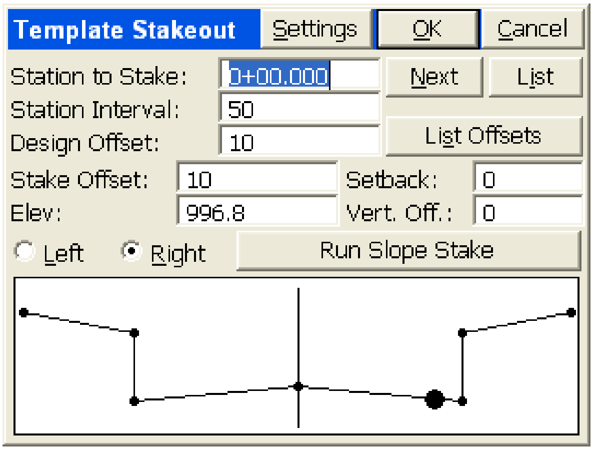


Figure 6-141

With the above settings, and a specified interval of 50, "List" in the upper right will list the stations and include PC, PT and high/low points, as shown in Figure 6-142.

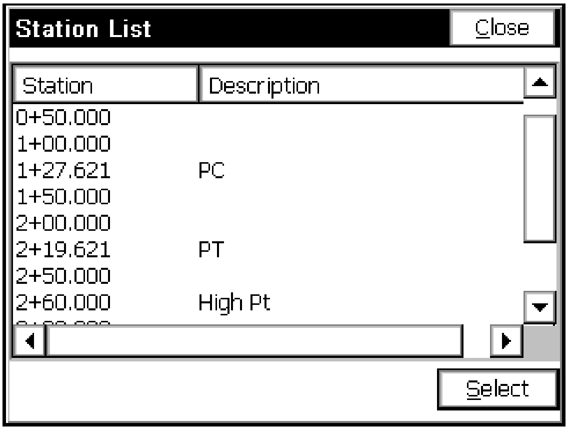


Figure 6-142

S Selecting an Offset to Stake: Any offset can be entered, even if it is not a “break point” on the template. For example, an offset of Left 5 (-5) or Right 7.23 could be entered. For any design offset, the elevation is calculated and presented. Offsets can also be chosen from a list of break points on the template. The offset List button presents all break points in the Template, left-to-right. If the entered offset matches a break point, it would be highlighted in the Offset List.

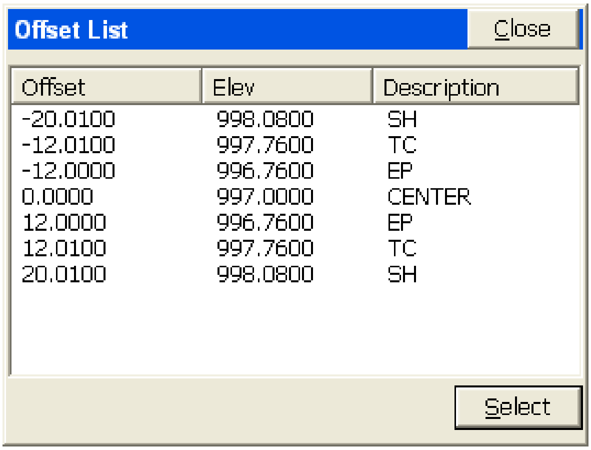


Figure 6-143

Another way to select an offset is to literally pick it on the screen. The touchscreen is active in the graphic, so you can select the -12 (EP) just by picking it. Picking on the graphic screen will take you to the "Offset List" screen for verification, where you can confirm your pick by pressing Enter or selecting another offset.

Stake Offset/Setback: When staking items such as back of curb (offset -12.01, TC above), one method is to place the stake itself at a setback or offset from the design offset. If you entered a setback of 2, then the stake would go in at offset 14.01 left, but the cut/fill would refer to the design elevation at -12.01 left (in the case above, that elevation is 1002.269). The setback and stake offset inter-react. A stake offset entry of 15 with a design offset of 12 left calculates to a setback of 3.

Run Slope Stake: This feature allows for dynamic slope staking in the middle of the Template Stakeout routine. This option is very useful for road staging, and also for staking interior catch points like central median ditches. When the slope stake is completed, the program returns to the main Template Stakeout dialog. Consider the template as shown in Figure 6-144.

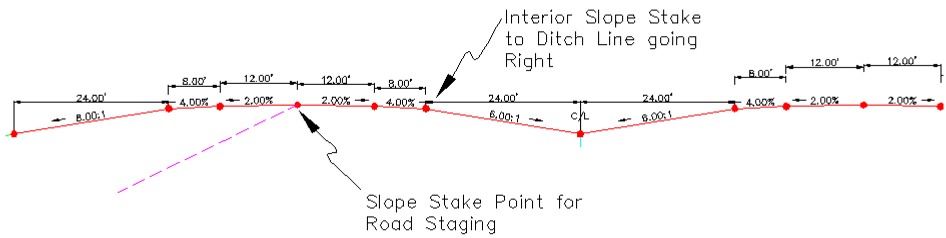


Figure 6-144

In this case, the standard interior ditch slope of 6:1 may "catch" existing ground and it may be desired to do a temporary slope stake, particularly if the right lane is to be constructed later. As another example of road staging, the goal may be to build only the inside 8' shoulder and 12' lane of the left side in Stage 1, requiring a temporary slope stake coming from the pivot point shown on the left arrow. The Run Slope Stake option allows for standard slope staking in the middle of the Template Stakeout command. You are asked to specify the desired cut and fill slope ratio, as shown in Figure 6-145.

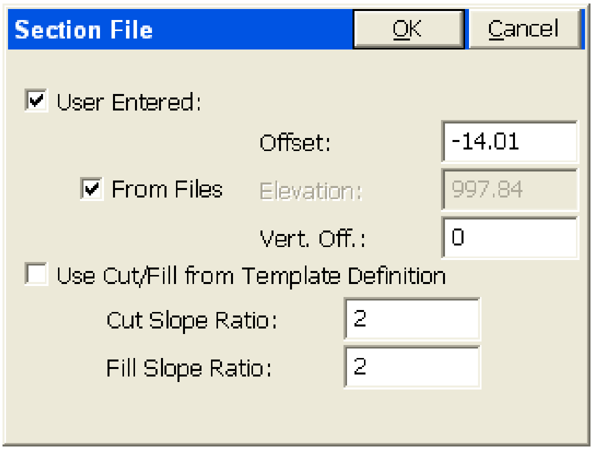


Figure 6-145

The default values for the slope come from the template, but can be overridden by clicking of "Use Cut/Fill from Template Definition". You can even override the actual offset and elevation used to pivot from, with the default being the current selected offset. Clicking off "From Files" allows you to change the pivot elevation, and since you may be pivoting from subgrade, not surface grade, you can enter a vertical offset. After entering the desired cut and fill slopes, the standard slope stake procedure activates, and after the slope stake and optional offset stakes are set, you are returned to the main Template Stakeout input screen, ready for both more slope staking or more template offset staking.

Locating the Template Point by Total Station: After selecting the station and offset to stake, you will be guided to the point by standard stakeout prompting, including the angle right and distance to go, as shown in Figure 6-146.

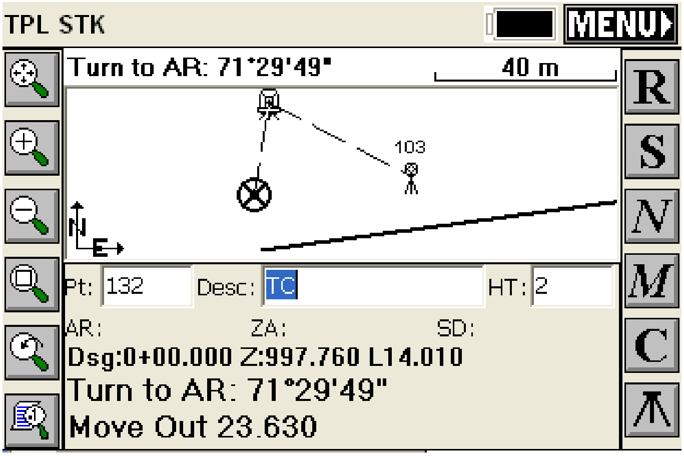


Figure 6-146

When this screen first appears, before the first shot, the station and offset of the targeted point will be displayed. After the first shot, the station and offset of the previous shot is displayed here. Immediately after each new shot is taken, the display includes the In/Out and Up/Down station information, allowing the rodman to move to the correct point in reference to the centerline itself, as shown in Figure 6-147.

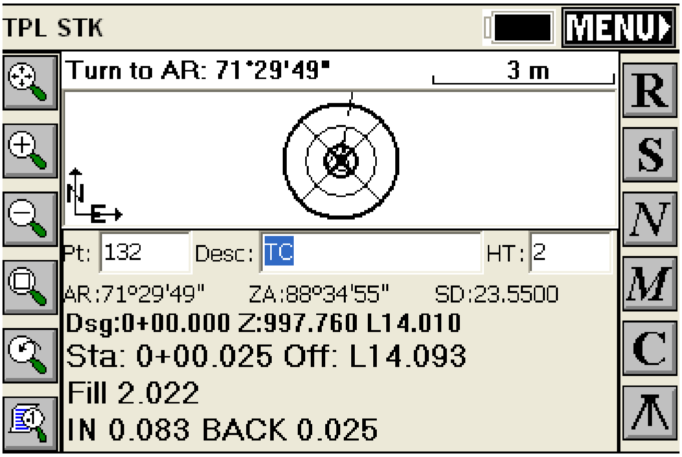
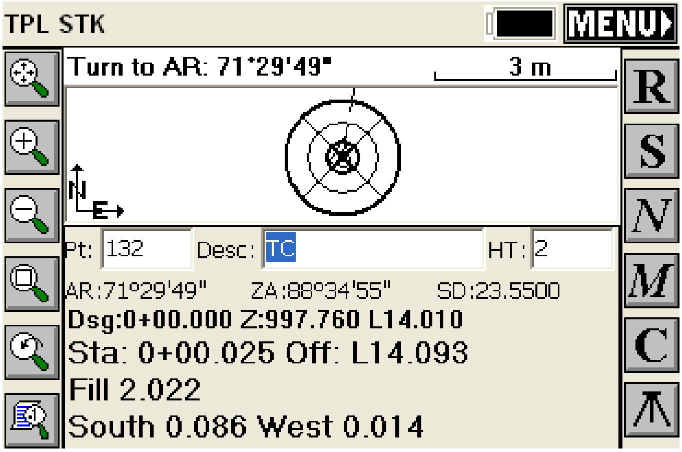


Figure 6-147

Note that the C button for Configuration is available on the stakeout screen, and if you click C and choose the Reference Tab, you would see that the In-Out with Alignment option has been selected. If you click this off, and select the North-South, East-West form, you obtain the following result:



Locating the Template Point by GPS: When staking by GPS, the standard GPS stakeout screen guides the user to the desired template point. Note that when a template break point is selected using design files, the template ID appears as the default description in case a new point is stored during the stakeout process.

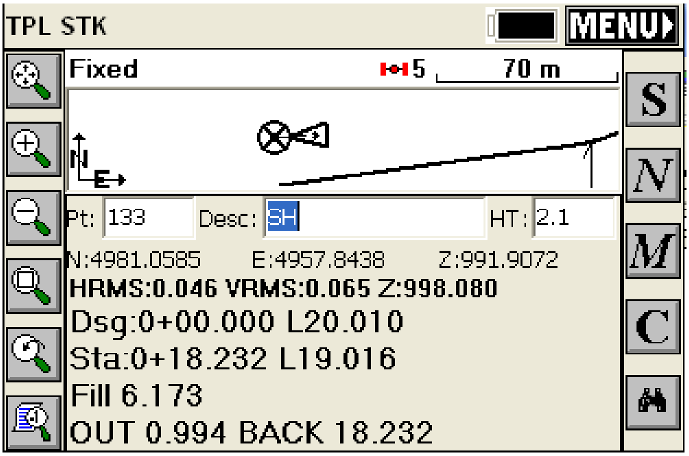


Figure 6-148

When the actual point is staked, you have the option to store the point and to calculate additional vertical offsets, as shown in the standard Stakeout Report in Figure 6-149.

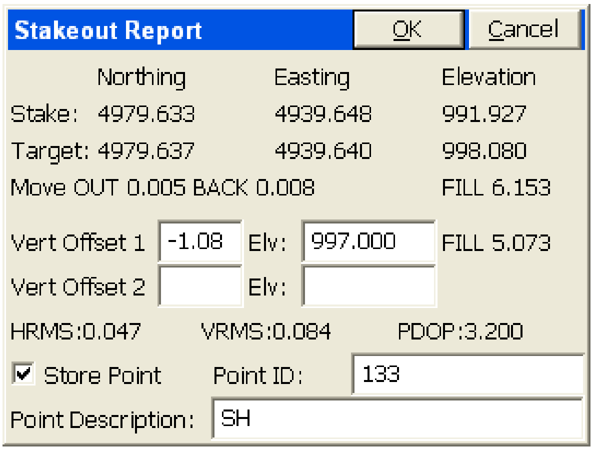


Figure 6-149

Touching OK here returns to the main Template Stakeout screen, where you can try another station or offset. Under Job Settings, Stakeout Tab, if you select "Set Cl Cutsheet Format", and within that option, specify a cutsheet file name and turn on "Store CL Cutsheet

File", then Template Stakeout will store to that file, as shown in Figure 6-150.

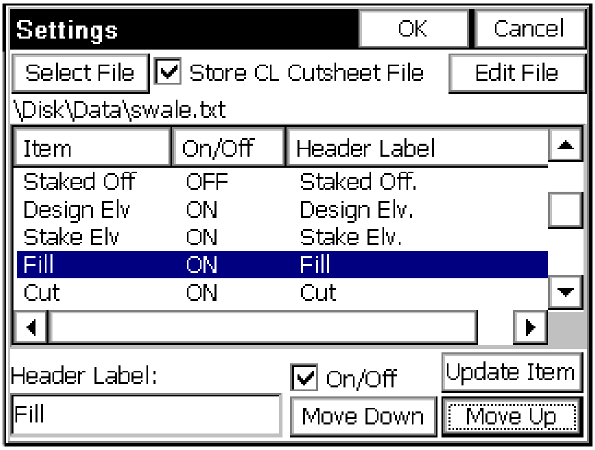


Figure 6-150

In this dialog, you can select the order of items that are reported, and turn on and off what items are reported such as those shown or other items in the list such as Design Station and Design Offset. With the "Store CL Cutsheet File" turned on, a series of template stakeout points at "EP", offset 5 Left and "Center" might present as shown in Figure 6-151 (using Edit File as shown in Figure 6-150):

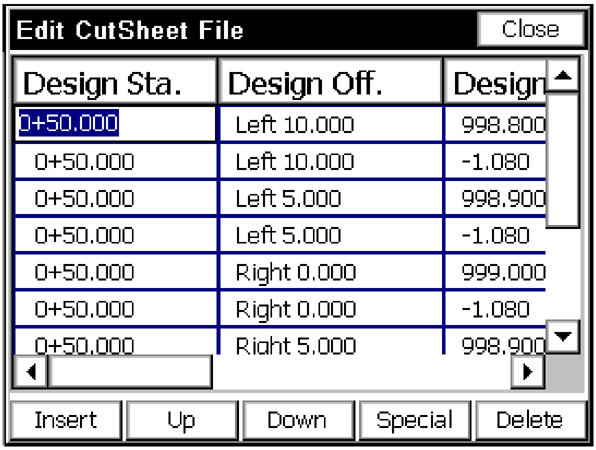


Figure 6-151

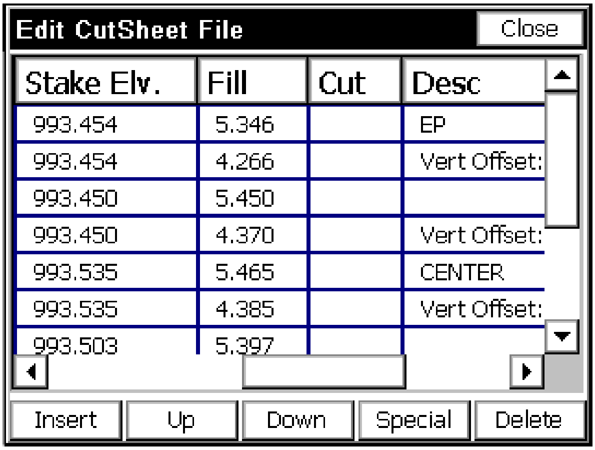


Figure 6-152

Template Stakeout by Cross Sections

As stated, since cross sections often represent the "record" plans, and must be conformed to, when cross sections are available, they are often the preferred method of template stakeout. After all, the cross sections represent the template at each defined cross section station. Every cross section is a "snapshot" of the template at a given station. When choosing the cross section method, you only have to specify 2 files, the centerline and the cross section file, as shown in Figure 6-153.

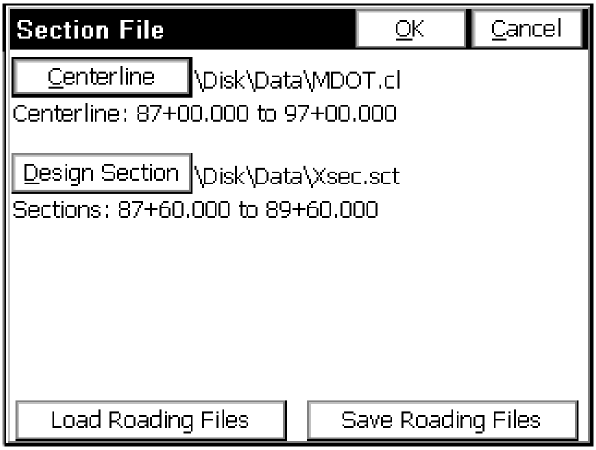


Figure 6-153

FAST Survey uses an “SCT” file format for the sections, which is ASCII and can be reviewed. You can enter the cross sections within FAST Survey under Road Utilities, or you can convert the cross sections from LandXML or Caice file formats. In all other respects, Template Staking by Cross Section is identical to Template Staking by Design Files.

Shown in Figure 6-154 is the Template Stakeout screen using cross sections. As before, offset points can be graphically picked on the screen, selected from the list or hand-entered. Note how much greater complexity can be handled with ease versus using Design Files.

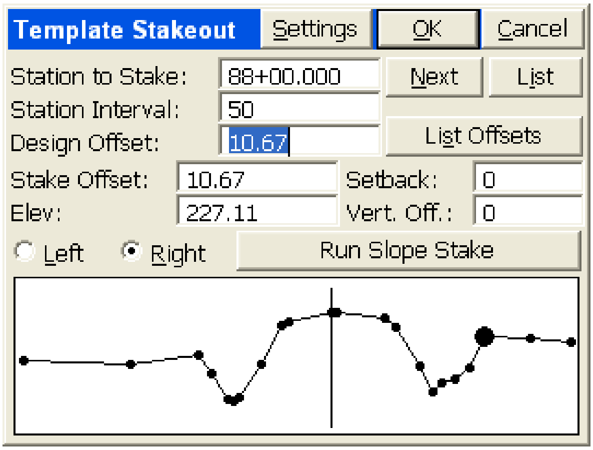


Figure 6-154

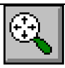
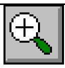
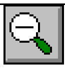
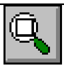
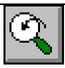
7

Map Screen Commands

This chapter describes the commands in the map screen available in the pulldown menus or at the command prompt. The map screen is useful for drawing, Cogo, creating points for stakeout, and for the import and export of DXF and shape files. No measurements are taken from the map screen.

Map View Icons

Note: The commands associated with these Map View Icons are described in detail below under Command Aliases.

	Zoom extents: Zooms to the extents of the map, showing all points and objects.
	Zoom in: Zooms in 25%.
	Zoom out: Zooms out 25%
	Zoom window: Zooms into a rectangular area that you pick on the map screen.
	Zoom previous: Zooms to the previous view, FAST Survey remembers up to 50 views.
	Opens the View Point Options dialog

Map Screen Pulldown Menus

The Map screen defaults to a pulldown menu format containing approximately 60 additional commands, virtually doubling the number of commands found in the Menu Screens. Many of the commands in Map offer CAD-like features such as layer freeze and thaw, predetermined area, polyline offsets and even contouring. One of the most important commands is Polyline to Points, which allows you to create points for stakeout (set out) from any selected polyline. The Map screen also includes a command line format that can be set using Preferences. Several Map screen pulldown menu commands involve "flyout" options, as shown below:

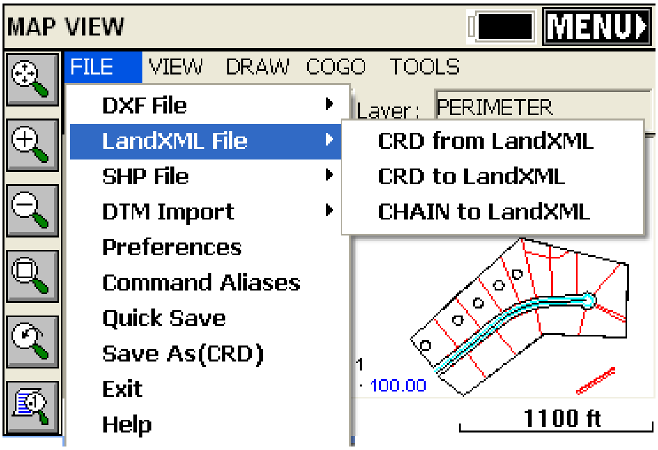


Figure 7-1

Executing commands

Select the command from the pulldown menu options. Alternately, type the command name or command alias at the Command prompt and press ENTER. For example, E for Erase is most easily entered at the command line, while multi-character commands are more easily selected from the pulldown menus.

Select the command from the left-toolbar menu or from the 5 menus across the top.

Each command from left-toolbar menu is a *transparent* command. The zooming commands will execute in the middle of other commands such as drawing a polyline from point to point (Draw-2D Polyline), for example. Pan, described below, is also transparent. Points can be turned off (frozen) or on (thawed) within the middle of another command.

Most commands do not immediately execute, but require user input. In this case, FAST Survey either displays a dialog box or displays prompts at the command line, requesting more information from the user.

Commands typically require selecting objects on the screen, choosing files or entering data on the command line. If you wish to abort or "bail out" of a command before you complete it, use the Esc key. This keeps you in the Map screen. If you use "Menu" to get out, you will go to the 5-item Menu screen and will need to select Map again.

Many commands contain a series of options, structured as follows:

Cmd: Command name-Option1/oPtion2/opTion3/.../<default option>

To select one of the options, the user can enter the entire option name or only the capitalized letters, and then press ENTER. If available, the default option always appears in angle brackets (<>). To select the default option, just press ENTER.

If no command is active, the user can repeat the previous command by pressing ENTER.

Panning the Screen

The user can move the drawing display (PAN) anytime. To use this command the user must hold down and slide a finger or the proper pointing device on the screen. The drawing display is moved in the same direction as the pointing device. When you release the pointing device, the panning stops. Only the display moves—all objects retain their correct coordinates. Be careful to start the pan by picking in "empty" space. If you hold down on a point, you may obtain the "Point Details" screen, or may see a list of points to select from (to see Point Details).

Point Details

Unless you are in the middle of a Map screen command, you can click on a point and see a Point Details dialog. If you tap near several points, a list of nearby points will appear from which you can select the target point. Otherwise, you will go straight to Point Details, and see a screen such as this:

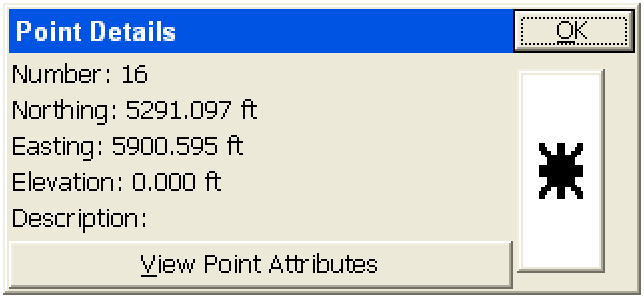


Figure 7-2

If you are in total station mode, and actively surveying (with a setup and backsight specified), clicking on the setup or backsight point will lead to a special graphic, as shown here:

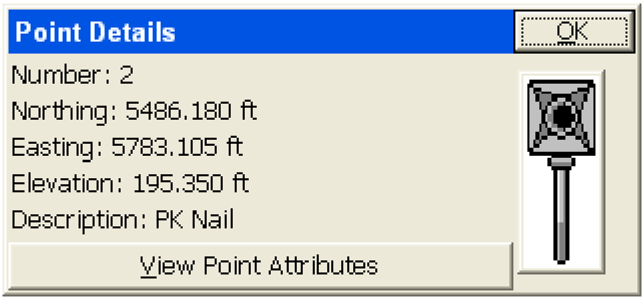


Figure 7-3

If you have assigned attributes to the points (e.g. Description Pole, Type-Metal, Wires-4, etc.) by use of the Feature Code capabilities, these attributes can be reviewed. The Point Details option works both within the Map Screen (when you are not being prompted for entering points or selecting objects) and in all graphic screens within the Menu options. It is not as transparent and available as the dynamic pan option, but nearly so.

File Menu

Import DXF: IDXF = Import Polylines from DXF Files

Similar to the AutoCAD DXFIN command, will bring in polylines from AutoCAD, MicroStation and other CAD formats that can export data into a DXF file format. Points, text and blocks such as symbols are not imported. However, many software packages such as Carlson SurvCADD allow text to be converted into polylines – in which case the text will import for reference. The find file dialog is shown in Figure 7-4

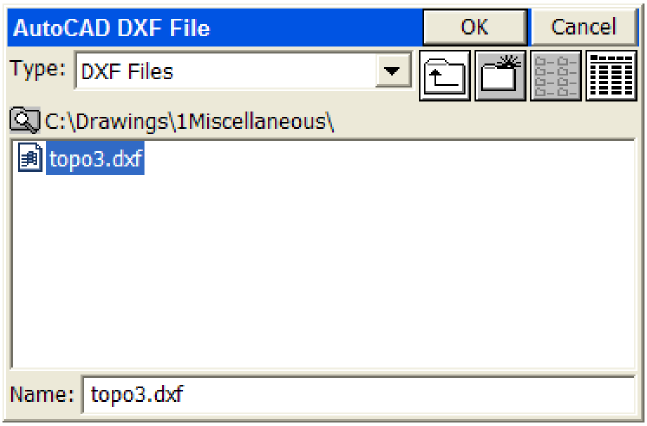


Figure 7-4

Export DXF: EDXF = Export Polylines to DXF Files

The EDXF command, similar to AutoCAD's DXFOUT command, will export a DXF file. It captures not only 2D and 3D polylines and their layer names but also exports all visible (layer on) points from the CRD file into AutoCAD "Point" entitites form (layer PNTS). All points and polylines that are visible (layers on) would be exported, not based on the current screen zoom, but based on the full extents of the drawing. The find file dialog is shown in Figure 7-4.

CRD from Land XML: XML2CRD = Import Points from LandXML to CRD

This command allows you to import points from LandXML format to FAST Survey. The file selection screen is shown in Figure 7-5.

CRD to Land XML: CRD2XML = Export Points from CRD to LandXML

This command allows you to export points from FAST Survey to LandXML format. The file selection screen is to that shown in Figure 7-5.

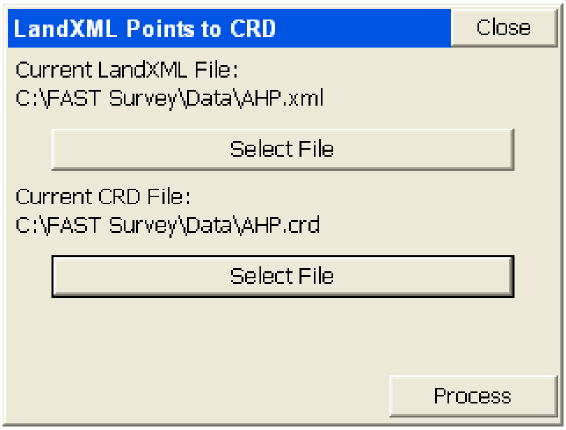


Figure 7-5

Export Chain File to LandXML: CHAINXML=Export Polylines to LandXML

This command allows you to export all the polylines from the current drawing created using Feature Codes, as LandXML chain objects into a LandXML file. For example, if you made strictly 3D polylines for break lines using descriptions such as EP for edge-of-pavement or DL for ditch line, then the 3D polylines can be exported as a LandXML chain file and used as break lines for contouring in other CAD programs. The combination of points and break lines can lead to optimal contouring. Most CAD packages will import linework using the DXF file approach, but many now recognize linework in LandXML "Chain" file format.

Import Shape File: ISHP = Import SHP (e.g. from ESRI)

This command allows you to import entities and also the associated attributes values from a SHP file. The routine displays "Import from SHP" dialog box. If the SHP file has POINT or POINTZ type, the entities will be stored into a CRD file. In the cases of an ARC, ARCZ, POLYGON or POLYGONZ SHP type, the entities will be stored into the current drawing. The attribute values will be stored into a *.vtt file. The routine requires a feature code name from the user, which will be used to store the name and the type of the attributes from the SHP file.

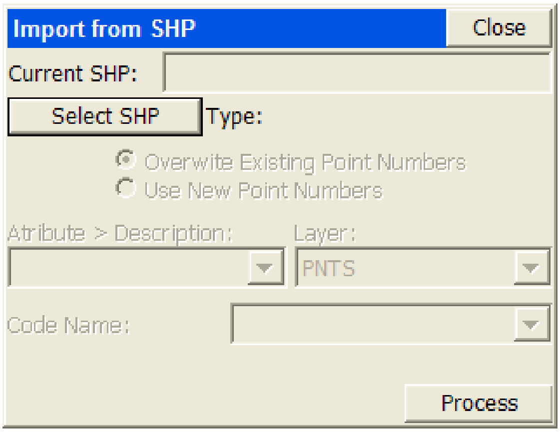


Figure 7-6

Quick Import SHP: QISHP = Quick Import of Entities from an SHP File

This command allows you to import entities from SHP files (used by most programs produced by ESRI). The routine displays the Import from SHP dialog shown below. POINT or POINTZ type entities will be stored in a CRD file. ARC, ARCZ, POLYGON, or POLYGONZ entities will be stored in the current drawing as POLYLINES.

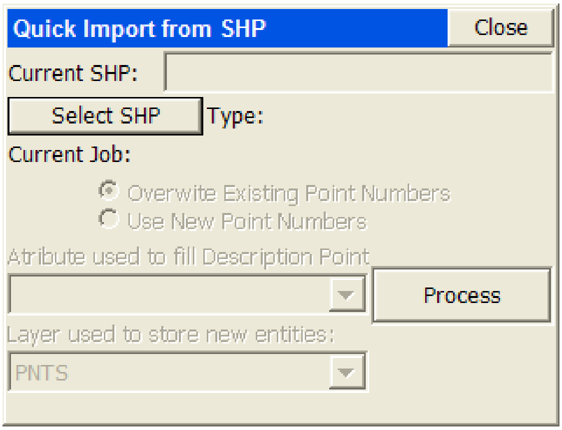


Figure 7-7

- **Current SHP**: Displays the name of the SHP file that will be imported when this command is completed. Read-only, you must use the Select SHP button to specify the file name.
- **Select SHP**: Tap this button to select a SHP file name.
- **Current Job**: Available when importing coordinate data. Specify whether to Overwrite Exiting Point Numbers or Use New Point Numbers.
- **Attribute used to fill Description**: Available when importing coordinate data. Lists the attributes in the currently selected SHP file. Select which attribute to use to fill out the Description field in the CRD file.
- **Layer used to store new entities**: Available when importing geometry. Select the layer to store the new entities.
- **Process**: Tap this button to begin the import process. If you are importing a large file, a progress bar at the bottom of the dialog will indicate the progress of the import.

Export SHP File: ESHP = Export SHP

This command allows you to export entities from the current drawing and also the associated attributes values, into a SHP file (or more accurately, multiple shape files). The routine will allow the user to select which entities will be exported, based on entity type and also based on the feature code name. The routine displays "Export to SHP" dialog box.

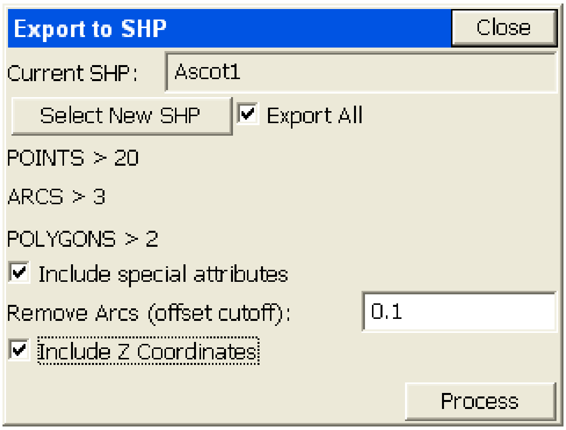


Figure 7-8

Click on Export All and Include special attributes and optionally the Z coordinates. If you have point, arcs (non-closed polylines in ESRI terminology) and polygons (closed poylines), all with one attribute, you will obtain up to 9 files as shown below:

Ascot1_11.dbf

Ascot1_11.shp

Ascot1_11.shx

Ascot1_13.dbf

Ascot1_13.shp

Ascot1_13.shx

Ascot1_15.dbf

Ascot1_15.shp

Ascot1_15.shx

The selection of the Z coordinate places the 1 after the underline character. Otherwise, the file form would be, for example, Ascot1_1.shx (special attributes only). The "1" group represent points, the "3" group represent arcs (unclosed polylines) and the "5" group represent polygons (closed polylines).

Quick Export SHP: QESHP = Quick Export of Polylines and Points to an SHP File

This command allows you to export polylines and/or points to an SHP file. Upon execution of this command, the dialog shown in Figure 7-9 will appear.

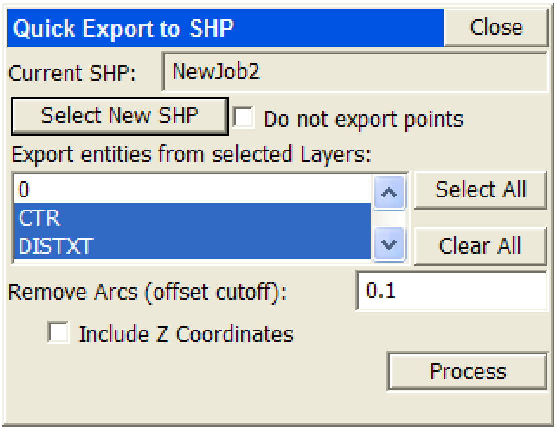


Figure 7-9

- **Current SHP**: Displays the name of the SHP file that will be created when this command is completed. Read-only, you must use the Select new SHP button to specify the file name.
- **Select new SHP**: Tap this button to select a SHP file name.
- **Do not export points**: When this option is checked, only polylines are exported to the SHP file.
- **Export entities from selected Layers**: Lists the layers in the current map. You may select certain layers for export.
- **Select All**: Selects all layers in the list.
- **Clear All**: Clears all selected layers in the list.
- **Remove Arcs (offset cutoff)**: Specifies the maximum distance that a vertex on a polyline segment will deviate from the original arc.
- **Include Z Coordinates**: When this option is checked, elevation data (or Z coordinates) will be included in the SHP file.
- **Process**: Tap this button to begin the export process. If you are exporting a large file, a progress bar at the bottom of the dialog will indicate the progress of the export.

DTM from DXF: TDXF = Import 3DFACE Entities from DXF File

Allows you to import 3DFACE entities from a DXF File and save them as a triangulation (FLT) file and also draw them as 3D faces.

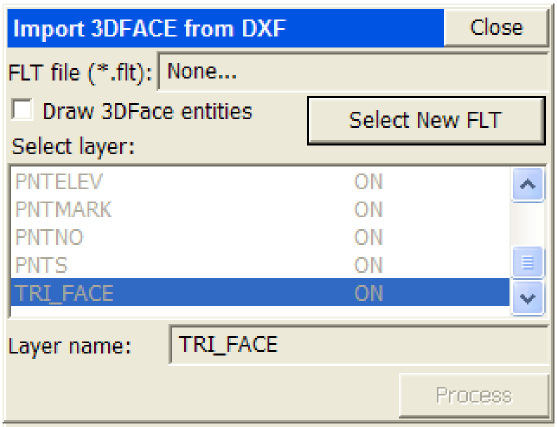


Figure 7-10

DTM from Land XML: TXML = Import 3DFACE Entities from XML File

Allows you to import 3DFACE entities from an XML File and save them as a triangulation (FLT) file and also draw them as 3D faces.

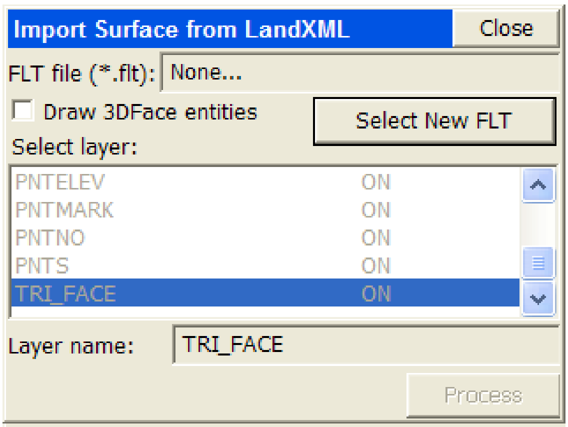


Figure 7-11

The DTM file is stored in FAST Survey as an FLT file and can be used for commands such as Elevation Difference (obtaining cut/fill by comparing field measurements to the DTM). Using either TDXF or TXML, the 3DFaces, if drawn, might appear in FAST Survey as shown below:

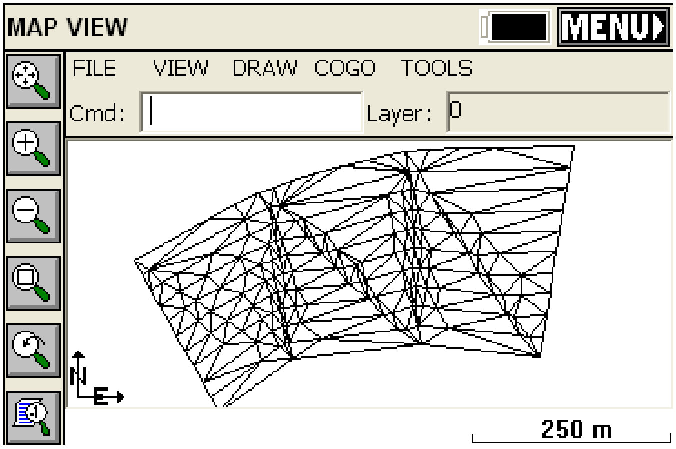


Figure 7-12

The 3DFaces are placed on a layer (TRI_FACE by default), and that layer can be turned off and removed from view. If you choose E for Erase, you can pick the 3DFace entities and erase them on command. There is no particular value to seeing the 3D Faces, so it is not recommended that they be drawn. The main value is to capture the FLT (triangulation) file for use in Elevation Difference.

Preferences: SETT = Settings or Preferences

This allows the user to turn on/off the pull-down MAP menus. The graphic screen style of normal or reverse (solid dark) background is set here.

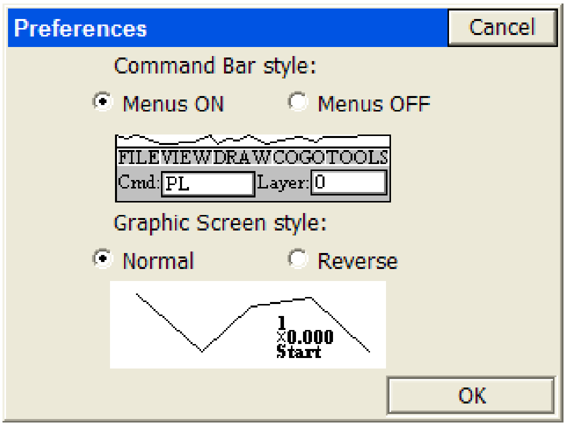


Figure 7-13

AL = Aliases (Command Aliases)

Brings up a list of commands in the Map mode for which the user can substitute an alias. If you would prefer to type A for Area rather than AR, you can substitute "A" as an alias for AR. Figure 7-15 is an alphabetical list of the commands that may be entered in the command line. Each may also be found in the menu.

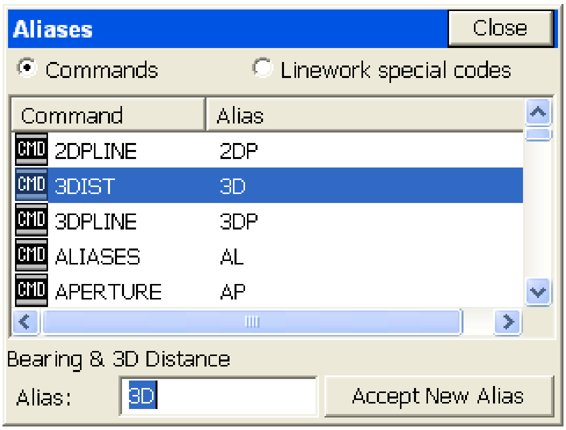


Figure 7-14

	Command name	Alias		Command name	Alias
1	2D Polyline	2DP	22	Export SHP	ESHP
2	3D Polyline	3DP	23	Field to Finish	F2F
3	Aliases	AL	24	Fillet	F
4	Aperture	AP	25	Find Point	FND
5	Area	AR	26	Help	H or ?
6	Bearing & 3D Distance	3D	27	Hinged Area	HA
7	Centerline File to Polyline	CL2P	28	Import 3DFACE from DXF Files	TDXF
8	Change Polylines Layer	CHG	29	Import Points from LandXML to CRD	XML2CRD
9	Circle	CHG	30	Import Polylines from DXF Files	IDXF
10	Convert 3D Polylines to 2D Polylines	C2D	31	Import SHP	ISHP
11	Curve Calculator	CC	32	Import Triangulation from LandXML	TXML
12	Delete Polylines from Layers	DL	33	Inverse	I
13	Divide by Interval	DVI	34	Isolate Layers	IL
14	Divide by Segment	DVS	35	Isolate Points	ISO
15	Edit Entity GIS Attributes	EGIS	36	Joins Polylines	JN
16	Edit Polyline	EDP	37	List Elevation	LELV
17	Erase Polylines	E	38	List Polyline	LI
18	Exit	X	39	Layer Manager	LA
19	Export Points from CRD to LandXML	CRD2XML	40	Offset Settings	OF
20	Export Polylines to DXF Files	EDXF	41	Offset 2D	O2
21	Export Polylines to LandXML File	CHAINXML	42	Offset 3D	O3

	Command name	Alias
43	Polyline	PL
44	Polyline to Centerline File	P2CL
45	Polyline to Points	P2P
46	Preferences	SETT
47	Quick Export SHP	QESHP
48	Quick Import SHP	QISHP
49	Quick Save	QS
50	Remove Arcs from Polyline	RMA
51	Reverse Polyline	RV
52	Save As - Current CRD	SCRD
53	Scale Bar Settings	SB
54	Side Shot	S or SS
55	Sliding Side Area	SA
56	Traverse	T or TR
57	Traverse Defaults	TD
58	Triangle Calculator	TC
59	Triangulate & Contour	TC
60	Trims Edges	TM
61	UCS Settings	UCS
62	View Point Options	VO
63	Zoom	Z

Figure 7-15

Three commands will not accept substitutes: Inverse, Traverse and Sideshot (I, T and S). In addition to commands, you can toggle over to the "Linework special code" option shown in Figure 7-16, and substitute aliases codes for the default special codes such as PC, PT and END (used to control linework using feature codes). As an example, you could choose the "X" or ".." to End a line, or use "CS" for curve start instead of PC.

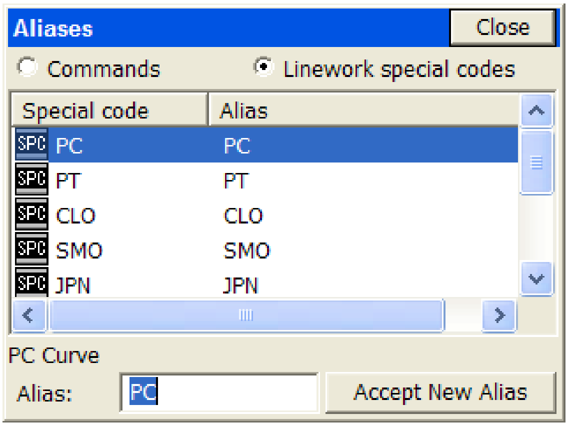


Figure 7-16

Quick Save: QS

Saves the current DXF file without prompting for the file name.

Save As (CRD): SCRD

Saves the current coordinate file to the location you choose as a backup copy.

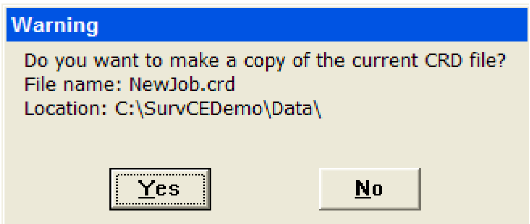


Figure 7-17

Exit: X

This exits the Map and CAD session and brings you back to the Menu screen. Hitting the MENU button in the top right corner does the same thing.

Help

Launches the interactive Help screen describing various Map screen commands. Scroll up and down to review.

View Menu

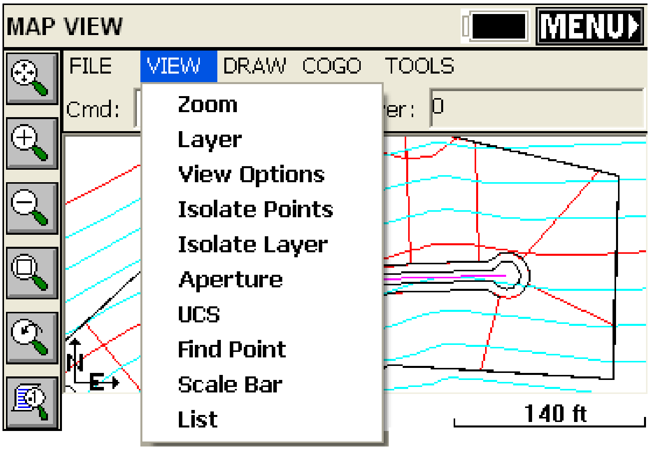


Figure 7-18

Zoom: Z

Increase or decrease the apparent size of polylines and distances between points, in drawing area. The Zoom command options can also be accessed using the first five buttons from left-toolbar menu. The order of buttons, starting with the first top button, is: Extents, In, Out, Window, Previous. The menu also has Num which lets you enter in a point number and zoom to it.

Layer: LA = Layer Manager

This command manages layers and layer properties. The Layer manager dialog is shown in Figure 7-19.

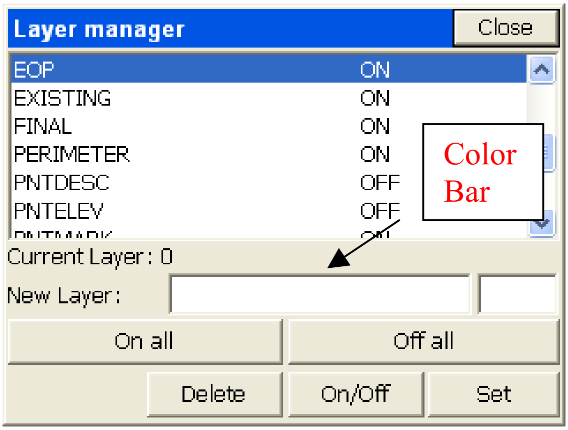


Figure 7-19

- **To add a new layer**: Type in a new name into the New Layer edit box. The New button will appear at the bottom. Tap this button. If you type in a new layer name and the New button does not appear, then the layer name you entered contains invalid characters.
- **To set a layer current**: Highlight the layer name in the list and then tap the Set button. You cannot set a layer current if that layer is turned Off. Turn the layer On first and then set it current.
- **To delete a layer**: Highlight the layer name in the list and tap the Delete button. You cannot delete layers that contain objects. If you select a layer and the Delete button is not visible, then this layer contains objects.
- **To turn a layer On/Off**: Highlight the layer name and tap the On/Off button. Objects on layers that are On will be visible, objects on layers that are Off are not visible.
- **On all**: This button will turn all layers on
- **Off all**: This button will turn all layers except the current layer off.
- **Color**: Clicking on the color bar will bring up the colr palette shown in Figure 7-32, allowing you to set or change the layer color of the highlighted layer.

One of the main purposes of the Layer command is to permit the import, by DXF, of a drawing containing all possible polyline work to stake out (set out). Then you can reduce clutter on the drawing by turning layers off, leaving only the layers you want. You can then do the command Cogo, Interpolate Points, Polylines to Points and make point numbers out of all vertices (corners) of polylines where you need to set stakes. Then proceed with Stakeout by Points. Here is the same drawing, shown above, with contour layers turned off, leaving only important boundary polylines. These were used to convert Polylines to Points, which are shown in "large size" format (see View Point Options below):

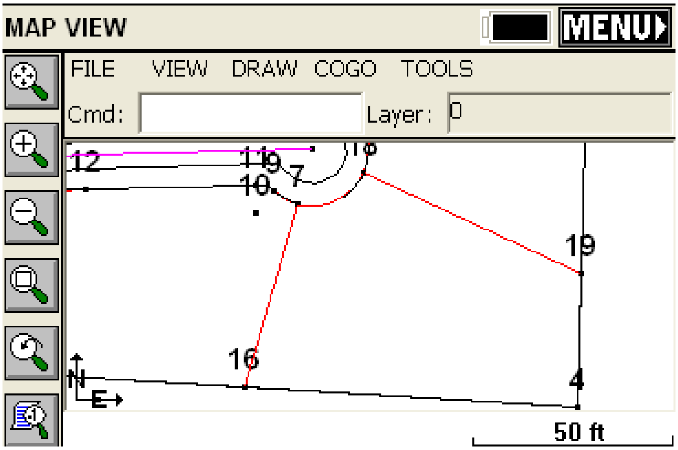


Figure 7-20

View Options: VO

This command controls the appearance of point objects on screen. This is exactly the same as touching the lower left graphic icon. The routine displays the View Point Options dialog box shown in Figure 7-21. Pt#, Description and Elevation toggles control whether these attributes are labeled with the points. If Freeze All is on, the points are placed on the map, without attributes. Available point symbols are: ".", "+", "x". The "Decimal is point location" toggle determines if the decimal point used in the display of elevations represents simultaneously the point location and symbol. This slightly reduces screen clutter. Small and Large toggles determine the size of font used to display the point object on screen. Set Color Attributes brings up the screen in Figure 7-22 (available only on color CE devices). This lets you choose the color of the point symbol, elevation and description text. The Traverse Defaults button brings up the dialog in Figure 7-23. This has the settings for prompting each time for instrument and rod height and the vertical angle. This applies to the T for Traverse and SS for Sideshot commands that allow point calculation within the Map Screen. For Cogo work, turn off Instrument/Rod Height and Vertical

Angle prompting. For manual entry of actual field measurements, turn them back on.

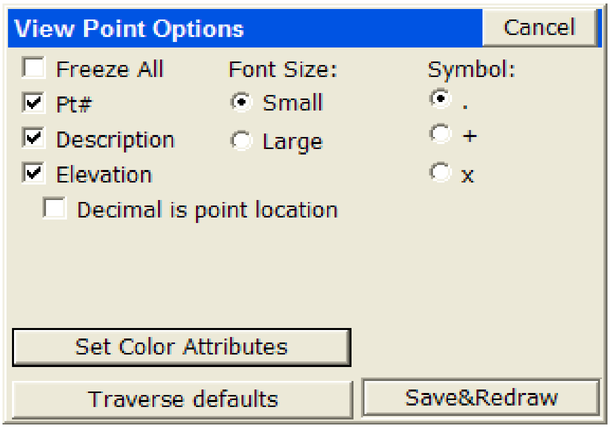


Figure 7-21

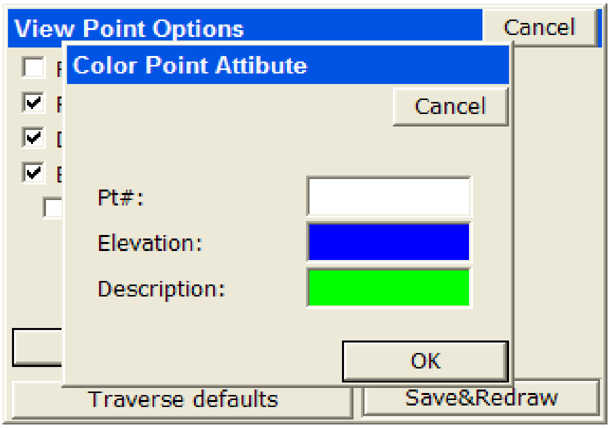


Figure 7-22

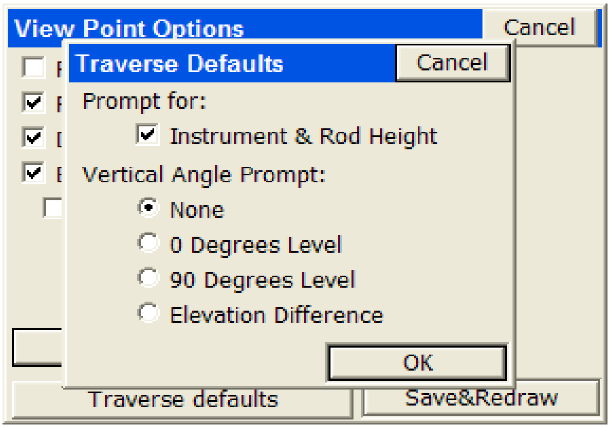


Figure 7-23

Isolate Points: ISO

This is another useful command to reduce screen clutter. If you have 500 points on the screen, you can isolate to only those points you wish to see, be entering a distinct point range, in the form 1-10, 22, 25-30, or a certain description. This would isolate to points 1 through 10, point 22 and points 25 to 30, and other points are "frozen". Repeat the ISO command and enter the full point file range (or "all") to restore all points.

Isolate Layer: IL

Select any polyline layer and isolate it to keep that layer. Other polyline layers are turned off (frozen), but point layers are retained. Use the Layer command to turn layers back on as needed.

Aperture: AP

Controls the size of the rectangle area used to select points or polylines from screen. Initially, the size in pixels is 40 units for points selection and 10 units for polylines selection. The routine displays the Aperture size dialog box as shown in 7-24.

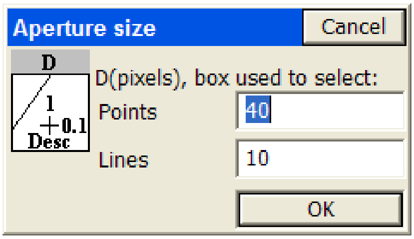
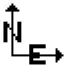


Figure 7-24

UCS: UCS = User Coordinate System Indicator

This toggles the visibility of the UCS icon shown in the map screen.



Find Point: FND

This command allows you to find a point on the map screen. The dialog shown in Figure 7-25 appears. Enter the point you want to find and a zoom height. If you enter a point that is not on the map, the dialog will warn you and allow you to enter another point number.

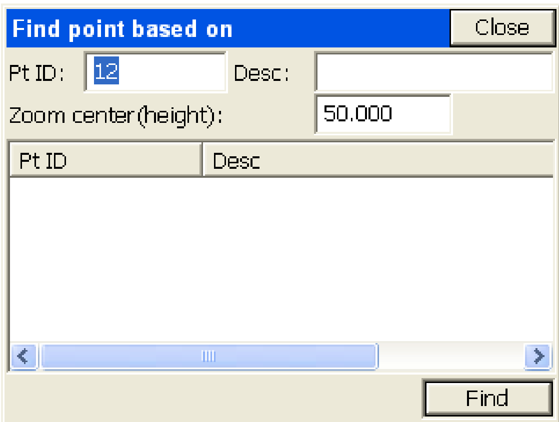


Figure 7-25

Click Find and the FAST Survey zooms centers to the selected point at the entered scale, shown here:

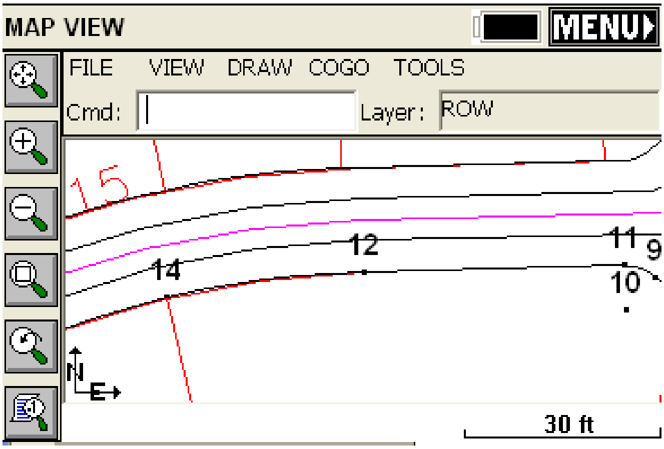


Figure 7-26

Note that although the scale bar shows 30 ft, the height from the base of the graphic area to the top is approximately 50 ft, as specified. Note also the number "15" in the upper left. This is text. FAST Survey extracts the polylines within DXF files for presentation of linework on the screen. If you wish to present text, use any available utility in your office CAD software to convert text to polylines. The "Explode Text to Polylines" or simply "Text to Polyline" command can be found, for example, in Carlson Survey and SurvCADD.

Scale Bar: SB = Scale Bar Settings

This toggles the visibility of scale bar on or off. The scale bar is normally shown at the bottom of the map screen.

List: LI = List (Polyline)

This lists the layer, 2D or 3D status, Closed or Open status, perimeter (length), and area or projected area (if not closed).

Draw Menu

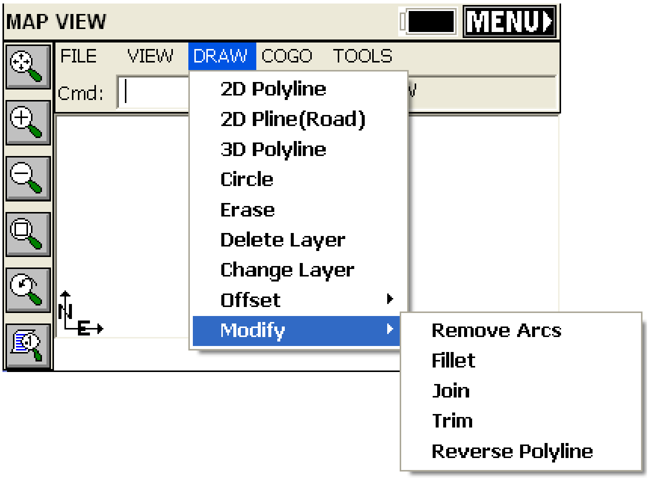


Figure 7-27

2D Polyline: PL – Polyline (AutoCAD style)

This command allows you to draw a polyline between points. You can pick points from the screen or type in point numbers. First, pick your starting point then you have several options on the command line. The default option is to keep picking points and the other options are described below.

Cmd:Polyline-Arc/Close/Undo/<End>

- **A**: Starts an arc segment. See below for details.
- **C**: Closes the polyline (you must have at least two polyline segments drawn before you can close)
- **U**: Will undo the last segment drawn.
- **E**: Will end the Polyline command.

Constructing an arc segment

After choosing A, the command line will change to:

Cmd: Polyline-Arc CEn/LEn/SEc/<RAd>

You have various options for constructing an arc as part of your polyline.

■ **CEn**: Allows you to specify the center point (or radius point) for the arc. After picking the center point, you must specify the arc end point and then the arc direction.
■ **LEn**: Allows you to specify the arc length. First you pick the arc end point and then you can enter the arc length. The minimum arc length is given to you.
■ **SEc**: Allows you to specify the second point and end point to define the arc.
■ **RAd**: Allows you to specify a radius length. First you pick the arc end point and then you can enter the radius length. The minimum radius length is given to you.

2D Polyline (Road): 2DP

This command allows you to draw a 2D Polyline. This command is similar to the Polyline command described above with the following additions:

■ **+/-**: The +/- options activate an additional prompt that allows you to plot line segments at a 90 degree deflection angle from the last line. [+] is a right deflection and [–] is a left deflection.
■ **Len**: This option prompts you for the length of a line segment. Enter the length and a line segment will be drawn that length using the same bearing as the previous line segment. If the previous segment is an arc, then the new segment will be tangent to that arc.

For other options, see the Polyline command above.

To add in the "missing" polyline from point 18 to point 14 in the drawing below, enter as shown using the 2DP command.

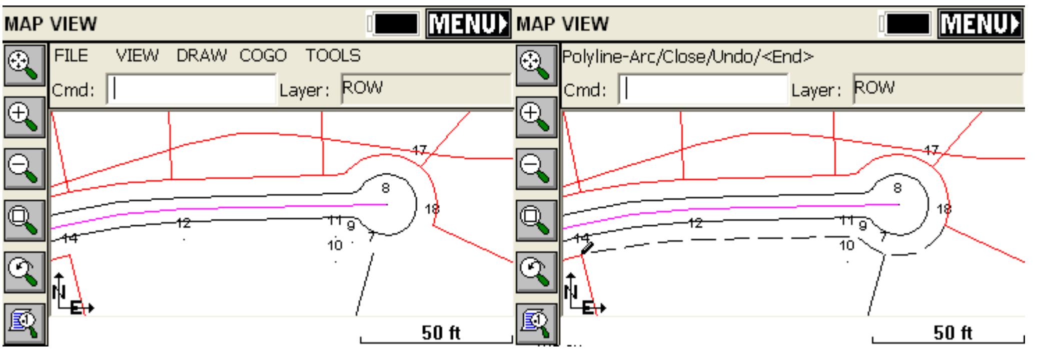


Figure 7-28

Polyline-Pick Point or point ID

Cmd: 18

Polyline-Arc/Close/Undo/<End>

Cmd: A

Polyline-Arc CEn/LEn/SEc/<RAd>

Cmd: CE

Polyline-Arc(Center)>Radius point

Cmd: 8

Polyline-Arc(Center)>End point

Cmd: 9

Polyline-Arc(Center)>Left/<Right>

Cmd: Enter or R for Right

Polyline-Arc/Close/Undo/<End>

Cmd: A

Polyline-Arc CEn/LEn/SEc/<RAd>

Cmd: CE

Polyline-Arc(Center)>Radius point

Cmd: 10

Polyline-Arc(Center)>End point

Cmd: 11

Polyline-Arc(Center)>Left/<Right>

Cmd: L

Polyline-Arc/Close/Undo/<End>

Cmd: 12

Polyline-Arc/Close/Undo/<End>

Cmd: A

Polyline-Arc CEn/LEn/SEc/<RAd>

Cmd: CE

Polyline-Arc(Center)>Radius point

Cmd: 13

Polyline-Arc(Center)>End point

Cmd: 14

Polyline-Arc/Close/Undo/<End>

Cmd: Enter for End

Note that every time a point number was entered using the keyboard, there was also the option to pick the point on the screen.

3D Polyline: 3DP

The 3D Polyline command is similar to the 2D polyline command. It will even draw arcs, but will create a polyline on the screen with many vertices at different Z elevations which are linearly interpolated around the arc. If the start of the arc is point 17 at elevation 100 and the end of the arc is point 9 at elevation 90, then using View, List, you would see intermediate vertices as shown here (note that the segment length between vertices is about 0.05 units):

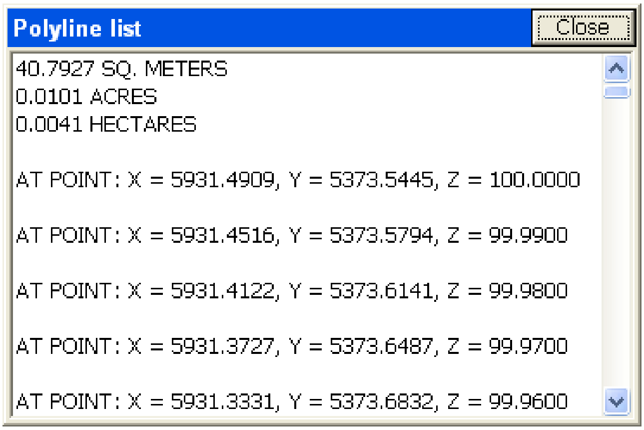


Figure 7-29

If you select 3D Polyline but pick points that are all at 0 elevation, you will create a 2D polyline.

Circle: CR

This command draws a circle entity, based on diameter defined by two points or based on a center point and a radius.

Erase: E = Erase Polylines

Erases all selected polylines. It will not erase points. Note that you can erase an entire area by drawing a Window through the polylines (picking first a lower left point in "blank space", then picking an upper right point). If you even contact or enclose any polylines with this window selection, they will be erased. So the "window" erase procedure mimics the "crossing" selection method of AutoCAD.

Delete Layer: DL = Delete Polylines from Layer

Select from a list one or more layers, then the routine will delete all the polylines on those layers. The screen is shown below.

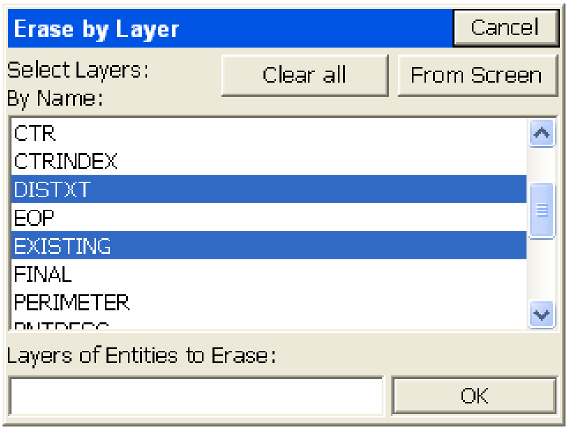


Figure 7-30

Change Layer: CHG = Change Polylines Layer

This changes the layer of the selected polylines. One form of selection is to type L and press Enter in order to select last created polyline from the drawing. The routine displays the "Change entities to layer" dialog box shown in Figure 7-31. When the dialog appears on the screen, the selection in the layer list will be set to the current layer. Clicking the color bar brings up the color palette, letting you change the color by picking or ByLayer, shown in Figure 7-32.

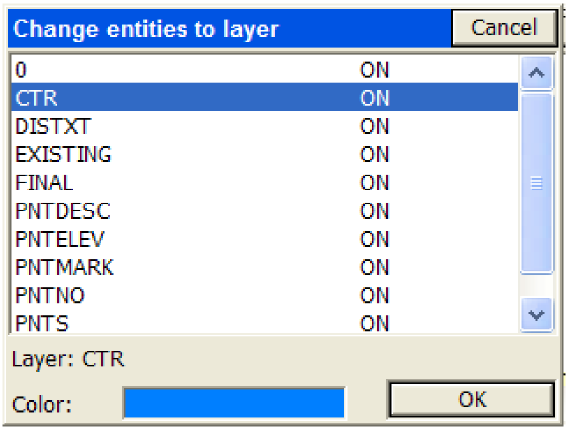


Figure 7-31

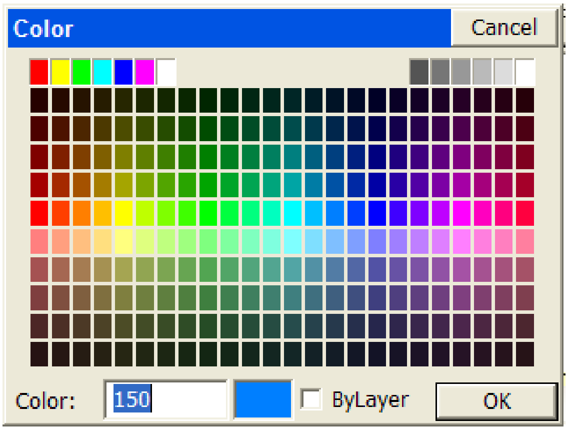


Figure 7-32

Offset 2D: O2 = Offset 2D Polyline

Mimics the AutoCAD Offset command, and only works with 2D polylines. Enter the offset distance and pick the left or right offset amount.

Offset 3D: O3 = Offset 3D Polyline

This offsets 3D polylines both horizontally and vertically. It is great in combination with road/utility centerlines to create offset polylines to stake. If you do the "segment" option versus the "continuous" option, it will break the corners and offset the projection of the line. This creates vertices that can be turned into points using the command P2P, and is useful for building offsets. See Figure 7-33.

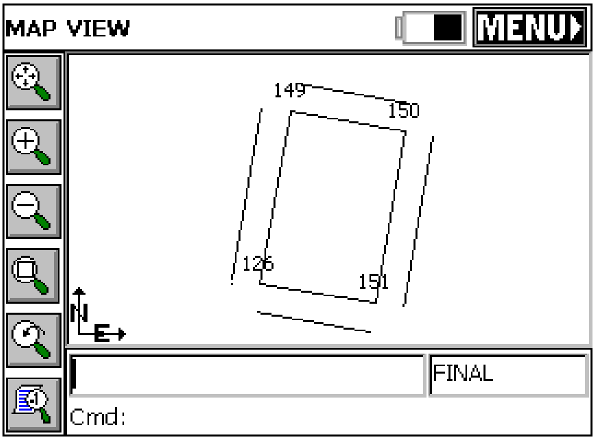


Figure 7-33

Remove Arcs: RMA = Remove Arcs from Polylines

Pick any polyline with an arc, specify the “offset cutoff” spacing, and turn the arc into chords. Offset cutoff refers to the maximum separation between the chord and the original arc. If you enter a small cutoff distance of 0.1, then at no point do the chord segments differ from the arc than 0.1. Be careful with this command – there is no “Undo” to restore the arcs (though you can immediately start a new job and “re-load” the last, saved DXF file of the drawing).

Fillet: F

Similar to AutoCAD’s Fillet command. It prompts:

Cmd: Fillet -Ra/Pl/eXit/First seg 25.00. If you are trying to inscribe a curve at the corner of a polyline, you enter the desired radius first (at the above prompt). Then you choose the P option. This leads to the prompt, Cmd: Fillet -Ra/Pl/eXit/Select pl 25.00. Select the polyline near the vertice where you want the curve to go. This completes the process. If you wish to change the radius, enter R. If you want to fillet the corner of 2 distinct polylines, then just pick them as prompted (do not do the P for Polyline option). This command will only work with 2D polylines, completed with the command 2DP, or imported from a DXF file as 2D polylines, or converted from 3D using the command C2D. Shown below is the effect of the Fillet command:

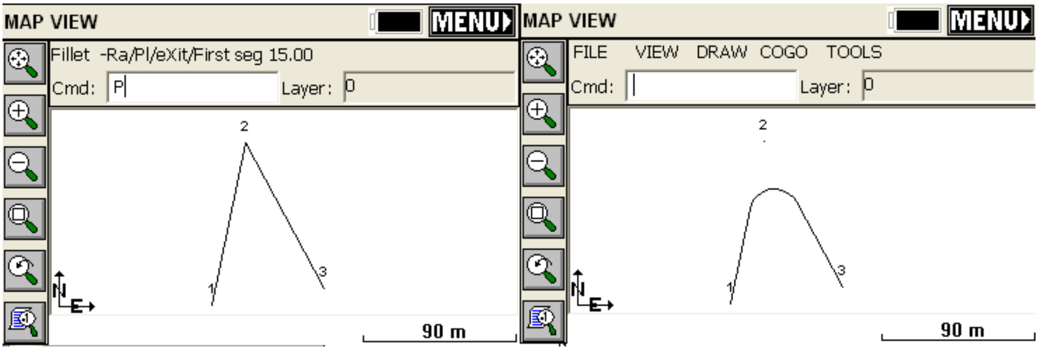


Figure 7-34

Because the figure from 1 to 2 to 3 was one continuous polyline, after the radius was set at 15, P was entered to set up the one-pick approach for polylines, leading to the completed fillet command and the result at right. Now you can do Cogo, Interpolate Points, Polylines to Points (P2P) and solve for the points for the beginning of the arc, radius and end of arc, for purposes of stakeout (set out).

Join: JN = Join Polylines

This command allows you to join polylines. Enter D to specify a new maximum separation distance, then select the polylines on the map screen. In the example below, points 3 and 4 are 19.5 meters apart. Therefore, if we "tolerate" a separation of 20 meters or less, the polylines will join together. The advantage of joining polylines is that they can then be offset as a unit, and the vertices of the offset polylines can be turned into points for stake out. The offset command, in effect, does all the complicated bearing-bearing intersects for you. For example, if the resulting polyline were a pipeline with a 20 meter total right-of-way, then to stake the right-of-way points, you would offset the polyline 10 units left, then 10 units right, then turn both offset polylines into points.

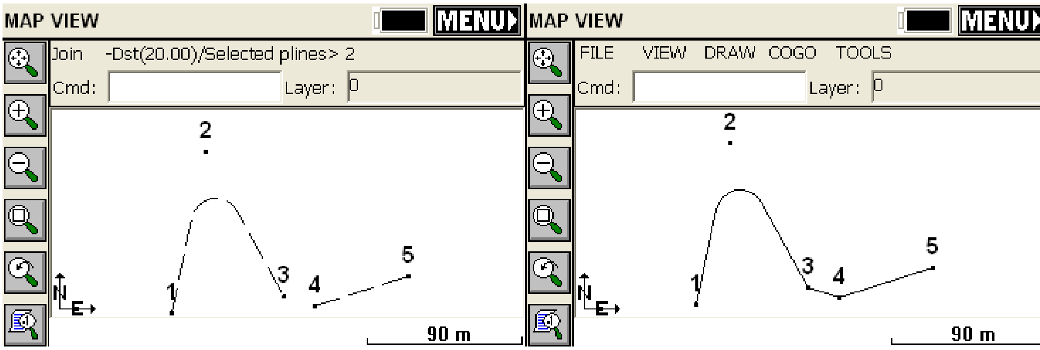


Figure 7-35

Trim: TM = Trim Edges

This allows you to trim polylines to the edge of other polylines just like in AutoCAD. Then the command Polyline to Points (P2P) will make turn all vertices, including the trimmed end points, into points for stakeout. In the drawing below, if the line from 6 to 7 were a property line, the trim command would allow you to set out points where the property line crosses the right-of-way lines. Again, it saves you the trouble of doing a series of bearing-bearing intersects.

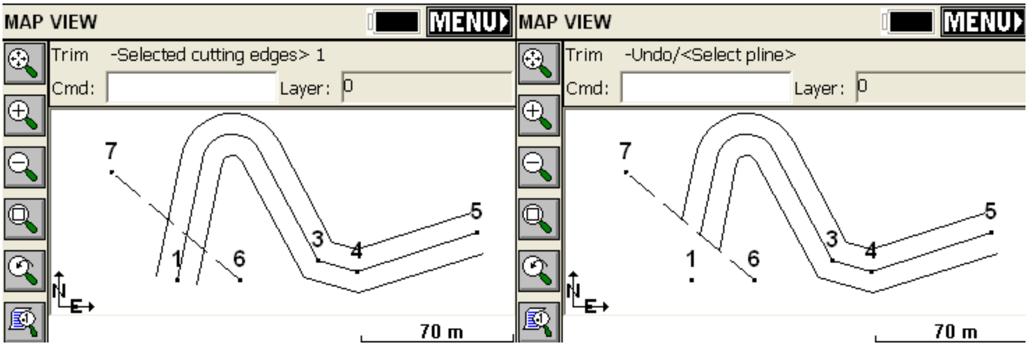


Figure 7-36

Note that we are still in the Trim command at right. We have selected all 3 polylines to trim (right-of-way left, center, right-of-way right) and if there are no more to trim, you simply press Enter.

Reverse Polyline: RV

When you turn a polyline into points, it will start the point numbering at the beginning of the polyline. Thus it may be useful to control the direction of the polylines. This is done with the command Reverse Polyline. Each time you pick a polyline using this command, you reverse its direction, and little temporary arrows are displayed along the polyline indicating the current direction. If it is not the direction you want, reverse again.

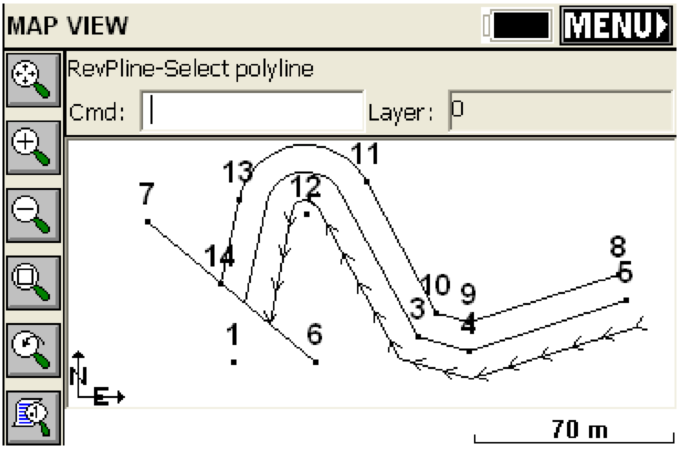
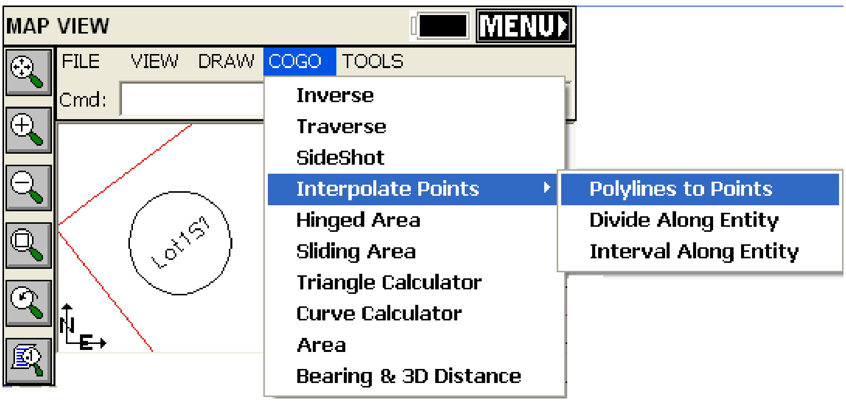


Figure 7-37

COGO Menu



Inverse: I

Inverses and presents the bearing and distance between point numbers. Has the added benefit that the previous point inversed becomes the backsight, and the current point inversed becomes the occupied point, allowing you to sequence directly into the Traverse or Sideshot commands. (Use angle code 7 to turn an angle right from the backsight to the foresight.) The prompting is shown in Figure 7-38.

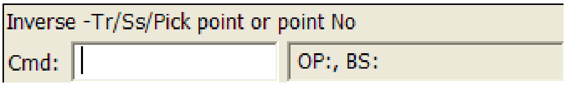


Figure 7-38

Traverse: T (also TR)

Similar to the Sideshot command, the Traverse command will "move up" to the last point traversed, holding the previous occupied points as the backsight. Exit with Esc.

Sideshot: SS (also S)

This allows for sideshots from any point that is "occupied" by use of the inverse command. For example, if you inverse from 126 to 150, you are "on" 150 and backsighting 126. Then at the prompt:

Cmd: Inverse – Tr/Ss/Pick point or point No:

You can enter S for Sideshot. The first prompt is the Angle-Bearing Code: Sideshot-eXit/I/Tr/H/Angle-BC(1-7)<7>, which can be any of the following:

1-NE (0 through 90 if degrees, 0 through 100 if gons/grads)
2-SE (same as above)
3-SW (same as above)
4-NW (same as above)
5-Azimuth (360 circle if degrees, 400 circle if gons/grads)
6-Angle Left (degrees or gons)
7-Angle Right (degrees or gons)

Angle/Bearing codes are further illustrated by pressing H for Help (within the command), which brings up the following graphic:

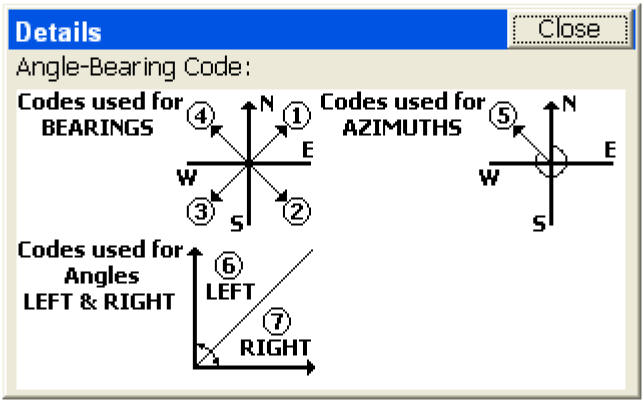


Figure 7-39

Note that at the Angle/Bearing prompt, you can transition back to inverse (from your occupied point) or to traverse, which would move you up to the next traversed point. Within Sideshot, you stay on your current point, holding the backsight, and foresighting (calculating) as many points as desired. X returns to the Map screen as does Esc.

The remaining prompts are the angle itself (as in 85.3522, DDD.MMSS), zenith angle, slope distance, description and point number. Exit with Esc anytime. In gons/grads, angles are also in decimal form, and angles such as 397.9871 are valid. Referring to the graphic below, if we inverse from point 17 to 18, then enter S (or SS) for Sideshot, in gons, we can enter an angle right of 200 and create point 19 in the same bearing as 17 to 18 (same as angle right of 180 in DD.MMSS).

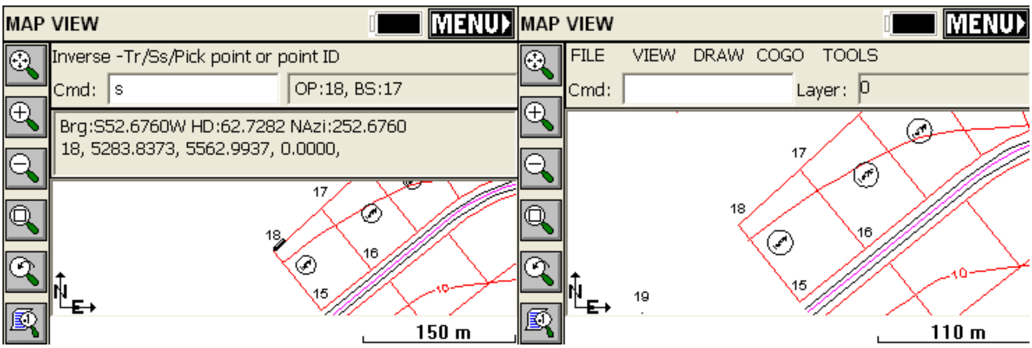


Figure 7-40

Polyline to Points: P2P

Converts any selected polylines into points. Useful in capturing points for stakeout from polylines created as offsets (see Figure 7-33) or brought in from DXF files. This allows you to react to circumstances in the field by creating points from polylines, when and where needed. For example, if you wanted to make point numbers out of the lot corners below on the SW lot, Select Cogo, Interpolate Points, Polyline to Points (or more simply enter P2P at the command line).

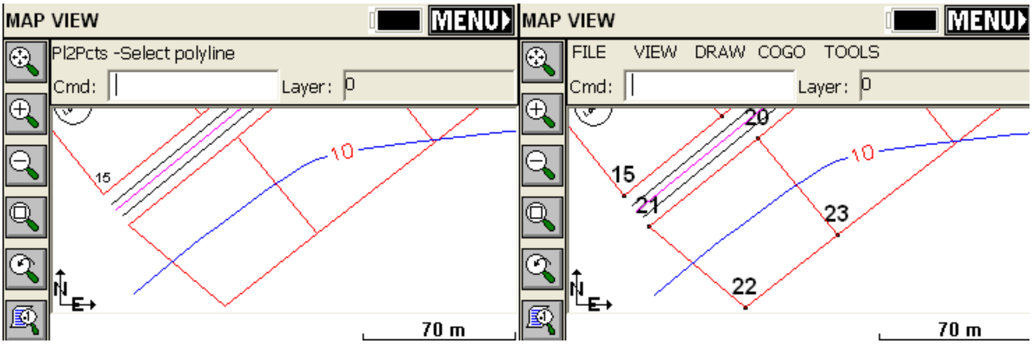


Figure 7-41

The new points are shown in "large" format for emphasis.

Divide Along Entity: DVS

This divides a polyline into the number of segments entered. The dialog shown in Figure 7-42 is where you enter in the number of segments. There are settings to prompt for descriptions and elevations and to create points at the endpoints of the polyline.

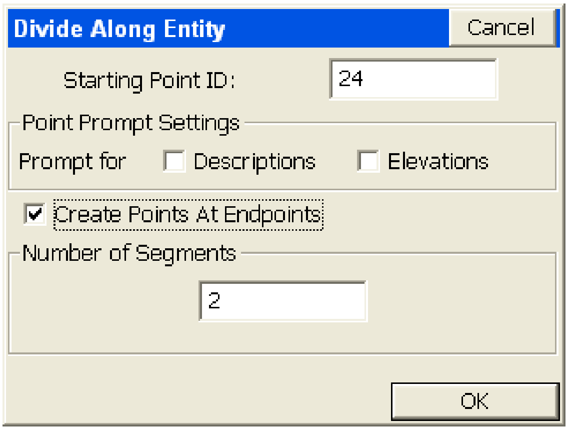


Figure 7-42

The command will create new vertices along the polyline, but can also create point numbers starting at the entered Point ID, and you can elect to be prompted for descriptions and/or elevations at each new point. If a property line were divided into 2 segments, you would create 3 new points as shown below:

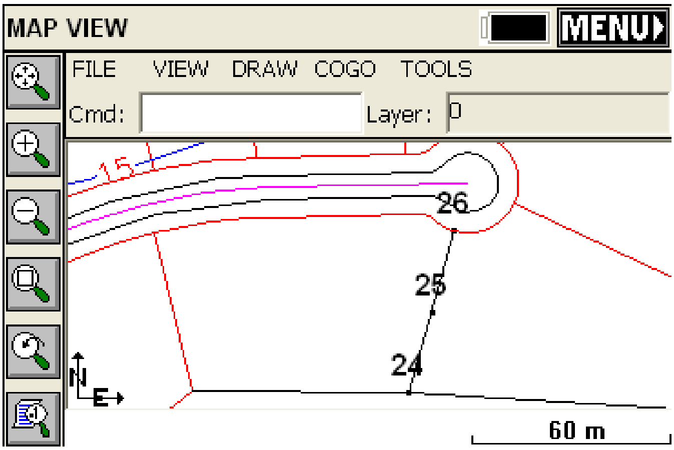


Figure 7-43

Interval Along Entity: DVI

This divides a polyline by the distance entered in. Curves can have a different interval. There are settings to prompt for descriptions and elevations and to create points at the endpoints of the polyline.

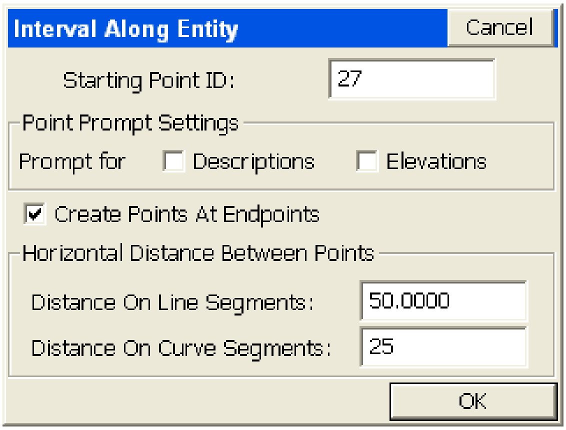


Figure 7-44

This command is often used for creating points on centerlines, as shown below:

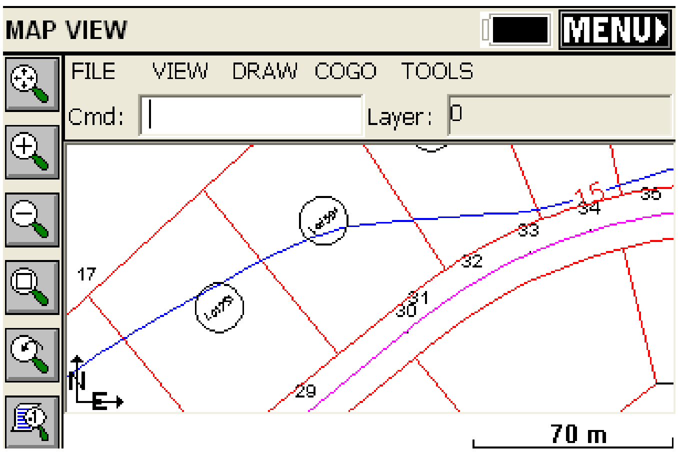


Figure 7-45

Points 27 through 30 are at 50 interval; the PC of the curve is point 31, and then the 25 interval is used through the curve. Note the the program resets the interval at break points like PI's and PC's.

Hinged Area: HA

This command can be used to determine the dimensions of a figure when the area is fixed and three or more sides are known. The figure must be defined by a closed polyline. After executing the command, select the polyline. Next, select the hinge point, the polyline segment clockwise from your hinge point will be the segment to move. FAST Survey will then ask you if you want to keep the existing polyline. If you answer Yes, a new polyline with the desired area is created, if you answer No, the polyline you pick is modified. Next, the current area of the polyline is shown. At this point, enter the new area in the units specified under Job Settings. (If your units are set to feet, the area will be specified in square feet). See Figure 7-46.

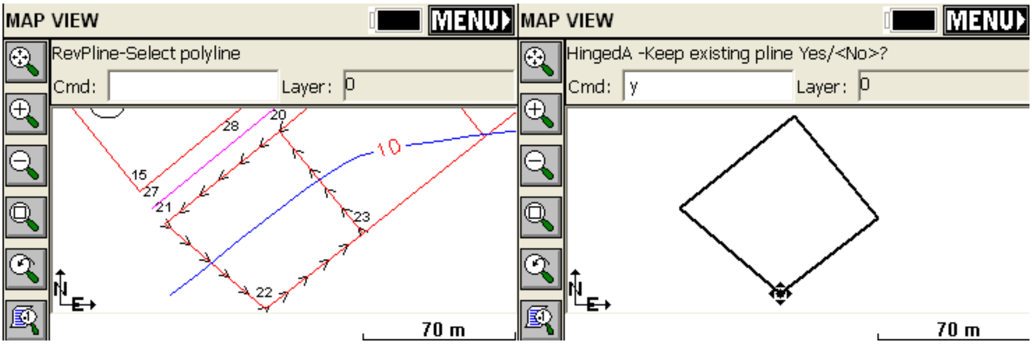


Figure 7-46

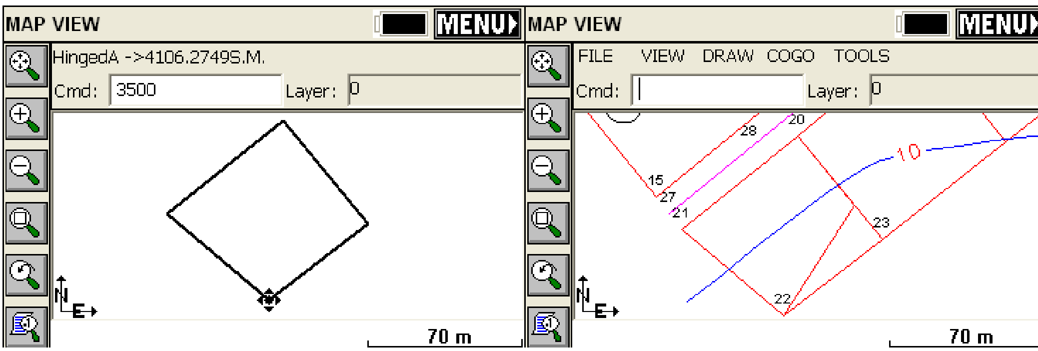


Figure 7-47

Note how the hinged side occurred on the clockwise side of the polygon perimeter (side 22 to 23). If we erase the new polyline, reverse the original polyline (RV) and repeat the command, this time answering "No" to "Keep existing" and targeting 4500 s.m. area, we get the following:

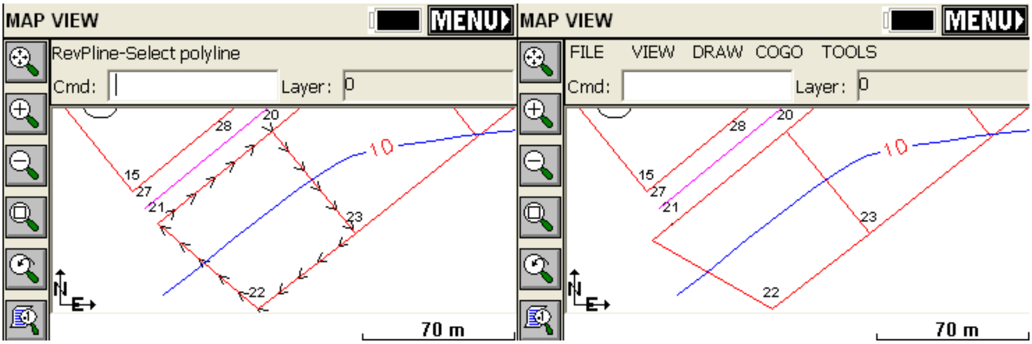


Figure 7-48

Sliding Area: SA = Sliding Side Area

This command adjusts one side of a polyline to meet a specified area. You must specify the new area in the same units as specified under Job Settings. The area to adjust must be a closed polyline. After executing the command, select the polyline. FAST Survey will then ask you if you want to keep the existing polyline. If you answer Yes, a new polyline with the desired area is created, if you answer No, the polyline you pick is modified. Next, the current area of the polyline is shown. At this point, enter the new area in the units specified under Job Settings. (If your units are set to feet, the area will be specified in square feet). See Figure 7-49 for an example.

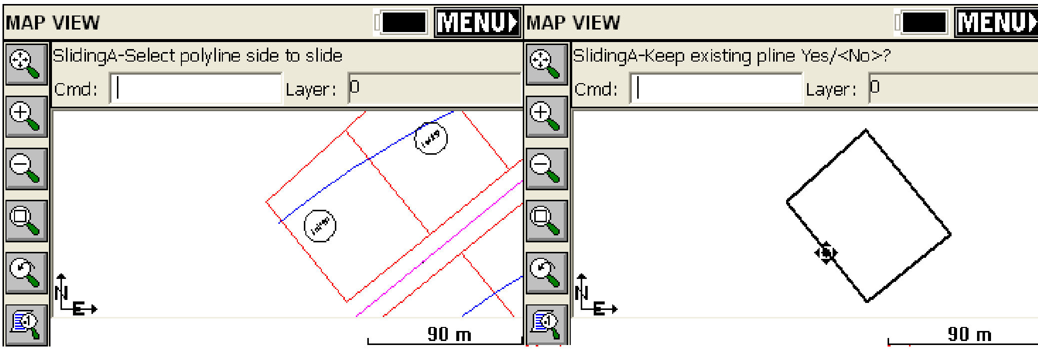


Figure 7-49

In the final result, we used Isolate Points, found in the View pulldown, and entered the range of points 15-18, to show the original property corners. To bring all the points back, select Isolate Points again and choose All.

Triangle Calculator: TC

Goes directly from the Map view to the Triangle calculator shown back in Figure 5-39.

Curve Calculator: CC

Shortcut to the curve calculator, then returns to Map. Curve Calculator is described in detail on page 371.

Area: AR

This will report the area of any picked polyline. If you pick an unclosed polyline, the program will draw a temporary line for the closing segment and report the area. See Figure 7-50.

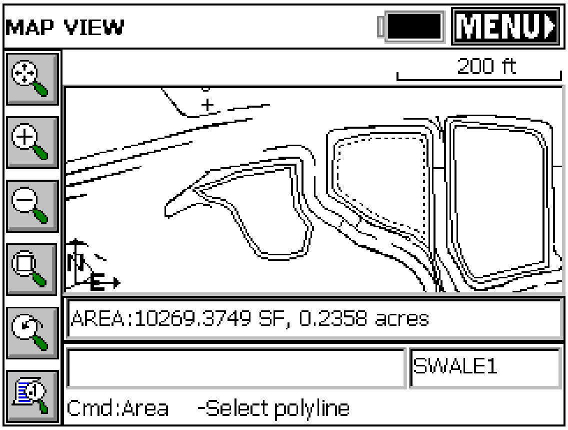


Figure 7-50

Bearing & 3D Distance: 3D

This command reports the horizontal distance, elevation difference, slope distance, vertical angle, percent slope, slope ratio, bearing and azimuth between two 3D points. The user can pick or enter the number of two points, select a polyline segment or pick two points on any polylines from map. See Figure 7-51 for sample results.

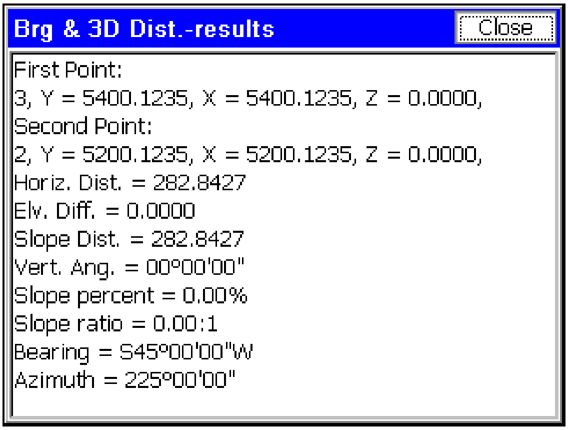


Figure 7-51

Tools Menu

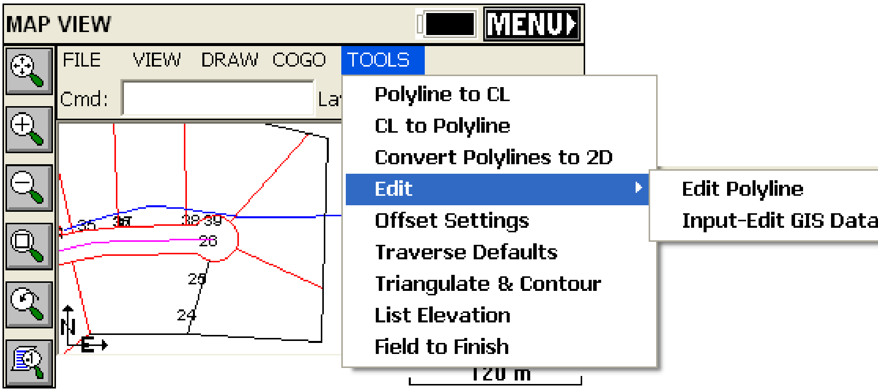


Figure 7-52

Polyline to CL: P2CL = Polyline to Centerline File

Converts any polyline into a centerline file for use in the Roading commands and in Centerline, Curve and Offset Stakeout. You will be prompted for starting station and will obtain a centerline report as shown below

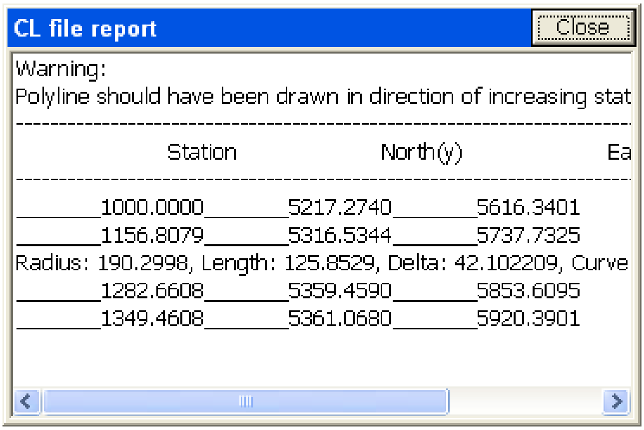


Figure 7-53

Use Reverse Polyline (RV) and repeat the command to change the direction of the stationing.

CL to Polyline: CL2P = Centerline File to Polyline

This command draws a POLYLINE entity using the data from a centerline file. You can practice this command by selecting the file Demo.cl, provided with the program.

Convert Polylines to 2D: C2D = Convert 3D Polylines to 2D Polylines

Pick any 3D polyline and convert it to 2D (elevations of vertices are set to 0).

Edit Polyline: EDP

Remove vertices, insert vertices and update (alter) the coordinates of any vertex. For example, if we pick the centerline that was used above to interpolate points using Interval along Entity, we obtain the following edit dialog:

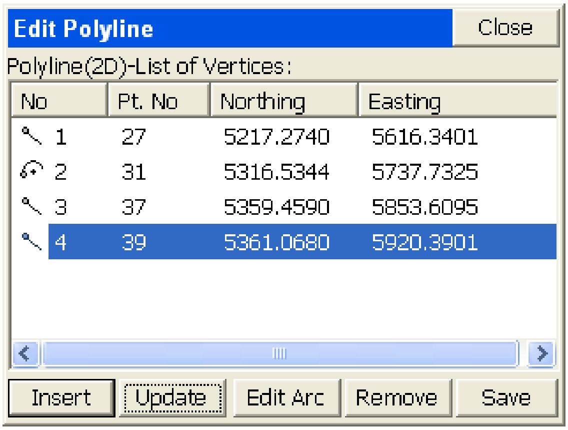


Figure 7-54

Input-Edit GIS Data: EGIS = Edit GIS Attribute

This command allows you to input or to edit GIS attributes associated with an entity. The user can select the entity from screen or for the case of a closed polyline he can pick inside the area defined by that entity.

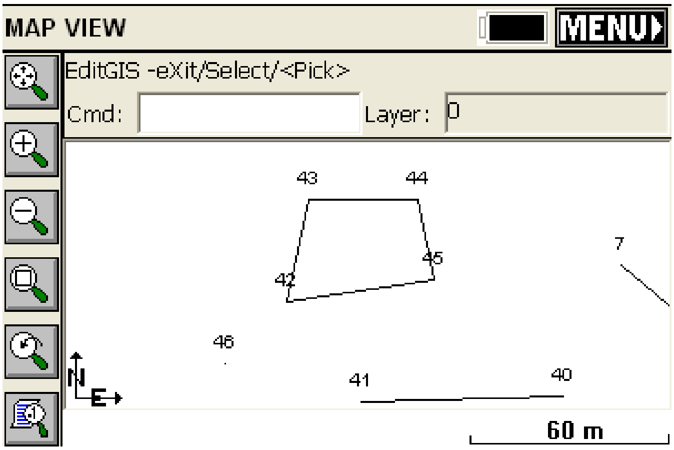


Figure 7-55

Only polylines (open or closed) can be selected. This command does not apply to attributes associated with points (use List Points to edit point attributes). Attributes are associates with points, polylines and polygons (closed polylines) either through use of feature codes or by importing shapefiles. If a polyline is closed, you can use the Pick option and simply pick inside its interior. This "fence" description included a "fence type" attribute, which now can be edited as shown below:

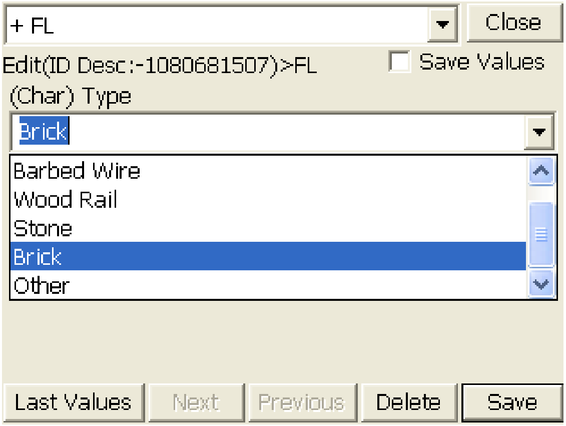


Figure 7-56

Offset Settings: OF

This command allows you to set the type of corner that FAST Survey should create when offsetting entities. The two types are shown in the dialog below.

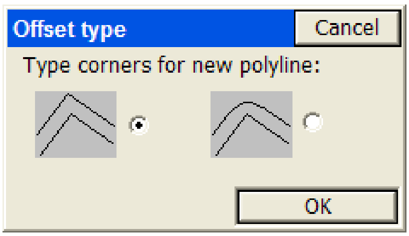


Figure 7-57

Traverse Defaults: TD

This sets the elevation prompting (none, zenith, vertical, elevation difference), within the Traverse and Sideshot commands within the Map view. Also enables a prompt for Instrument and Rod Height. See Figure 7-58. Default setting is no instrument or rod heights and no vertical angle prompting, so inputs are simplified as angle/bearing code, angle/bearing, distance, description, point number. Traverse and Sideshot entries within the Map screen are stored to the RW5 file.

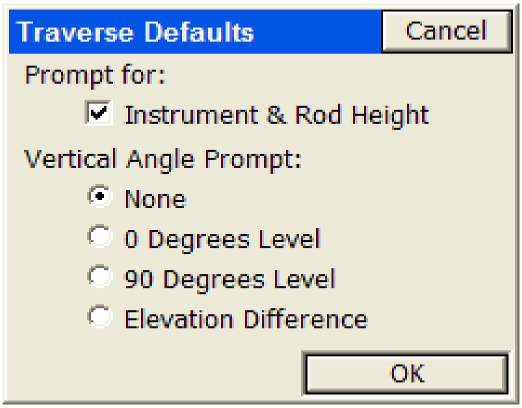


Figure 7-58

Triangulate & Contour: TRGC

Triangulate and Contour can create a final contour map based on the user given data: points, polylines. This function has many options which are specified in the dialog box shown in Figure 7-59. The routine will prompt also for inclusion and exclusion polylines.

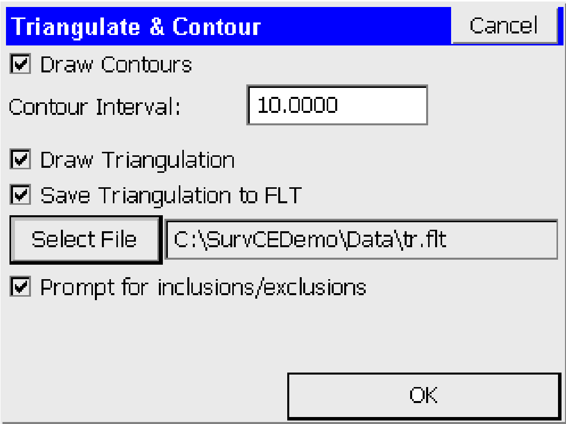


Figure 7-59

Figure 7-60 for results.

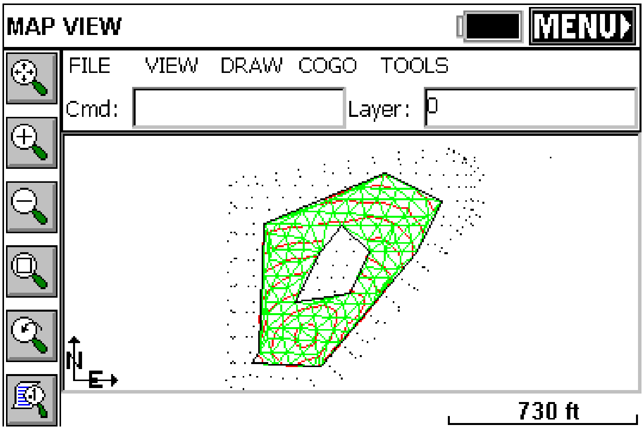


Figure 7-60

List Elevation: LELV

This command allows the user to pick on an entity and retrieve the elevation of that point. See Figure 7-61 for an example.

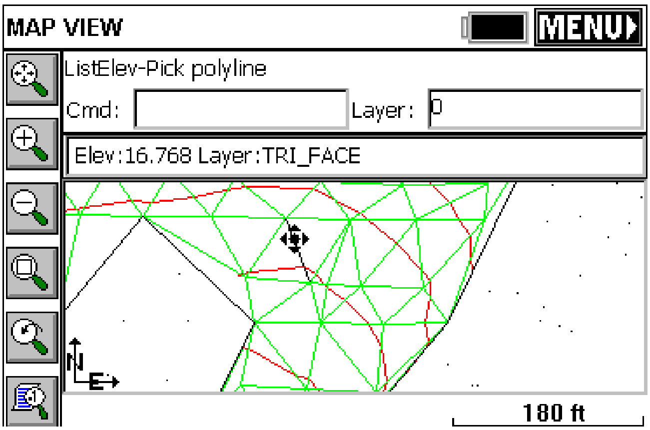


Figure 7-61

Field to Finish: F2F

This command will redraw the linework created with Feature Codes based on the current coordinates of the points. So if a GPS file was "processed" using a new localization, or a total station survey was adjusted, the existing linework made by use of Feature Codes will erase and redraw by connecting to the adjusted coordinates. In this way, polylines on the Map screen created by field surveying will be redrawn to recapture their association with the adjusted point coordinates.

8

Keyboard Entry

This chapter describes all special “hot” key commands activated by the “Alt” key. It also covers the “instant calculator” hot key, which is “?” (the question mark), conventions for math and point-defined directions, and finally special “formatted” entries, such as “2m” which converts 2 meters to feet (if configured English) and “4.75ft” which converts 4.75 US feet to metric (if configured metric).

Quick Calculator Command

From virtually any dialog entry line in the program, the “?” command will go to the Calculator routines, and allow “copying” and “pasting” of any selected calculation result back into the dialog entry line. For example, if you were grading a site that had 19.5” of subgrade, and had modeled the top surface, you need to grade to the top surface with a vertical offset of -19.5/12. You could quickly obtain the value in feet by entering ? in the Vertical Offset field within Elevation Difference (see Figure 8-1).

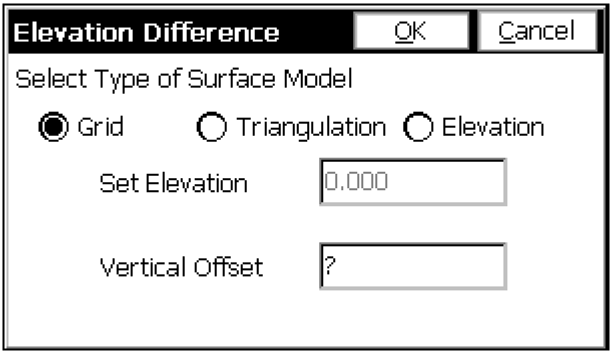


Figure 8-1

This leads immediately to the Calculator screen, with its 4 “tabs” or options, many with sub-options. Using the Standard tab, we can enter 19.5/12 and get 1.625 as shown. Then select the “Copy” button, which places the value in the “banner” line at the very top of the screen. Then choose Paste in the upper right to past it back into the Vertical Offset dialog “edit” box. It can also be pointed out that this value could be entered two additional ways, within Vertical Offset: (1) as 19.5 in for “inches”, which would auto-convert to feet or the current units setting or (2) 19.5/12, which would do the division directly in this edit box. See Figure 8-2

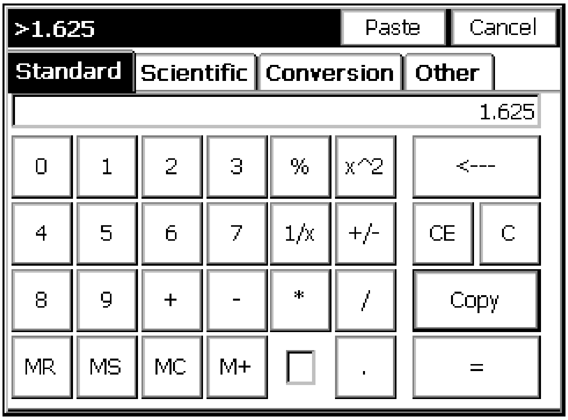


Figure 8-2

Executing Alt Key Commands

The Alt key commands take the form Alt C (Configure Reading) or Alt N (Next Point). The Alt key and the subsequent “hot” key (“C” or “N”, as mentioned here) can be entered at nearly the same time or with an delay desired. If you press Alt and delay the entry of the hot key, you will see a text instruction: “Waiting for HotKey… Press Alt again to return”. A second Alt returns to the previous position in the program without executing any command. “Alt <” and “Alt >” will brighten or darken screens on “At Work” brand CE data collectors.

List of Hot Key Commands activated by Alt

Hot Keys vary by command. For example, in the Sideshot/Traverse (Store Points) screen shown in **Error! Reference source not found.**, the hot keys are as follows.

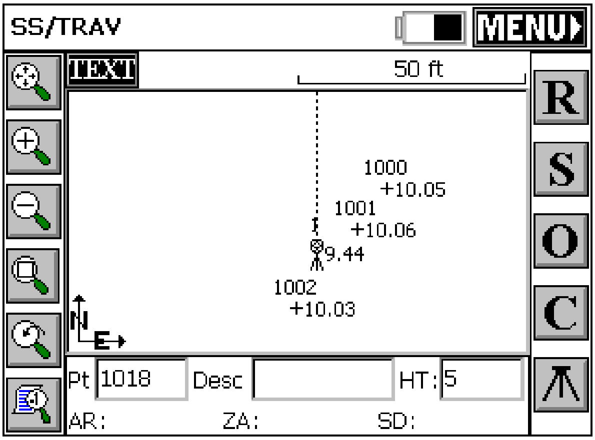


Figure 8-3

- **Alt R**: Read
- **Alt S**: Store (or Shot/Store)
- **Alt O**: Offset
- **Alt C** :Configure Reading,
- **Alt B**: Backsight

Many of the hot keys work only within related data gathering commands (as in **Error! Reference source not found.** above), as opposed to working from the main menus. Here is a list of other common hot keys:

- **Alt E**: Target Elevation—From any Stakeout screen, Alt E will allow the user to enter an alternate design elevation different from the computed current design elevation. It brings up the dialog shown in Figure 8-4.

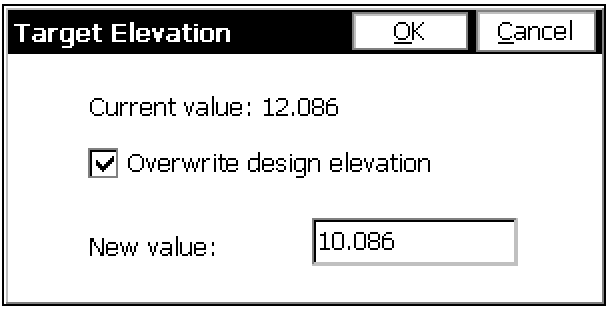


Figure 8-4

- **Alt F**: Foresight Only Toggle. When in the Sideshot/Traverse graphic screen and taking new shots, Alt F will freeze all but the setup point number, backsight point number and current foresight shot. This is helpful when points are densely located. Alt F again returns to the full point plot.
- **Alt I**: Inverse. Does a quick inverse and upon exit returns you to the command you were in.
- **Alt J**: Joystick. Applies only to Robotic Total Station. Takes you to the Settings option. Alt J typically only functions if you are configured for a robotic total station. Alt J will work from within data gathering commands and from the main menus.
- **Alt L**: List, as in Feature Code List. When entered in any Description field, this will recall the Feature Code List, which displays the characteristics (layer/linework) of the feature code. This serves not only as a way to select the code and apply it to the description, but it also serves as a handy reminder of the code's properties.
- **Alt M**: Menu. Returns you to the dialog of the local command, keeping all current inputs. For example, in Intersection, you are returned to the entry dialog, with all entered point numbers,

distances and azimuths intact, allowing you to alter one or more and re-calculate. Except when used as a "local" menu return, Alt M will switch to the map screen.

- **Alt N**: Next. Moves you to the Next point in the Stakeout commands, and moves you to the Next calculation (all entries nulled out) in commands such as Intersection.
- **Alt T**: Traverse (takes a shot, but moves the instrument up to the next foresight and backsights the current occupied Station, and moves you to the Backsight screen (for verification)
- **Alt V**: Shortcut to View the Raw Data.
- **Alt W**: Write a Note anytime with this command. Notes store to the Raw File. Equivalent to going to the Surv Menu and selecting Keyboard Input.
- **Alt X**: Shortcut to Exit most commands. Similar to Esc (escape key).

Formatted Distance Entries

Entries for distances that include certain special, commonly understood "measurement" extensions are automatically interpreted as a unit of measurement and converted to the "working" units. For example, an entry of 19.5 in is converted to 1.625 feet or 0.4953 meters if units are configured for meters. The "extension" can appear after the number or can be directly appended to the number as in 35.5cm. Recognized text, and their corresponding units, as shown below:

In	Inches
Ft	US Feet
Ift	International Feet
Cm	Centimeters
M	Meters

These extensions can be caps or lower case, or any combination (entries are not case-sensitive).

Formatted Bearing/Azimuth Entries

Most directional commands within FAST Survey allow for the entry of both azimuths and bearings. Azimuth entries are in the form 350.2531 (DDD.MMSS), representing 350 degrees, 25 minutes and 31 seconds. But that same direction could be entered as N9.3429W or alternately as NW9.3429. FAST Survey will accept both forms.

Mathematical Expressions

Math expressions can be used in nearly all angle and distance edit boxes. For example, within the Intersection routine, an azimuth can be entered in the form 255.35-90, which means 255 degrees, 35 minutes minus 90 degrees. Additionally, point-defined directions can be entered with the comma as separator, as in 4,5. If point 4 to point 5 has an azimuth of 255 degrees, 35 minutes, then the same expression above could be entered as 4,5-90. For math, the program handles "/", "*", "-" and "+". To go half the distance from 103 to 10, enter 103,10/2.

Point Ranges

When ranges of points are involved such as in stakeout lists, a dash is used. You can enter ranges in reverse (eg. 75-50), which would create a list of points from 75 down to 50 in reverse order.

9

Tutorials

This chapter contains tutorial lessons for performing tasks in FAST Survey.

Tutorial 1

Defining Field Codes - Line/Layer Properties & GIS Prompting

FAST Survey can have one pre-defined FCL (Feature Code List) file loaded with the job coordinate CRD file.

The Feature Code List file stores pre-defined field codes that define Line/Layer drawing properties and optionally GIS prompting. (More than one FCL file can exist but only one can be loaded at a time per job coordinate CRD file.)

The operator builds this FCL file using option 5 “Feature Code List” in the File main menu - see Figure 9-1.

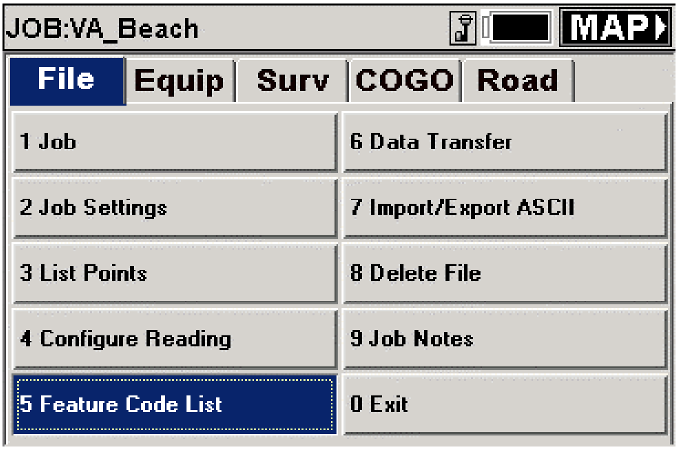


Figure 9-1

Selecting 5 Feature Code List, the following Code List pop-up box is displayed (**Error! Reference source not found.**)

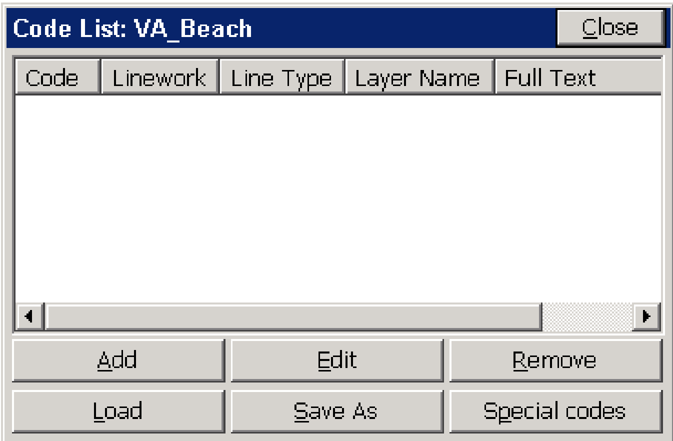


Figure 9-2

FCL (Feature Code List) files can be created, edited or reviewed on a PC using Carlson X-Port or any Carlson surveying office software. (FAST Survey's FCL file is equivalent to Carlson's Field-to-Finish FLD Table used in their PC office software. Transfer all PC Field-to-finish FLD table files using SurvCOM or Carlson Export. Select the

Field Code Table option to upload the FLD file to FAST Survey as a FLC file.)

Defining Field Code Line/Layer Properties

To define codes with line/layer drawn features and optionally GIS prompting, select in the Code List pop-up box “Add” (**Error! Reference source not found.**). The following Add Code pop-up box allows the operator to define Field Code Line/Layer drawing properties (Figure 9-3).

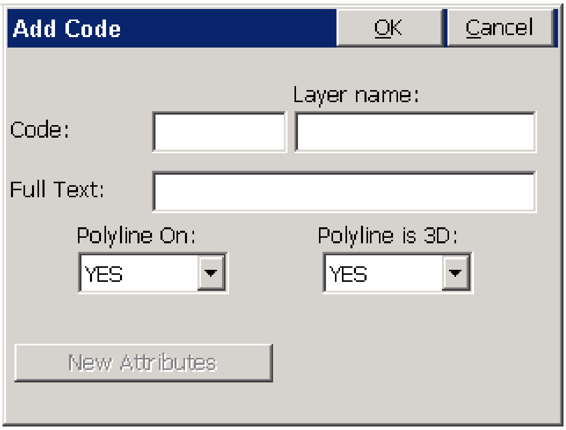


Figure 9-3

- **Code**: Input one word Field Code
- **Field Text**: User defined full text description for code
- **Polyline On**: Yes or No defines to draw or not to draw between similar codes e.g. EP, EP1
- **Polyline is 3D**: Yes or No-Yes draws in 3D, No in 2D
- **Layer Name**: Defines the layer the linework 2D & 3D will draw in using SideShot/Traverse or Store Point.

The following EP code has been input in the FCL file. When surveying using SideShot/Traverse or Store Point in the SURV menu, input field codes EP, EP1, EP2 and so on will draw 3D Polylines between these similar codes in the EOP layer. A 3D Polyline will be drawn in real-time when collecting data and inputting EP or EP# codes in surveyed points descriptions.

"New Attributes" becomes highlighted after inputting all the Line/Layer drawing properties. GIS prompting information can be added for this field code. If no GIS prompting is applicable for this field code simply pick OK and create another field code or exit and store the FCL file.

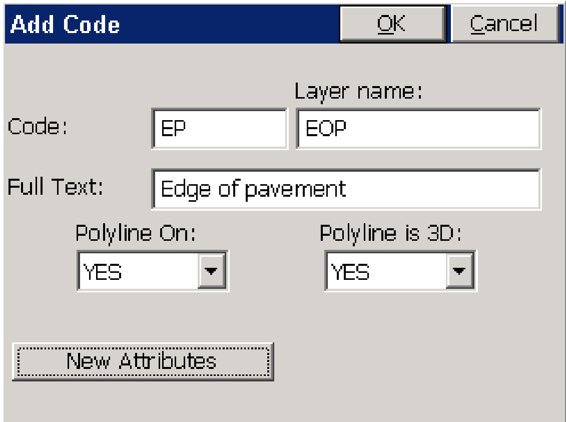


Figure 9-4

Defining Field Code GIS Prompting

To add GIS prompting to a defined Line/Layer code, select "New Attributes" (Figure 9-4). The following GIS Feature pop-up box is displayed (Figure 9-5). To define GIS prompting for the EP field code select "Add" in Fig. 5. The next pop-up box titled New attribute displayed below (Figure 9-6) creates GIS prompting.

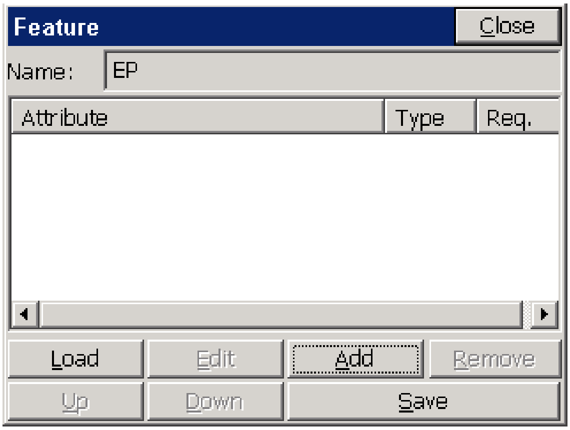


Figure 9-5

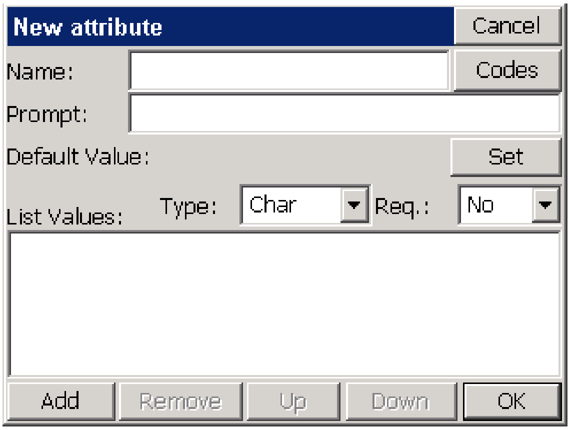


Figure 9-6

Load will load any existing Field Code GIS prompting for reuse. Edit reviews or revises existing GIS prompting. Add creates individual GIS prompting shown in Figure 9-6. Remove deletes any highlighted GIS attribute. Up and Down reorders the sequence of GIS attribute prompting. Save stores input or edited GIS prompting and exits to Line/Layer drawing properties.

Defining GIS Prompting

- **Feature Code Name**: No spaces GIS title for database
- **Codes**: Special codes e.g. Date, Time, Lat, Long.

- **GIS Prompt**: Including spaces full name for GIS
- **Default Value**: Most common GIS value/default value
- **Set**: Lets the operator highlight and select the default value if there is a List of attribute Values.
- **Type**: Offers 4 options CHAR, INT, REAL and Code. Code Type will default to character type corresponding to special Codes. Codes can be Char, Int. or Real automatically.
- **Req**: Requisite/required entry. Operator cannot leave any GIS prompt empty when this field is set to Yes.

To add GIS attribute prompting for List Values select "Add" below in Figure 9-7. The following New value pop-up box appears in Figure 9-8. The operator inputs after selecting Add again for each possible material e.g. macadam, concrete, brick, stone cobbles and so on.

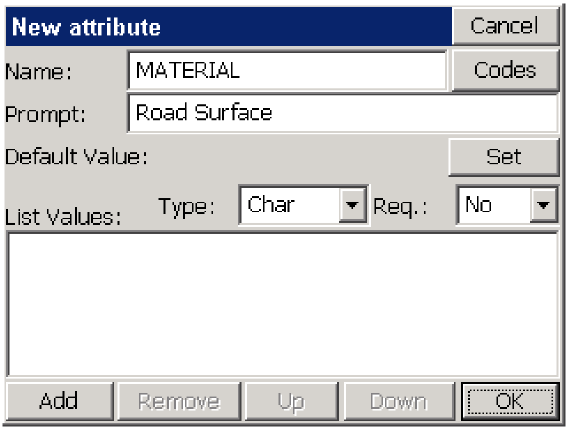


Figure 9-7

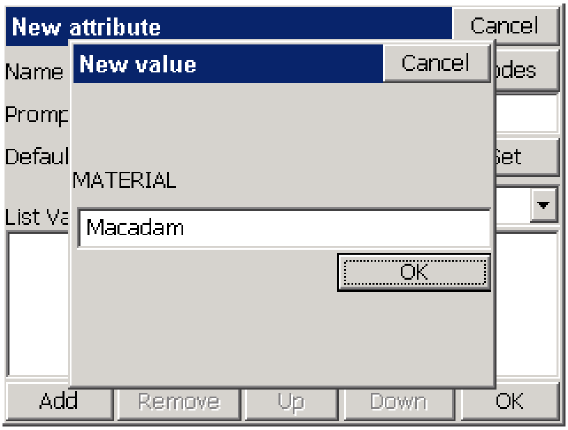


Figure 9-8

The data input for all GIS List Values is shown below in Fig. 9. Note Macadam is highlighted and will be the default value. If there are more than 6 attribute List Values scroll bars will appear. This defines only one GIS entry Material for the EP field code. Each GIS prompt for the field code EP e.g. Material, Location, Condition, Width, Slope and so on would require being created using Add in the Feature pop-up box in Figure 9-5. The completed GIS field code for EP is shown below in Figure 9-10.

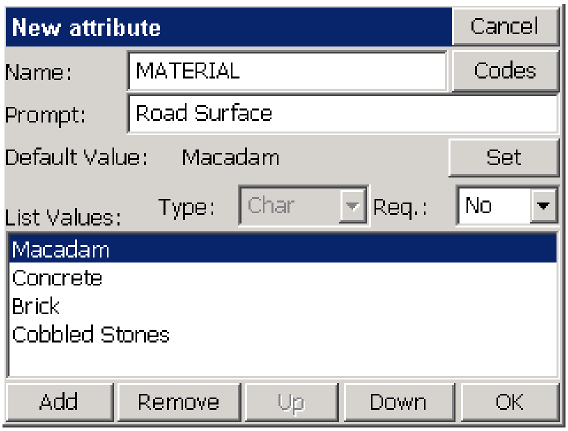


Figure 9-9

Add, Remove, Up and Down pertain to GIS List Values prompting. Add and Remove create or delete List Values entries. Up or Down reorders the highlighted List Value up or down.

OK exits the GIS prompting screen retaining the GIS prompting entries and Cancel exits and discards all new inputs.

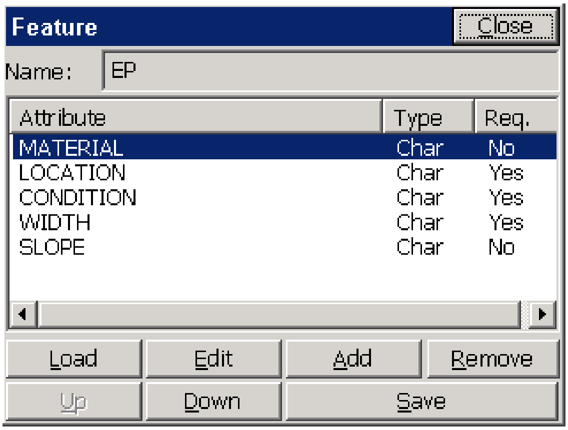


Figure 9-10

With all the GIS Features input Material, Location, Condition, Width and Slope the operator can select Save to store the GIS prompting for the field code EP. When storing points in the SURV menu in SideShot/ Traverse or Store Points with EP or EP#, 3D linework when ended will prompt for EP GIS data as defined here. If 2D or 3D linework is created the GIS data will be attached to the linework. Note Location, Condition and Width are required input GIS fields. Load allows selecting any existing field codes GIS prompting for reuse. Edit reviews or revises existing GIS prompting. Remove deletes highlighted GIS attribute prompting. Up and down reorder GIS attribute prompting. Save stores and exits.

Importing & Exporting GIS Information from FAST Survey

FAST Survey imports and exports ESRI SHP files. FAST Survey solely uses ESRI SHP files to interface with all GIS programs. ESRI SHP files are open architecture and are a widely used and accepted GIS format for most common GIS packages. To import or export GIS data to or from FAST Survey select in MAP – File – SHP File – Import or Export SHP File (Quick Import or Export only reads and writes the drawing entities and doesn't include the GIS info.) See Figures at bottom 25 and 26.

FAST Survey creates 3 ESRI GIS Drawing Objects – Points, Arcs (Polylines) & Polygons (Closed Polylines)

There are only three types of drawing entries in ESRI SHP files points, arcs (open 2D or 3D Polylines) and polygons (closed 2D or 3D Polylines). The EP field code creates points and arcs and/or polygons. GIS information is stored only to the arcs or polygons and not the EP points. All GIS information for EP will be attached to the 3D Polylines. The second Field Code UP in the FCL job file creates points only with no linework. The UP field code attachs GIS information to the UP points. See Figure 9-11 and Figure 9-12.

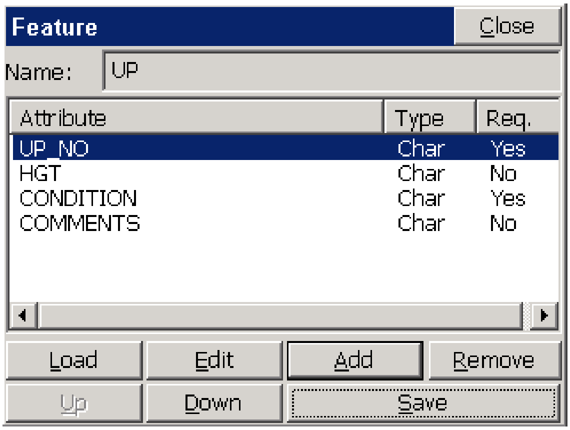


Figure 9-11

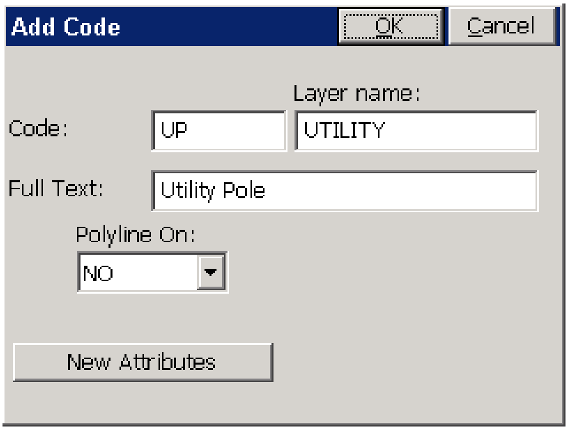


Figure 9-12

Save Feature Code List File

With two field codes EP and UP with GIS information input and stored in File – 5 Field Code List, lets collect some survey data in SideShot/Traverse with GIS information. Save As Feature Code List file See Figure 9-13 and Figure 9-14.

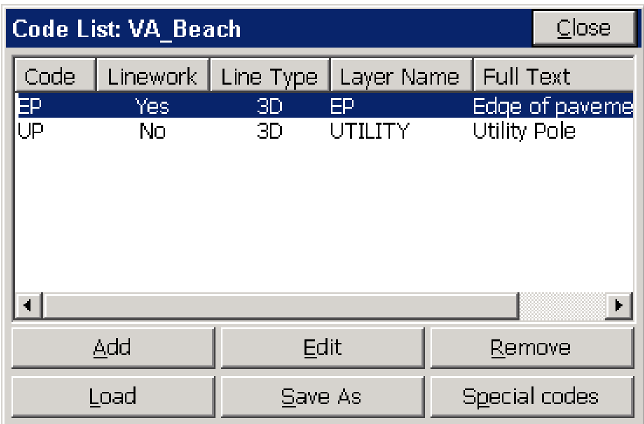


Figure 9-13

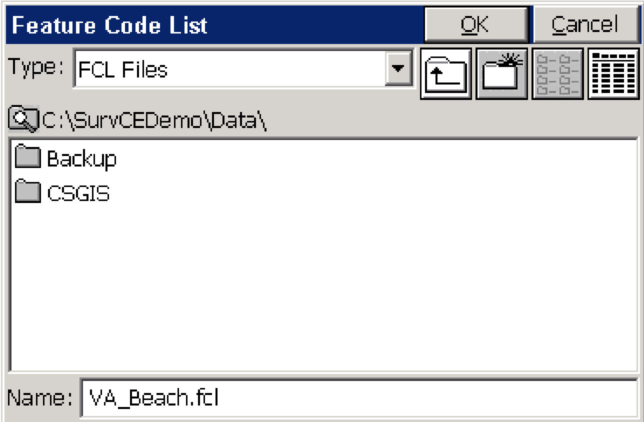


Figure 9-14

Add and Edit create or revise Line/Layer drawing properties and GIS prompting. Remove deletes field codes highlighted. Load unloads the current FCL file and loads another existing FCL Field Code Listing.

Collecting & Storing GIS information in FAST Survey

To demonstrate collecting survey data with GIS information FAST Survey is set to Manual Total Station or GPS Simulation.

For Manual Total Station go to menu SURV – SideShot/Traverse (See Figure 9-15 & Figure 9-16) – Follow figures for Manual TS. (Important in main menu File - Configure Readings - HGT/Desc Prompting is toggled ON!)

For GPS Simulation go to menu SURV – Store Point (See Figure 9-17 & Figure 9-18) Follow figures for GPS Simulation.

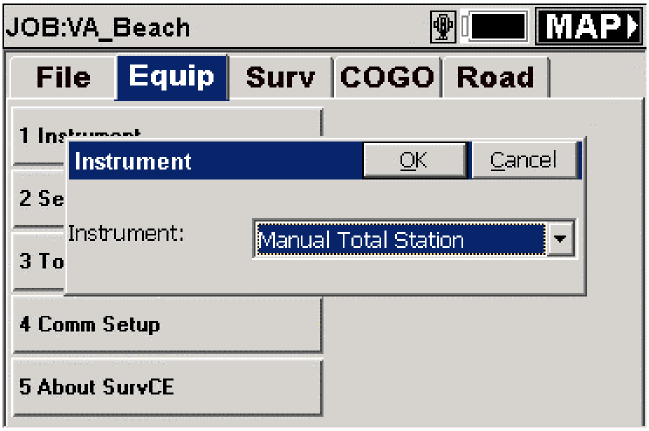


Figure 9-15

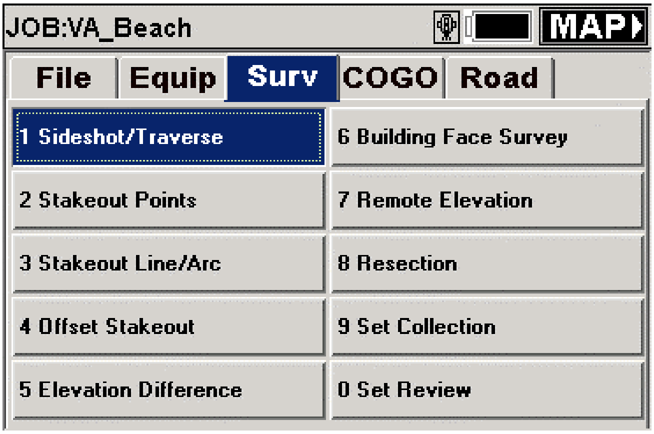


Figure 9-16

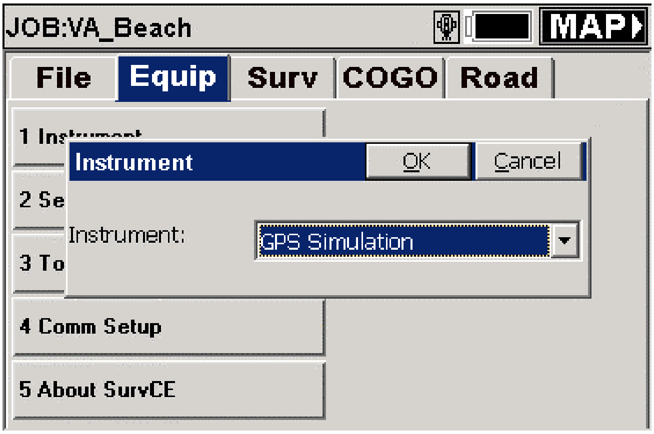


Figure 9-17

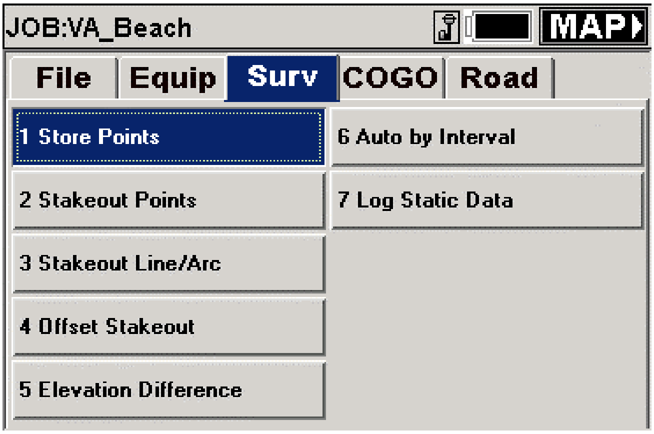


Figure 9-18

Manual Total Station Example Figure 9-19 - Figure 9-22

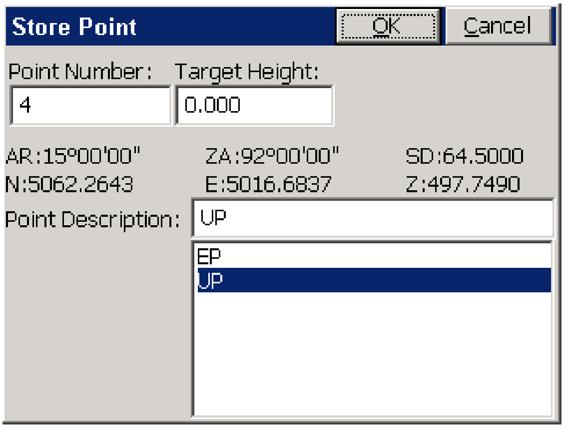


Figure 9-19

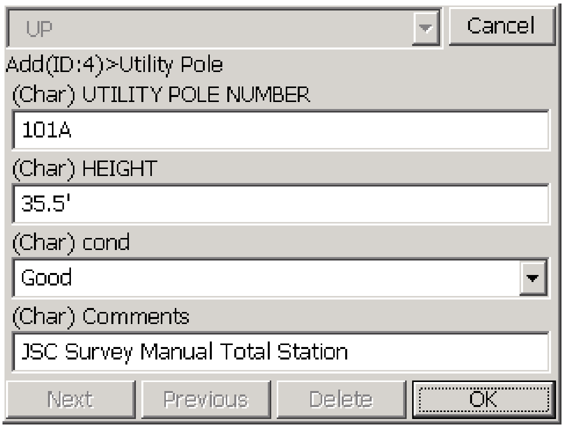


Figure 9-20

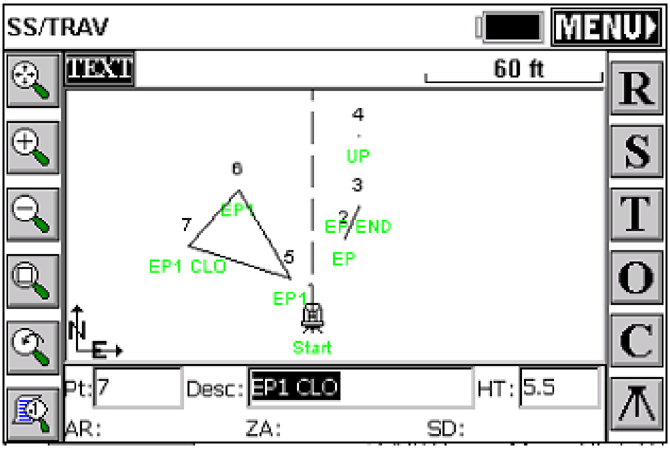


Figure 9-21

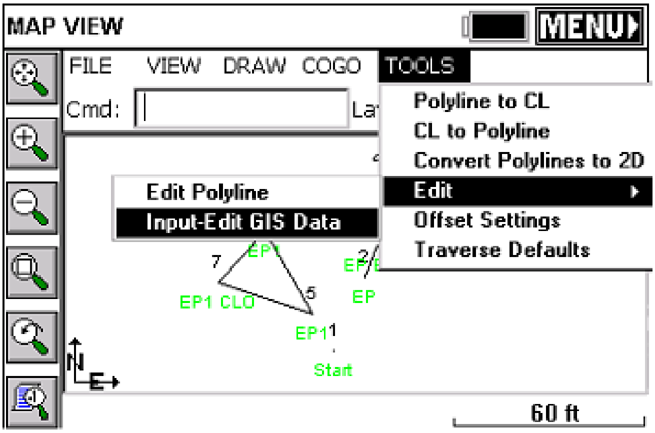


Figure 9-22

GPS Simulation Example Figure 9-23 - Figure 9-26

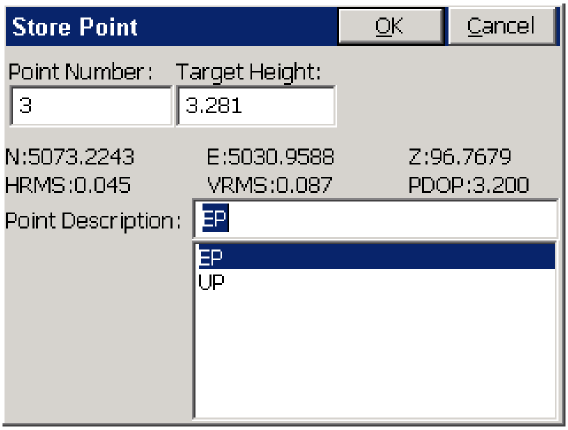


Figure 9-23

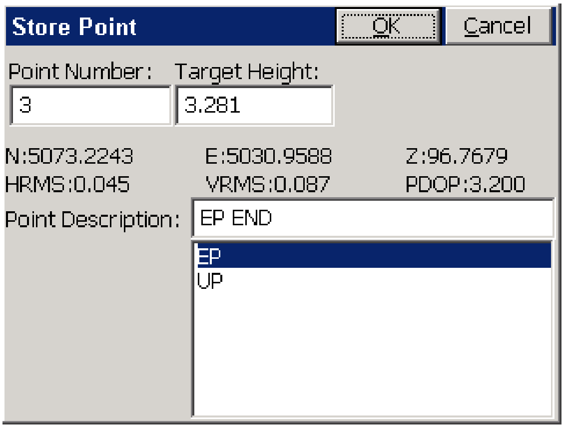


Figure 9-24

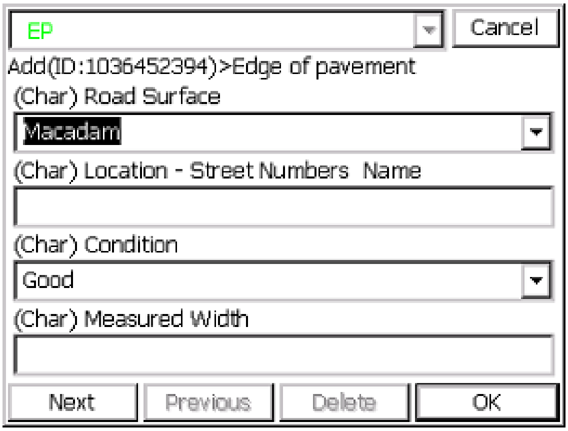


Figure 9-25

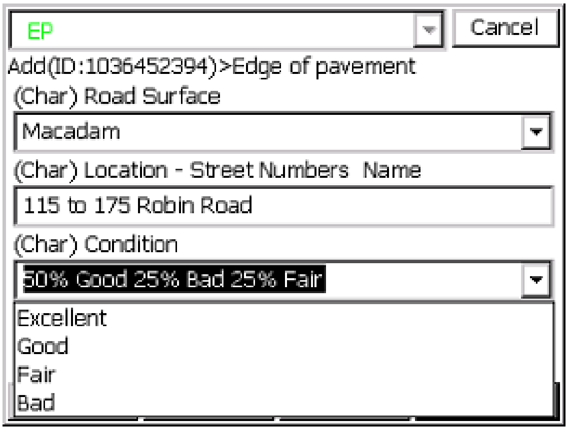


Figure 9-26

The Sequence of shoots started with GPS Simulation stored points 2 and 3 as EP codes. Point 3 was stored as EP END. A 3D Polyline was drawn between 2 to 3 and GIS prompting popped-up after point 3 was stored shown above. Note in the Condition field the operator input data not found in the default settings. Point 4 was stored using manual total station as a UP point code. Point 4's UP GIS prompting appeared after point 4 was stored. Points 5 through 7 were stored as a closed polygon. This was done by storing point 7 as EP1 CLO to close back to the start point 5 of the EP1 3D Polyline. The GIS prompting appeared for EP1 (not shown) and entered. The last sequence above was to exit SideShot/Traverse and select MAP.

Editing GIS Information on Arcs and Polygons – Input-Edit GIS Data

To edit existing GIS informations stored on Arcs (2D/3D Polylines) or Polygons (closed 2D/3D Polylines) in the MAP pop-up box select Tools – Edit – Input/Edit GIS Data and pick any polyline or polygon. In Figure 9-27 below, the closed 3D Polyline between points 5, 6 and 7 was selected using this command. GIS data for the closed 3D Polygon is shown in Figure 9-28

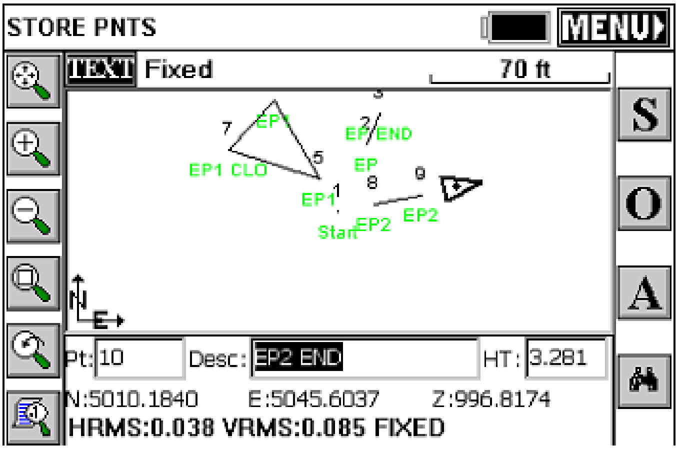


Figure 9-27

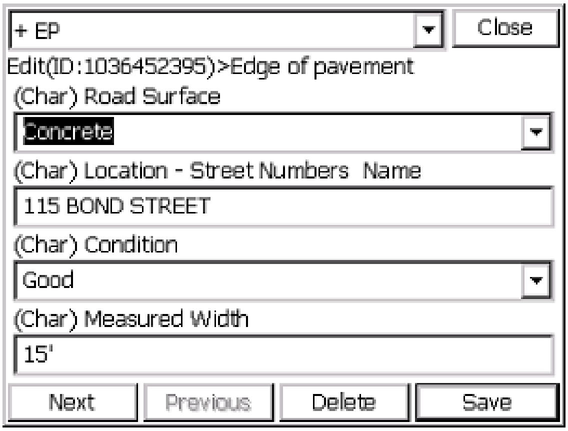


Figure 9-28

Figure 9-28 displays the ease reviewing, creating or editing GIS data using Input-Edit GIS Data. From the MAP screen Input-Edit GIS Data was selected and the closed 3D Polyline picked on the screen. The GIS data stored prior was displayed for review or editing. Any data point, polyline or closed polyline could be selected using the Input-Edit GIS Data command in MAP and new GIS attached to this entity or existing GIS data reviewed and edited.

Figure 9-27 displays the next EP code EP2 stored using GPS Simulation. When ended with a END or CLO description after EP2 FAST Survey will prompt for EP GIS data to attach to the polyline as defined above.

Editing GIS Information on Points using List Points

Input-Edit GIS Data only works creating, reviewing or editing GIS information on Arcs or Polygons. To create, review or edit GIS information on points use List Points shown below under File – 3 List Points.

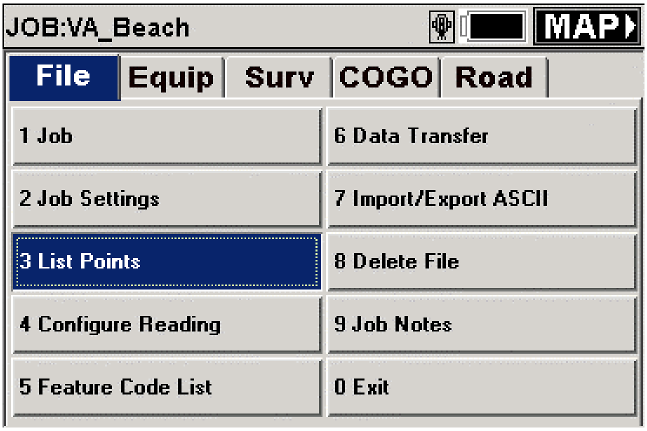


Figure 9-29

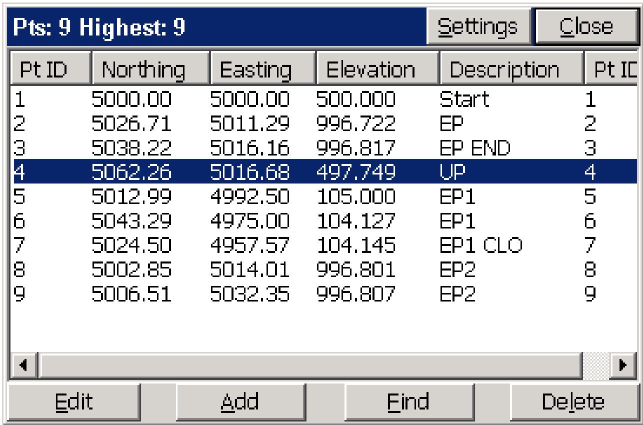


Figure 9-30

Highlight point 4 and select Edit (See Figure 9-30). Point 4 is the only surveyed number with GIS data stored to the point. The following Edit Point pop-up box appears Figure 9-31. To create, review or edit GIS information select Input/Edit Attributes (See Figure 9-32).

Note: At the +UP box on top the down arrow can be selected and one or more GIS field codes could attach GIS data to this same point. Points, Arcs or Polygons can all have one or more GIS field codes attached to these entities.

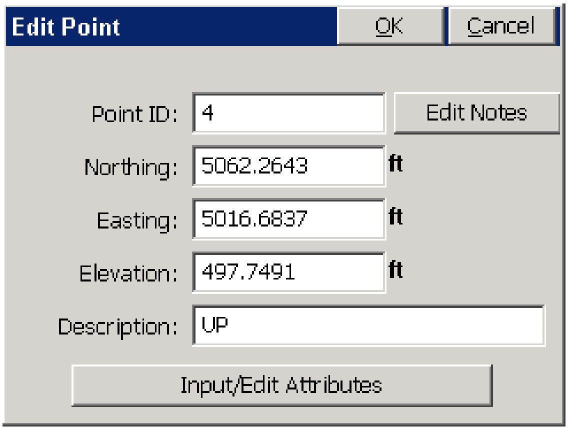


Figure 9-31

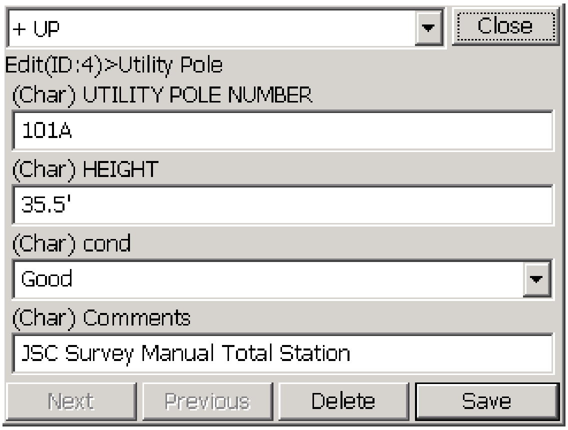


Figure 9-32

Exporting FAST Survey GIS Data as ESRI SHP files

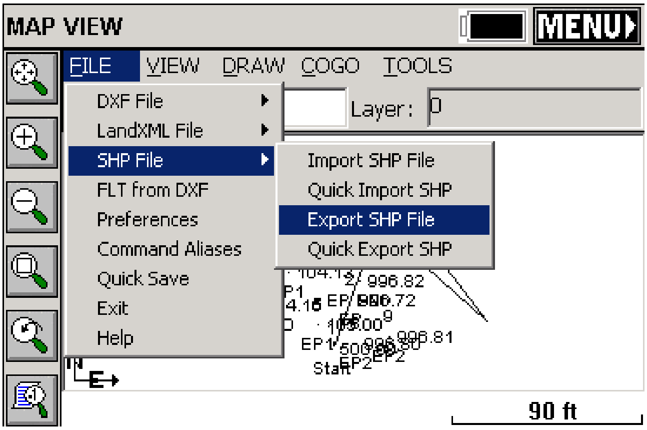


Figure 9-33

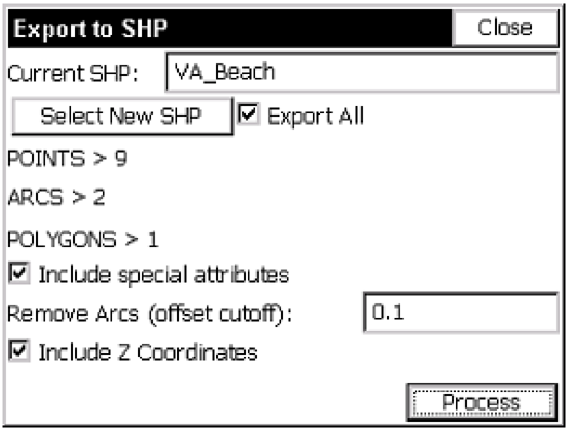


Figure 9-34

Figure 9-33 and Figure 9-34 display exporting our VA_Beach MAP and GIS data. The ESRI SHP file consists of 9 points, 2 arcs and 1 polygon (closed polyline). Only one point, point 4 has UP GIS data. Two arc polylines and one polygon have EP GIS information attached. Note - Include special attributes is checked. This adds to polyline arcs and closed polygons the polylines length and area to the GIS data automatically. Process with Export All checked stores the VA-Beach three SHP files automatically to a user defined subdirectory and a fourth SHP file with 8 points without GIS data.

Tutorial 2

Standard Procedures for Conducting GPS Localizations

This tutorial is intended to assist users with the recommended localization method for FAST Survey. Other methods can be used and it is up to the individual users to determine which is best for them.

File Extensions	
Localization File	*.dat
Geoid Model File	*.gsf
Coordinate File	*.crd
Raw Data File	*.rw5

Projections

It is essential that the proper plane coordinate projection is selected prior to creating a localization file. This should be the first step performed during the creation of the job file and be performed easily through File → Job Settings → GPS.

Geoid Model

An important item to note is if the user intends to use a geoid model (typical for localizations that contain less that 3 control points), the geoid model must be applied prior to the creation of the localization file.

A local portion of the geoid grid must be extracted from the Carlson Geoid Model using Carlson X-Port, SurvCOM, Survey or SurvCADD and the geoid model file must be installed prior to the creation of the local geoid file. It is also highly recommended that the local geoid file grid size does not exceed 100 miles.

Web Link to the Geoid Files

http://update.carlsonsw.com/public/CarlsonGeoidGrids.exe

Transfer or Enter the Known (local) Points

It's a good idea to simplify the process by transferring the known (local) points to the data collector prior to going to the field. Conversely, the user can keyboard enter the known coordinates for these points into the CRD file, one at a time, using File → List Points

→ Add. It is not recommended that the user keys in the local coordinates from within the localization process as transpositions can occur easily. However, this can be done as well.

Collect the GPS Locations with Averaging

Using the Surv → Store Points routine, specify your point ID. It is usually a good idea to use something that will relate to the original known point. Example, if the known point for the first control point is 1, then you may want to collect the measured location as 1001.

Use the average reading icon <A> to collect several epochs of data at each point. Typically when using a 1 Hz receiver, 10 to 30 readings will be collected to ensure that the RTK solution is consistently reporting the same position for 10 to 30 seconds. On a 5 Hz receiver, the user may want to collect 50 or more readings as 50 readings would be 10 seconds.

Create the Localization File

Once the data collector has points that represent the known (local) coordinates and the measured data for these points, the localization file can be created.

Select Equip → Localization → Add to enter each point into the localization file.

Local Point

The first dialog presented to the user will be the Local Point dialog shown below. Enter the known (local) coordinate point ID or coordinates. If the point does not exist in the CRD file and coordinates are entered into this dialog, do not enter a point ID. Select OK when the known (local) position has been defined.

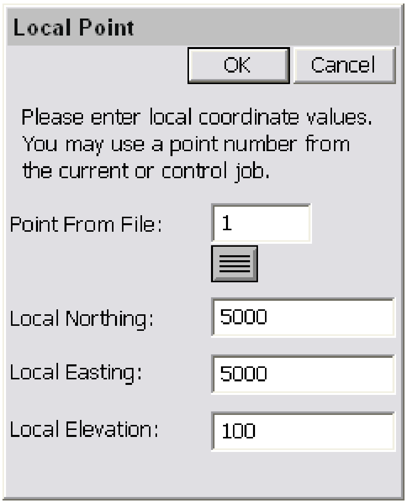


Figure 9-35

GPS Coordinates

The next dialog presented will be the GPS Coordinates dialog shown below. Since the measured locations for each point has already been recorded, the user will want to use the option From Raw File in this dialog. Select OK to continue.

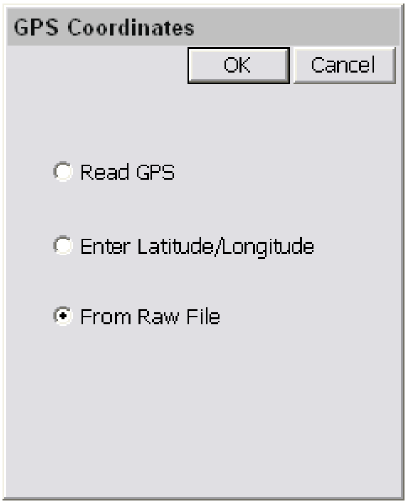


Figure 9-36

Surveyed Point

Next, the user will be presented with the Surveyed Point dialog shown below (left). This dialog allows the user to select or enter the GPS measured point that represents the known (local) point. If the user selects the GPS measured point using the list icon, they should ignore the current coordinates displayed in the List Points dialog shown below (right), as they only reflect the non-localized position at this point. The important thing to remember is that if the local point was 1 and the GPS measured point was 1001, the user must enter 1001 in this dialog.

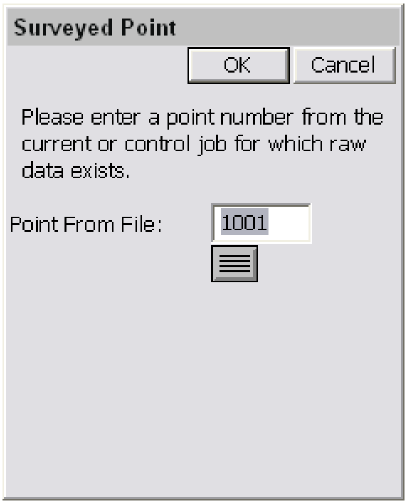


Figure 9-37

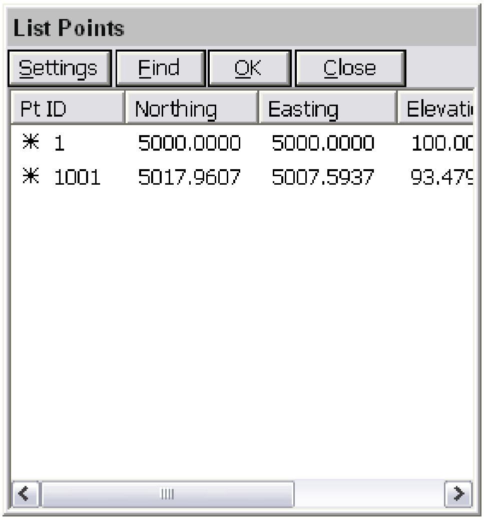


Figure 9-38

Save the Localization File

Once all of the points have been added to the localization dialog, save the localization file before exiting using the Save button.

Reprocess Raw File and Update Coordinates

At this point all of the coordinates in the CRD file that represent the measured positions need to be updated to reflect the newly created localization. To do this, select COGO → Process Raw File and process the raw file through the localization file. This will update the previously measured GPS points. Verify that the positions look valid by viewing the points in File → List Points. You should be able to compare the known and measured positions to see if they look right. Depending on the localization method, the measured values may not be exactly the same as the original known positions due to error that may have existed in the original positions.

Additional GPS Measurements

Once the localization is defined, all of the GPS points measured after its creation will be recorded to the CRD file based on this localization.

Changing the Localization

If the user determines that they want to redefine the current localization during a job, they must reprocess the entire raw file after making any changes to the localization file. It may be prudent to simply define a new localization file from scratch, leaving the original intact, and reprocess the raw file through this new localization file. Just remember that the last localization loaded, will be the current localization.

Selecting Projections for use in Localization

Whenever you select a projection or coordinate system, you can place it in a "most used" list of coordinate systems to choose from under the GPS tab in Job Settings. This list can contain one projection system or as many different systems as the user would like.

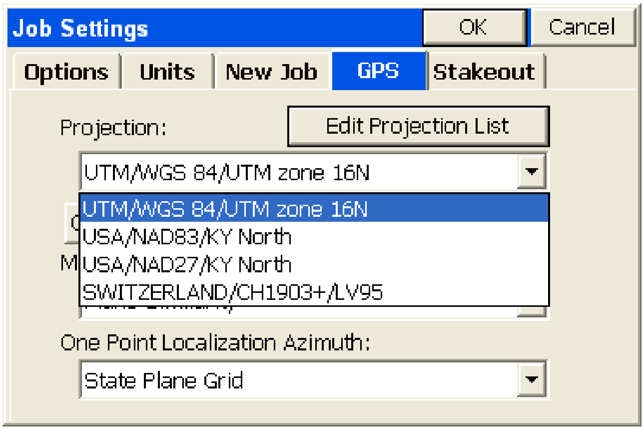


Figure 9-39

This is a special list of either predefined (eg. KY North NAD83) or user-defined coordinates systems. To get the list started or add to the list, select Edit Projection List and click Add Predefined. In the U.S., for example, surveyors might want to keep the UTM (WGS84) system plus the NAD83 and NAD27 "state plane" zones in the list for quick access, covering the region of your work. European and other worldwide zones can be added. When setting up a UTM selection, you can choose your zone, referencing the graphic below for the US:

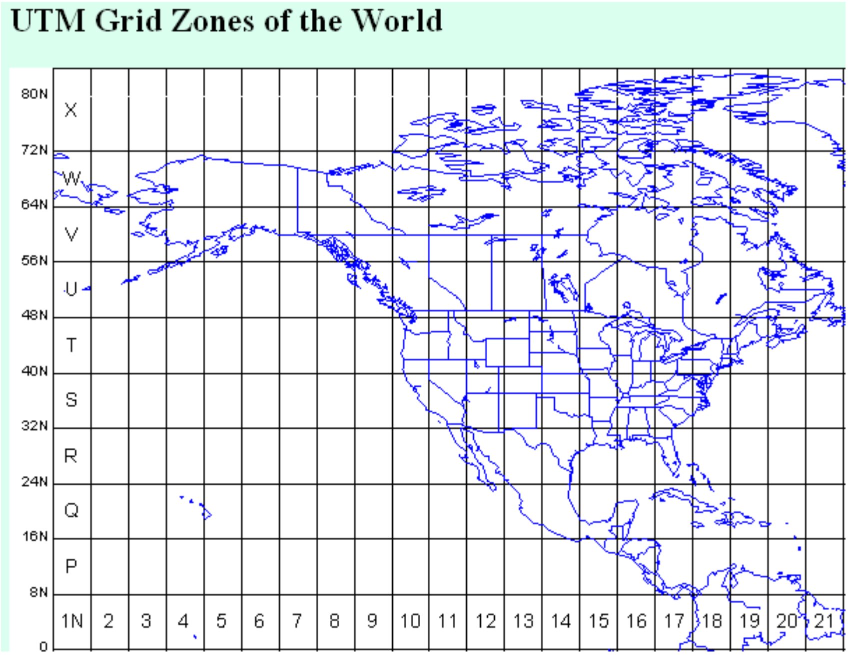


Figure 9-40

You can see a map of the UTM zones online at: http://www.dmap.co.uk/utmworld.htm.

To edit the list of saved projections, click on Edit Projection List. Here we select a user-defined UTM system from the list to Delete or Edit.

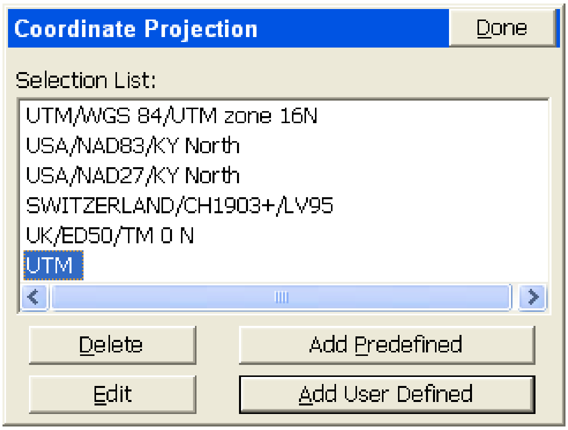


Figure 9-41

Choosing Edit will bring you to the screen below:

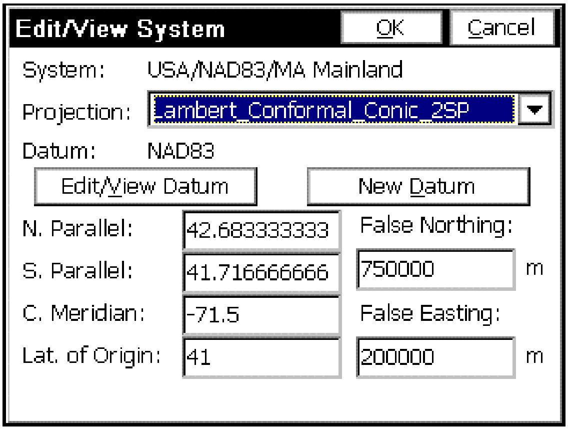


Figure 9-42

From this screen, you can select the Projection calculation method as well as calculation parameters. Projections include:

Lambert Conformal_Conic_2SP,
Transverse_Mercator,
Oblique_Sterographic (Double),
Lambert_Conformal_Conic_1SP,
Oblique_Mercator_83,
Stereographic, Oblique_Mercator_27,

Transverse_Mercator_OSTN02,
Oblique_Stereographic_RD2000,
Oblique_Mercator,
Cassini_Soldner,
Transverse_Mercator_27,
Lambert_Conformal_Conic_27,
Transverse_Mercator_Alaska_27
Transverse_Mercator_34.

You may also use the buttons on this screen to edit the existing datum or create a new datum definition.

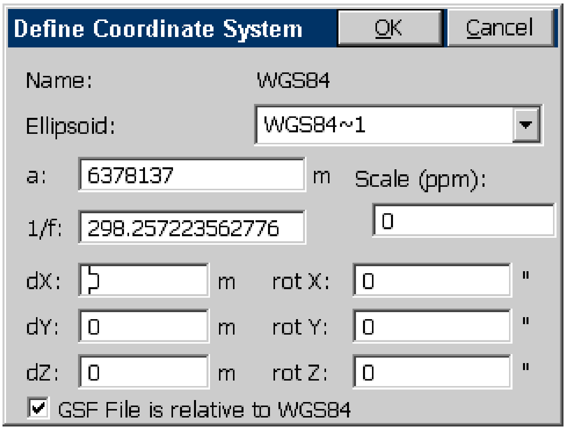


Figure 9-43

The Datum definition screen is where you select the ellipsoid and Helmert parameters to apply.

If you select Add User Defined within the Coordinate Projection List screen, you proceed to the screen below:

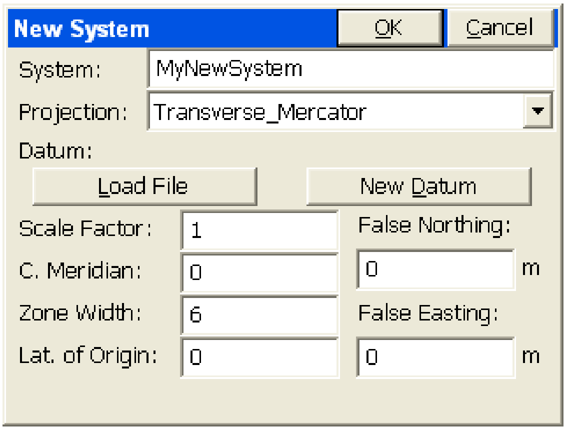


Figure 9-44

Here you enter the name of the new system and select the projection type and parameters, or you can "Load File" to load a pre-defined system stored earlier (in the form *.sys or *.csl).

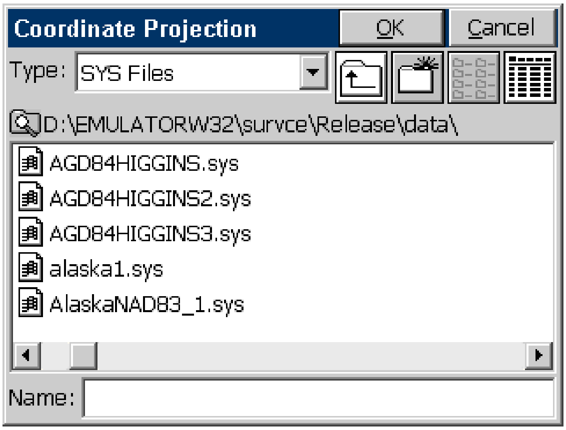


Figure 9-45

If you select "Add Predefined" to create a new, stored projection system, you will be presented with this screen:

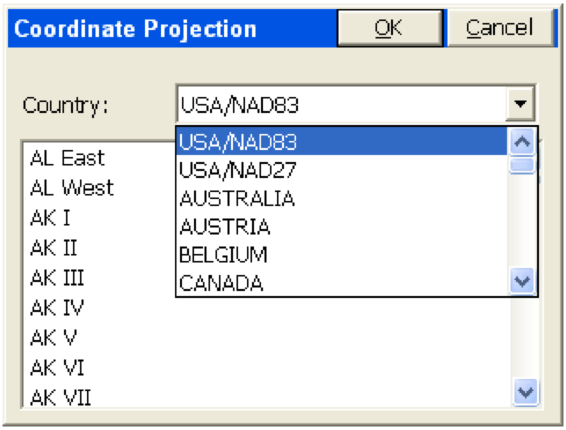


Figure 9-46

Here you can select the country and then the corresponding system for your area. There is a very extensive list of European and Asian systems including in the list.

The "quick-access" short list of most used projections enhances job efficiency.

10

Troubleshooting

This chapter contains troubleshooting tips for FAST Survey and the various hardware devices supported by FAST Survey.

Handheld Hardware

How do I reset the computer after a lock up?

Ranger

Hold down the power button until the computer resets or instructs you to hold it for 5 more seconds to reset.

Allegro

Hold down the power button until the computer resets.

Why can't I load the software?

The computer may disconnect from ActiveSync when there is not enough memory allocated to "Storage Memory". In the control panel, select the "System" icon followed by the Memory tab. Position the slider so that there is 5mb (5120 kb) allocated and not in use (i.e. if the "In Use" value says 1024 kb then add 1024 & 5120 to determine what the "Allocated" value should be.

How do I clear the RAM backup and why?

Clearing the RAM backup seems to improve performance on the Ranger platform after new programs have been installed or removed. Make sure that all software applications are closed and select the "RAM Backup" icon from the control panel. Select the "Delete" button and answer "Yes" to the three resulting message boxes.

Why can't I communicate through the COM port?

If you cannot communicate with the instrument, verify all COM settings in FAST Survey and make sure that they match the COM settings on the instrument. If it happens to be that you were communicating fine and the COM settings have not been altered, try one of the following until it clears up the COM port:

- Exit FAST Survey, turn off the computer, turn back on the computer and re-enter FAST Survey.
- Exit FAST Survey and perform a soft reset on the device (Verify that all applications have been closed).
- Exit FAST Survey and perform a hard reset on the device (Verify that all applications have been closed).

How do I set the CAPS LOCK status?

Ranger

Hold down the yellow shift button [^] and the [ALT] buttons, then press and release the power button.

A small keyboard should be showing. On the small keyboard, press the [CAPS] button then repeat step 1 to dismiss the keyboard.

Allegro

Press and release the blue function button followed by the CapLk/Shift button located at the lower left side of the keyboard.

How frequently should I charge the device?

Refer to your hardware manual for specifics, but most of the newer CE devices are coming with lithium ion batteries that do not establish a "memory" based on your charging habits after the initial charge has been established per the manufacturers suggestions. Charge the device as necessary which will likely be nightly to ensure a full battery for the next day in the field.

How do I calibrate the touch screen?

In the control panel of the CE device, select the “Stylus” icon to configure the “Double Tab” and “Calibration” of the touch screen.

How do I turn on/off the backlight?

Ranger

Hold down the shift button [^] and then press and release the power button.

Allegro

Press and release the yellow function button followed by the F3/F8 button located at the top center of the keyboard.

How can I speed up the Allegro performance?

In the control panel of the Allegro, select the “System” icon and then the “Memory” tab. Set your “Storage Memory” allocation to 8000 KB or 8 MB +/-. This should provide more RAM to the system for operating the programs and increase performance.

Miscellaneous Instrument Configuration

Leica Robotic - Do I need to be in RCS (Remote Control) mode?

You must verify that you are NOT in RCS mode when using FAST Survey with Leica robotic equipment. It will appear as though you are not communicating with the instrument if this mode is active. Refer to the Leica documentation for how to exit RCS mode.

Leica GPS - What firmware will allow radio channel changing?

Firmware version 3.52 or later is required for FAST Survey to have radio channel changing functionality.

Geodimeter 600 - What firmware version is required?

Firmware version 696-03.xx or later is required for FAST Survey to operate with this instrument. To check the firmware on the instrument, follow the key strokes below:

Menu, 5, 4, 1

FAST Survey

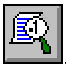
What file types does FAST Survey use?

ALN	TerraModel Road Alignment File
CL	Carlson Horizontal Road Alignment File
CR5	TDS Binary Coordinate File
CRD	Carlson coordinate file in binary form (Point ID, Northing, Easting, Elevation, Description).
DAT	Carlson Localization File
DXF	Drawing file format that can be used for exchanging drawing information with drafting programs that cannot read the DWG format. FAST Survey can import DXF files into the map screen using the IDXF command.
EGM	Carlson EGM Geoid File
FCL	Carlson Field Code Library file, comma delimited file in ASCII form (Field Code, Linework On Y/N, 3D Line Type Y/N, Layer Name, Full Text).
FLT	Carlson Triangulation Mesh File
G99	Carlson Geoid99 File
GRD	Carlson Grid File
INF	Carlson User Preferences Settings File
NOT	Carlson Note File
OBS	Geodimeter Coordinate File
POS	Sokkia or Trimble Coordinate File
PRO	Carlson Vertical Road Alignment File
RD5	TDS Road Alignment File
REF	Carlson Base Station Reference File
RLN	TerraModel Road Alignment File
RW5	Carlson Raw Data File

SCT	Carlson Design Section File
SDR	Sokkia Raw Data File
SHP	ESRI Shape File
SUP	Carlson Road Superelevation File
TPL	Carlson Road Template File
TPT	Carlson Road Template Transition File
TRV	Traverse PC Coordinate File
XML	LandXML File

How do I calculate a traverse (By Hand) with FAST Survey?

In order to do a hand traverse with FAST Survey, go to the MAP screen by clicking the icon in the upper right corner labeled MAP.

While in the map screen, select the map settings icon to set your Traverse Defaults .

Traverse Steps:

1 To begin, you must key in the command for inverse by typing “I” (Without the quotes) to establish your occupied and backsight points. The command prompt will display the following:

Cmd:Inverse - Tr/Ss/Pick point or point No

2 Key in the backsight point number followed by the [ENTER] key.

3 Key in the occupied point number followed by the [ENTER] key.

4 Key “T” for Traverse or “S” for Sideshot followed by the [ENTER] key.

5 If you keyed in “T” for traverse the command prompt will be waiting for an angle code by displaying the following:

Cmd:Traverse - eXit/I/Ss/Angle-BC(1-7)<7>

If you keyed in “S” for sideshot the command prompt will also be waiting for an angle code by displaying the following:

Cmd:Sideshot - eXit/I/Tr/Angle-BC(1-7)<7>

The code choices you can key in are as follows:

1 - Northeast Bearing

2 - Southeast Bearing

3 - Southwest Bearing

4 - Northwest Bearing

5 - Azimuth

6 - Angle Left

7 - Angle Right

6 Key in the angle code of choice followed by the [ENTER] key

7 Key in the angular value in the dd.mmss format followed by the [ENTER] key.

8 If you selected a vertical prompt under “Traverse Defaults”, then key in the appropriate value followed by the [ENTER] key.

9 Key in the slope distance followed by the [ENTER] key.

10 Key in the point description followed by the [ENTER] key.

11 Press the [ENTER] key to accept the next available point number or key in a new point number followed by the [ENTER] key.

12 If you traversed, then you are now occupying the new point and are back sighting the previous point of occupation. If you sideshot the new point, then you are still at the previous setup and ready to compute the next point.

13 Options at the command prompt when presented with the messages listed in step 5 are as follows:

X - Exit

I - Inverse

S - Sideshot

T - Traverse

Remember that in order to establish new occupied and backsight point information, you must use the “I” (Inverse) command and define the backsight point first and the occupied point second.

How do I perform math functions in FAST Survey input boxes?

Many input boxes in FAST Survey allow the user to calculate math functions on-the-fly.

To enter rod heights while in a GPS setup screen that is not in your current units (e.g. you're using a 2 meter pole but working in U.S. Feet), key in the following:

The Rod Height followed by "M" for Meters, "FT" for Feet and "IFT" for International Feet (Without the quotes) followed by the [ENTER] key will convert the measurement into your current units (e.g. 2M = 6.5617).

To compute the azimuth from one point to another to automatically enter in the azimuth while using the "Point by Direction" option in "Point Store", key in the following:

Point ID,Point ID (e.g. 1,2)

To add or subtract a value from the computed azimuth, key in the following:

Point ID,PointID+Angle (e.g. 1,2+90)

Or

Point ID,Point ID-Angle (e.g. 1,2-90)

How do I do a compass rule adjustment?

In the example below as shown in Figure 10-1, the traverse was performed by occupying point 1 located at the NW corner of the block. The initial backsight was established by azimuth, measured and stored as point 2 shown NW along the hanging leg. Angles and distances were measured in a clockwise direction. Point numbers 6 and 1 are at the same location and point numbers 7 and 2 are at the same location. This method allowed for the closing of the angles and the measurement of all traverse legs.

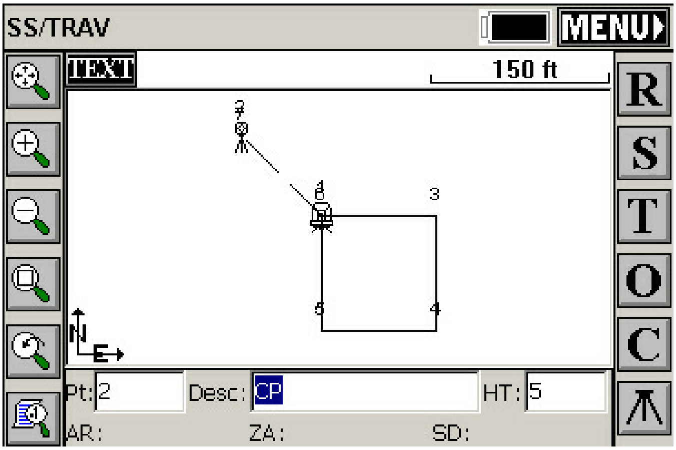


Figure 10-1

Process Raw File

Select "Process Raw File" from the "COGO" tab as shown below in **Error! Bookmark not defined.**.

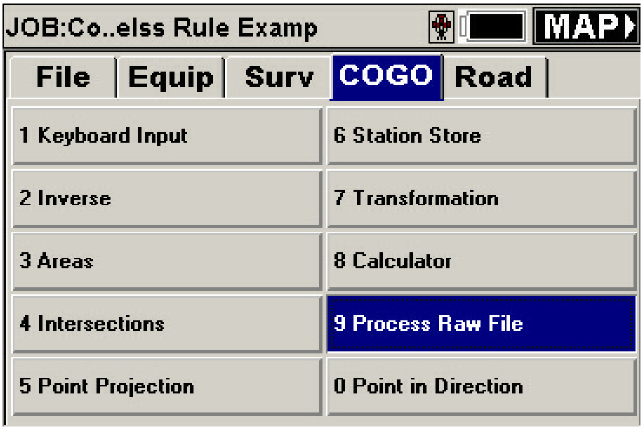


Figure 10-2

Select Raw File

Figure 10-3 shows the standard Windows file selection dialog.

Select the RW5 file you want to process followed by the “OK” button.

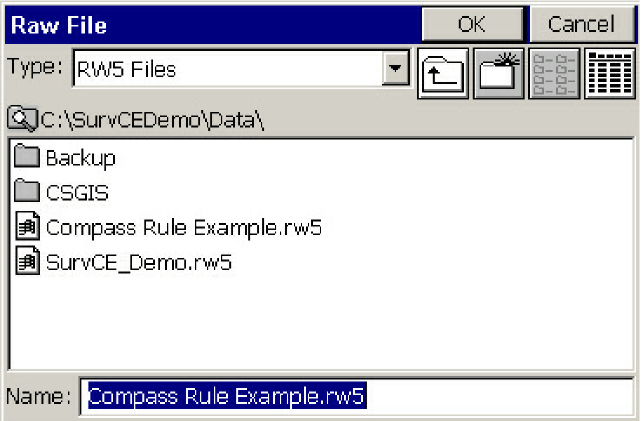


Figure 10-3

Select “Compass” from the adjustment options dialog box as shown in Figure 10-4.

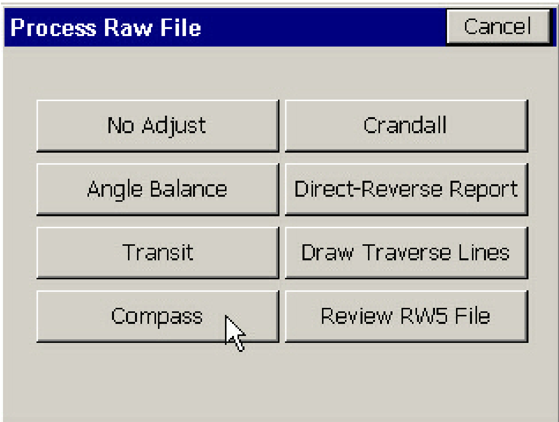


Figure 10-4

Reference Closing Point

Key in the initial occupied point number for the “Reference Closing Point #:” and toggle on the “Apply Angle Balance” option followed by the “OK” button as shown in Figure 10-5.

Closed Traverse

In a closed traverse scenario, the reference closing point will always be your initial occupied point name.

Note that you will need two known points, or one point and a known azimuth, for a closed traverse. The angle balance point will be the same location as the original backsight and will not be adjusted.

Open Traverse

In an open traverse scenario, the reference closing point will be a stored point name or coordinates that represents the known values for the last occupied point in the traverse.

Note that you will need two known points, or one point and a known azimuth, at the beginning and at the end of an open traverse; one point at the end will be used to close on and other will be used for angle balance (When Angle Balance is applied). The angle balance point will be the same as the last foresight point in the traverse and will not be adjusted.

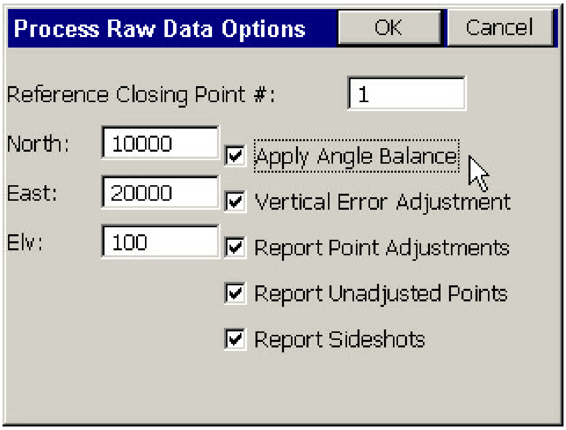


Figure 10-5

Traverse Points

You'll notice in Figure 10-7 or since you keyed in the data yourself that the number of traverse points in this survey is 7. Since point 7 was only measured to avoid and recording the closing angle balance measurement by hand, in this example the traverse is only from points 1 through 6. Replace the 7 in the "Ending Point Number" input box with a 6 as shown in Figure 10-6 followed by the "OK" button.

Note that point 6 should the same location as point number 1 in a closed traverse.

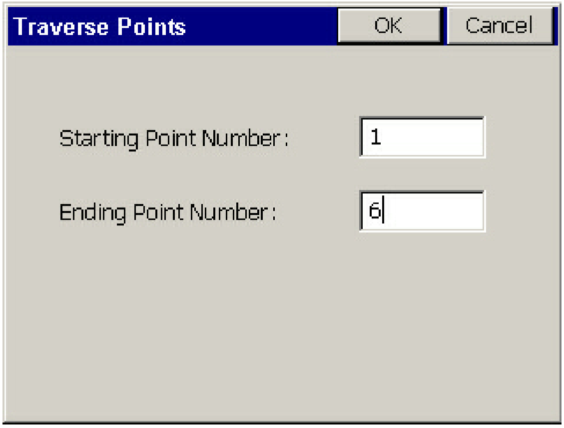


Figure 10-6

Angle Balance

Select the foresight shot from the last occupied point to the original backsight location. In this example we would select the leg measured from point 6 to point 7 since point 7 was our foresight angle balance shot to point 2. Press the "OK" button.

In an open traverse, this would be the measured leg that represents the known azimuth or bearing at the end of the traverse.

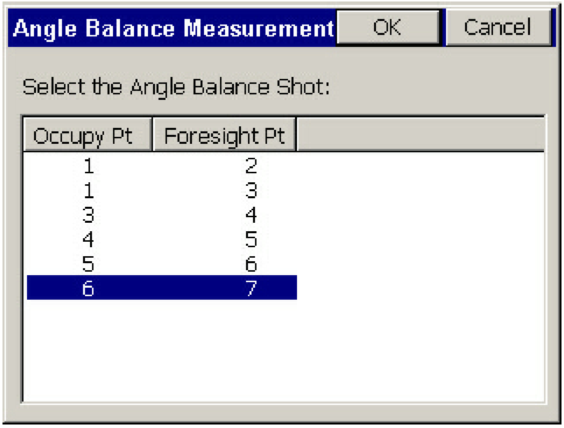


Figure 10-7

Reference Closing Angle

Finally we need to provide the reference closing angle (record). This is the original backsight azimuth. Key in point 1 and point 2 or key in the known azimuth or bearing followed by the "OK" button.

In an open traverse, key in the stored point numbers that represent the values for the known control points at the end of the traverse, or key in the known azimuth or bearing.

The adjustment report should be presented and the adjustment should be complete. The angle balance point number 7 will not be adjusted to fit point number 2 and can be discarded.

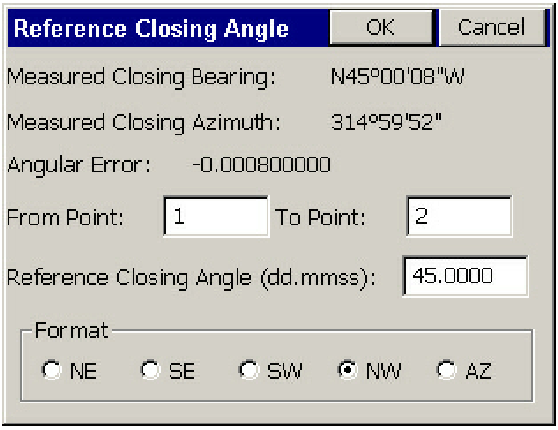

Reference Closing Angle
OK
Cancel
Measured Closing Bearing:
N45°00'08"W
Measured Closing Azimuth:
314°59'52"
Angular Error:
-0.000800000
From Point:
1
To Point:
2
Reference Closing Angle (dd.mmss):
45.0000
Format
NE
SE
SW
NW
AZ

Figure 10-8

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