TOPCON

TopSURV

Integrated Controller Software

User's Manual

TOPCON
POSITIONING SYSTEMS

TopSURV
User's Manual

Part Number 7010-0493
Rev I

February, 2007

Table of Contents

Preface

Thank you for purchasing your Topcon receiver, survey product or accessory (the “Product”). The materials available in this manual (the “Manual”) have been prepared by Topcon Positioning Systems, Inc. (“TPS”) for owners of Topcon products. This Manual is designed to assist owners with the use of software (the “Software”) to be used with the Product and its use is subject to these terms and conditions (the “Terms and Conditions”).

Please read these Terms and Conditions carefully.

Terms and Conditions

USE This product is designed to be used by a professional. The user should have a good knowledge of the safe use of the product and implement the types of safety procedures recommended by the local government protection agency for both private use and commercial job sites.

COPYRIGHT All information contained in this Manual is the intellectual property of, and copyrighted material of TPS. All rights are reserved. You may not use, access, copy, store, display, create derivative works of, sell, modify, publish, distribute, or allow any third party access to, any graphics, content, information or data in this Manual without TPS’ express written consent and may only use such information for the care and operation of your receiver. The information and data in this Manual are a valuable asset of TPS and are developed by the expenditure of considerable work, time and money, and are the result of original selection, coordination and arrangement by TPS.

TRADEMARKS Topcon®, HiPer®, TopSURV™, Topcon Link™, Topcon Tools™, and Topcon Positioning Systems™ are trademarks or registered trademarks of TPS. Windows® is a registered trademark of Microsoft Corporation. Bluetooth® is a registered trademark owned by Bluetooth SIG, Inc. and is used by Topcon Positioning Systems, Inc. under license. Sokkia Corporation and the names of Sokkia Corporation products referenced herein are either trademarks or registered trademarks of Sokkia Corporation. Satel is a trademark of Satel, Oy. Other product and company names mentioned herein may be trademarks of their respective owners.

DISCLAIMER OF WARRANTY EXCEPT FOR ANY WARRANTIES IN AN APPENDIX OR A WARRANTY CARD ACCOMPANYING THE PRODUCT, THIS MANUAL AND THE RECEIVER ARE PROVIDED “AS-IS.” THERE ARE NO OTHER WARRANTIES. TPS DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE. TPS AND ITS DISTRIBUTORS SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN; NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE OR USE OF THIS MATERIAL OR THE RECEIVER. SUCH DISCLAIMED DAMAGES INCLUDE BUT ARE NOT LIMITED TO LOSS OF TIME, LOSS OR DESTRUCTION OF DATA, LOSS OF PROFIT, SAVINGS OR REVENUE, OR LOSS OF THE PRODUCT’S USE. IN ADDITION TPS IS NOT RESPONSIBLE OR LIABLE FOR DAMAGES OR COSTS INCURRED IN CONNECTION WITH OBTAINING SUBSTITUTE PRODUCTS OR SOFTWARE, CLAIMS BY OTHERS, INCONVENIENCE, OR ANY OTHER COSTS. IN ANY EVENT, TPS SHALL HAVE NO LIABILITY FOR DAMAGES OR OTHERWISE TO YOU OR ANY OTHER PERSON OR ENTITY IN EXCESS OF THE PURCHASE PRICE FOR THE RECEIVER.

LICENSE AGREEMENT Use of any computer programs or software supplied by TPS or downloaded from a TPS website (the “Software”) in connection with the receiver constitutes acceptance of these Terms and Conditions in this Manual and an agreement to abide by these

Terms and Conditions. The user is granted a personal, non-exclusive, non-transferable license to use such Software under the terms stated herein and in any case only with a single receiver or single computer. You may not assign or transfer the Software or this license without the express written consent of TPS. This license is effective until terminated. You may terminate the license at any time by destroying the Software and Manual. TPS may terminate the license if you fail to comply with any of the Terms or Conditions. You agree to destroy the Software and manual upon termination of your use of the receiver. All ownership, copyright and other intellectual property rights in and to the Software belong to TPS. If these license terms are not acceptable, return any unused software and manual.

CONFIDENTIALITY This Manual, its contents and the Software (collectively, the "Confidential Information") are the confidential and proprietary information of TPS. You agree to treat TPS' Confidential Information with a degree of care no less stringent that the degree of care you would use in safeguarding your own most valuable trade secrets. Nothing in this paragraph shall restrict you from disclosing Confidential Information to your employees as may be necessary or appropriate to operate or care for the receiver. Such employees must also keep the Confidentiality Information confidential. In the event you become legally compelled to disclose any of the Confidential Information, you shall give TPS immediate notice so that it may seek a protective order or other appropriate remedy.

WEBSITE; OTHER STATEMENTS No statement contained at the TPS website (or any other website) or in any other advertisements or TPS literature or made by an employee or independent contractor of TPS modifies these Terms and Conditions (including the Software license, warranty and limitation of liability).

SAFETY Improper use of the receiver can lead to injury to persons or property and/or malfunction of the product. The receiver should only be repaired by authorized TPS warranty service centers. Users should review and heed the safety warnings in an Appendix.

MISCELLANEOUS The above Terms and Conditions may be amended, modified, superseded, or canceled, at any time by TPS. The above Terms and Conditions will be governed by, and construed in

accordance with, the laws of the State of California, without reference to conflict of laws.

Manual Conventions

This manual uses the following conventions:

Example	Description
File ▸ Exit	Tap the File menu and tap Exit.
Enter	Indicates the button or key labeled Enter.
Topo	Indicates the name of a dialog box or screen.
Notes	Indicates a field on a dialog box or screen, or a tab within a dialog box or screen.

Supplementary information that can help you configure, maintain, or set up a system.

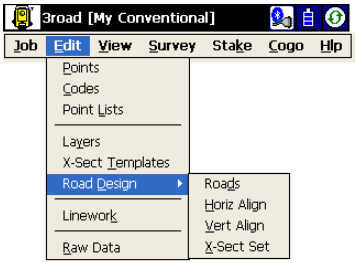
Supplementary information that can have an affect on system operation, system performance, measurements, personal safety.

What's New with TopSURV

This chapter briefly describes new features and functions for version 6.11 of TopSURV.

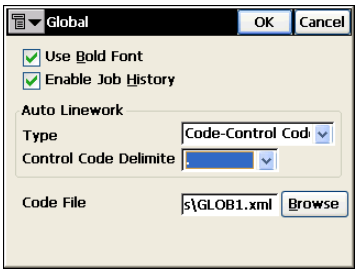
Updates on Road Design

Sections of roads are now available for separate editing.
For details on the road design, see "Designing Roads" on page 4-22.



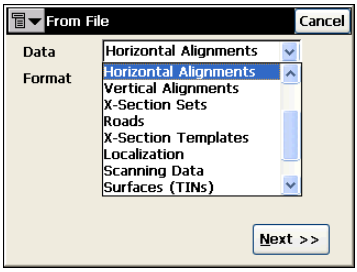
Layers from Global Data Dictionary

Besides the codes, the layers from a Global Data Dictionary file can be used in the current job.
For details on global settings for the job, see "Global Settings" on page 3-44.



New Import/Export Functionality

Sections of road can be selected separately from data types for import/export from/to a file.
For details on import/export functionality, see *TopSURV Reference Manual*.



Notes:

Introduction

TopSURV is Topcon's survey software available for hand-held controllers. When installed on a hand-held controller, TopSURV is used for surveying, common layout, and GIS purposes including:

- Field data collection with GPS receivers, Total Stations, and Digital Levels
- Roads design to create cross section templates, horizontal, and vertical alignments
- Stakeout designed objects
- Data conversions to a variety of file formats
- COGO calculations

TopSURV installs on hand-held controllers that run Windows® CE operating system, such as Topcon's FC-100, FC-2000, FC-200 and the integrated controller of GMS-2. Topcon Link software is included with TopSURV providing data integration with your current office software.

The TopSURV setup file will first be loaded onto a computer. To install TopSURV onto the controller, use ActiveSync and a connection between the computer and the controller receiving the software download.

Microsoft® ActiveSync® must be installed on the computer before installing TopSURV.

ActiveSync is available for free from the Microsoft website. (For downloading, access the website http://www.microsoft.com/windowsmobile/).

System Requirements

Minimum system requirements includes display 240x320 or 320x240 pixels, 64 MB RAM and 64 MB flash disk (internal), and Windows® CE version 3.0 or higher.

ActiveSync

Using ActiveSync, the controller can exchange data to a computer via USB cable.

1. Install ActiveSync in the computer and turn on the controller.
2. Connect the controller to the computer with the USB cable.
3. The controller will give the prompt, *Connecting to Host*.
4. The controller will prompt to set up a partnership or set up as a guest. Select the desired type of connection.
5. Once a connection has been established, the ActiveSync window will display on the computer.

Installing TopSURV

Use the steps below to install TopSURV onto the computer and controller.

1. Run TopSURVSetup.exe on your computer. The ***Welcome*** screen displays (Figure 1-1).

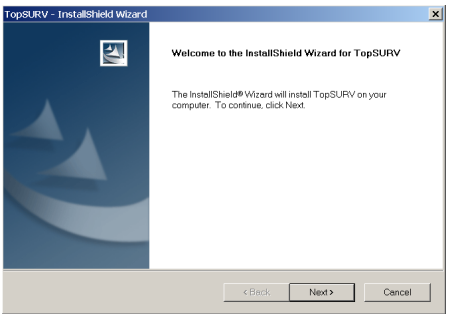


Figure 1-1. Welcome

If TopSURV is already installed, the Maintenance wizard displays the following screen (Figure 1-2):

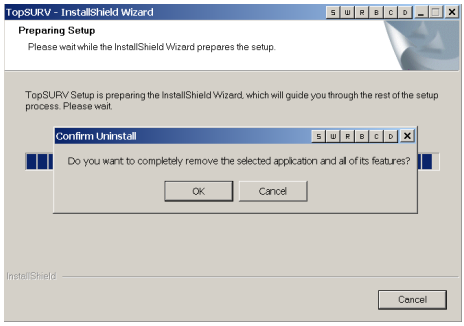


Figure 1-2. Confirm Uninstall

Click **OK** to remove the previous installation of TopSURV from your computer.

NOTICE

TopSURV will NOT be removed from the controller.

Once the previous TopSURV installation is removed, run TopSURVSetup.exe again.

2. Review the ***License Agreement*** (Figure 1-3).

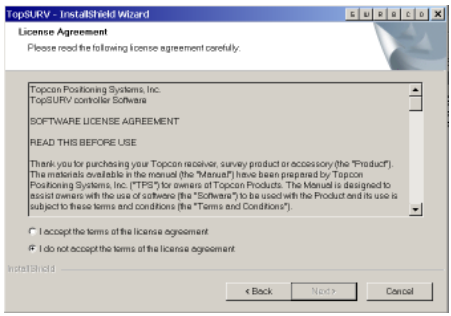


Figure 1-3. License Agreement

- To accept the terms and continue, click the “I accept...” radio button and click **Next**.

- To decline the terms and quit installing TopSURV, click the "I do not accept..." radio button and click **Next**. The InstallShield Wizard will close and TopSURV will not install onto the computer or controller.

3. Select the features to install (Figure 1-4) and click **Next**.

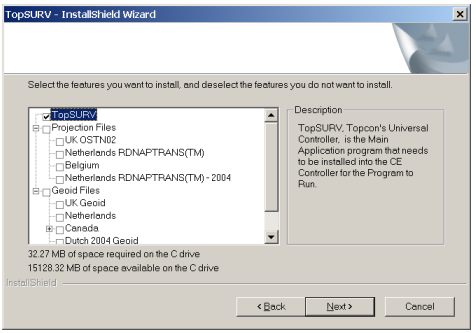


Figure 1-4. Select features

4. After detecting device information, the wizard will begin the installation.
5. Click **Install** to begin (Figure 1-5).

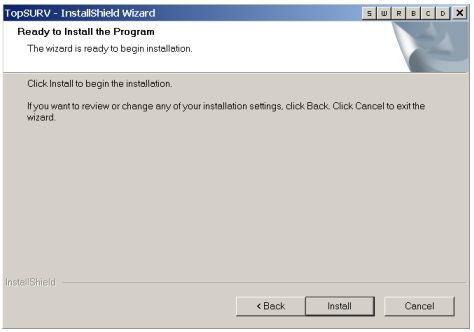


Figure 1-5. Select device

During the setup process, installation files are copied to the appropriate directories in your computer for ActiveSync to access.

Once finished, TopSURV installation accesses ActiveSync and launches Add/Remove Programs to install TopSURV in the controller (Figure 1-6).

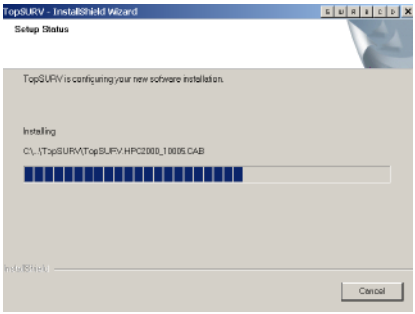


Figure 1-6. Setup Status

If the controller is disconnected from the computer, the following screen displays (Figure 1-7). After connecting the controller and computer, click **OK** to continue.

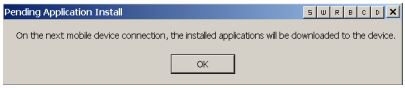


Figure 1-7. Install Completion Pending Controller Connection

ActiveSync starts the Add/Remove Programs process, which automatically detects an available installation and attempts to install it on the controller (Figure 1-8).

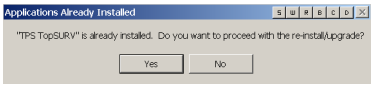


Figure 1-8. Data Retrieved from Mobile Device

6. Click **Yes** at the ***Installing Applications*** screen (Figure 1-9) to install TopSURV into the default directory in the controller.

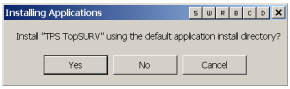


Figure 1-9. Installing Applications

If the controller does not have space available (Figure 1-10), a prompt will display to delete some files or programs to make room for TopSURV, or to select other destination media.

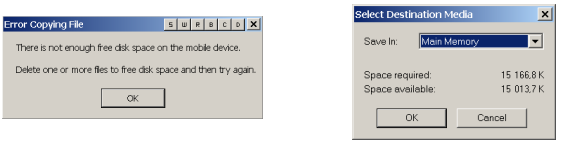


Figure 1-10. Delete Files to Provide Space or Select Destination Media

7. After clicking **Yes**, ActiveSync copies the installation file (CAB file) from the computer to the controller.

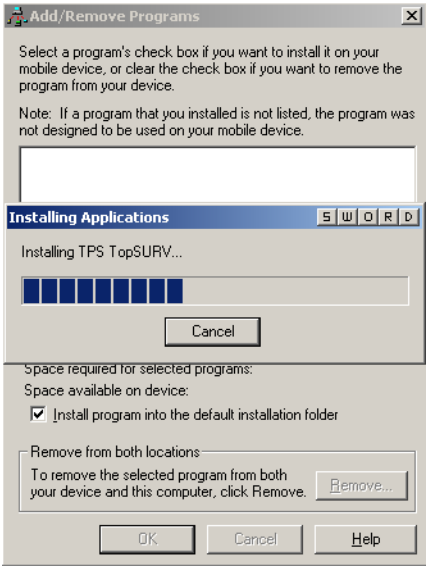


Figure 1-11. Installation Complete

8. Once the transfer completes, follow the steps indicated on the controller's screen to complete the TopSURV installation.

   Then the ***Setup Status*** screen displays to configure software installation. When finished, the ***InstallSheild Wizard Complete*** screen displays.

9. Click **Finish** to exit the install program.
10. Once the installation completes, the TopSURV icon will display on the controller screen to start TopSURV.

Uninstalling TopSURV

The Remove Programs tool in Windows CE or through the Add/ Remove Programs tool in ActiveSync both uninstall (remove) TopSURV from the controller.

Removing TopSURV from the controller is recommended before installing a software upgrade. Be sure to save all necessary job files first.

Starting TopSURV

To start TopSURV, tap the TopSURV icon on the controller screen and then press the **Enter** button. Upon initial startup, TopSURV requires an access code to run (Figure 1-12). Contact a Topcon representative to acquire the necessary codes.

- *Key Value* – the identification number of the device; record to give to a Topcon representative.
- *Activation IDs* – the fields in which to enter the security codes received from a Topcon representative to activate either one or more of the following purchased modes: *TS, Contractor, Robotic, GPS+*, *GIS (RT DGPS and PP DGPS)*, *Roads,* and *mmGPS*.

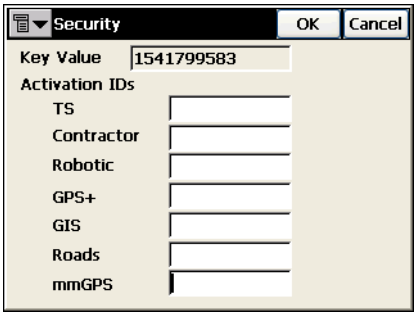


Figure 1-12. Security

Once entered, the access codes are saved in the hidden file in the directory where TopSURV is located. To view existing codes or add a new code, tap **Help ▸ Activate Modules**.

Demo Mode

Upon initial startup, a Demo version of TopSURV is accessible after tapping either **OK** or **Cancel** on the ***Security*** screen.

To run the demo version, tap **OK** on both the ***Security*** screen and the warning message that displays (Figure 1-13).

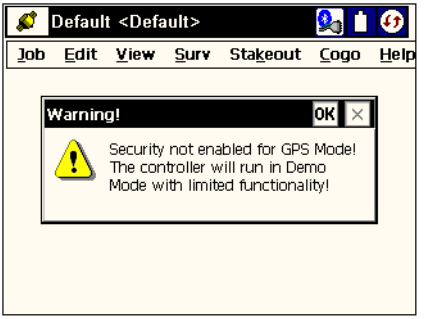


Figure 1-13. Access to Demo

A full-featured demo version of TopSURV will be available with operational data limited. This demo version can store up to 25 surveyed points and roads of 100 meters in length.

Getting Started

To start surveying with TopSURV, make several preparations of the available equipment (see “Preparation” on page 2-1), and create a job to perform specific tasks on the jobsite (see “Creating a New Job” on page 3-1).

The following sections describe the various TopSURV functions to assist in getting started with the software.

NOTICE	Data corruption can occur during data collection if the controller is low on power. If a warning about low power level displays, save and close the current job.

Preparation

Global Navigation Satellite System (GPS+) Setup

1. Plumb the survey antenna over the mark and switch on the receiver and the controller.
2. If the receiver and the controller are Bluetooth® enabled, set the Instrument type to GPS+ and check the Bluetooth option in TopSURV (change this setting later in the ***Observation Mode*** screen).

   To change the Bluetooth device that the controller is connected to, click the Reconnect icon  in the upper right corner of the main screen.
3. If the receiver or the controller are not Bluetooth enabled, or the Bluetooth option is unchecked, connect the receiver to the controller with the cable and set the Instrument type to GPS+ in TopSURV (change this setting later in the ***Observation Mode*** screen).

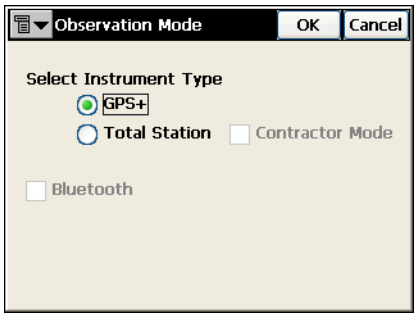


Figure 2-1. Observation Mode – GPS

Total Station (TS) Setup

1. Set up a tripod and then center the instrument over the mark.
2. By adjusting the tripod legs, center the cross hairs on the ground mark. Complete the process by using the leveling screws of the instrument so that the bubble indicates a level position. Switch on the total station and the controller.
3. If the total station and the controller are Bluetooth enabled, perform the following operations:
   - In the total station: select Bluetooth option and set PIN code.
   - In TopSURV: set the Instrument type to Total Station in the ***Observation Mode*** screen; select the TS model and set the Connection mode to Bluetooth TS; enable the Bluetooth option in the ***Observation Mode*** screen.
   - Select the TS from the list of devices and set the Passkey value to PIN code (use the same code used in the total station).

   To change the Bluetooth device that the controller is connected to, click the Reconnect icon  in the upper right corner of the main screen.
4. If the total station or the controller are not Bluetooth enabled, or the Bluetooth option is unchecked, connect the controller to the total station with the cable and set the Instrument type to Total Station in TopSURV. Make sure the data transfer parameters in the total station correspond to those in the controller.

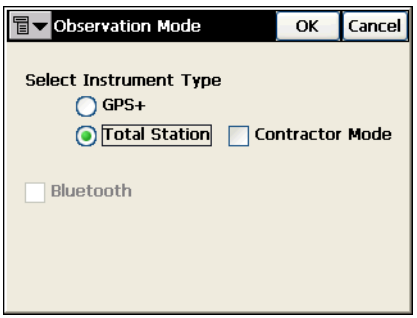


Figure 2-2. Observation Mode – TS

Level Setup

1. Set up the instrument in a desired location, with the tripod legs well spread and tapped into the ground.
2. By adjusting the tripod legs, roughly level the instrument. Complete the process by turning the level screws of the instrument to center the bubble within the circle. Switch on the instrument and the controller. Make sure that in the level the Out Module is set to RS-232C and the Measure option is selected from the Menu.
3. Connect the controller to the instrument with the cable and set the Instrument type to Total Station in TopSURV.

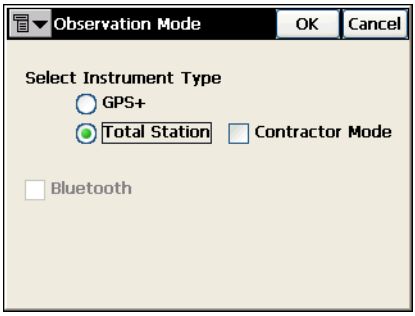


Figure 2-3. Observation Mode – Level

Notes:

Creating a New Job

Follow the procedure below to begin working with TopSURV and to create a New Job file.

1. Select **Job ▸ Mode** and choose the survey mode, GPS+ or Total Station, then tap **OK** (Figure 3-1). Choose Contractor Mode in Total Station survey mode for use by non-surveyors for Topo and Stakeout with total stations. Choose Total Station survey mode to configure a Level survey.

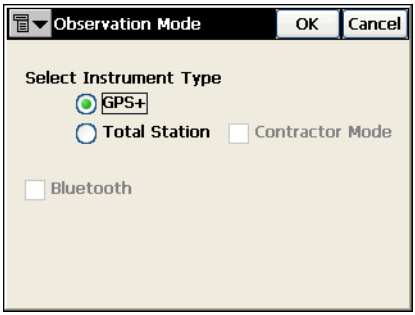


Figure 3-1. Observation Mode

- To create a new job, select **Job ▸ New** or tap the **New** button on the ***Open Job*** screen (during initial startup). The ***New Job*** screen displays. At any stage, select the finish button to create a new job. See the following sections to create a new job for your mode of survey.
- To open a job, select **Job ▸ Open**. In the ***Open Job*** screen, a list of all available jobs is displayed. If the desired job is not in the list, tap the **Browse** button. Select a *.tsv file in this screen and tap the **OK** button. Once opened, the job will be available through the Job list unless removed.

2. On the ***Open Job*** screen, do one of the following:
   - Select the job to open (Figure 3-2). Initially, a default job displays. Tap the **Open** button.

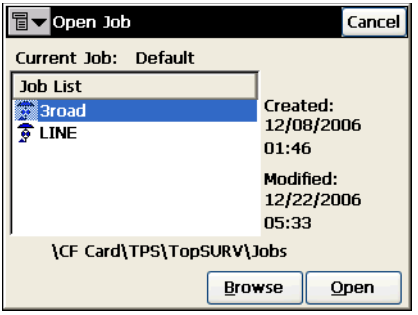


Figure 3-2. Open Job

   - Tap **New** to create a new job file (Figure 3-3). The following procedure describes creating a new job file.

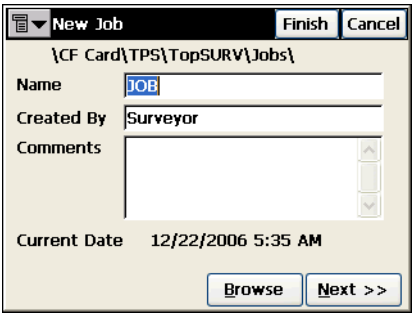


Figure 3-3. New Job

A Job file contains all the pertinent data for the work being done: settings of the performed work and information on the Survey Configuration. Survey Configuration is a set of settings, such as instrument parameters or radio settings, which are independent of the job (one configuration can be used on several jobs).

Configuration settings are applied to the equipment only after opening a screen that measures and stores data in the job file.

3. On the ***New Job*** screen (Figure 3-3), tap **Browse** to choose the location of the job being created. Enter the Name of the job and corresponding information (that is, the name of the surveyor and any necessary comments). The date is stored automatically. Tap **Next** to move to the next screen.
4. On the ***Select Survey Config*** screen (Figure 3-4), select the Survey Configuration, for both the GPS+ and TS. A Survey Configuration is a set of parameters that describe work conditions and depend upon the instrument used for the survey.

The last open configuration will initially display.

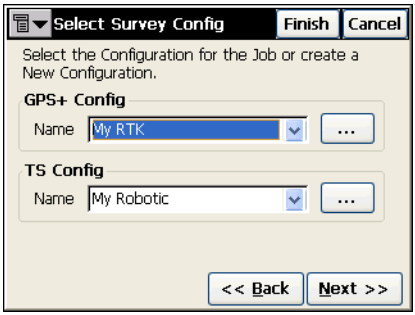


Figure 3-4. Select Survey Config

See the following sections for procedures to create and edit survey configurations.

- “Creating a GPS+ Configuration” on page 3-4
- “Creating a Total Station Configuration” on page 3-32

Creating a GPS+ Configuration

A new configuration is performed with the help of a Wizard.

When creating a GPS+ configuration, use pre-defined configurations or create new ones. The pre-defined configurations are listed in drop-down menus in the corresponding fields. In the GPS+ Configuration field, choose one of the pre-defined configurations or tap the Browse

button to create a new one or edit the parameters of an existing one. The ***Configurations*** screen displays.

The ***Configurations*** screen contains a list of available GPS+ configurations (Figure 3-5). Either edit an existing configuration or create a new configuration.

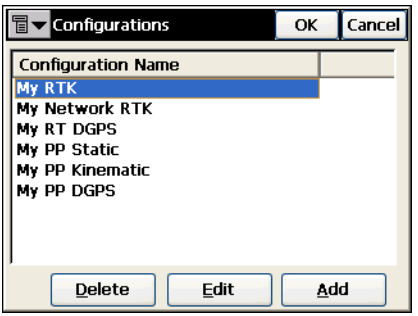


Figure 3-5. Configurations

1. To create a new configuration, tap the **Add** button.
2. On the ***Config: Survey*** screen, choose the configuration type (*RTK*, *Network RTK*, *Real Time DGPS*, *Network DGPS, PP Static*, *PP Kinematic*, or *PP DGPS*) and enter the name of the configuration (Figure 3-6 on page 3-5).

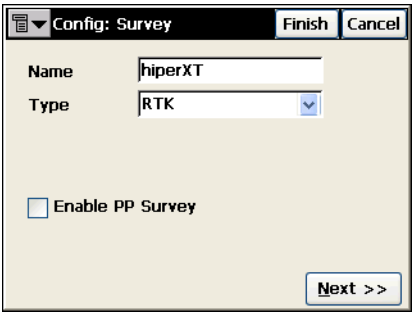


Figure 3-6. Config: Survey

For Network RTK and RT DGPS survey modes, select the corrections type (Figure 3-7):

- *VRS, FKP, Single Base* or *External Config* for Network RTK surveys
- *User Base*, *Beacon*, *WAAS*, *CDGPS*, *EGNOS*, *OmniSTAR-VBS* or *OmniSTAR-HP* for RT DGPS surveys.

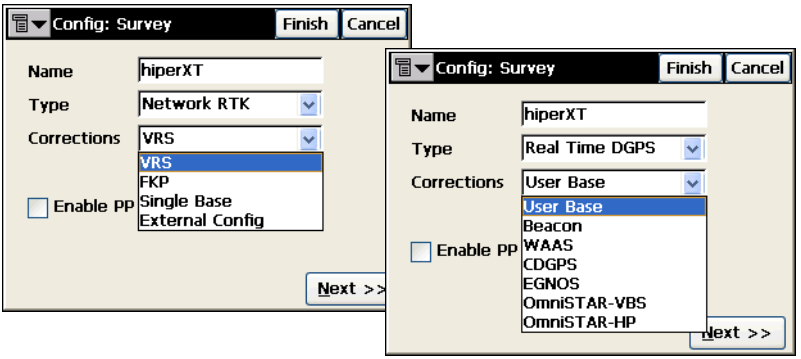


Figure 3-7. Config: Survey (Network RTK) and Config: Survey (RT DGPS)

3. Select the *Enable PP Survey* checkbox to configure a post processing survey type in RTK, Network RTK, RT DGPS and Network DGPS.
4. To set Multi-Port mode to transmit/receive data from different ports, select the *MultiPort* option from the menu on the upper left corner of the ***Config: Survey*** screen.

5. Depending on the mode, continue creating the configuration:
   - For RTK on page 3-6.
   - For Network RTK on page 3-16.
   - For RT DGPS on page 3-22.
   - For PP Static survey mode on page 3-29.
   - For PP Kinematic and PP DGPS on page 3-27.

RTK Survey Configuration

Real time kinematic (RTK) surveying is used for topographic survey and stakeout, and is the most precise method of real-time surveying.

RTK requires at least two receivers (Base and Rover) collecting navigation data simultaneously and being linked via a communication system. The Base receiver is usually at a known location and serves as a reference station. The Base receiver collects carrier phase measurements, generates RTK corrections, and transmits this data to the Rover. The Rover receiver processes its carrier phase observations with the received corrections, computing its relative position. The closer the Rover is to the Base, the higher the probability of determining the integer values of ambiguities. Typically, the distance between the Base and Rover should not be more than 10-15 km.

To enable logging Base and Rover data for post processing in RTK survey, select the *Enable PP Survey* checkbox in the ***Config: Survey*** screen.

After naming the configuration and selecting its type, tap **Next** on the ***Config: Survey*** screen (Figure 3-6 on page 3-5) and continue below to finish the configuration for an RTK survey.

1. Set the parameters for the Base Receiver: Elevation Mask and RTK Format (Figure 3-8 on page 3-7), and tap **Next**. Select the *Receiver Settings* option from the menu in the upper left corner of the ***Config: Base Receiver*** screen, to turn charging mode of the receiver battery off as needed.

Figure 3-8. Config: Base Receiver (RTK)

2. Set the Base Radio: choose the modem to be used and its parameters, and tap **Next**. In Multi-Port mode (see page 3-5) depending on the number of ports selected, there can be several radios for correction data output.

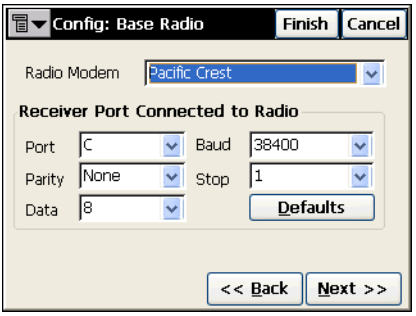


Figure 3-9. Config: Base Radio

- Custom modems use a standard set of parameters: port, parity, the number of data bits, the baud rate and the number of stop bits. Tap the **Default** button to set default settings for the port.

  AirLink GPRS, AirLink CDMA, CDPD[1], CDMA2000, Generic, Sierra Wireless MP200 CDPD and Internal HiPer Pro modem types do not require additional parameters.

1. CDPD stands for “Cellular Digital Packet Data”. CDPD is an open packet data service, defined as an autonomous overlay network, specified for the cellular TDMA network.

- Pacific Crest and Internal HiPer (Pacific Crest) modems need a channel and sensitivity to be chosen (these parameters are available through the **Next** button).
- For FH915 modem (Internal Hiper® Lite), set the operating channel of the modem. (This parameter is available through the **Next** button.)
- For FH915+ modem (Internal HiPer Lite+ FH915+ and Internal GR-3 FH915+), in addition to the operating channel, set the operation protocol and select the territory (specifically for Australia) to adjust the frequency range and RF power level for the modem and the operating protocol to communicate with different types of FH915 modem at the base/rover side. (These parameters are available through the **Next** button.)
- For the Satel modem, set the model, channel and frequency of connection. (These parameters are available through the **Next** button.)
- For HiPerXT UHF modem, set the protocol, channel, and power. (These parameters are available through the **Next** button.)
- For AirLink CDMA (Multicast UDP), set IP addresses for data transmission from the base station to more than one rover receiver using CDMA modems. (These parameters are available through the **Next** button.)
- For the Internal HiPer GSM, HiPerXT GSM, CR-3(GSM), Motorola V60, Motorola V710, MultiTech GSM/GPRS, Siemens TC35, Siemens M20, Wavecom Fastrack GSM or Nextel i58sr Cell Phone modem types, set the Base PIN. (This parameter is available through the **Next** button.)

3. Configure the Base Antenna settings and tap **Next** (Figure 3-10 on page 3-9).
   - Select the TPS Antenna type from the list.
   - Set the height and height type.

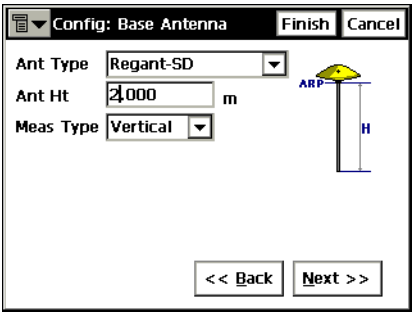


Figure 3-10. Config: Base Antenna

4. Set the parameters for the Rover Receiver and tap **Next**:
   - Elevation Mask for satellites to be used.
   - RTK Format, which needs to coincide with this set for the Base station (Figure 3-11).

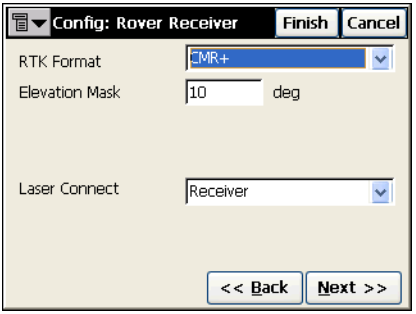


Figure 3-11. Config: Rover Receiver (RTK)

5. To set a number of ports for output of NMEA messages, select the *Output Port* option from the bitmap menu in the upper left corner of the screen (Figure 3-12 on page 3-10).
6. For using a hand held laser measurement system, select the *Laser Config* option from the bitmap menu in the upper left corner of the screen. Select which device the laser is connected to, and configure the laser device (for this configuration, see “Laser Configuration” on page 3-13).

7. To use the *CSD* form of data transmission for receiving RTK corrections through a cellular phone used as modem, select the *RTK protocol* option from the bitmap menu in the upper left corner of the screen (Figure 3-12).

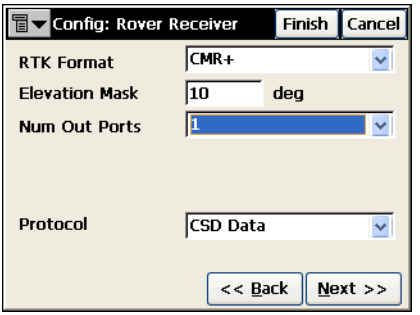


Figure 3-12. Config: Rover Receiver

8. Set the Rover Radio in a manner similar to setting the Base Radio and tap **Next**.

In Multi-Port mode (see page 3-5) depending on the number of ports selected, there can be up to two *Config: Rover Radio* screens to configure radios for data input.

Use only one radio to receive correction from the Base.

In Output-Port mode (see page 3-9) depending on the number of output ports selected, there can be up to two *Config: Output Radio* screens to configure radios for NMEA data output.

9. Configure the Rover Antenna (in the same way as the Base Antenna), and tap **Next**.
10. On the ***mmGPS*** screen, select options to use a mmGPS+ system in RTK survey if needed.

When measuring the height of the rover antenna, include the height of the PZS-1 sensor with 5/8 inch plug.

11. On the ***Config: Survey Parms*** screen enter Survey parameters and tap **Next**.
    - Select the *Solution Type* filter to be used for data logging (Fix Only; Fix and Float; Fix, Float, DGPS; or All).
    - Set the *Auto Accept* conditions for a simple Topo survey: number of measurements to be averaged and acceptable horizontal and vertical precision.
    - Set *Auto Topo* survey parameters: method of automatic data logging and the interval in corresponding units.

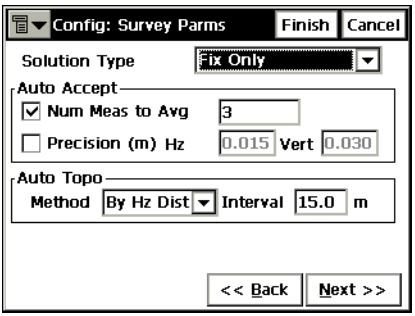


Figure 3-13. Config: Survey Parms (RTK)

12. Set the Stakeout Parameters: the horizontal distance tolerance, the reference direction, the rule for generating the point name and Note of the staked point (if necessary), and the Solution Type, then tap **Next** (Figure 3-14).

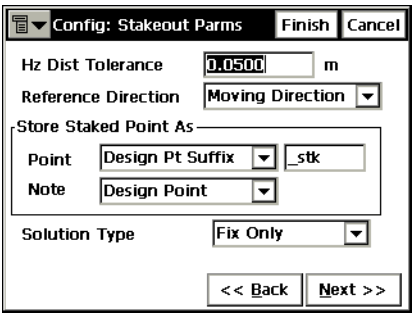


Figure 3-14. Config: Stakeout Parms

13. To display the icon for the staked point on the map, select the *Display* option from the menu in the upper left corner of the ***Stakeout Parameters*** screen. In the ***Staked Point Icon*** screen, set appropriate parameters for the icon.

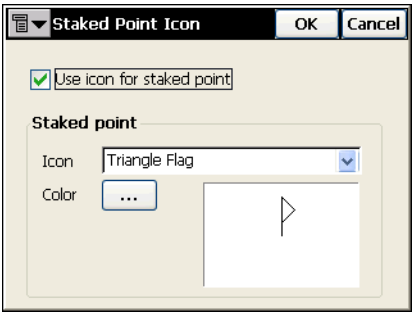


Figure 3-15. Staked Point Icon

14. Set advanced parameters for the survey (Figure 3-16).
    - Multipath reduction is used when a signal received represents multiple reflections from nearby objects. Enable this field to use this mode during the survey.
    - To use the Co-Op tracking mode, allowing higher efficiency of multipath reduction, enable this field.
    - Define the Satellite system to be used.
    - Set the RTK Position computation mode.

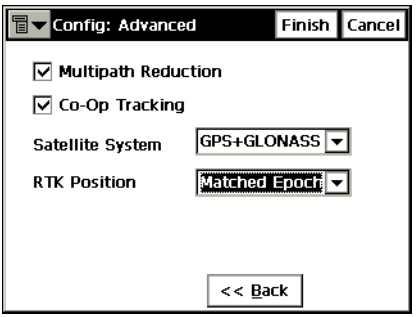


Figure 3-16. Config: Advanced

15. Tap **Finish** to store the settings and to return to the ***Select Survey Config*** screen. The name of the created configuration will display in the drop-down menu in the *GPS+ Config* field.

Laser Configuration

To use a hand held laser measurement system, set the properties for the laser device and tap **Next**:

1. Select the *Laser Config* option from the menu in the upper left corner of the ***Config: Rover receiver*** screen (Figure 3-11 on page 3-9). Select the device which the laser is connected to.
2. In the ***Laser Config*** screen set the properties for the laser device: a laser manufacturer, the instrument model and type, and laser port settings (Figure 3-17).

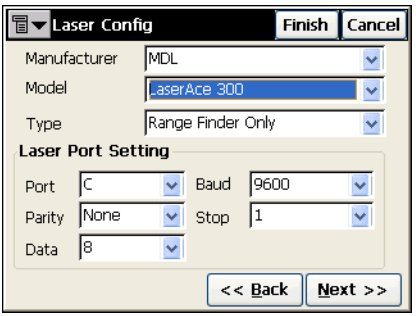


Figure 3-17. Laser Configuration

mmGPS Configuration

If mmGPS+ system is used in RTK survey (check the *Use mmGPS* box to enable mmGPS+), select the options in the ***mmGPS*** screen (Figure 3-18) and tap **Next**:

1. Select the *Receiver port* used for communication between receiver and PZS-1 sensor (typically port D).
2. Select *Auto* from the *Sensor Gain* drop down list to automatically control the mmGPS receiver's detection level of the transmitter's signal.
3. Select *Init Time Improvement* to use the mmGPS signal to assist in initializing the GPS receiver. This option is useful to decrease the initialization time when satellite visibility is limited (for example, tracking only four or five satellites).
4. Select *Weighted Height* to combine mmGPS elevations and GPS elevations. When selected, this option will force the

receiver/sensor to always consider the angle and distance when determining the elevation, then combine the two elevations accordingly. This option works well at large (300m) distances and steep angles.

5. In *Height Difference Limit*, set the threshold for the difference between GPS and mmGPS+ height measurements.

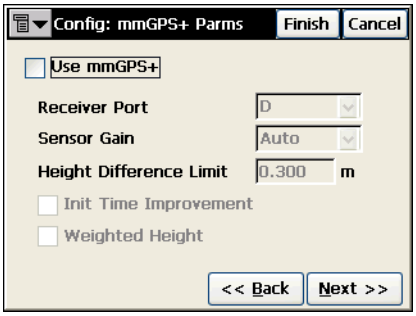


Figure 3-18. mmGPS

PP Enabled RTK Survey Configuration

In RTK survey with enabled post processing, the collected base and rover data are written to files for further post processing.

1. Enable logging the base and rover data by selecting the *Enable PP Survey* checkbox in the ***Config: Survey*** screen (Figure 3-6 on page 3-5).
2. Set the logging parameters for the Base receiver: the file name, logging rate and the device in which raw data is logged to (currently the Receiver is only available). Tap the **Next** button.

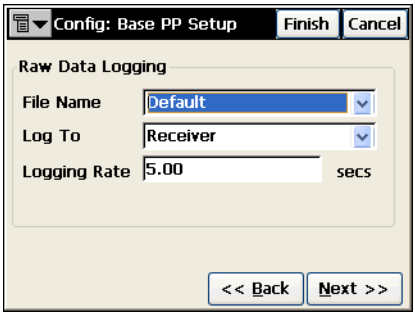


Figure 3-19. Config: Base PP Setup

3. Configure the Base Receiver, Radio and Antenna (for details, see “RTK Survey Configuration” on page 3-6) and tap **Next**.
4. Set the logging parameters for the Rover receiver: the file name, logging rate and the device in which raw data is logged to (currently the Receiver is only available). Select whether to start logging manually or automatically as data are being collected (Figure 3-20). Tap the **Next** button.

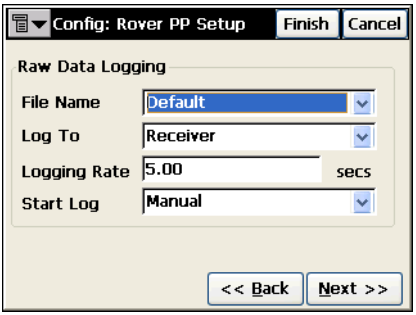


Figure 3-20. Rover PP Setup

5. Configure the Rover Receiver, Radio and Antenna, and the mmGPS device if used (for details refer to “RTK Survey Configuration” on page 3-6), then tap **Next.**
6. On the ***Config: Init Times*** screen (Figure 3-21), set the Initialization Times parameters, the times required for ambiguity resolution in the specific operating environment. These are used during automatic mode of the survey and depend upon the number of satellites available and the number of frequencies being used. Then tap **Next**.

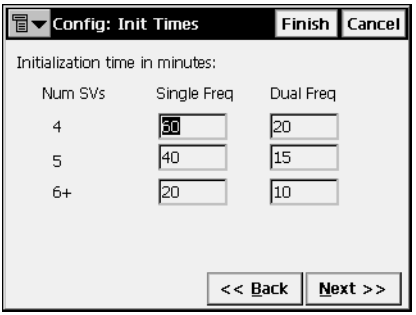


Figure 3-21. Config: Init Times

7. On the ***Config: Survey Parms*** screen, be sure to set the *Auto Topo Interval* multiple to the logging rate in the receiver.
8. Complete configuring the PP enabled RTK in a manner similar to RTK.

Network RTK Survey Configuration

Network real time kinematic (Network RTK) surveying is similar to RTK surveying but the correction data for the Rover is derived from the reference station network solution. Today's operating reference station networks are creating either Virtual Reference Station (VRS) data or network area corrections (FKP parameters). The concept of Network RTK allows performing RTK positioning in reference station networks with distances of up to 40 km.

1. After naming the configuration and selecting its type in the ***Config: Survey*** screen, select the desired correction type (Figure 3-7 on page 3-5) and tap **Next**.
   - VRS – to receive RTK corrections from a VRS base station.
   - FKP – if the base is transmitting FKP corrections.
   - Single Base – to receive RTK corrections from a single base.
   - External Config – when the receiver uses an External program to configure RTK corrections.
2. Continue below to finish the configuration for a Network RTK survey.

Survey Configuration for VRS and FKP Methods

1. Set the Elevation Mask for the Rover Receiver and select one of the following protocols from the *Protocol* drop-down list (Figure 3-22 on page 3-17), then tap **Next.**
   - NTRIP – (default) Networked Transport of RTCM via Internet Protocol to receive RTK corrections from a NTRIP Caster.
   - TCP/IP – to receive RTK corrections through the Internet.

- CSD Data – to use CSD form of data transmission to receive RTK corrections through a cellular phone used as a modem.

Figure 3-22. Rover Receiver

2. Select the desired modem connection and tap **Next**.
   - Select *Controller* if the modem is connected directly to the controller.
   - Select *Receiver* if the modem is connected directly to the receiver. For *CSD Data* only *Receiver* can be selected.

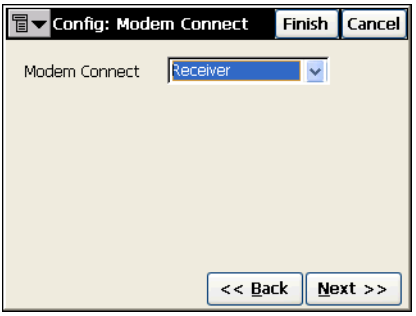


Figure 3-23. Modem Connect

- To use the Internal TopSURV NTRIP client, select *Controller*. Tapping **Next** will bring up the ***Config: Modem Internet Info*** screen (Figure 3-25 on page 3-18).

3. If connecting to the *Receiver*'s modem, configure the connection parameters for *External, Generic,* or *Internal GPRS* modem and tap **Next**.

NTRIP Internet Configuration

The following setup is an example of a GPRS connection. However, any generic method for connecting to the Internet can be used. Note that a Network RTK setup requires two-way communication links (like GSM and GPRS setups).

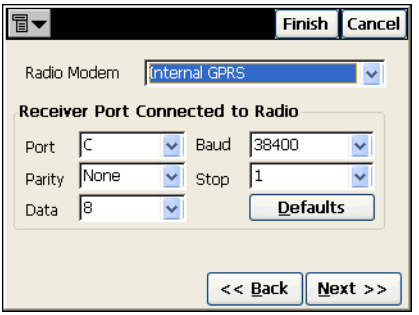


Figure 3-24. Rover Radio

4. Select a base IP address and port from the list and tap **Next**. IP addresses/ports can be deleted or added to the list.

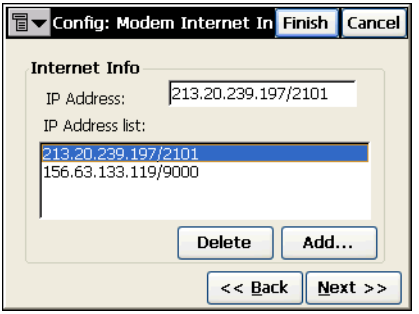


Figure 3-25. Modem Internet Info

5. Tapping **Next** will bring up the ***Config: NTRIP Login Info*** screen (Figure 3-26 on page 3-19) only if NTRIP was selected as the protocol to receive RTK corrections via the Internet.
6. Enter the NTRIP user name and password provided by the VRS service provider and tap **Next**.

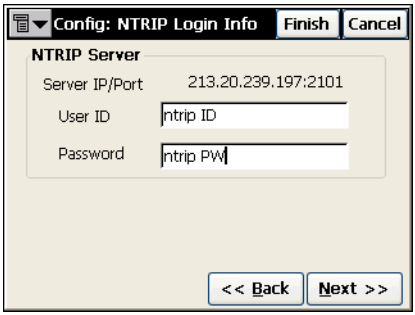


Figure 3-26. NTRIP Login Info

7. Use the ***Config: Modem Dialup Info*** screen to input Internet User ID, Password, PIN number, and APN (Access Point Name).

   If connected to a HiPer XT or a GR-3 receiver, select this field.

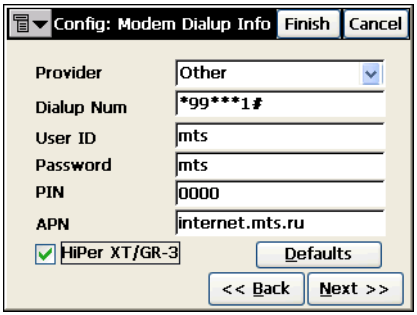


Figure 3-27. Config: Modem Dialup Info

Clicking the **Defaults** button will reset all settings to default values of the selected provider.

8. Select the *Virtual Radio Port* for Advance Input Mode. Only a port currently not in use can be selected as Virtual Radio Ports.

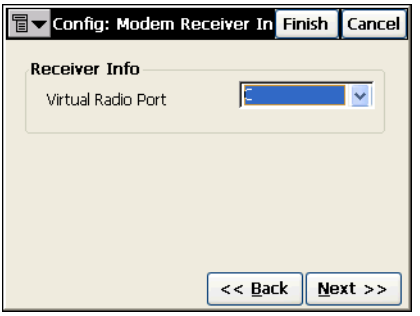


Figure 3-28. Modem Receiver Info

9. Continue configuring the Network RTK survey type in a manner similar to RTK.
10. After completing the survey configuration, tap **Survey ▸ Status**. Select *Config Modem* from the bitmap menu in the upper left corner of the ***Status*** screen.
11. Tapping the red icon next to the **OK** button on the ***Config Modem*** screen will open the ***Internet Connect*** screen.
12. The ***Internet Connect*** screen displays all of the parameters you will need for PPP connection. Make sure all values are correct and tap the **Connect** button to make PPP connection.

Figure 3-29. Internet Connect

13. Tapping the **Connect** button returns you to the ***Config Modem*** screen.

When doing the connection, PPP connection starts to cycle through the baud rates: first 9600, then19200, and finally it should connect at 38400. It can take a few minutes to do so.

Once connected the icon next to the OK button will turn from red to green .

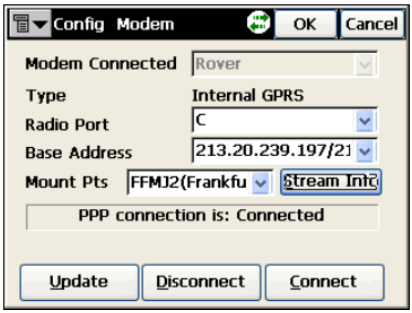


Figure 3-30. Config: Modem

14. If the Internet connection is configured as NTRIP, tap:
    - **Update** – to retrieve Mount Points from the NTRIP Caster at the specified IP address and Port; select the correct Mount Point.
    - **Stream Info** – to display information on the selected Mount Point.
    - **Connect** – to connect to the specified Mount Point and get correction data.
    - **Disconnect** – to disconnect from the selected Mount Point.

PP Enabled Network RTK Survey Configuration

In Network RTK survey with enabled post processing, the correction data at the reference station and the collected Rover data are written to files for further post processing.

1. Enable logging Rover data by selecting the *Enable PP Survey* checkbox in the ***Config: Survey*** screen (Figure 3-6 on page 3-5).
2. Set the logging parameters for the Rover receiver: the file name, logging rate and the device in which raw data is logged

to (currently only "Receiver" is available). Select whether to start logging manually or automatically as data are being collected (Figure 3-20 on page 3-15). Tap the **Next** button.

3. Continue configuring the PP enabled Network RTK in a manner similar to Network RTK (for details, see "Network RTK Survey Configuration" on page 3-16) until the ***Config: Init Times*** screen appears.
4. On the ***Config: Init Times*** screen (Figure 3-21 on page 3-15), set the Initialization Times parameters, the times required for ambiguity resolution in the specific operating environment. These are used during automatic mode of the survey and depend upon the number of satellites available and the number of frequencies being used. Then tap **Next**.
5. Complete configuring the PP enabled Network RTK in a manner similar to Network RTK.

Network DGPS

The configuring of the Network DGPS survey type is the same as for Network RTK. For details on configuring Network survey, see "Network RTK Survey Configuration" on page 3-16. The difference is that the Solution type is set to DGPS.

The same applies the PP enabled Network DGPS configuration. For details on configuring PP enabled Network survey, see "PP Enabled Network RTK Survey Configuration" on page 3-21.

RT DGPS Survey Configuration

Real time differential (DGPS) surveying is used for topographic survey and stakeout. RT DGPS typically uses the measurements from two or more remote receivers to calculate the difference between measurements, providing more accurate position solutions.

One or more Base receivers are placed at known locations and serves as reference stations. These reference stations collect the range measurements from each GPS satellite in view and forms the differences (corrections) between the calculated distances to the satellites and the measured pseudo-ranges to the satellites. These

corrections are then built up to the industry standard (RTCM or various proprietary standards) established for transmitting differential corrections and broadcast to the rover receiver(s) using a data communication link. The Rover receiver applies the transmitted DGPS corrections to its range measurements of the same satellites.

A number of differential services exist to transmit differential correction data, including maritime radio beacons, geostationary satellites (as with the OmniSTAR service), and the wide area augmentation system (WAAS) service.

To enable logging rover data for post processing in RT DGPS survey, select the *Enable PP Survey* checkbox in the ***Config: Survey*** screen.

After naming the configuration, selecting its type and correction type, (see Figure 3-7 on page 3-5) continue below to finish the configuration for a RT DGPS Survey configuration. In user-based mode, the Base and Rover receivers are set in a manner similar to setting RTK receivers.

1. Set the parameters for the Rover Receiver: RTK Format and/or Elevation Mask in the same way as for RTK survey (see Figure 3-11 on page 3-9), then tap **Next**.
2. Set appropriate parameters to use differential correction data from a differential service enabled for the Rover, and tap **Next**.
   - For Radio Beacons, select the country and the name of beacon station (Figure 3-31).

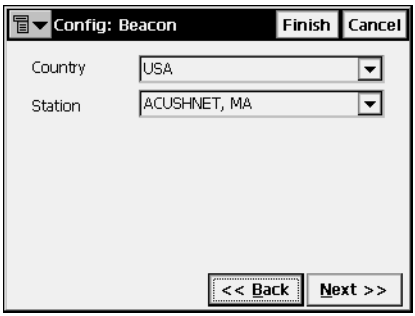


Figure 3-31. Config: Beacon

   - For WAAS (Wide Area Augmentation System), select the following (Figure 3-32 on page 3-24):

– the PRN number of the WAAS satellite to be tracked in the first and second receiver channels

– the GPS satellite's PRN number to be associated with the WAAS PRN number

– enable use of ionospheric corrections from the WAAS satellite when computing positions:

None: ionospheric corrections are not used

Apply if avail: use ionospheric corrections if available

Use sat only if avail: use only the satellites for which ionospheric corrections are available

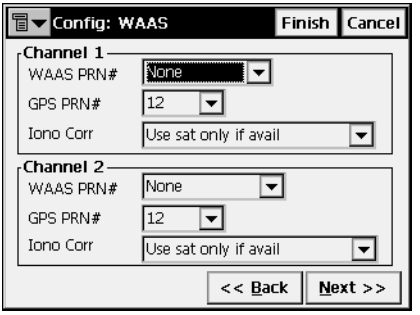


Figure 3-32. Config: WAAS

- For EGNOS (European Geostationary Navigation Overlay Service), set the corresponding parameters (Figure 3-33), which are identical to the WAAS parameters.

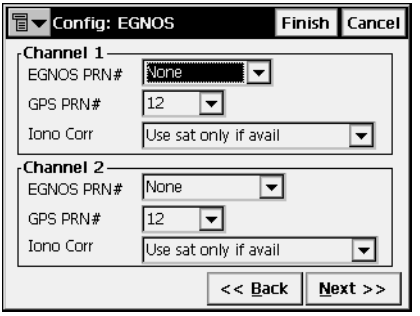


Figure 3-33. Config: EGNOS

- For OmniSTAR-VBS and OmniSTAR-HP (a wide-area, satellite delivered, differential Virtual Base Station and High Performance GPS services), set the name of the satellite to be used (Figure 3-34).

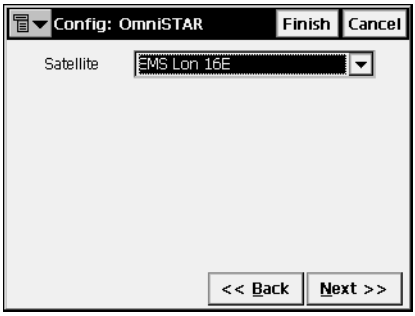


Figure 3-34. Config: OmniSTAR

- For CDGPS (Canadian nation-wide DGPS service), set the CDGPS Radio in the usual way of radio configuration (Figure 3-35).

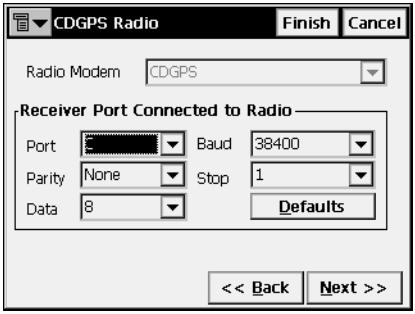


Figure 3-35. CDGPS Radio

3. The remaining steps are similar to those for an RTK survey configuration (see page 3-10 for details).

PP Enabled RT DGPS Survey Configuration

In RT DGPS surveys with enabled post processing, the differential correction data and the collected rover data are written to files for further post processing.

1. Enable logging the rover data for post processing in DGPS survey by selecting the *Enable PP Survey* checkbox in the ***Config: Survey*** screen (Figure 3-6 on page 3-5).
2. Set the logging parameters for the Rover receiver: the file name, logging rate and the device in which raw data is logged to (currently only "Receiver" is available). Select whether to start logging manually or automatically as data are being collected (Figure 3-20 on page 3-15). Tap the **Next** button.
3. Configure the Rover Receiver and Antenna, set appropriate parameters to use differential correction data from a differential service enabled for the Rover, and tap **Next** (for details refer to "RT DGPS Survey Configuration" on page 3-22). Then tap **Next**.
4. On the ***Config: Init Times*** screen (Figure 3-21 on page 3-15), set the Initialization Times parameters, the times required for ambiguity resolution in the specific operating environment.

   The parameters are used during automatic mode of the survey and depend upon the number of satellites available and the number of frequencies being used. Then tap **Next**.
5. Complete the configuration of the PP enabled Real Time DGPS in a manner similar to Real Time DGPS.

PP Kinematic and PP DGPS Survey Configurations

After naming the configuration, selecting its type and correction type, continue below to finish the configuration for a RT DGPS Survey configuration.

1. Set the parameters for the Base Receiver: Elevation Mask and Raw Data Logging parameters: device where raw data is logged, logging rate and file name (Figure 3-36), then tap **Next**.

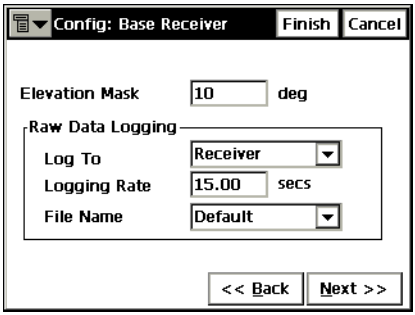


Figure 3-36. Config: Base Receiver (PP Kinematic or PP DGPS).

2. Configure the Base Antenna, and tap **Next**.
3. Set the Raw Data Logging parameters for the Rover Receiver (Figure 3-37).

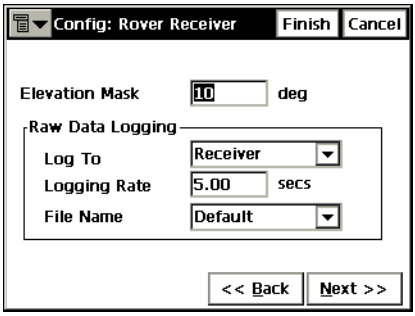


Figure 3-37. Config: Rover Receiver (PP Kinematic and PP DGPS)

4. Configure the Rover Antenna, then tap **Next**.
5. In PP Kinematic mode, set Initialization times for a given number of satellites and frequency modes on the ***Config: Init Times*** screen (Figure 3-38 on page 3-28), and tap **Next**.

Initialization Times are the times required to estimate fixed ambiguity positions. These depend upon the number of satellites available and the number of frequencies being used.

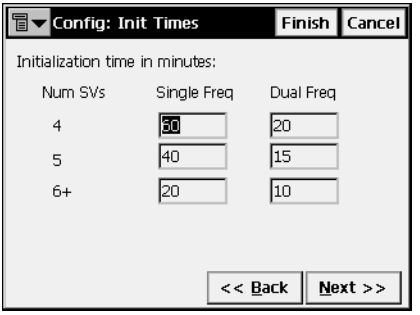


Figure 3-38. Config: Initialization Times

6. On the ***Config: Survey Parms*** screen, set the *Auto Topo Interval* multiple to the logging rate in the receiver (Figure 3-39).
   - Set the *Number of Epochs* for the Topo survey.
   - Set the method of *Auto Topo* survey and the interval.

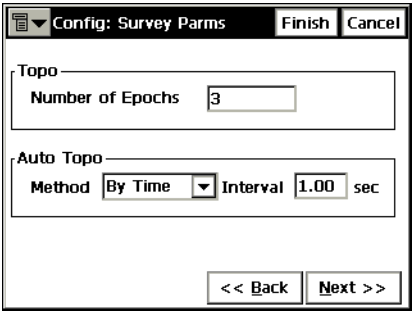


Figure 3-39. Config: Survey Parms (PP Kinematic and PP DGPS)

7. Complete configuring the RTK and PP survey type in a manner similar to RTK.
8. Tap **Finish** to store the settings an to return to the ***Select Survey Config*** screen. The name of the created configuration displays in the *GPS+ Config* field drop-down menu.

PP Static Survey Configuration

After naming the configuration and selecting its type, continue below to finish the configuration.

1. Set the elevation Mask and the Raw Data Logging parameters: device where raw data is logged, logging rate and file name (Figure 3-40).

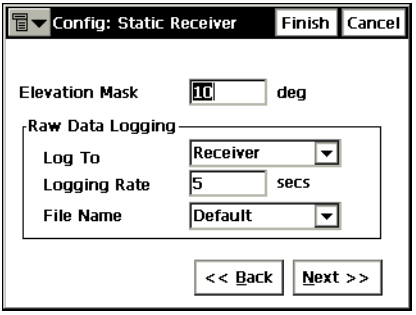


Figure 3-40. Config: Static Receiver

2. Configure the following Static Antenna settings (Figure 3-41) and tap **Next**.
   - Choose the TPS Antenna type from the list.
   - Set the height and height type.

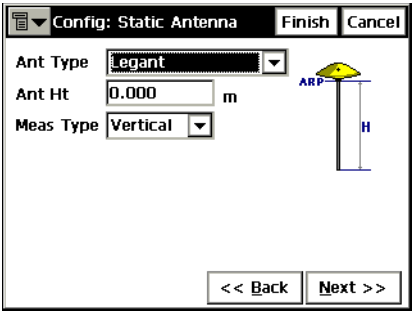


Figure 3-41. Config: Static Antenna

3. Set the *Occupation Times* parameters, the times required for ambiguity resolution in the common operating environment (Figure 3-42 on page 3-30). These are used during automatic mode of a PP Static Survey and depend upon the number of satellites available and the number of frequencies being used.

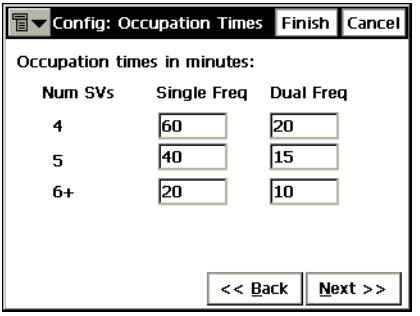


Figure 3-42. Config: Occupation Times

4. Set Stakeout Parameters: select the horizontal distance tolerance, reference direction, and rule for generating the point name, and Note of the staked point (if necessary), then tap **Next** (Figure 3-43).

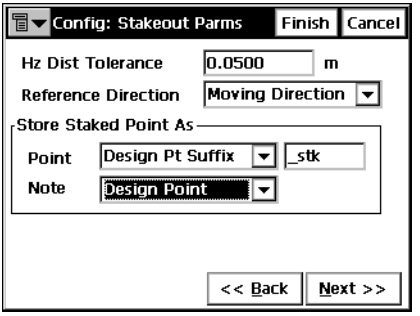


Figure 3-43. Config: Stakeout Parms

5. Set the advanced parameters for the survey (Figure 3-44 on page 3-31).
   - Multipath reduction is used when a signal received represents multiple reflections from nearby objects. Enable this field to use this mode during a survey.

- To use the Co-Op tracking mode, allowing higher efficiency of multipath reduction, enable this field and select the satellite system to be used.

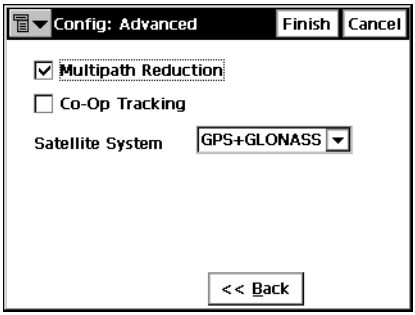


Figure 3-44. Config: Advanced

6. Tap **Finish** to store the settings and return to the ***Select Survey Config*** screen. The name of the created configuration displays in the *GPS+ Config* field drop-down menu.

Creating a Total Station Configuration

When creating a Total Station configuration, use pre-defined configurations or create new ones. The pre-defined configurations are listed in the drop-down menus in the corresponding fields in the ***Select Survey Configurations*** screen (Figure 3-4 on page 3-3). In the TS Configuration field choose one of the pre-defined configurations or tap the browse ... button to create a new configuration or edit an existing one. The ***Configurations*** screen displays (Figure 3-45) which contains a list of available TS configurations. Either edit the existing configuration or create a new one.

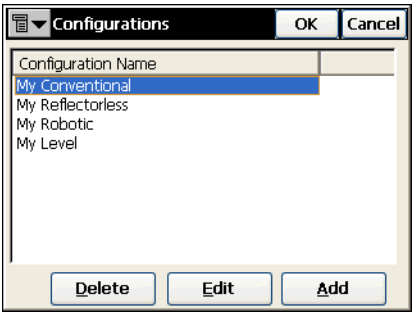


Figure 3-45. Configurations

NOTICE

A Level survey can be configured when a Total Station survey mode is chosen. If Contractor Mode is selected, the existing Total Station configurations will be scaled down to a restricted Conventional and Reflectorless configuration.

1. To create a new configuration, tap the **Add** button. To edit an existing configuration, select it from the list and tap **Edit**.
2. On the ***Config: Survey*** screen, enter a name for the Configuration and select its type, then tap **Next** (Figure 3-46 on page 3-33).

- Use the Robotic type if the survey can be performed by one person and the instrument is motorized.
- If a reflector is not used, choose the Reflectorless type.
- In all the other cases of surveying with Total Station, use the Conventional type.
- Use the Level type to perform Levelling with digital level.

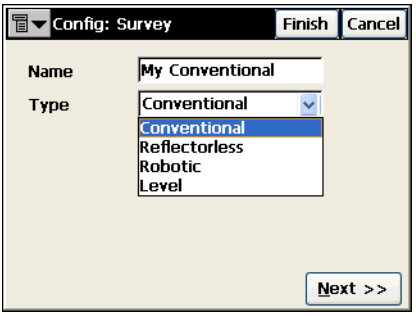


Figure 3-46. Config: Survey

3. In the ***Config: Instrument*** screen, enter the manufacturer and model of the device, then tap **Next** (Figure 3-47). Note that the models shown in the list correspond to the chosen type of survey. To emulate a real survey, select Manual Mode. In this mode, no measurements are performed, all the data is entered manually.

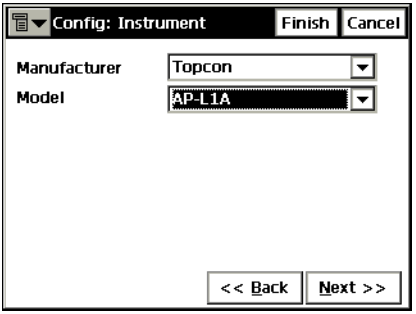


Figure 3-47. Config: Instrument

For the Monitor survey with robotic total stations, select *Monitor* from the context menu in the upper left corner of the screen to set the format and destination of the output file.

4. Select the connection mode (the Initial Connection parameter) using the ***Config: Conn Mode*** screen and tap the **Next** button (Figure 3-48). Selections depend on the instrument type.

   For Conventional and Reflectorless modes, only Cable; for Robotic, also Radios Only, RC2 with Radios, RC2 Only, and RC2 Only (Bluetooth®).

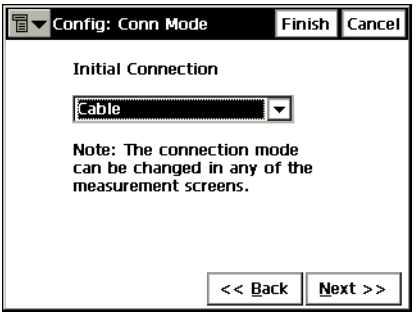


Figure 3-48. Config: Conn Mode

5. Select the communication settings of the cable connection in the ***Config: Cable*** screen: Baud (baud rate), Parity, Data (number of the data bits), and Stop (number of the stop bits) and tap the **Next** button (Figure 3-49).

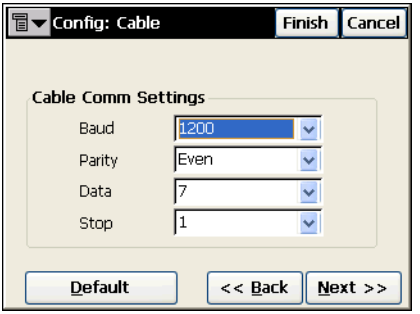


Figure 3-49. Config: Cable

   The **Next** button opens the ***Config: Radio*** screen (for a Robotic survey), ***Config: Mode*** (for motorized Conventional or Reflectorless surveys), or ***Config: Survey Parms*** (for Conventional, Reflectorless, or Level surveys).

6. For a Robotic Survey, choose the modem to be used and its parameters, then tap **Next** (Figure 3-50 on page 3-35).

- Generic modems use a standard set of parameters: port, parity, the number of data bits, the baud rate, and the number of stop bits.
- Pacific Crest modems also need a channel and sensitivity to be chosen (these parameters are available through the **Configure Radio** button).
- The Satel modem also requires the model, the channel number and the frequency of the Radio Modem to be chosen (these parameters are available through the **Configure Radio** button).

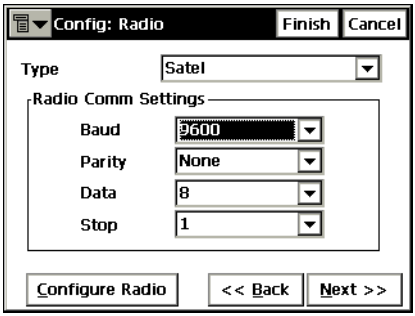


Figure 3-50. Config: TS Radio

7. For the motorized instruments in the Conventional mode of operation, enable the motor turning in the ***Config: Mode*** screen (Figure 3-51 on page 3-36). Also, the instrument can be set with auto tracking or auto aiming tasks:
   - The Auto Tracking mode causes the total station to track the reflector while the surveyor moves from point to point.
   - The Auto Tracking/Auto Aiming mode causes the instrument to find the prism in the predefined region.
   - The No Aiming/No Tracking mode disables the total station operation program.

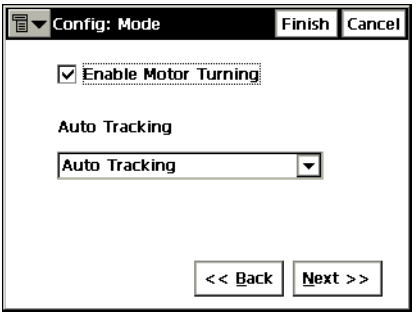


Figure 3-51. Config: Mode

8. For a Robotic Survey, on the ***Config: Search/Track*** screen, set the search parameters: the range of search along the vertical and horizontal axes, pattern, track speed, sensitivity, delay between the loss of signal and a new search start, turning speed (measured in revolutions per minute) and the scan range (the width of the signal), then tap **Next** (Figure 3-52).

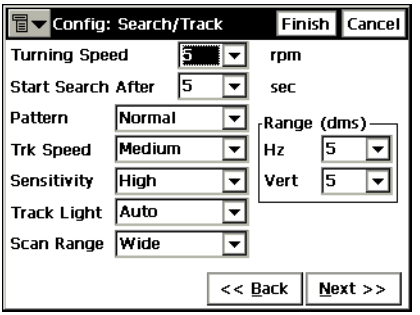


Figure 3-52. Config: Search/Track

9. On the ***Config: Survey Parms*** screen, set the method for performing measurements and tap **Next** (Figure 3-53 on page 3-37).
   - For the *Angle/Dist - Dir/Rev* method, select the sequence for measuring angles: FS is foresight point (the next occupation point), BS is backsight point (the previous occupation point), and Plunge is a rotation of the total station telescope and body by 180 degrees. These are used for reduction of angular errors. Also select the number of such sets of measurements.

- To enable the reverse distance measurements, check the corresponding field. These are used for the reduction of the distance measurement errors.
- The Automatic Repetition of the measurements is available only in the Robotic mode (for the motorized instrument).
- Insert the allowable tolerances for the measurements and enable distance averaging (indicates if distance is measured using one signal or computed as the average of several signals), if desired.

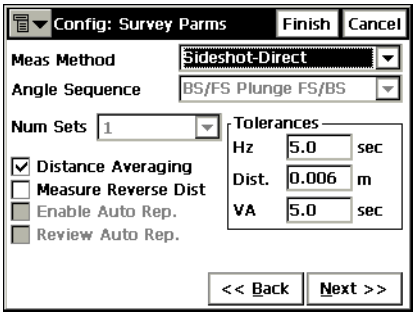


Figure 3-53. Config: Survey Parms

10. In the next ***Config: Survey Parms*** screen, set the following parameters (Figure 3-54 on page 3-38):
    - Meas Type – the order and the type of the measurements in one set).
    - EDM mode – determines the sensitivity of the distance measurements; coarse or fine.
    - Prism Constant – the parameter of the prism, characterizing the difference between the reflection plane and the center of the prism.
    - Point Guide – operates the tracking lights.
    - Non-Prism – enables the non-prism mode.
    - AutoTopo (only for the Robotic survey) – the parameters of the automatic survey.

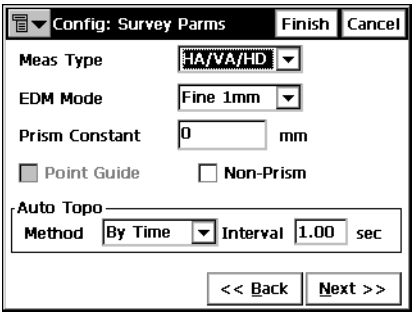


Figure 3-54. Config: Survey Parms. Second Screen.

11. Set the Stakeout Parameters: the Horizontal distance tolerance, reference direction, the rule for generating the name and Note of the staked point (if necessary), and the way the total station is to be turned towards the design point, and tap **Next** (Figure 3-55).

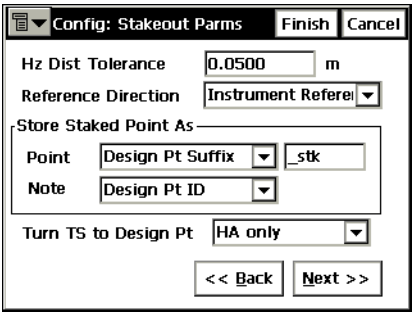


Figure 3-55. Config: Stakeout Parms

The reference point for a Conventional Survey coincides with the total station and for a Robotic survey, with the point where the controller is located.

12. To display an icon for the staked point on the map, select the *Display* option from the menu in the upper left corner of the ***Stakeout Parameters*** screen. In the ***Staked Point Icon*** screen, select the desired parameters for the icon (Figure 3-56 on page 3-39).

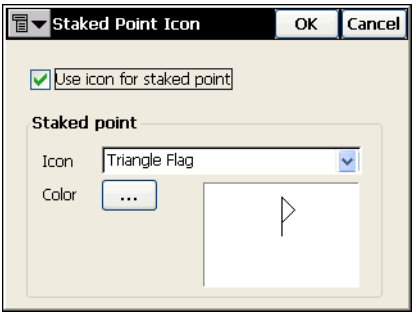


Figure 3-56. Staked Point Icon

13. Select additional customizing parameters in the ***Miscellaneous*** screen (Figure 3-57).

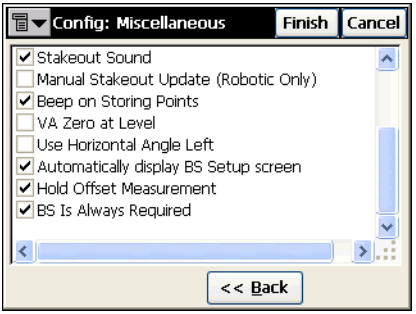


Figure 3-57. Config: Miscellaneous

14. Tap **Finish** to store the settings and to return to the ***Select Survey Config*** screen. The name of the created configuration displays in the drop-down menu in the *TS Config* field.

Creating TS Configuration in Contractor Mode

Contractor Mode is designed for use by non-surveyors for Topo and Stakeout with total stations. In this mode, a restricted functionality of the existing Total Station module is available to the user. Follow the procedure below to begin working with TopSURV in TS Contractor Mode (TS CM).

1. Select **Job ▸ Mode** and choose Contractor Mode in Total Station survey mode, then tap **OK** (Figure 3-1).

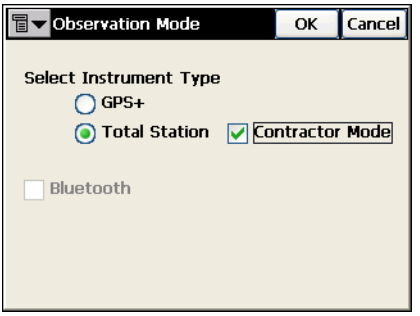


Figure 3-58. Select Contractor Mode

2. In the TS Configuration field of the ***Select Survey Config*** screen choose one of the pre-defined configurations or tap the browse button to create a new configuration or edit an existing one. The ***Configurations*** screen displays a list of available TS configurations. Only two configurations, Conventional and Reflectorless, are supported in the contractor mode.

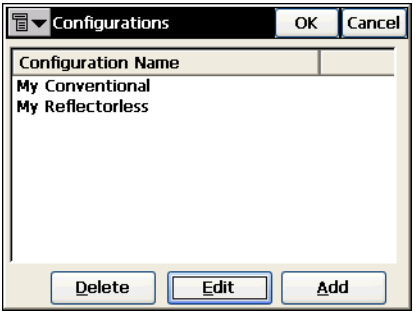


Figure 3-59. Contractor Mode Configurations

3. The remaining steps are similar to those for an usual TS survey configuration (for details, see the steps beginning on page 3-33).

In contractor mode, *Sideshot-Direct* is the only method available for performing measurements.

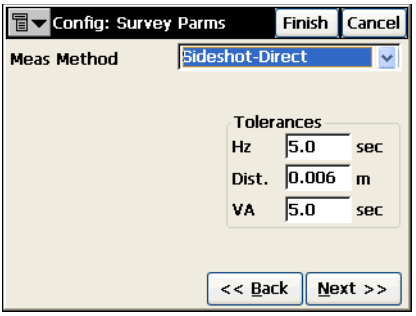


Figure 3-60. Contractor Mode Config Survey Parameters

Configuration Setup

Once the survey configuration has been saved, other job settings can be selected by tapping **Next** on the ***Select Survey Configuration*** screen (Figure 3-61).

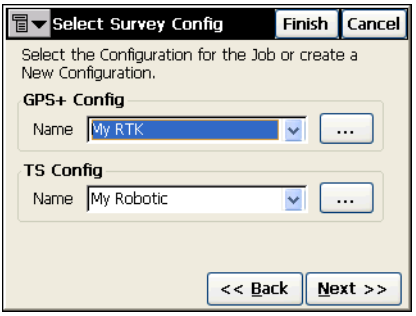


Figure 3-61. Select Survey Config

1. On the ***Coordinate System*** screen, set the parameters of the coordinate system used: the projection, the Datum, and/or Geoid, then tap **Next** (Figure 3-62 on page 3-42). To add a projection/datum/geoid, tap the browse button in the corresponding field (for details, refer to the *TopSURV Reference Manual*).

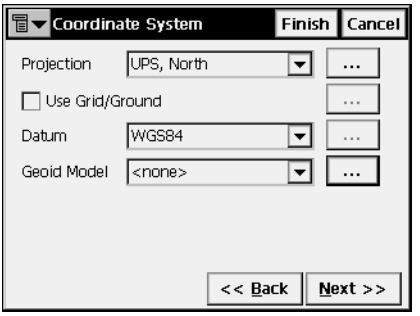


Figure 3-62. Coordinate System

In the setup of a TS configuration in the Contractor mode, the ***Coordinate System*** screen will not appear as only ground coordinates are used in this mode.

2. Set the distance and angle units of the job in the ***Units*** screen and tap **Next** (Figure 3-63). For the Total Station mode (except when in the Contractor Mode), also select the temperature and pressure units.

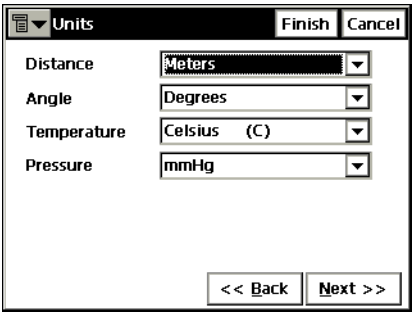


Figure 3-63. Units

3. Select the Display parameters: the type of Coordinates displayed, the plane coordinates order, the reference direction for Azimuth and representation type and the method for displaying position on the CenterLine (Station or Chainage). If the Station is selected as representation type to display position on the CL, set the Full Station value and tap **Next** (Figure 3-64 on page 3-43).

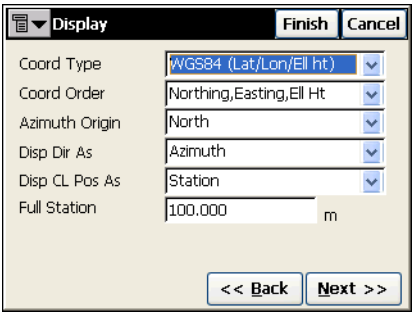


Figure 3-64. Display

In the setup of a TS configuration in the Contractor mode, the *Coord Type* field is absent because no coordinate system is set in this mode.

4. On the ***Alarms*** screen, check the Audible Alarm field to enable a sound for alarms in the Controller, Receiver, or Total Station. Place the check marks, where necessary (Figure 3-65).

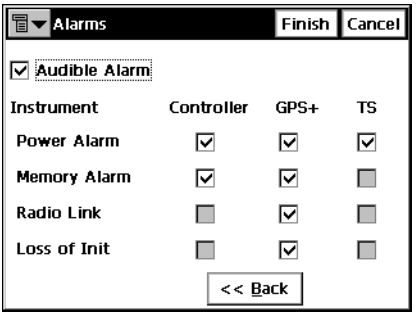


Figure 3-65. Alarms

In the setup of a TS configuration in the Contractor mode the ***Alarms*** screen is not displayed.

5. Tap **Finish** to save the settings for the newly created job.

Global Settings

Set general settings in TopSURV if needed to use with the currently selected job. Tap **Job ▸ Config ▸ Global**.

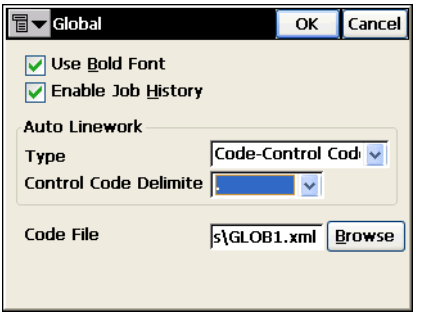


Figure 3-66. Global Settings

- Select the *Use Bold Font* checkbox to use the bold font on the controller display to see more clearly.
- Select the *Enable Job History* checkbox to save every surveyor's operation on the job in a history file.
- Select the type of linework to form automatically open and closed polylines:
  - *Code-String:* all points with the same unique combination of Code and Strings are connected to form a line. This line is named as "~~~Code&String".
  - *Point/Line/Area:* all points are selected to be a part of either points or named lines or areas (GIS mode). Areas in this mode are simply closed lines. Strings and control codes are not supported in this mode.
  - *Code-Control Code:* the control codes /BEG and /END are indicated along with codes to start and end lines. All points with the same code between and indicating the points with the /BEG and /END control codes are then connected in the measurement order to form a line. This line is named as "~~~Code&XXXXXXXX", where the XXXXXXXX is an automatically generated number which increments for each

additional line created. Strings cannot be entered in this mode at all.

– If the selected mode is either Code-String or Code-Control Code mode, then the *Control Code Delimiter* option selects a delimiter for entering control codes along with codes in a single field, separated by this delimiter.

- If needed, set a Global Data Dictionary file to use the file's codes and layers with the currently selected job. Use the **Browse** button to select the necessary file.

Setting Background Images

To position a geographic image under observed data on the map, use the Background Images function.

1. To load an image, tap **View** ▸ **Background Images**.
2. In the ***Background Images*** screen select the image. It is possible to select multiple background images. Using multiple background images is limited by the amount of free space in the controller memory. Tap **Add** to add the appropriate file to the list.

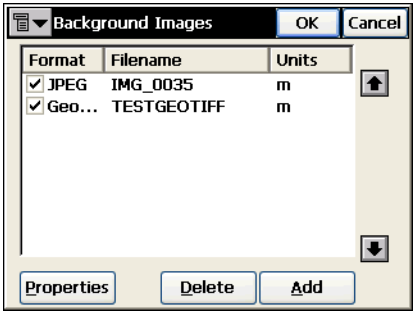


Figure 3-67. Select Background Images

To be imported into TopSURV correctly, any images need to be geo-referenced. GeoTIFF images have their own geo-referenced data while other images need a separate World file that references the geographic location of the image. The World file must have the filename extension associated with the image format (TFW,

JGW or BPW) and should be located in the same directory as the image file.

To map a Background Image correctly, the image (it's geo-reference point) should be in the job's current coordinate system or at least in a very similar one (e.g., in a corresponding UTM zone).

If the selected image uses a World File, tap **Properties** to select the projection in which the coordinates in the World File are given.

3. To use a file once it is added, make sure the file is checked in the list. Tap **OK**. Tap **OK** to open the selected file. If no world file exists for the background image file selected, a warning displays, and the Background Images screen will appear again to select another file.

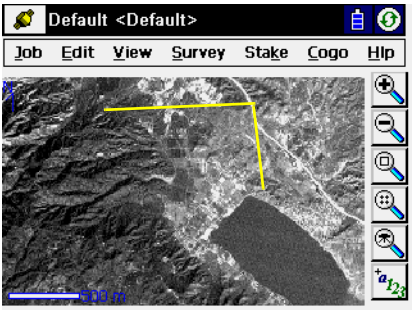


Figure 3-68. Background Image

Storing Data

All the data used in the TopSURV application is stored in a database. The types of data stored include points, codes, layers, roads, linework, raw data and survey sessions for post-processing.

Adding and Editing Points

Select **Edit ▸ Points**, the ***Points*** screen displays (Figure 4-1).

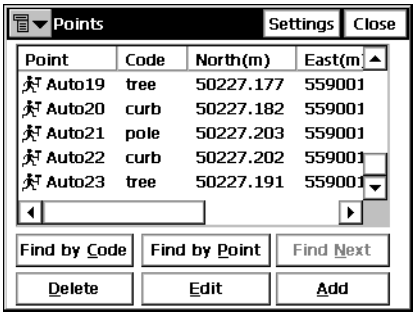


Figure 4-1. Points

1. To add a point, tap the **Add** button in the ***Points*** screen.
   - In the *Point Info* tab, enter information on a new point.

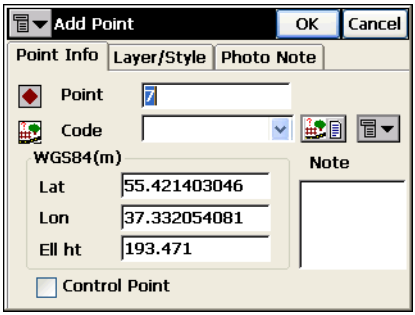


Figure 4-2. Enter New Point Information

- Using the *Layer/Style* tab (Figure 4-3), select the layer that the point will be stored to and the plotting properties to represent the point on the selected layer. (If needed, tap the ... button to edit layers.)

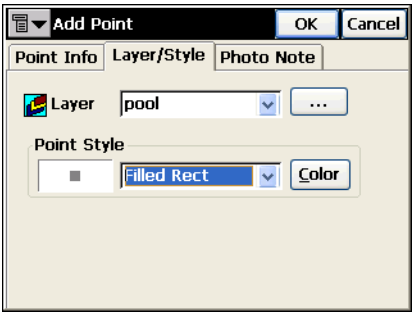


Figure 4-3. Set Layer and Point Style

- In the *Photo Note* tab, add a photo comment on the new point. Tap the **Add** button to open the Browse screen to select the image. To erase the image, use the **Delete** button.

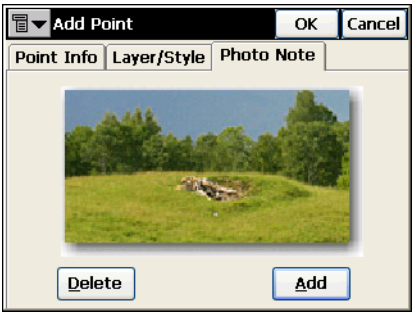


Figure 4-4. Add Photo Note

- Tap **OK**. The point will appear in the list of the ***Points*** screen.

2. To edit a point, either double-tap the point or select it in the list and tap the **Edit** button. Enter all the necessary changes and tap **OK** to save the changes.
3. To delete a point, select it in the list and tap the **Delete** button (Figure 4-1 on page 4-1).

4. To find a point by name, tap the **Find by Point** button and insert the whole name or a part of the name (in the latter case select the Match partial name field). Tap **Search**. The first point satisfying the search criterion is highlighted in the list in the ***Points*** screen. Tap the **Find Next** button to find another point with the same name.
5. To find a point by code, tap the **Find by Code** button and select the code from the drop down list (in the latter case select the Match partial name field). Tap **Search**. The first point satisfying the search criterion is highlighted in the list in the ***Points*** screen.tap the **Find Next** button to find another point with the same code.
6. To enter a PTL point, turn on the PTL Mode using the top-left corner menu. When adding or editing a PTL point insert the starting and ending reference points and the PTL offsets: offset from the starting point along the reference line, horizontal offset from the reference line and the height offset with respect to the starting point.

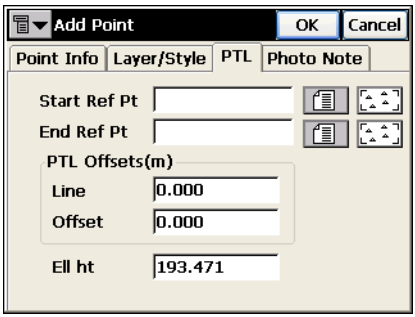


Figure 4-5. Add Point – PTL Tab

7. If the point is contained in multiple point objects, these points will display in the *Check Points* tab of the ***Edit Point*** screen.

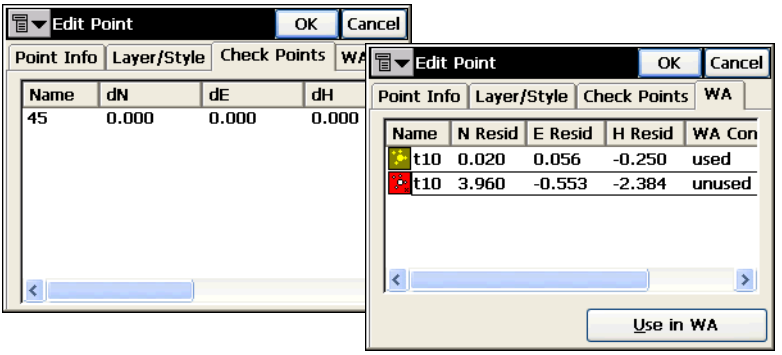


Figure 4-6. Check Points to Use in Weighted Average

8. When editing a point which has a station available for Weighted averaging, the *Weighted Average* tab will display in the ***Edit Point*** screen. The *Weighted Average* tab displays coordinate residuals of the check point.

   Use the **Use In WA** button to control either use or not use the station as a weighted average (Figure 4-6).

Storing Points in Linework

To store the points which will be connected to form open or closed polylines, tap **Job ▸ Config ▸ Global**. In the ***Global*** screen, select one of the following three modes to perform linework (Figure 4-7 on page 4-5).

- Code-String – all points with the same unique combination of codes and strings are connected to form a line.
- Point/Line/Area – all points are selected to be included in either points (stand-alone points), named lines (open polylines), or named areas (closed polylines).
- Code-Control Code – points with the same codes are used to create polylines. The first and last points use the control codes /BEG and /END to start and end the line.

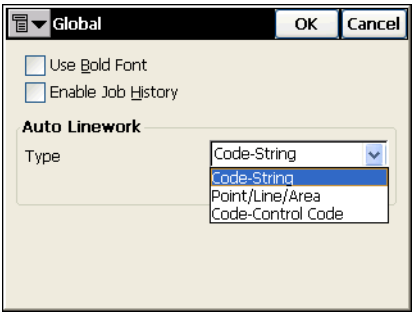


Figure 4-7. Global Auto Linework

Code-String Linework Mode

In *Code-String* mode selected, codes and strings can be entered along with other point related information, such as the point name. This linework mode has the following characteristics:

- All points then with the same code-string combination are connected in the order of measurement to form a line which is named as "~~~Code&string".
- Points can also be associated with multiple codes and strings, thus making the point a part of numerous lines.
- Points which have no codes, or have codes but no strings associated with the codes, are simply stored as points.

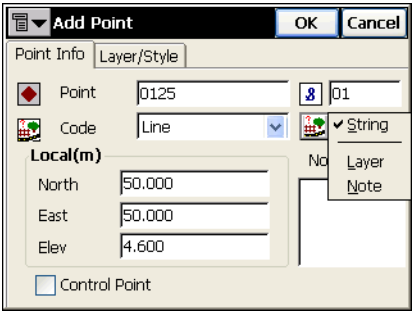


Figure 4-8. Add Point to Code-String Linework

- Additional manipulations of linework can be performed in this mode using control codes. Up to two control codes can be specified for every code associated with a point.

  The supported control codes of /AS, /AE, /C, and /R control line behavior by allowing creation of arcs, closure of lines and creation of rectangles, respectively.

  – The /AS control code indicates the start of an arc; the /AE control code indicates the end of the arc. Arc parameters are determined by the presence of additional points in the line.

  - These points can create the line segment with the arc start/or end point which will act as the tangent to the arc (Figure 4-9 on page 4-6).
  - If only one point is between the arc start and end points, the arc is formed such that all the three points lie on the arc.
  - If there are two or more than two points between the points with the /AS and /AE control codes, the points are all connected by straight line segments.

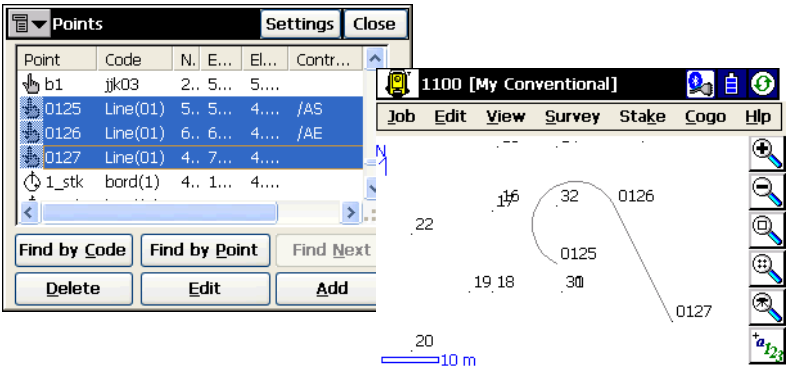


Figure 4-9. Code-String Linework with Arc Control Code

– The /R control code is applied to the third point of a three point polyline, and results in the automatic creation of a fourth point of a parallelogram whose diagonal is specified by the first and the third point.

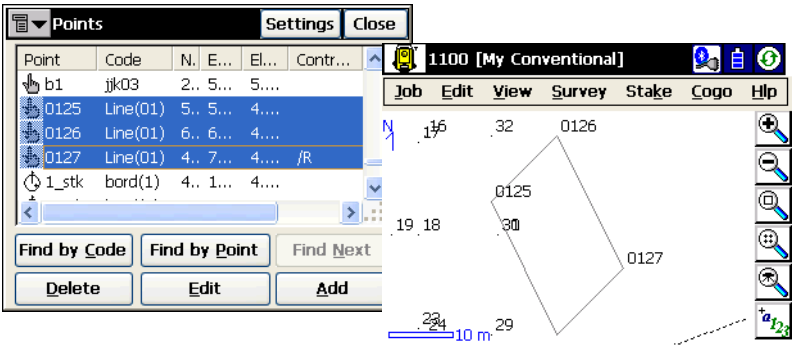


Figure 4-10. Code-String Linework with Rectangular Control Code

– When the /C control code is applied to a point, it connects it to the starting point of the line, thus closing the line.

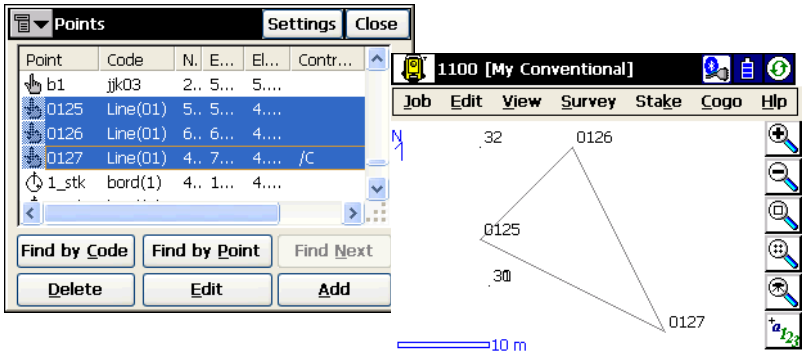


Figure 4-11. Code-String Linework with Closure Control Code

Code - Control Code Linework Mode

If the selected mode is *Code-Control Code*, an additional option displays to select a delimiter for entering control codes and codes in a single field, separated by this delimiter.

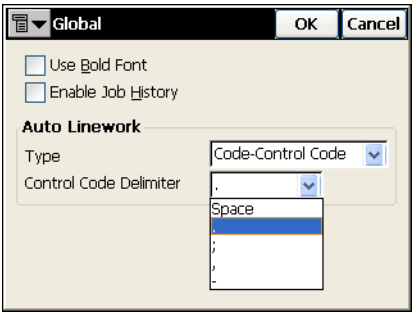


Figure 4-12. Code - Control Code Option

This linework mode has the following characteristics:

- Instead of specifying strings to generate new lines, the control codes of /BEG and /END are used to start and end lines. Strings cannot be entered in this mode. The line's name is automatically generated as "~~~Code&XXXXXXXX", where XXXXXXXX is an automatically generated number that increments for each additional line created.
- On devices that have a keyboard (for example, the FC-1000), a menu displays that lists available codes when the user enters the delimiter. Once a delimiter has been selected, it may not be used in the code name.

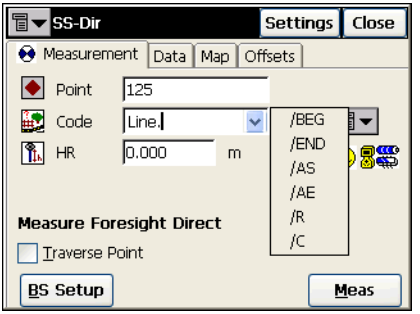


Figure 4-13. Control Code Menu

- On controllers that feature TopSURV's Soft Input Panel (for example, the FC100, RECON, Pocket PC), it is required to type in the control code manually following the delimiter. In this case, entering the control code both with and without the forward slash is valid.
- All points with the same code between, and including the points with the /BEG and /END control codes, are then connected in the measurement order to form a line. If a /BEG is specified without ending a previous line, the previous line will be automatically ended.

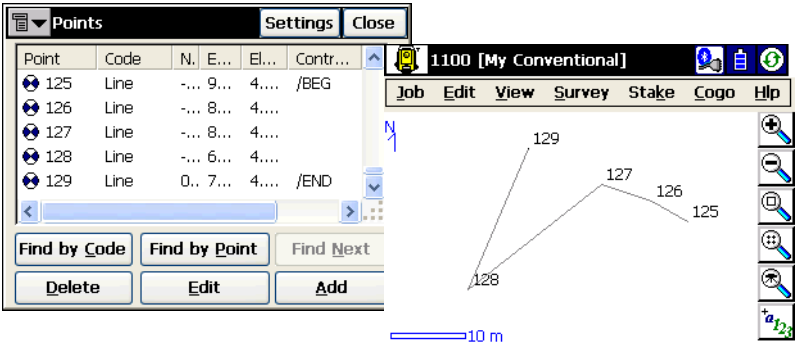


Figure 4-14. Code - Control Code Linework

NOTICE

Since strings are not specified in this mode, only one line associated with a certain code can be used at any given point. As in the Code-String mode, points can be part of multiple lines by associating them with different codes.

- The /AS, /AE, /C, and /R control codes are supported for additional linework manipulation; only two control codes are supported per code. In this mode, if the /AS control code is selected without having started a line using the /BEG control code, a line is automatically started at this point.

Closing a job, leaving TopSURV, or selecting a new code will end all open lines. Ended lines and the points comprising these lines can only be edited (see "Adding and Editing Linework" on page 4-35).

Point/Line/Area Linework Mode

In *Point/Line/Area* (or GIS) mode, all points are selected to be a part of either points or named lines or named areas (this mode does not support Strings and Control Codes). Areas in this mode are simply closed lines. The GIS object (points, lines, and/or areas) selections made for the current point are continued for subsequent points.

In this mode, closing the job or leaving TopSURV clears the Active object list. The Active object list contains objects that measured points should be a part of.

This linework mode has the following characteristics:

- The active GIS object selections can be modified via a menu available by clicking on the GIS menu button next to the Codes-Attributes button on all measurement pages.

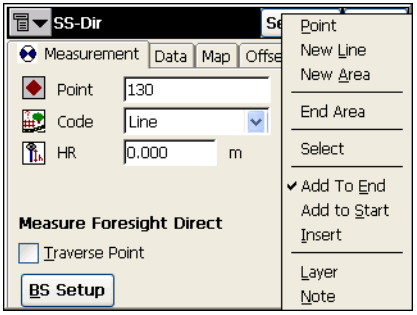


Figure 4-15. Point/Line/Area Menu

- The button appearance varies depending on the active object list, as follows:

  -  : when the current point is to be stored only as point.
  -  : when the current point is to be a part of a line only.
  -  : when the current point is to be a part of an area only.
  -  : when the current point is to be a part of multiple points, lines, and/or areas.

- There are four types of operations offered through this menu for manipulating the active objects list: New Object, Select Object, End Object, and Change Insert Location.

New Object

As many new objects can be created using the *Point*, *New Line* or *New Area* options (Figure 4-13 on page 4-8), as codes are selected. The active objects list is cleared and only the newly created objects added to this list. That is, the current point and subsequent points will be a part of the newly created objects only.

- Point – When this option is selected, the current point will be stored only as a point with the selected codes. If a single code or no code was selected, clicking on this option would modify the GIS menu button to  , whereas if multiple codes are associated with the point, the button is modified to  .
- New Line – When this option is selected, the ***New Lin***e screen displays (Figure 4-16 on page 4-12), which accepts property and plotting information pertaining to the new line. TopSURV allows for the creation of as many new lines as are codes selected for the point (the ***New Line*** screen displays as many times as there are codes selected, or just once if no code is selected). The current point would then be a part of all these new lines, as will the subsequent points.

- New Area – The behavior for this menu option is similar to the *New Line* option, except that new areas are created. When this option is selected, the ***New Area*** dialog displays and is similar to the ***New Lin***e screen.

  The ***New Line/Area*** screen is comprised of two tabs, which accept the name and code of the new line, along with layer and plot styles.

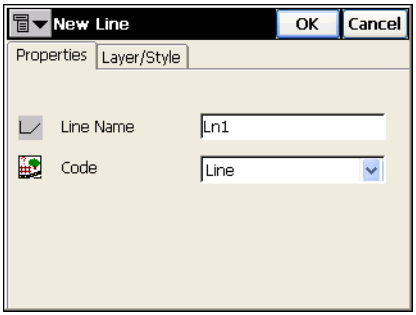


Figure 4-16. New Line Properties

Select Object

The *Select* option opens the ***Select*** screen to select which of the currently open lines or areas or point the current point should belong to (Figure 4-17). Unless specifically ended using the *End Object* option (described below), all lines and areas created in the job, are considered open.

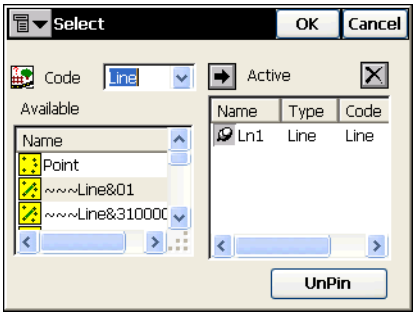


Figure 4-17. Select Object

- Code – A list of available codes for which points, lines and areas can be selected. Optionally, tap the field to enter a new code.

- Available – This list displays all open lines and areas for the selected code. The “Point” selection in this list allows a point with that code to be selected when moved to the active list. The icon next to the object indicates the type of object point, line, or area).
- Active – This list contains all objects that should be part of the measured point and displays the name, type (point, line or area), code and insertion location of selected GIS objects. Insert location determines the location of the point within the associated line, and can be modified using the *Add To Tail*, *Add to Head* and *Insert* options described below. When the screen displays, this list shows the currently active points, lines and areas. The icon indicates whether the object is pinned or not.
-  – Moves objects from the available list to the active list.
-  – Removes objects from the active list.
- Pin/UnPin – Clicking on this button Pins/UnPins the selected object from the active list. Objects that have been pinned would remain active after the current point has been recorded; whereas, unpinned objects are active only for the current object.
- OK – saves the changes in this screen.

End Object

The *End* option opens the ***End Object*** screen to end currently active lines and/or areas. This action closes areas, and removes both lines and areas from the list of all open or available objects.

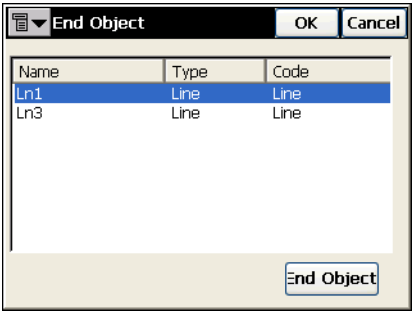


Figure 4-18. End Object

The ***End Object*** screen displays when multiple lines or areas are currently active.

1. Select the object from the list of currently active lines and areas and tap the **End Object** button to end the selected object.
2. Tap **OK** to save the changes in this screen.

When the currently active GIS objects that the point will be a part of comprises only one line and no area, the *End Line* option is available.

When the currently active GIS objects that the point will be a part of comprises only one area and no line, the *End Area* option is available. Once ended, the area will be closed at the last point (that is, the last point will be connected to the first point).

NOTICE

Ended lines and areas will be removed from the Active objects list and can only be edited using the Edit Linework feature (see "Adding and Editing Linework" on page 4-35). Subsequent points cannot be made a part of these objects using the GIS menu.

Change Insert Location

The *Add to End*, *Add to Start*, and *Insert* options are available when only one line or area object type is active. The default behavior is for points to be connected in the measurement order, with the most recent point being added to the end of the line. However, this order can be changed such that the point is inserted at the start of the line or inserted in location.

- Once the insert order has been changed, this behavior is retained for that particular object till the user changes it, closes the job, or quits the program. The behavior cannot be modified when multiple lines and/or areas are selected.
- The *Add to End* option is the default behavior of insertion for lines and areas with the current point being added to the end of the line.
- When the *Add to Start* option is selected, the current point is added to the start of the line.
- When the *Insert* option is selected, the current point is inserted in the line or the area, such that the modified line is of shortest length.

Note the following when working in this mode:

- This mode of data collection is not applicable to the Digital level survey screens or the COGO screens. These screens store the measured or calculated points as only points with the entered codes.

- The object insertion and pin selection options are not available for design point generation in Stakeout operations or for the X-Sect survey operation.

- When editing a point, the list of active objects does not get modified to the ones selected for the edited object, but rather for the last recorded point.

Since control codes are not acceptable in this mode, arcs are not supported in this mode.

Adding and Editing Codes

Select **Edit ▸ Codes**, the ***Code - Attributes*** screen displays.

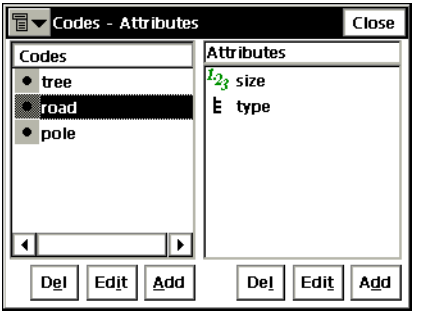


Figure 4-19. Codes - Attributes

1. To add a code, tap the **Add** button on the left side of the screen. Enter the code name. Select the layer that the code will be stored to and the plotting properties to represent lines and

points with this code on the selected layer (Figure 4-20). Tap **OK**.

2. To define the attributes for the new code, select the code and tap the **Add** button on the right side of the screen. Set the name, type, and parameters of the attribute for the code in the ***Attributes*** screen. Attribute type indicates whether attribute values can be selected from a list of available values (Figure 4-20), or are alphanumeric strings, integers or real numbers. Tap **OK**.

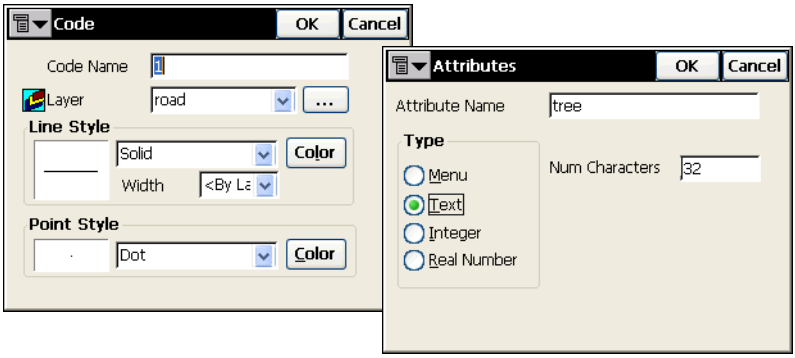


Figure 4-20. Edit Codes / Attributes

3. To edit a code or attribute, double-tap the object or select it the corresponding **Edit** button. In the ***Code*** or ***Attribute*** screen, make changes and tap **OK** (Figure 4-20 on page 4-17).
4. To delete a code or attribute, highlight it in the list and tap the corresponding **Del** button (Figure 4-19 on page 4-16). Codes being used in points, and their corresponding attributes cannot be deleted.

Adding and Editing Point Lists

To work with Point Lists, tap **Edit ▸ Point Lists** menu.

1. To add a point list, tap the Add button in the ***List of Point Lists*** screen (Figure 4-21).

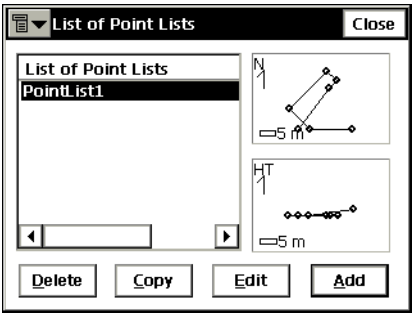


Figure 4-21. List of Point Lists

2. In the ***Add Point List*** screen (Figure 4-22) set the Point List Name and select the points for the list.

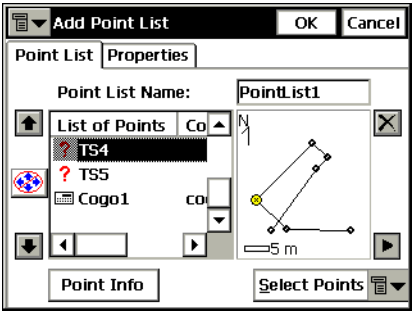


Figure 4-22. Add Point List – Point List Tab

Adding a point to the Point List can be performed in two ways, through the map or through the Select Points button:

3. To add a point through the map, tap the plot on the right. The large ***Map*** screen opens. Select the points by tapping them on the map - the two consequently tapped points will be connected with a line. tap **Close**.
4. To add a point through the **Select Points** button, tap the button, and using the floating menu of six items: *By Range, By Code, By CodeString, By Radius*, *From Map,* and *From List*, select the desired way of adding points.

- *By Range*: When specifying the range of points, the symbols ‘,’, ‘.’ or ‘;’ should be used to separate the names of the points to be selected. The symbol ‘-’ can be used between two point names when the two points, and all the points between them are to be selected.
- *By Code*: All the points with the codes checked here will be selected.
- *By CodeString*: All the points with the highlighted code with the Strings checked here will be selected.
- *By Radius*: By specifying the center point and the radius, all the points that lie within the area are selected.
- *From Map*: The points can be selected from the ***Map*** screen as described above.
- *From List*: Desired points can be selected from a list of available points.

5. Repeat actions until all the points are added to the list.
6. Use the arrow buttons to modify the order of points in the list, and the delete button to remove points from the list.
7. Tap **OK**, and the created point list will appear in the ***List of Point Lists***.
8. To edit a point list, highlight the desired list in the corresponding field and tap the **Edit** button.

Adding and Editing Layers

The “layers” in a TopSURV job can be thought of as overlapping sheets of paper containing different drawing elements. Each layer is associated with definite set of points, codes, lines and alignments. When creating a layer, it can be either showing or hiding (that is, displayed or not displayed).

Each new job contains a special “0” layer. By default all job objects will be stored to this layer. Layer 0 cannot be deleted or renamed.

Select **Edit ▸ Layers** to display the ***Layers*** screen.

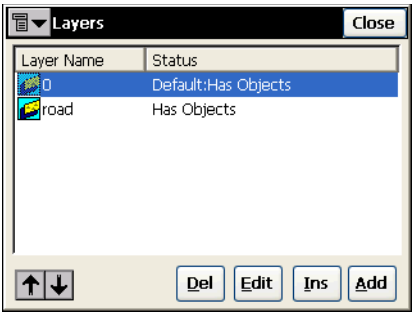


Figure 4-23. Layers

1. To add a layer, tap the **Add** button in the ***Layers*** screen. On the ***Add Layer*** screen, enter the layer's parameters and tap **OK** (Figure 4-24 on page 4-20). The layer will be included in the list of layers.
   - In the *Layer* tab, enter a new layer name, enable *Visible* to show the layer on the map, enter any additional information in the *Note* field.
   - In the *Style* tab, define the plotting properties for the layer's lines and points. Tap **OK.** The layer will appear in the list of the ***Layers*** screen.
2. To turn on/off the visibility of a layer or multiple layers at a time, select the desired layers and tap on the *Layer Name* column header in the ***Layers*** screen.

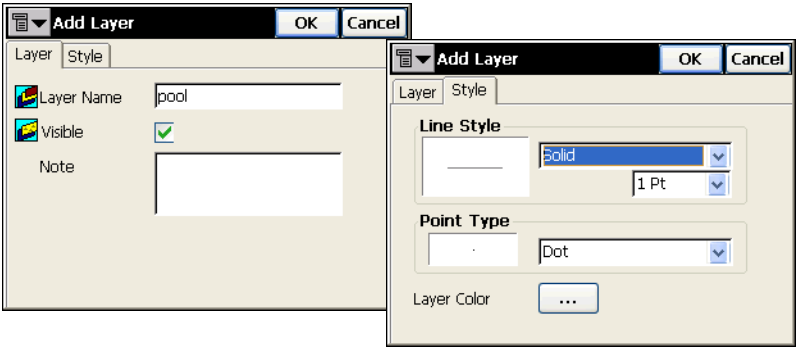


Figure 4-24. Add Layer

3. To edit a layer, either double-tap the layer or select it in the ***Layers*** screen and tap **Edit**. On the ***Edit Layer*** screen, change the layer's parameters as needed and tap **OK**. To view objects on the existing layer, tap the **Objects** tab (Figure 4-25).

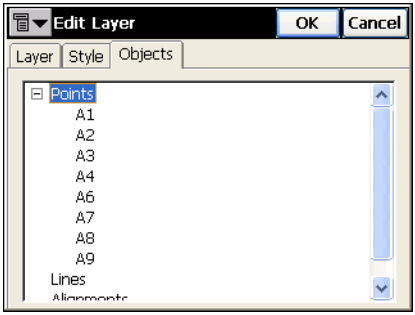


Figure 4-25. Layer Objects

4. To delete a layer, select it from the list of layers and tap **Delete**.
5. Use the arrow buttons to modify the order of layers in the list, and the **Ins** button to add a layer and insert it below the currently selected layer.

Adding and Editing X-Sect Templates

To work with Cross Section Templates, select **Edit ▸ X-Sect Templates** menu.

1. To create a cross-section, tap the Add button in the ***X-Sect Templates*** screen (Figure 4-26).

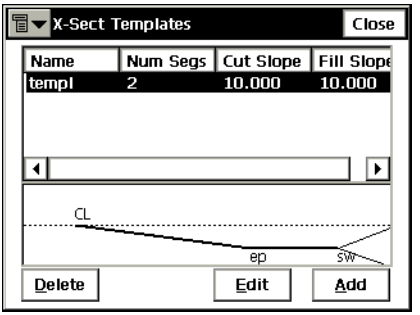


Figure 4-26. X-sect Templates

2. In the ***X-Sect Templates*** screen enter the parameters of the template: the name of the template, the Cut and Fill slope parameters and the segments comprising the template (Figure 4-27).

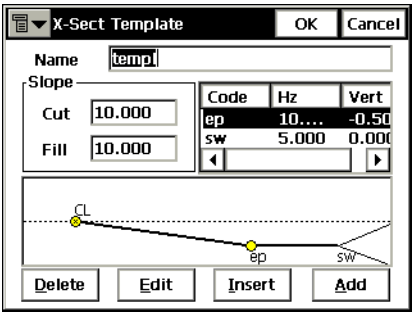


Figure 4-27. X-sect Templates

3. To add a segment to the template, tap the **Add** button and in the ***Segment*** screen enter the parameters of the segment (code and offset) (Figure 4-28 on page 4-23). Tap **OK**. The added segment will be attached after the last segment in the list.

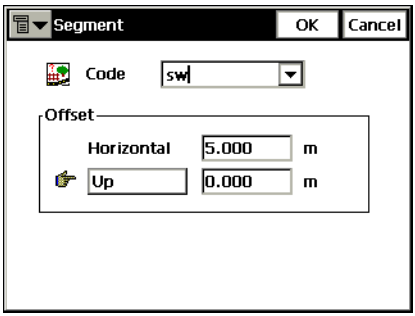


Figure 4-28. Segment

4. Repeat adding segments until the template is ready for work.
5. Tap **OK**. The template will appear in the list of templates.

Designing Roads

Designing a road is performed by establishing numerically known station points along a center line of the proposed route (*horizontal alignment*). To furnish data for estimating volumes of earthwork, a profile is run along the center line (*vertical alignment*) and cross profiles are taken along lines passing through each station and at right angles to the center line (*cross sections*).

The horizontal alignment can be designed by sections described through *lines, spirals, arcs* and *intersection point*s. *Intersection point* is defined as the intersection of the two lines tangential to the 'incoming' and 'exiting' spirals, or to the central curve at the PC and PT points, if spirals are not specified.

The vertical alignment can be described through *vertical grades* and *parabolas,* or *long sections*.

The cross section can be described using templates.

To design a road, select **Edit ▸ Road Design**. Road designing consists of designing a road as a whole and designing each component of the road: horizontal alignments, vertical alignments, and cross section sets.

Adding and Editing Roads

To create a road, tap **Edit** ▸ **Road Design** ▸ **Roads**.

1. In the ***Roads*** screen (Figure 4-29) tap the **Add** button.

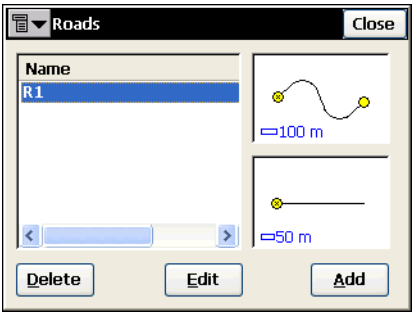


Figure 4-29. Roads

2. In the ***Add Road*** screen, set the name of the road and select the layer, the alignments, and cross section set of the created road and tap **OK** (Figure 4-30).

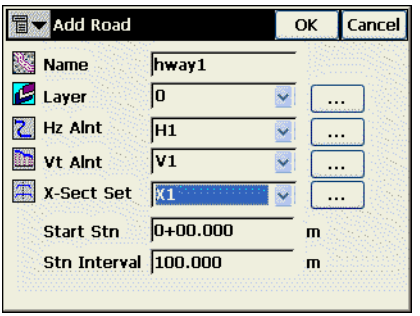


Figure 4-30. Add Road

- If needed, change the layer from the pull-down list to locate the road. Select the layer from the *Layer* pull-down list, or use the ... button to edit layers. (For details refer to "Adding and Editing Layers" on page 4-19).
- *S*elect a pre-defined horizontal alignment from the *Hz Alnt* pull-down list to use in designing the road. Use the ... button to edit horizontal alignments. (For details refer to "Adding and Editing Horizontal Alignments" on page 4-26).

- *S*elect a pre-defined vertical alignment from the *Vt Alnt* pull-down list to use in designing the road. Use the ... button to edit vertical alignments. (For details refer to "Adding and Editing Vertical Alignments" on page 4-29).
- *S*elect a pre-defined cross section set from the *X-Sect Set* pull-down list to use in designing the road. Use the ... button to edit cross section sets. (For details refer to "Adding and Editing Cross Section Sets" on page 4-33).
- Set the starting station with distance to it, or the starting chain distance, depending on a selection made in the Display screen.
- Set the interval between the station points where road related computations are made.
- After the road is created, calculate the road points using the *Calculate Road Points* option from the bitmap menu in the upper left corner of the ***Roads*** screen.

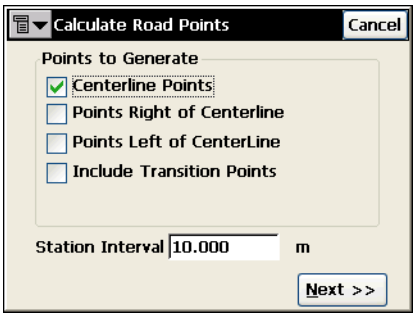


Figure 4-31. Calculate Road Points

Select the desired road point types. If needed, change the station interval and tap **Next** to set the properties of the generated points in corresponding screens. In the last screen, opened by the **Next** button, tap the **Calc** button to perform calculations.

3. To save the road file, tap **OK** and return to the ***Roads*** screen. The new road will be displayed in the list of roads.
4. To edit the road, either double-tap the road or tap the **Edit** button.
5. To remove a selected road from the list, tap the **Delete** button.

Adding and Editing Horizontal Alignments

To create a horizontal alignment, select **Edit ▸ Road Design ▸ Horiz Align**.

1. In the ***Hz Alnt*** screen, tap the **Add** button.

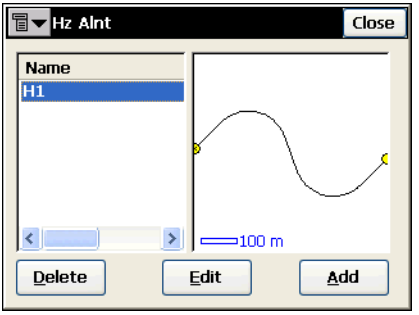


Figure 4-32. Horizontal Alignment

2. In the *Start Pt* tab of the ***Edit Hz Alnt*** screen, enter the alignment name and Start Point, the Code, the North/East coordinates, and the Start Station number (or the starting chain distance).

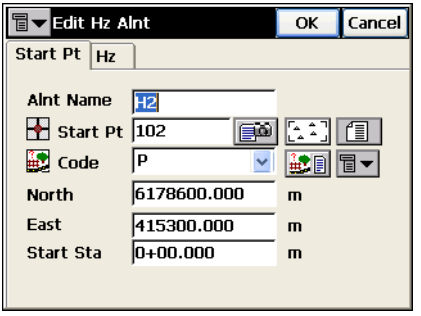


Figure 4-33. Add Horizontal Alignment

The point name can be entered manually (if a new point name is entered, the point will be created with the coordinates entered in the *North* and *East* fields), selected from the map, or selected from the list. If needed, enter a photo note for the point.

3. In the *Hz* tab of the ***Edit Hz Alnt*** screen, add the horizontal alignment elements.

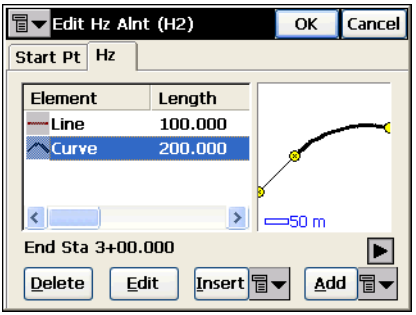


Figure 4-34. Add Horizontal Alignment Elements

- To add a horizontal alignment element, tap the **Add** button and select an element from the floating menu: line, curve, spiral, or intersection point.
- In the corresponding screen displayed, enter parameters for the element (length and azimuth for line, length, radius, azimuth, turn for curve; length, radius, azimuth, turn, direction, for spiral; point coordinates, curve radius, incoming and exiting spiral lengths, for intersection point) and tap **OK**. Add as many elements as needed to define the road.
- Tap the *Station* information under the element list to display start and end stations for the selected element.

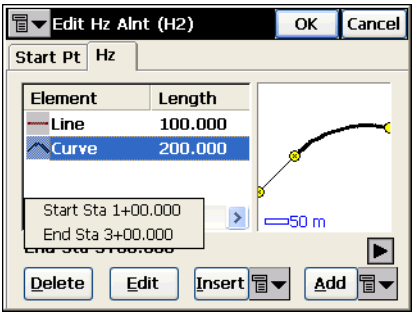


Figure 4-35. Information on Element Start and End Stations

- Also, the information on the selected element can display from the greater ***Map*** opened by double-tapping in the plot area. Select the alignment element and double-tap it to display detailed information.

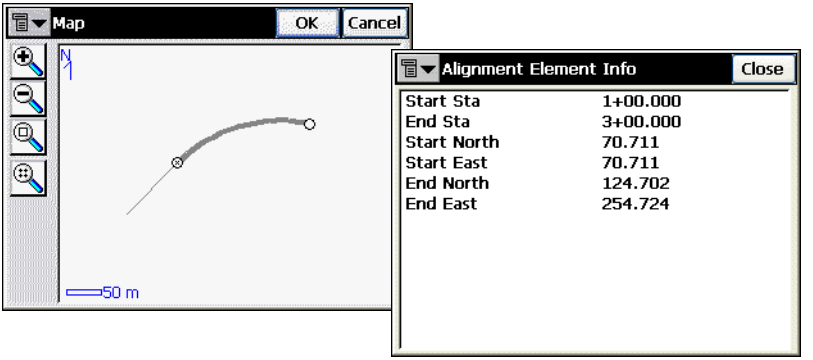


Figure 4-36. Information on Horizontal Alignment Element

4. Tap **OK** in the ***Edit Hz Alnt*** screen to save the horizontal alignment and return to the ***Hz Alnt*** screen. The new horizontal alignment displays in the list.
5. To edit the horizontal alignment, either double-tap the horizontal alignment or highlight it and tap the **Edit** button.
6. To remove a selected horizontal alignment from the list, tap the **Delete** button.

Adding and Editing Vertical Alignments

To create a vertical alignment, select **Edit ▸ Road Design ▸ Vert Align**.

1. In the ***Vt Alnt*** screen, tap the **Add** button to add a new vertical alignment.

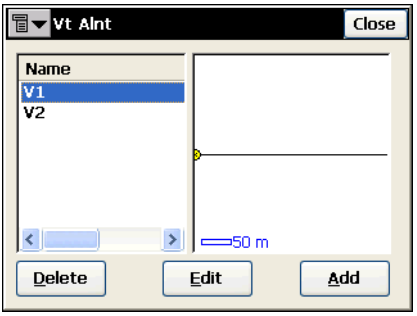


Figure 4-37. Add Vertical Alignment

2. In the ***Add Vt Alnt*** screen, enter the name of a new vertical alignment and select a way of creating the vertical alignment. Tap **OK**.

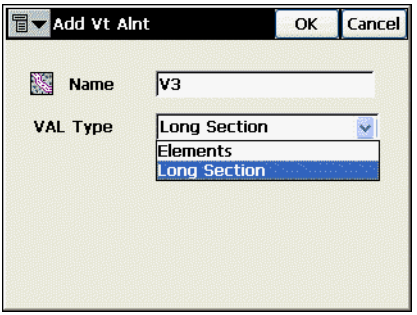


Figure 4-38. Add Vertical Alignment

- Long Section: select to present a vertical alignment as a set of sections between stations where the heights are known (usually the extreme of the vertical alignment line). A vertical curve length specifies the length of the interval near the station, where the alignment has a parabolic shape.

- Elements: select the Elements type to create the road, element by element, finishing wherever desired and starting again.

3. In the *Start Pt* tab of another ***Add Vt Alnt*** screen, enter the name of the vertical alignment and parameters of the starting point and station. (For the Long Section vertical alignment type, only the vertical alignment name is needed).

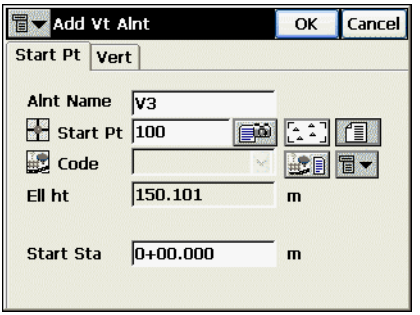


Figure 4-39. Add Vertical Alignment – Start Pt Tab

- The start point name can be entered either manually, selected from the map, or selected from the list (the point will be created with the height entered in the height field for a new point name). If needed, enter a photo note for the point.
- The point code can be entered manually or selected from the drop-down list. The code of an existing point cannot be edited.

4. In the *Vert* tab, add the vertical alignment elements, or long sections (for the Long Section vertical alignment type).

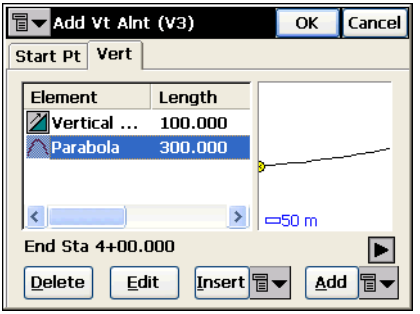


Figure 4-40. Add Vertical Alignment – Vert Tab

- When the vertical alignment type is Elements, tap the **Add** button and select either vertical grade or parabola from the floating menu. Enter the parameters of the element: length and grade for the vertical grade, or parameters for a selected curve (either length, start and end grade for the parabola, or the radius of the arc for the circular arc).
- When the vertical alignment type is Long Sections, tap the **Add** button and enter the parameters of the Long Section: the length of the parabola at the station (with the assumption that the station is located in the middle of the interval), or the radius of the arc, depending on the type of the curve type selected.
- Add as many elements or long sections as needed to define the road.
- Tap *Station* information under the list of elements or long sections to view the start and end stations for the selected item.

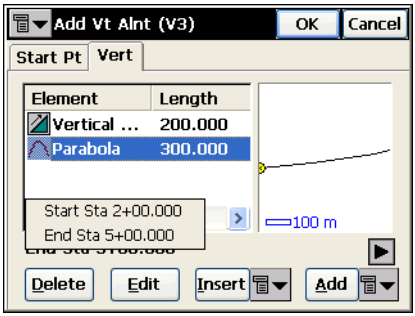


Figure 4-41. Information on Start and End Stations

- Double-tap in the plot area to open the greater ***Map*** for the vertical alignment. For vertical curves, the map displays the PVC point where the vertical curve begins, the PVI point of intersection of two tangents, and the PVT point where the curve ends (Figure 4-42 on page 4-32).

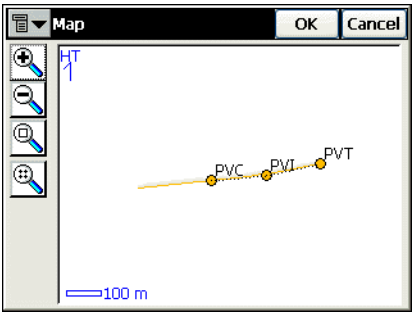


Figure 4-42. Vertical Alignment Map

- Tap **OK** in the ***Add Vt Alnt*** screen to save the vertical alignment created and return to the ***Vt Alnt*** screen. The new vertical alignment will be displayed in the list.

5. To edit a vertical alignment, either double-tap the vertical alignment or highlight the desired alignment and tap the **Edit** button.
6. To remove a selected road from the list, tap the **Delete** button.

Adding and Editing Cross Section Sets

To create a set of cross sections, select **Edit ▸ Road Design ▸ X-Sect Set**.

1. In the ***X-Sect Set*** screen, tap the **Add** button to add a new cross section set.

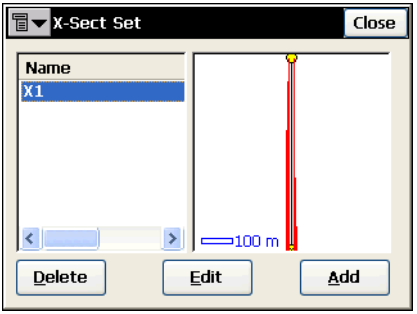


Figure 4-43. Cross Section Set

2. In the ***Add X-Sect Set*** screen, enter the name of the cross section set and tap the **Add** button,

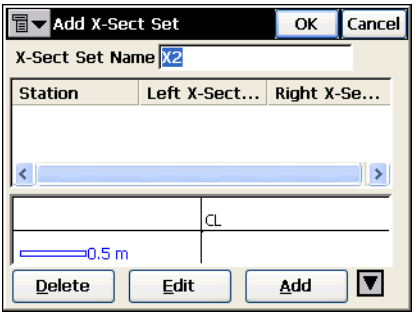


Figure 4-44. Add Cross Section Set

3. In the ***X-Section*** screen, define the station, where the cross section will be applied, or the distance to this station, and specify the cross section templates for the left and/or the right parts of the road cross section (Figure 4-45 on page 4-34). These can be chosen only from the existing cross section templates. Tap **OK**.

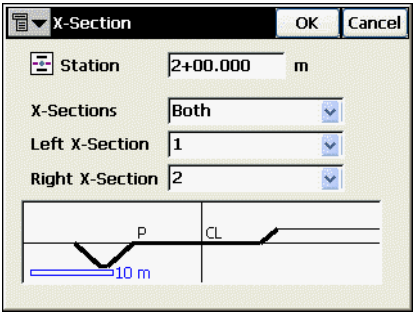


Figure 4-45. Cross Section

4. To add a station, tap the **Add** button in the ***Add X-Sect Set*** screen (Figure 4-44 on page 4-33). Add as many templates as necessary to define the road. If two or more cross sections are defined in one set, the intermediate cross sections are calculated using interpolation.

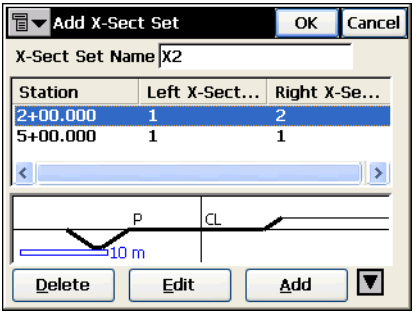


Figure 4-46. Cross Sections in Set

5. Tap **OK** to save the cross section set created and return to the ***X-Sect Set*** screen. The new cross section set will be displayed in the list.
6. To edit a selected cross section set, either double-tap the cross section set or highlight it and tap the **Edit** button.
7. To remove a selected cross section set from the list use the **Delete** button.

Adding and Editing Linework

Linework is provided in the points which are connected to form open or closed polylines. Tap **Job** ▸ **Config** ▸ **Global** and select the mode to use for automatically creating linework. For details, see "Storing Points in Linework" on page 4-4.

To add linework, select **Edit** ▸ **Lineworks** menu.

1. In the ***Linework*** screen, tap the **Add** button to create new linework (Figure 4-47).

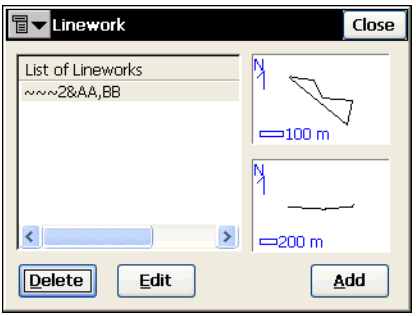


Figure 4-47. Edit Linework

The ***Edit Line*** screen displays (Figure 4-48 on page 4-36).

2. To delete the linework from the list, tap **Delete** (Figure 4-47).
3. To edit the properties of a linework, either double-tap or highlight the linework in the list and tap **Edit**.
4. In the *Point in Line* tab of the ***Edit Line*** screen, change the name of the linework if necessary (Figure 4-48 on page 4-36).
   - If necessary, move the selected point up or down in the order of the points using the up and down arrows.
   - To view information on a point, select the point in the list and tap **Point Info**.
   - To add points to the selected/created linework, tap the menu in the lower right corner. Select the appropriate parameter from the *Select Points* pop-up menu. The menu contents depends on which mode is selected for performing linework in the ***Global*** screen.

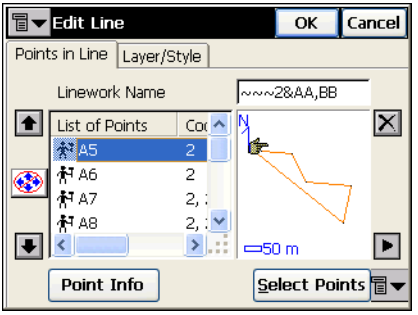


Figure 4-48. Edit Line

5. In the *Layer/Style* tab of the ***Edit Line*** screen, set layer and plotting properties to use for display the linework on the map (Figure 4-49) and tap **OK**.

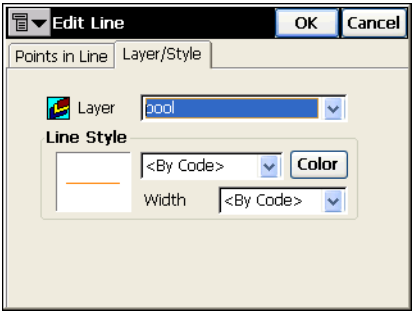


Figure 4-49. Edit Line/Point Style

Operating Raw Data

Select **Edit ▸ Raw Data**. The ***Raw Data*** screen reflects all the collected measurements. In the GPS+ mode, this screen also displays the coordinates of the base and the vector of the stored points from the rover to the base (Figure 4-50).

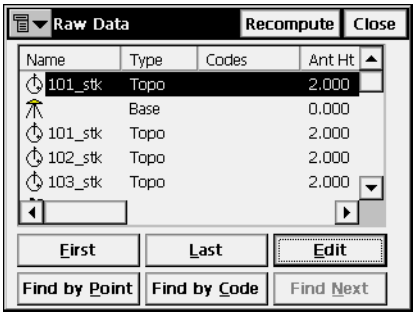


Figure 4-50. Raw Data

- To move the cursor to the first or last point, tap the **First** and **Last** buttons.
- To find a point, tap the **Find by Point** button and fill out the fields in the ***Find by Point*** screen. The point can be found by name or a part of its name.
- To find a point by code, tap the **Find by Code** button and select the code in the ***Find by Code*** screen.
- To find the next point that satisfies the same conditions as the previous found point, tap the **Find Next** button.
- To edit the raw data point, tap the **Edit** button and make changes to the ***Edit Raw Data*** screen. Enter additional notes for a point by typing the note in the suggested field. The appearance of this screen varies based on the type of raw data being edited. (Note that editing Ant Ht, HR & HI values, azimuth, etc., will not immediately recompute coordinates.)
- To recompute the point coordinates, tap the **Recompute** button in the Raw Data screen.

Adding and Editing Survey Sessions

To create or edit sessions (only in GPS+ mode) of automatic survey for post-processing, select **Edit ▸ Sessions** (Figure 4-51).

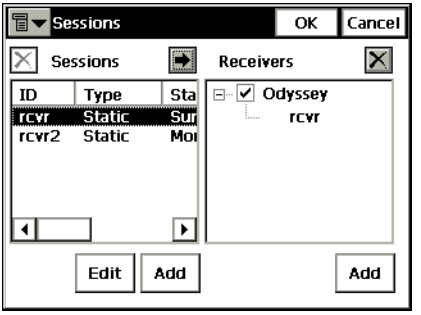


Figure 4-51. Session Edit

1. To create a new session, tap the **Add** button on the left side of the screen. The ***Session Setup*** screen opens (Figure 4-52).

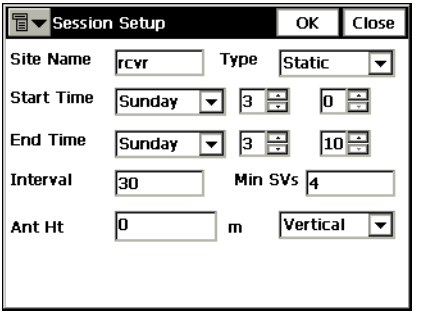


Figure 4-52. Session Setup

2. On the ***Session Setup*** screen, enter the site name, the type of the survey, the time (in local time) and date of the start and end of session, the interval between measurements, minimum number of satellites needed for the survey and the value and type of the antenna height. Then tap **OK**.

3. Then add a receiver: tap the **Add** button on the right side of the screen and enter the name of the receiver in the ***Receiver Name*** dialog box (Figure 4-53). Then tap **OK**.

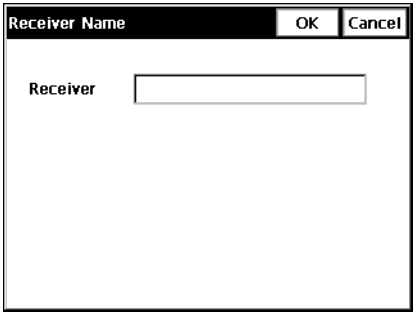


Figure 4-53. Receiver Name

4. To hide/display the session plans of the receiver, tap on the "-/+" sign located near the receiver name (Figure 4-51 on page 4-38.
5. To put a session to the session plan of the receiver, highlight the desired session in the left panel and check the necessary receiver on the right and tap the button (Figure 4-51 on page 4-38).
6. To edit the session, select it in the left panel and tap the **Edit** button (Figure 4-51 on page 4-38).
7. To delete the session from the sessions list or the receiver, use the button (Figure 4-51 on page 4-38).
8. Tap **OK** to save the changes and close the screen.

Editing Objects from the Main Map

Editing objects in the job can be accessed either from the Edit menu or from the Main Map.

When in the Main Map, tap the desired object to highlight it. Then hold the stylus on the selected object for a while until a pop-up menu displays. The menu options depend on the object selected.

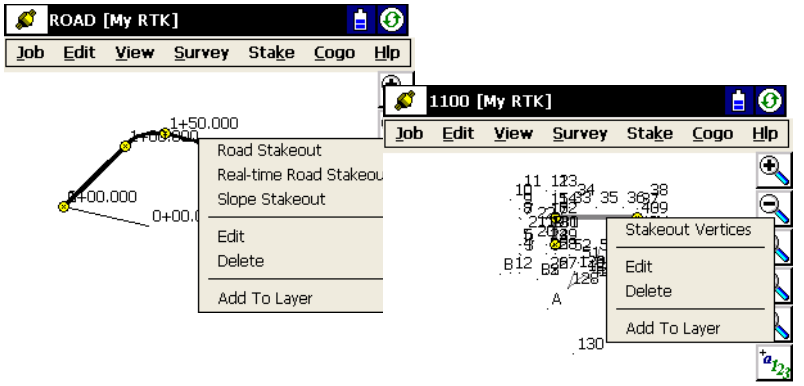


Figure 4-54. Editing from the Main Map

To select multiple objects, tap the  toolbar button and extend a square window from right to left to include the desired objects. These objects can be deleted or added to a Layer.

Importing and Exporting

Importing

TopSURV can import data from another job, from a file, or from another controller device. Codes can also be imported from Code Libraries.

Import from Job

1. Select **Job ▸ Import ▸ From Job**.
2. In the ***Select Job*** screen, highlight the name of the job file in the Job List or tap **Browse** to select the Job file from the disk, then tap **Select** (Figure 5-1).

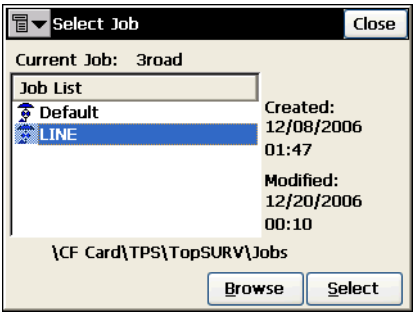


Figure 5-1. Select Job

3. In the ***Import from <Job>*** screen select whether points are to be imported, and if necessary, filter the imported points by type; by range and code; or by type, range and code (Figure 5-2 on page 5-2).

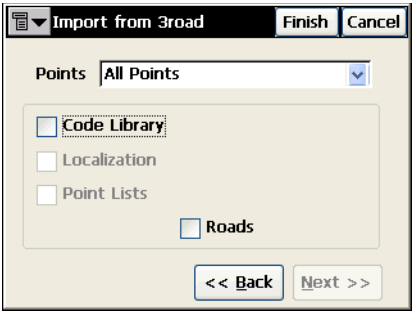


Figure 5-2. Import

Also, place appropriate check marks if the following data should be imported along with points: Code Library, Localization, Roads, and/or Point Lists.

4. Tap the **Next** button. Depending on the selections in the ***Import from...*** screen, one of the following screens opens:

   - If *By Type* or *By Type, Range and Code* selected in the *Points* drop-down menu, the ***Select Point Type(s) to Import*** screen displays. On this screen, select the types of points to be imported (Figure 5-3).

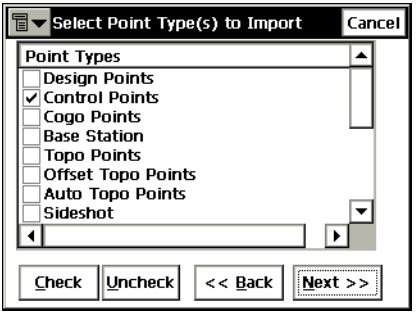


Figure 5-3. Select Point Type(s) to Import

   - If *By Range and Code* selected in the *Points* drop-down menu, the ***Points to Import*** screen displays. On this screen, select the codes and/or the range of points to be imported (Figure 5-4 on page 5-3). To select codes, tap the **Select** button, check the codes associated with the points to be

imported in the ***Code*** screen, and tap the **OK** button. The Range of Points sets a range of point names that should be imported. The symbols ‘,’, ‘.’ or ‘;’ can be used to differentiate individual point names, whereas the symbol ‘-’ is to be used for specifying a range.

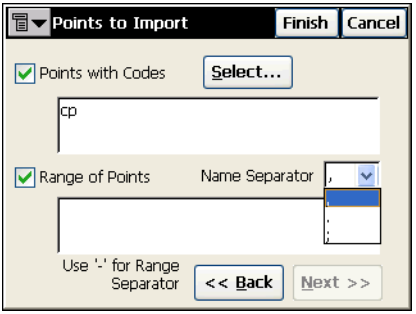


Figure 5-4. Points to Import

- If *All* or *None* is selected in the *Points* drop-down menu and *Roads* checked, the ***Select Road(s) to Import*** screen displays. Based on the selections in this screen, tapping the **Next** button on the subsequent pages will result in appropriate screens being displayed.

5. In the ***Select Road(s) to Import*** screen select the roads (if available) to import (Figure 5-5).

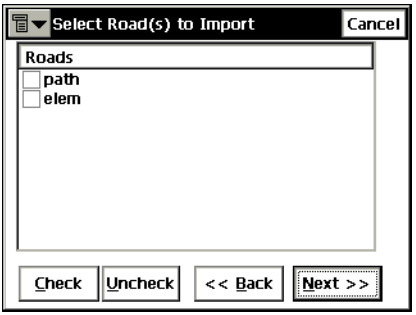


Figure 5-5. Select Road(s) to Import

6. In the ***Select Point List(s) to Import*** screen select the point lists (if available) to import (Figure 5-6).

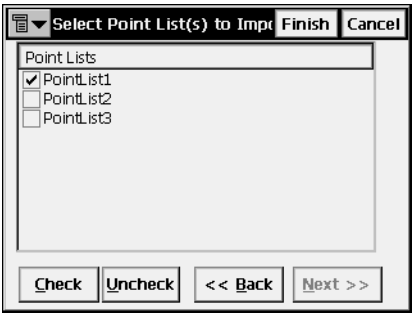


Figure 5-6. Select Point List(s) to Import

7. In the final screen for importing from a job, the **Next** button will be disabled. tap **Finish** to start Import process.

Import from File...

1. Select the **Job ▸ Import ▸ From File** menu.
2. On the ***From File*** screen select the type of data to be imported, the type of file to be imported from, and the point type (if data type is Points or Point Lists) to import. If the Text file type is chosen, check the *ASCII File Properties* field buttons if necessary. Then tap **Next** (Figure 5-7).

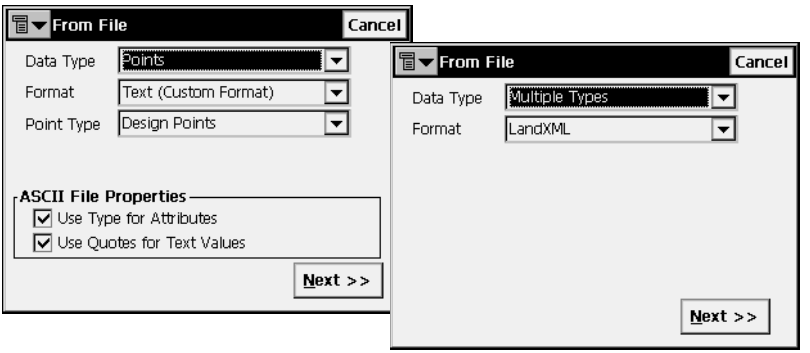


Figure 5-7. From File

3. Using the standard Windows® CE interface, browse for the file to import from or type the name of the file, and tap **OK**.

...Importing from Text File Formats

1. Specify the format in which data is stored in the file (Figure 5-8).

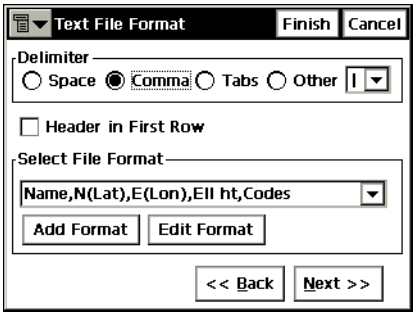


Figure 5-8. Text File Format

   - Choose the delimiter between different fields.
   - If a header is provided in the first row of the file, check the appropriate field.
   - Select the File Format (the order of the fields), using the drop-down menu. Or create a new file format using the procedure below

2. Tap **Next** to select the coordinate system of the data in the imported file.
3. Tap **Finish** to start the import process.

To create a new file format, enter the order of data using the ***Custom Style*** screen (Figure 5-9 on page 5-6).

1. Tap **Add Format** on the ***Text File Format*** screen.
2. Select items from the Available list and tap the right arrow button to move them to the Order list.
3. To arrange the item sequence, use the up and down arrow buttons. The order of items in the Order list should correspond to that in the selected file.
4. Tap **Save** (Figure 5-9 on page 5-6). The combination will display in the *Select File Format* drop-down list on the ***Text File Format*** screen.

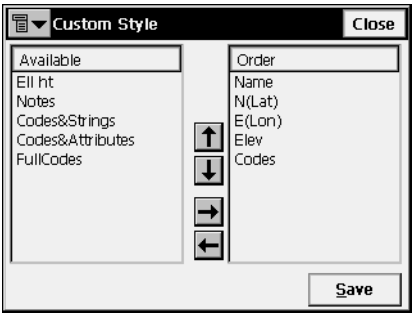


Figure 5-9. Custom Style

...Importing From Multiple Data Types

1. Choose specific data type from the appropriate file (Figure 5-10), then tap **Next**.

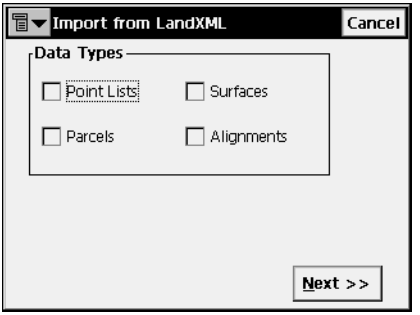


Figure 5-10. import From LandXML

2. Select an object to import and tap **Next** to start the import process.

TopSURV can import DWG files only in AutoCAD 2000 format.

For details on the formats of the files from which TopSURV can import data, refer to *TopSURV Reference Manual*.

Import from Controller

1. Select the **Job** ▸ **Import** ▸ **From Controller** menu.
2. On the ***Import/Export Settings*** screen, select the means of communication, then tap **Next** (Figure 5-11).

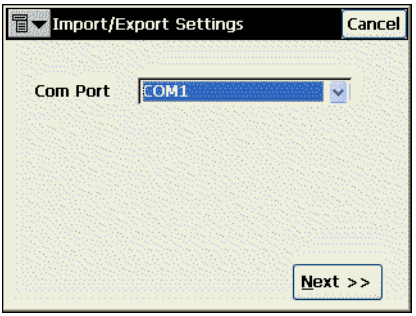


Figure 5-11. Import/Export Settings

3. Choose the location for the imported file, then tap **Finish** (Figure 5-12).

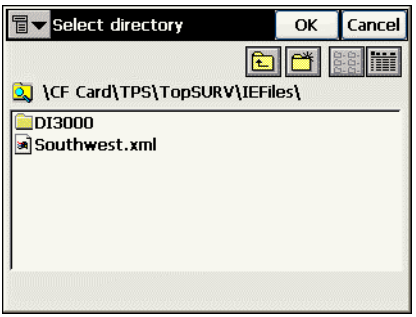


Figure 5-12. File Import Directory

4. If *Bluetooth* is chosen to perform the connection between the controllers, highlight the appropriate Bluetooth Device and tap **Select**.
5. Prepare the other controller device for the export process as described in the "Export to Controller" on page 5-14.
6. Tap **Import** on the ***File Import Directory*** screen (Figure 5-12).

Exporting

TopSURV can export data to another job, to a file, and to another controller device. Codes can be exported to code libraries, and sessions to receivers (in the GPS+ mode).

Export to Job

1. Select **Job** ▸ **Export** ▸ **To Job**, the ***Select Job*** screen opens (Figure 5-13).

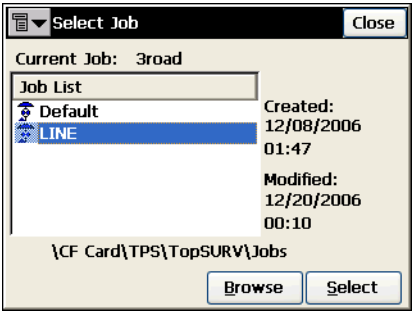


Figure 5-13. Select Job

2. To select the Job, do one of the following:
   - Highlight the Job from the Job list and tap **Select**.
   - Tap **Browse** and select the Job file on the disk. Tap **OK** in the upper-right corner of the browse dialog box.
3. In the ***Export to...*** screen select whether points are to be exported, and if necessary, filter the exported points by type; by range and code; or by type, range and code (Figure 5-14 on page 5-9).

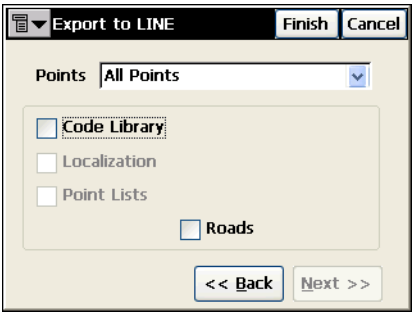


Figure 5-14. Export

Also place appropriate check marks, if the following data should be exported along with points: Code Library, Localization, Roads, and/or Point Lists.

4. Tap the **Next** button. Depending on the selection made in the ***Export to...*** screen, one of the following screens opens:

   - If *By Type*, or *By Type, Range and Code* was selected in the *Points* drop-down menu, the ***Select Point Type(s) to Export*** screen displays. On this screen, select the types of points to be exported (Figure 5-15).

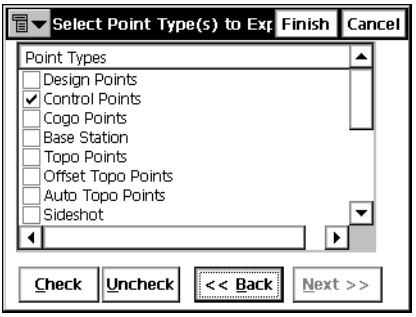


Figure 5-15. Select Point Type(s) to Export

   - If *By Range and Code* was selected in the *Points* drop-down menu, the ***Points to Export*** screen displays. On this screen, select the codes and/or the range of points to be exported (Figure 5-16 on page 5-10). To select codes, tap the **Select** button, check the codes associated with the points to be

exported in the ***Code*** screen, and tap the **OK** button. The Range of Points sets a range of point names that should be exported. The symbols ‘,’, ‘.’ or ‘;’ can be used to differentiate individual point names, whereas the symbol ‘-’ is to be used for specifying a range.

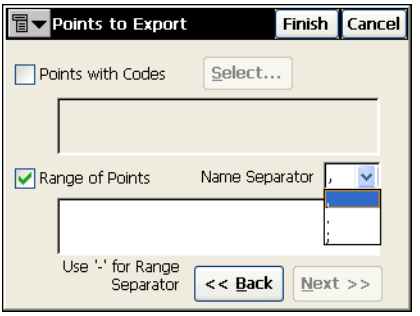


Figure 5-16. Points to Export

- If *All* or *None* is selected in the *Points* drop-down menu and *Roads* checked, the ***Select Road(s) to Export*** screen displays. On this screen, select the roads (if available) to export (Figure 5-17).

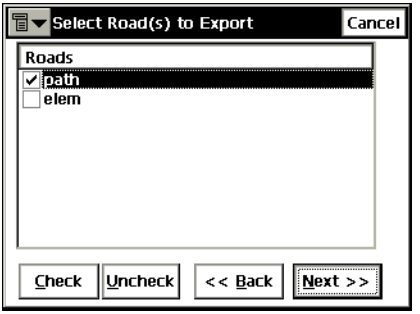


Figure 5-17. Select Road(s) to Export

- If *All* or *None* is selected in the *Points* drop-down menu, *Roads* is not checked and *Point Lists* checked, the ***Select Point List(s) to Export*** screen displays. Based on the selections in this screen, tapping the **Next** button on the subsequent pages will result in appropriate screens being displayed.

5. In the ***Select Point List(s) to Export*** screen select the point lists (if available) to export (Figure 5-18).

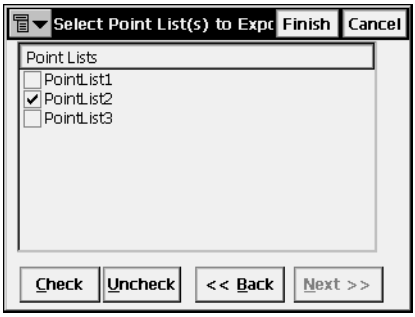


Figure 5-18. Select Point List(s) to Export

6. In the final screen for importing from a job, the **Next** button will be disabled. Tap **Finish** to start Import process.

Export to File

1. Select **Job ▸ Export ▸ To File**.
2. In the ***To File*** screen, select the type of data to be exported and the type of file to export to. If desired, check the appropriate fields to choose the data being exported.

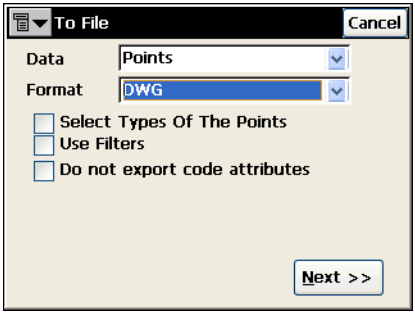


Figure 5-19. Export to File

NOTICE

TopSURV can export DWG files only in AutoCAD 2000 format.

3. If the Text file type is chosen, check the *ASCII File Properties* field buttons if necessary.

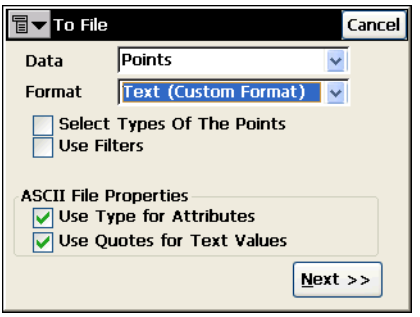


Figure 5-20. To File

Tapping the **Next** button will open the ***Select Point Type(s) to Export*** (page 5-9) and the ***Point To Export*** (page 5-9) screens if the respective fields have been checked.

4. When all data export conditions have been specified, a screen to choose the file opens. Using the Windows CE interface, browse for the file to export to or type the name of the file, and tap **OK**.
5. For Text file formats, specify the format of data in the file.

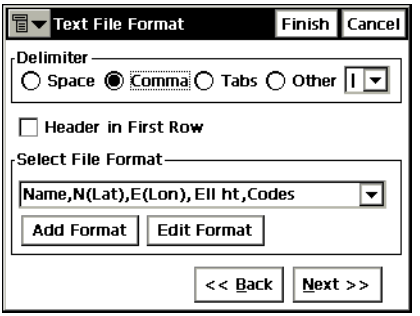


Figure 5-21. Text File Format

- Choose the delimiter between fields.
- If a header is provided in the first row of the file, check the appropriate field.

- Select the File Format (the order of the fields), using the drop-down menu. Or create a new file format using the procedure below.

6. Tap **Next** to select the coordinate system of the data in the imported file.
7. Tap **Finish** to start the export process.

To create a new file format, enter the order of data using the ***Custom Style*** screen (Figure 5-22).

1. Tap **Add Format** on the ***Text File Format*** screen.
2. Select items from the Available list and tap the right arrow button to move them to the Order list.
3. To arrange the item sequence, use the up and down arrow buttons. The order of items in the Order list should correspond to that in the selected file.
4. Tap **Save** (Figure 5-22). The combination will display in the *Select File Format* drop-down list on the ***Text File Format*** screen.

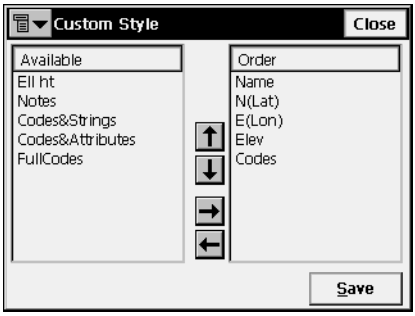


Figure 5-22. Custom Style

For details on the formats of the files to which TopSURV can export data, refer to *TopSURV Reference Manual*.

Export to Controller

1. Select the **Job ▸ Export ▸ To Controller** menu.
2. On the ***Import/Export Settings*** screen, select the means of connection using the **Com Port** drop-down list, then tap **Next** (Figure 5-23).

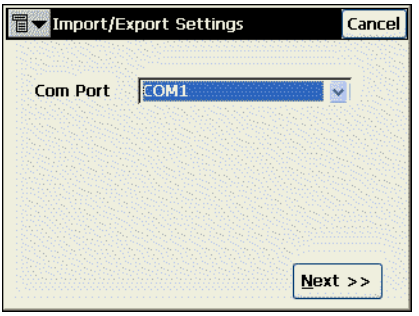


Figure 5-23. Import/Export Settings

3. If *Bluetooth* is selected to perform the connection between the controllers, choose the desired Bluetooth Device and tap **Select**.
4. Choose the files to be exported.
5. Prepare the other controller device for the import process as described above in the Import section.
6. Tap the **Export** button.

Exporting Sessions to the Receiver

1. To export the session to the receiver, establish a connection between the controller and the applicable receiver, then select **Job ▸ Export ▸ Sessions**, the ***Sessions*** screen opens (Figure 5-24).

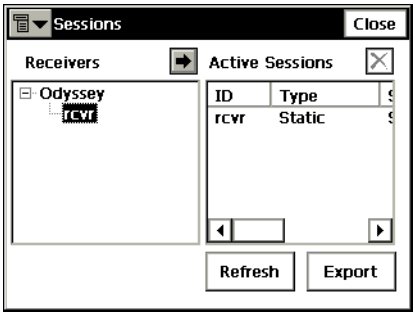


Figure 5-24. Job Session

2. Select the sessions to export in the left panel and tap the button. The sessions to be exported are displayed in the right panel.
3. Tap the **Export** button. The session will be transmitted to the receiver.

Notes:

Surveying with TopSURV

Performing GPS+ Surveys

After creating a job with a desired configuration in TopSURV and completing preliminary work (the antenna is plumbed and the receiver and controller are connected), the survey can begin.

- To use RTK measurements, two receivers are needed: a Base Station receiver, with an antenna plumbed above a point with known coordinates, and a Rover receiver, with an antenna plumbed above the points being surveyed.

If a local system is used, perform Localization first to determine coordinate transformation parameters from Geodetic coordinates to local coordinates.

Survey work can be performed in two modes: Topo and Auto Topo. Topo surveys collect data one at a time at several locations, whereas Auto Topo surveys continuously collect data (usually for trajectory survey work).

- To use Network RTK and Network DGPS positioning, a Rover receiver is needed, with an antenna plumbed above the points

being surveyed, and correction data received by the Rover from reference station networks.

- To use the Real Time DGPS survey mode, a Rover receiver is needed, with an antenna plumbed above the points being surveyed, and correction data received by the Rover from differential services.
- To use the PP modes, two receivers are needed: one located on an occupation with known coordinates, and the other is either located on static occupations (PP Static mode), moves along a trajectory (PP Kinematic mode), or moves to position points of interest (PP enabled RTK, Network RTK, Network DGPS and PP DGPS). Data collected in PP (post-processing) modes can be processed later in the office for estimation of baseline vectors. The Topo and Auto Topo surveys for PP Kinematic and PP DGPS modes are performed similarly to real-time surveys.

Job configuration settings will be applied to the Base receiver only after starting the Base and to the Rover receiver only after selecting the Topo/Auto Topo option.

Localization

The Localization parameters can be defined either before beginning the job or after the completing the job.

The Localization parameters provide transforming coordinates between a local system and the WGS84 system. To calculate these parameters, the localization (control) points with pairs of coordinates in both systems are used. The local coordinates and the WGS84 coordinates are those of the same point on the surface of the earth, in the local and WGS84 systems, respectively. The names of the Local and WGS84 points must be different.

For localization to work properly, enter or import the local coordinates with Projection set to <none> in the Coord System screen Coord Type set to Ground in the Display screen. The quality of coordinates of localization points directly affects localization accuracy.

Localization points should be located more or less evenly around the jobsite. They are not to be together or to be all at one section of the site.

1. Select **Survey ▸ Localization**. On the ***Localization*** screen, tap **Add** (Figure 6-1).

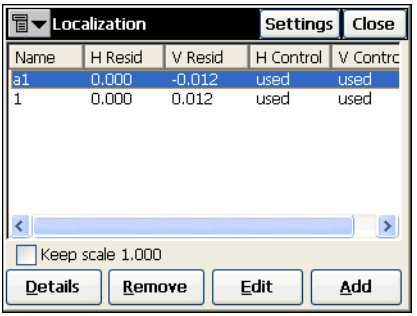


Figure 6-1. Localization

2. In the ***Add Localization Point*** screen, set the following parameters, then tap **OK** (Figure 6-2):
   - In the *Local Point* field, select the point with the local coordinates. Check the *Use Horizontal* and *Use Vertical* fields to use this point for horizontal and/or vertical localization.
   - In the *WGS84 Point* field, specify the point with global coordinates and select a code for this point. Add the point manually to the job points, or tap the **Start Meas** button to use the current position.

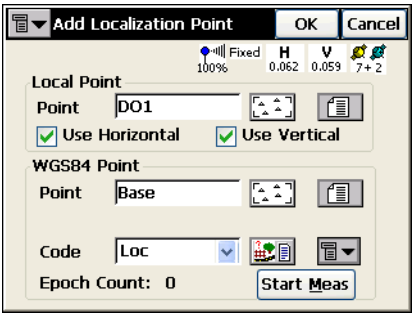


Figure 6-2. Add Localization Point

3. Repeat steps 1 and 2 to enter additional localization points.

Note the following information about localization points.

- When only one localization point is available, the offsets are computed and the system is oriented to North, and the scale is set at height.
- When two localization points are available, the offsets, azimuth and scale are computed. With three localization points, Vertical deflection is also computed. When additional localization points are specified, the parameters resulting in the least errors will be computed.
- The localization is updated (recomputed) every time a new point (local and WGS84 coordinates) is added to the list of localization points.
- The value of the residuals specify the level of reliability for each localization point. The residuals are along horizontal or vertical axes. The control columns display the status of the point, either used or not used. Select the line and tap **H Control** or **V Control** to change the status.
- The parameters of the localization are available through the **Details** button (Figure 6-3 on page 6-4).

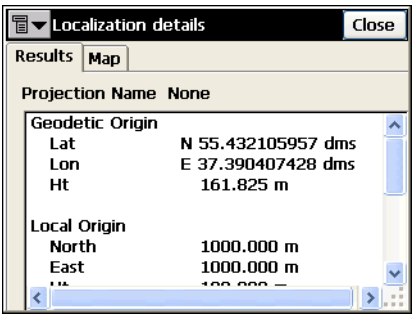


Figure 6-3. Localization Details

The new coordinate system will be saved under the name "Localization" and is automatically selected when the **Close** button is tapped, if one or more localization points are specified.

Starting the Base

1. Connect the controller to the Base Receiver. Switch on the devices.
2. Select **Survey ▸ Start Base**. On the ***Start Base*** screen, set the following information, then tap **Start Base** to transmit coordinates to the receiver (Figure 6-4):

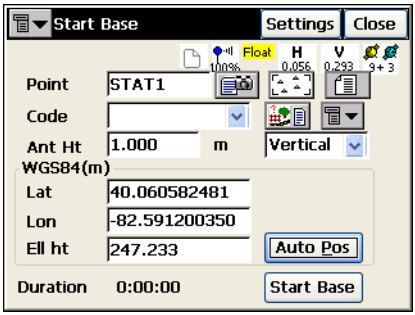


Figure 6-4. Start Base

- Enter the coordinates of base location manually, select a point with the known coordinates, using the map or list of available points. To enter a photo note for the point, use the  button near the point name.
- Enter the code of the Base manually or select the code from the list.
- The current location can also be measured by tapping the **AutoPos** button (the coordinates of the current point will appear), and can be used to set the base.
- Measure and insert the Antenna height in the corresponding field. If the antenna has not been set up yet for the job, specify the antenna parameters.

3. To start multiple bases, tap on the *Multi Base* menu item in the upper left corner of the screen.
4. Tap **Close** to exit the screen.

Multi Base

The Multi Base function in TopSURV is implemented using the Time Division Multiple Access (TDMA) mode of transmission. This means that one Base can transmit at the beginning of the second and another Base can transmit a half second later on the same frequency. The Rover can recognize the two separate data streams.

1. Create a job: configure RTK survey and set all necessary settings.
2. Setup Base 1: connect the controller to the receiver at Base 1. Select **Survey ▸ Start Base**.
   - Select *Multi Base* from the menu in the upper left corner of the ***Start Base*** screen. Then select the *Base Station ID* and *Transmit Delay*. Select base station ID, for example 11, and set the Transmit Delay for 30 msec. With transmission delays, the bases are allowed to broadcast multiple RTK data on the same frequency.

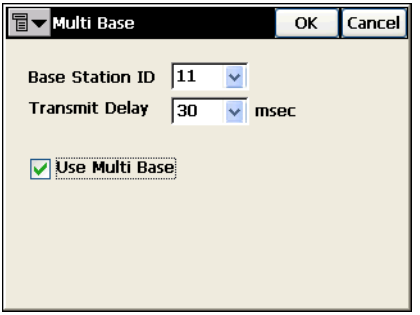


Figure 6-5. Multi Base

   - Tap the **Start Base** button. Base 1 will transmit as ID 11 at 30 milliseconds after the second. It will output RTK data at a transmission rate of 1 second. Disconnect from Base 1.
3. Setup Base 2: connect the controller to the receiver at Base 2.
   - Setup of Base 2 is the same process as for Base 1 but a different ID and transmission time must be selected for Base 2, for example 12. Recommended time delay for Base 2 is 530 msec.

- Tap the **Start Base** button. Base 2 will transmit as ID 12 at 530 milliseconds after the second or 1/2 second after Base 1. Base 2 will also output RTK data at transmission rate of 1 second. Disconnect from Base 2.

4. Note that both transmitters need to be set to transmit at the same frequency and they must transmit CMR+ format.
5. At the Rover: connect the controller to the rover receiver. If the rover receives CMR+ corrections from more than one base, there will be an additional tab in the Survey/Status menu called *Multi Base.* This is a table with information about the base stations the rover receiver is listening to.

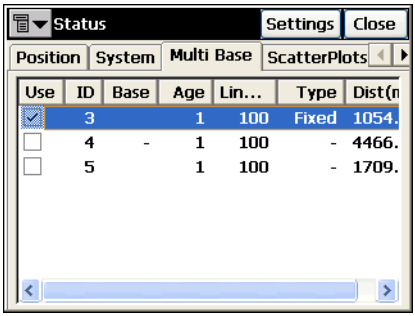


Figure 6-6. Multi Base tab

- Check which base to use. Currently, TopSURV only supports processing RTK baselines from one base at a time.
- After the ***Topo*** screen is opened, the receiver connected to the controller will be configured as the rover.

6. For a new job created: the bases remain active for another job. It is not necessary to reconnect to the bases and start them. Only at the rover side open the ***Status*** screen and select the base with which to work.

Initializing mmGPS+

Before beginning the setup for mmGPS+ system, configure the mmGPS+ aided survey (see “mmGPS Configuration” on page 3-13).

The setup process of mmGPS+ system includes calibration of the laser transmitter and initialization of the sensor.

Transmitter Calibration

The laser transmitter is the vertical grade control reference for the jobsite. The following procedure will calibrate the transmitter with the correct channel and communication port, as well as setup the transmitter’s height and locate it at the jobsite.

1. Connect the controller and transmitter.
2. Select **Survey ▸ Init mmGPS+.**
3. On the ***Init mmGPS+*** screen and *Trans Data* tab, select the **ID** that corresponds to the channel of the transmitter, then tap **Add.**

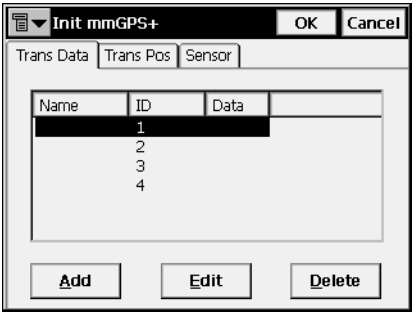


Figure 6-7. Initialize mmGPS - Trans Data Tab

4. On the ***Transmitter*** screen, enter a *Name* for the transmitter (usually the serial number), select the *Com port* for the transmitter (usually COM1), then tap **Get Data** (Figure 6-8 on page 6-9).

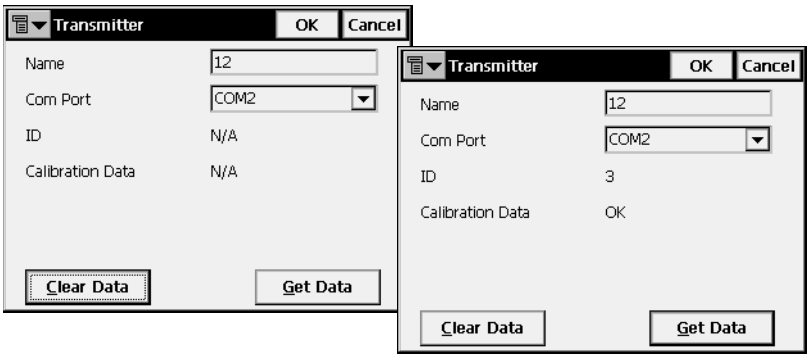


Figure 6-8. Enter and Get Transmitter Data

5. Once TopSURV retrieves the transmitter's data, close the setup successful screen. Then tap **OK**.
6. Select the *Trans Pos* tab and the desired transmitter. Tap **Edit** to enter the transmitter's position.

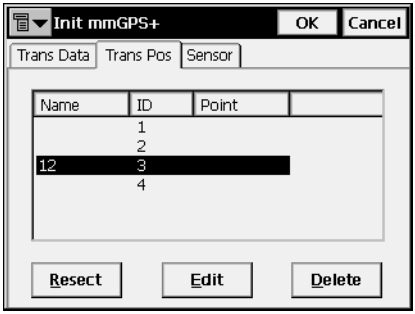


Figure 6-9. init mmGPS -Trans Tab

7. On the ***Known Point*** screen, enter the following information and tap **OK** (Figure 6-10):
   - Using the map, select the point the transmitter is installed over.
   - Enter the height of the transmitter using one of the following:
     – Enter the *Ht* measurement from the ground to the mark on the transmitter's side and the *m* method as slant.

– Select *2m Fixed Tripod* if using a 2 meter fixed tripod.

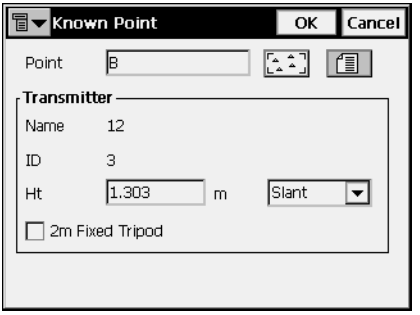


Figure 6-10. Enter Transmitter's Position

8. Unplug the controller from the transmitter. Continue with the following section to initialize the sensor.

Sensor Initialization

The initialization process will upload transmitter calibration information to the sensor connected with the receiver, as well as set up the sensor for receiving the transmitter's laser beam.

1. Connect the controller and GPS receiver.
2. Select the *Sensor* tab and enter the following information (Figure 6-11 on page 6-11):
   - Select the *Receiver Port* that connects the receiver and sensor, usually port D.
   - Select the *Transmitter ID*, usually ANY. The ANY selection will allow the sensor to independently select the transmitter with the smallest error rate.
   - Select AUTO for the *Sensor Gain* to automatically control the mmGPS receiver's detection level of the transmitter's signal.
   - Enable *Init Time Improvement* to improve the RTK fix time for the receiver.

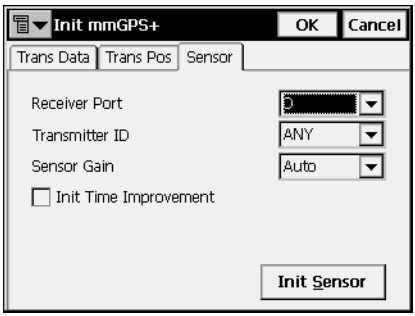


Figure 6-11. Init mmGPS – Sensor Tab

3. Tap **Init Sensor** (Figure 6-12).

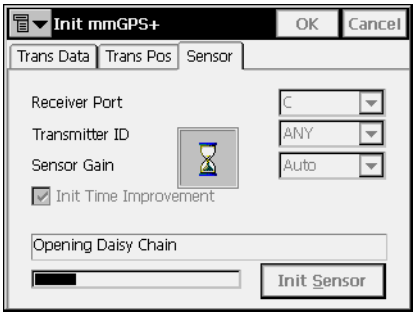


Figure 6-12. Initializing Sensor

4. When the initialization completes, tap **Close** on the setup successful screen.

In the event that a point has been lost, the resection operation can measure an unknown point. The self-levelling mechanism may also need to be measured and the transmitter calibrated to ensure correct grade. For details on these mmGPS operations, see Appendix A.

NOTICE

When using mmGPS+, include the height of the PZS-1 sensor with 5/8 inch plug into the rover antenna height.

Performing a Topo Survey

1. Select **Survey** ▸ **Topo**. On the ***Topo*** screen, enter the Point name, enter a photo note using the  . button if necessary, select the Code and select the antenna height and height type (Figure 6-13).

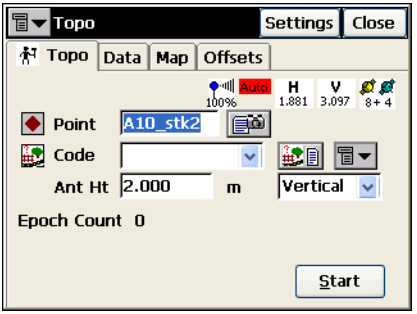


Figure 6-13. Topo

2. When in DGPS survey mode using OmniSTAR differential corrections, select the *Config OmniSTAR* item from the bitmap menu in the upper left corner to start the OmniSTAR service.
3. Tap the **Settings** button to change the survey parameters settings to desired values.
4. If the location of the point to be observed is unreachable, set offset parameters using simple offset or offset from a line. Tap the Offsets tab (Figure 6-14 on page 6-13).
   - For simple offset use, tap the **Az Dis Ht** button, enter the name and Code of the offset point, and insert the angle parameter (Azimuth or Bearing), the height parameter (zenith distance, elevation angle or vertical distance) and the horizontal distance. Toggling between angle or height parameters is performed by tapping the corresponding button. tap **Store** to save the offset point.
   - For line offset use, tap the **Line** button, enter the names of two points comprising the reference line, specify the direction of the line and enter the parameters of the offset point: Name, Code, the distance along the line of sight between the second

point and the projection of the offset point on the reference line, the distance from the reference line to the offset point along the projection, and the height of the point. tap **Store** to save the point; several offset points can be saved using one line.

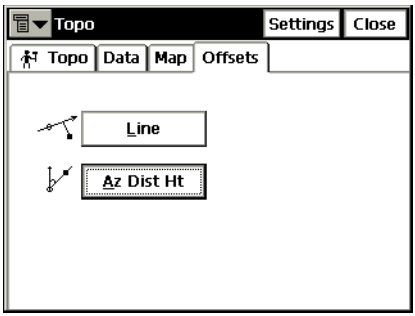


Figure 6-14. Topo – Offsets

5. Tap **Start** on the *Topo* tab to start the survey (Figure 6-13 on page 6-12). When using a mmGPS system, the *Topo* tab displays a mmGPS icon  . This icon displays when the receiver calculates mmGPS heights.
6. In the survey for post processing, begin logging files to the receiver: tap the **Start Log** button. To stop logging, tap the same button (during the logging process, this button says **Stop Log**, and the symbol  located in the icon bar on the place of Status icon in the RTK mode becomes: ).
7. View the *Data* tab for details on the last point stored.
8. Use the *Map* tab to view a plot of the point with respect to other stored objects. If necessary, select the *Grid Setup* option from the pop-up menu on the top left corner of the screen to setup a grid to be displayed with the Map.
9. If a topo point is observed a second time and named with the identical name, a prompt will ask to Override, Rename, or Store as Weighted Average point. Multiple WA points can be stored and the results can be viewed in the ***Edit Points*** screen. The Use in WA button makes weighted averages of topo points.

Performing an Auto Topo Survey

1. Select **Survey ▸ Auto Topo**. On the ***Auto Topo*** screen, enter the point name, select the Code if necessary and insert the Antenna height and antenna type (Figure 6-15).

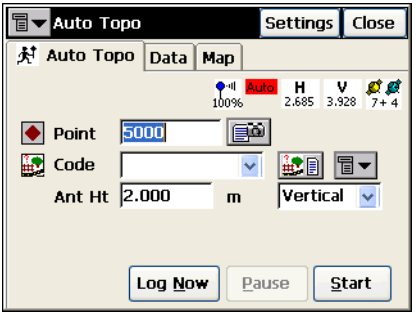


Figure 6-15. Auto Topo

2. When in DGPS survey mode using OmniSTAR differential corrections, select the *Config OmniSTAR* item from the bitmap menu in the upper left corner to start the OmniSTAR service.
3. Tap the **Settings** button, select the parameters for data logging, and tap **OK**: the solution type solution for automatic data logging while moving and the interval between measurements (meters or seconds). To return to default values, tap **Defaults**.
4. Tap **Start** on the *Auto Topo* tab and begin moving. When using a mmGPS system, the *Auto Topo* tab displays a mmGPS icon  . This icon displays when the receiver calculates mmGPS heights.
5. To interrupt the process of survey, tap the **Pause** button.
6. To override the interval Survey parameter temporarily and log the current location, tap **Log Now** button.
7. In PP Kinematic and PP DGPS surveys, begin logging files to the receiver: tap the **Start Log** button. To stop logging, tap the same button (during logging, the button changes to “Stop Log”, and the symbol  located in the icon bar changes to ).

The *Data* tab displays details of the last point stored. The *Map* tab shows a plot of the point with respect to other stored objects.If necessary, set up a grid displayed with the map using *Grid Setup*.

Cross-Section

Cross-Section survey is performed to obtain the coordinates of points that lie on a plane perpendicular to a center line. It is typically performed by moving from one side of a road to the other in the cross-sectional plane, and then crossing back in the opposite direction at a different location along the road. This process is repeated at different stations along the centerline, till all the desired cross-sectional points have been observed.

1. To start working, select the **Survey ▸ X-Section** menu.
2. In the ***Cross Section*** screen, set the parameters of the station, where the cross section survey is to be performed: the road name, the code and attributes of the center line, the station where the cross section is surveyed and the increment of distance towards the next station (Figure 6-16). Tap **OK**.

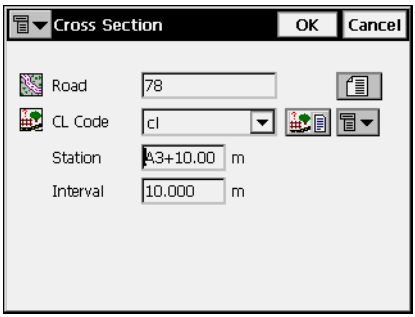


Figure 6-16. Cross Section

The Station and Interval fields appear only if the road is selected.

3. In the ***X-Sect*** screen (Figure 6-17 on page 6-16) perform the usual observation work relative to the cross section, as described in “Performing a Topo Survey” on page 6-12.

Cross-sectional points at the same station should have different codes, with at least one of them having the centerline code. For example codes for cross-sectional points could be A, B, C, cl, D, E, F, in the order of survey. After the **Close** button is taped, the station number automatically changes. Also, the application automatically uses same codes but in the opposite order for the next station (F, E, D, cl, C, B, A). The station and the codes can be changed.

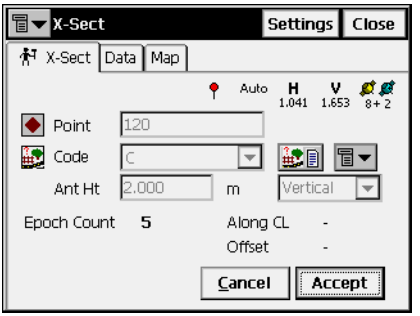


Figure 6-17. X-Sect

Find Station

The Find Station task is used for the identification of the station by computing the distance from the beginning of the road to the projection of the station to the road, and the offset of the station from the center line of the road.

1. To start working, select **Survey ▸ Find Station** menu.
2. Enter the road, the name, and the code of the point and the antenna height and type (Figure 6-18 on page 6-17).

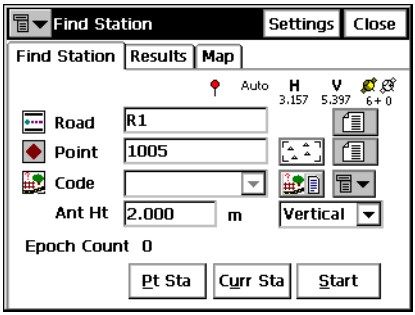


Figure 6-18. Find Station.

3. To compute the result with an existing point, tap the **Pt Sta** button.
4. To compute the result with the coordinates of the current location without making an observation, tap the **Curr Sta** button.
5. To make an observation of the current location and store the coordinates to a point, and compute the result with this point, tap the **Start** button.

Tape Dimension

Using the *Tape Dimension* task, calculate the periphery of structures such as buildings that have features perpendicular to each other. This is done using tape measurements, relative to the two known points that belong to one side of the structure (wall of the building), forming the so called *reference line*.

1. To start working, select **Survey ▸ Tape Dimension**.
2. In the *Ref Line* tab, enter the information about the two points comprising the reference line: the names and codes. If the reference line points are to be observed, tap the **Meas** button in the corresponding fields (Figure 6-19 on page 6-18).

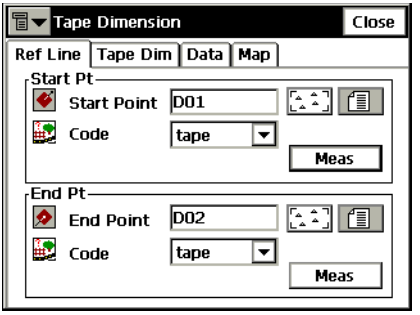


Figure 6-19. Tape Dimension – Ref Line Tab

3. In the *Tape Dim* tab, set the parameters for performing the survey: the name and code of the surveyed point, and the direction (left or right of the previous line) and the distance of the movement from the previous point (Figure 6-20).

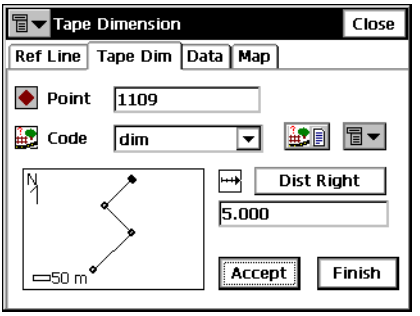


Figure 6-20. Tape Dimension – Tape Dim Tab

4. To apply the taped distance to the perimeter line, tap the **Accept** button.
5. Closing of the Tape Dimension work is available in two ways:
   - To connect the first and the last point with a line, tap **Finish** and select the *Close Polygon* item from the menu.
   - To calculate the difference between the last and the first point, tap **Finish** and select the *Calc Closure* item from the menu.

Performing a Static Survey

1. To open the ***Static Occupation*** screen (Figure 6-21), choose the *PP Static* configuration in the ***Select Survey Config*** screen (**Job ▸ Config ▸ Survey**) and select **Survey ▸ Static Occupation** menu.

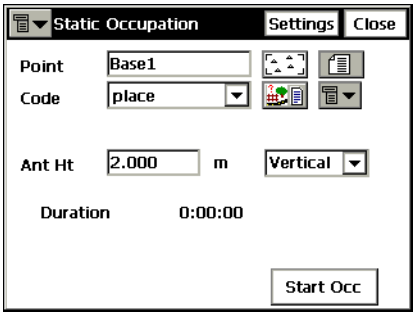


Figure 6-21. Static Occupation

2. Enter the parameters of the occupation point: name, code and antenna height and height type.
3. Tap **Start Occ.** The survey will start, and the Duration field displays the time passed since the beginning of survey.
4. To stop survey tap the same button (when taped, it changes its appearance on **Stop Occ**).

Performing Total Station Surveys

After completing preliminary work (that is, the instrument is plumbed above the reference point and the controller is connected to a modem (for Robotic Surveys) or to the total station), the survey can begin.

First, set one or more backsight points to be used for the survey. Then choose a task to perform: sideshot (single or multiple) survey, cross-section survey, finding station, tape dimension measurement, or missing line determination. In the case of Robotic Survey, the auto topo task is also available. The remote control function should be set before performing a Robotic survey.

In the case of Contractor Mode, it is possible to perform only Sideshot-Direct measurements with conventional and reflectorless total stations.

Backsight Setup

1. Select **Survey ▸ Occ/BS Setup.**
2. On the ***Backsight Survey*** screen, set the following backsight parameters (Figure 6-22 on page 6-21):
   - Choose the occupation point. This can be done in several ways:
     – enter the name manually,
     – select the point from the map,
     – select the point from the list of fixed or job points, or
     – calculate the occupation point coordinates using the coordinates of known points with the side shot method. The elevation can be computed using the known elevations of the other points.

- Then set the height of the instrument and the height of the reflector, choose the backsight point/ backsight azimuth (or enter multiple backsight points using the floating menu on the bitmap in the corresponding field) and check if the distance to the backsight should be measured and if the height of the backsight point rod is fixed.

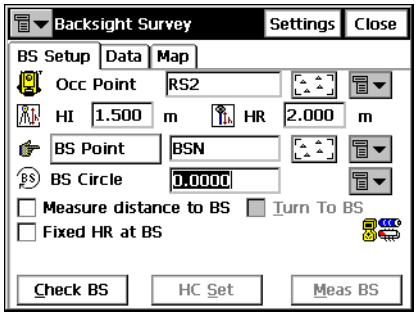


Figure 6-22. Backsight Survey

3. To measure the angle position of the backsight point, tap the **Meas BS** button.
4. To check the quality of the chosen backsight point, tap the **Check BS** button. The ***Check Backsight*** screen displays the residuals of the current backsight point after tapping the **Check** button (Figure 6-23). Tap **Close**.

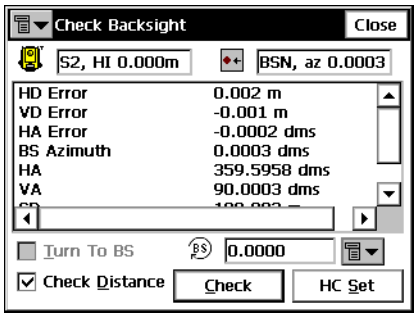


Figure 6-23. Check Backsight

5. To adjust the horizontal circle of the total station, tap the **HC Set** button. Using the ***Backsight HC*** screen, set the horizontal circle reading that corresponds to the backsight point direction.

Enter the value manually, or choose the value of the horizontal circle using the menu on the bitmap in the *BS Circle* field.

6. Tap **OK** to store settings.

Note that when moving to the next occupation, the previous occupation point becomes a backsight point by default.

Sideshot Setup

Once the backsight point is set, make a single sideshot.

1. Select **Survey ▸ Observations**. On the ***Sideshot-Dir*** screen, enter the point name, code, and the height of the target.

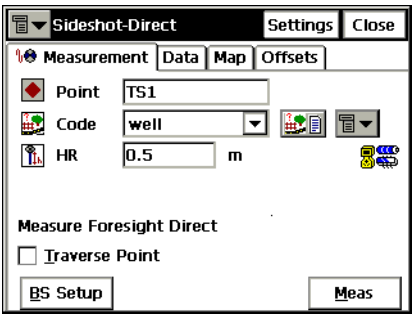


Figure 6-24. Sideshot-Direct

2. Set the backsight point, if that has not been done before. tap the **BS Setup** button and follow the instructions in "Backsight Setup" on page 6-20.
3. Enable the *Traverse Point* field to tag the point as Traverse. The Traverse Points for the Measurement are stored in the Traverse Point List.
4. To select next occupation point, select the **Adv** entry from the menu on the bitmap in the upper-left corner. Once the next occupation point is selected from the traverse point list, the controller automatically sets the current occupation point as the backsight and the selected traverse point as the next occupation point. If only one point is tagged as a traverse point, then this point is automatically chosen as the next occupation point and the current point as the backsight (when the *Adv* (advance) menu is selected).

5. To perform the sideshot, tap the **Meas** button.
6. If a point location is unreachable, set offset parameters using the *Offsets* tab. For details on these settings, refer to the *TopSURV Reference Manual*.
   - *Hz Angle:* defines a point using the horizontal angle from one point and the distance to another.
   - *Hz-Vt Angle* defines a point using the horizontal and vertical angles.
   - *Dist. Offset* defines a point giving from which to add or subtract distances horizontally and vertically.
   - Hidden Point defines a point on the ground surface, with a slanted rod touching the ground point. The rod has two targets.
   - *2 Line ISection* determines a point by the intersection of the two lines. Each line is defined by two points or two measurements.
   - *Line & Corner* determines a point on the corner using one line defined by two points.
   - *Line & Offset* determines a point distant from a line defined by two points.
   - *Plane & Corner* determines a point (Corner) by a plane defined by three points and an angle measurement.

Sideshot Sets

If the measurement method is Sideshot-Direct/Reverse (performed using the ***Sideshot-Direct/Reverse*** screen, Figure 6-25), a set of sideshots can be measured once the backsight has been setup.

The measurement to a single point is taken using the Direct Position and the Reverse Position of the Total Station (that is, Plunge (flip). Rotate the Total station by 180 degrees to get the reverse measurement).

For instance, if the Total Station Measurements in Direct Position are HA =70, VA =60, SD =143.23m, then the reverse measurements without any errors would be HA 250(=70+180), VA 300(=360-60), SD=143.23m. One set consists of one direct and one reverse measurement. These measurements are used to eliminate the Vertical circle centering errors.

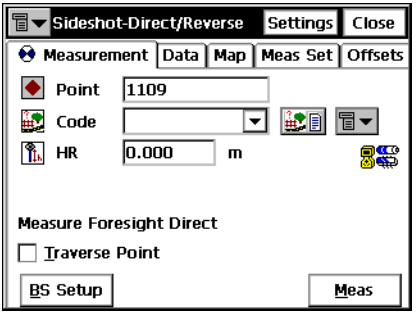


Figure 6-25. Sideshot-Direct/Reverse

1. If necessary, change the measurement mode: tap the **Settings** button, and select the mode in *Meas Method*.
2. Perform the sideshot survey as described in "Sideshot Setup" on page 6-22, taking any measurements necessary.
3. Move to the next point and repeat these steps. The last recorded measurement is displayed on the *Data* page.
4. If a point location is unreachable, set offset parameters as described above.

Angle/Distance Sets

If the measurement mode is Ang/Dist Sets-Dir/Rev (performed using the ***Ang/Dist Sets-Dir/Rev*** screen, Figure 6-26), the instrument uses the specified Angle sequence to perform repeated measurements. A sequence of four measurements constitutes one set. One example sequence is:

- first the measurement of the sideshot in direct face,
- then the measurement of the backsight in direct face,
- then the measurement of the backsight in reverse face,
- and finally the measurement of the sideshot in reverse face.

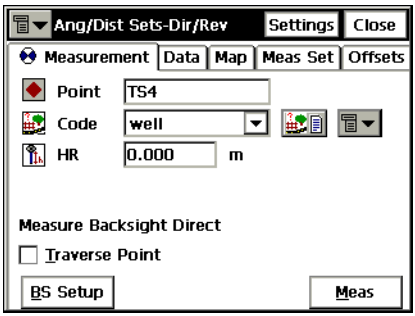


Figure 6-26. Ang/Dist Sets-Dir/Rev

1. If necessary to change measurement mode, select **Settings ▸ Meas Method** and pick the desired mode.
2. Perform the sideshot survey as described in "Sideshot Setup" on page 6-22, taking any measurements necessary.
3. The last recorded measurement is displayed on the *Data* page.
4. If a point location is unreachable, set offset parameters as described above.

Resection

The coordinates of the unknown point at which the total station is set can be calculated by resection when the number of points of known position are observed.

The location by resection can be performed when minimum two points of known coordinates are observed.

1. Add the points of known coordinates to the Point List.
2. Select the **Survey ▸ Resection** menu. This function is also available from the *Backsight Survey* screen. Select **Survey ▸ Occ/BS Setup**, then tap the bitmap next to the Map icon in the *Occ. Point* field and select the *Resection* item.
3. In the ***Resection*** screen, select the point of known coordinates from the map or from the list.

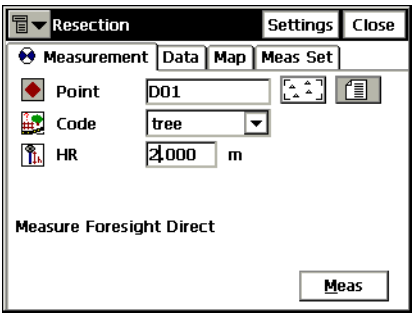


Figure 6-27. Resection

4. In the ***Resection Options*** screen, choose whether to calculate the height (3-D) or just the horizontal coordinates (2-D).

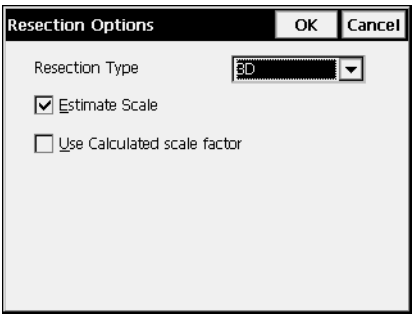


Figure 6-28. Resection Options

5. Aim the instrument at the point and enter the reflector height. Then tap the **Meas** button to take the sideshot to the point.
6. Repeat the procedure for the remaining known points.
7. Open the *Meas Set* tab. In the ***Resection*** screen, tap the **Accept** button. The coordinates of unknown point will be calculated.

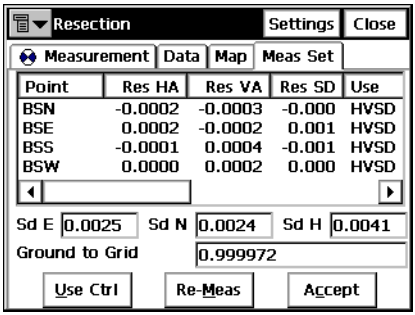


Figure 6-29. Meas Tab

8. In the screen that appears, enter the name of the calculated point and tap **OK**. The point will be added to the Point List.

Elevation

The elevation or height of the point at which the instrument is set can be calculated when two or more points of known coordinates are observed.

1. Add the points of known coordinates to the Point List.
2. Select the **Survey ▸ Elevation** menu. This function is also available from the *Backsight Survey* screen. Select **Survey ▸ Occ/BS Setup**, then tap the bitmap next to the Map icon in the *Occ. Point* field and select the *Elevation* item.
3. In the ***Elevation*** screen select the point of known coordinates from the map or from the list (Figure 6-30 on page 6-28).

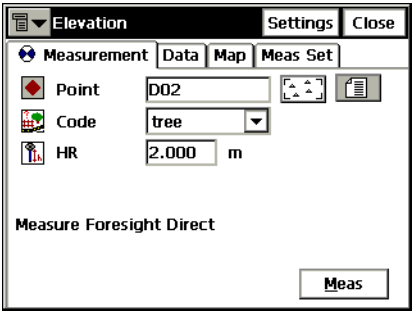


Figure 6-30. Elevation

4. Aim the instrument at the point and enter the height of the rod (target). Then tap the **Meas** button to take the sideshot to the point.
5. Repeat the procedure for the remaining known points.
6. Open the *Meas Set* tab. In the ***Elevation*** screen, tap the **Accept** button. The vertical coordinate of unknown point will be calculated.

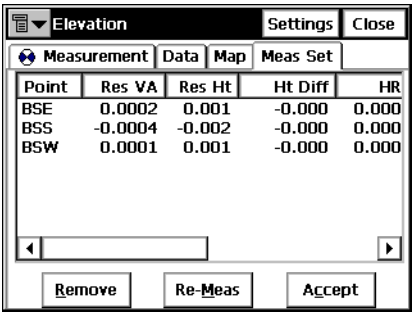


Figure 6-31. Calculate Coordinates for Unknown Point

7. In the ***Store Point*** screen that appears, enter the name of the point and tap **OK**.

Remote Control

If the survey process is performed by one person with a robotic instrument, the remote control is used for the transmission of the commands from the controller to the total station. The radio modems need to be set and connected to the controller and the instrument.

1. Select the **Survey ▸ Remote Control** menu.
2. Using the ***Remote Control*** screen, you can make the instrument search for the target (with the **Search** button), lock on the target (with the **Lock** button), stop rotating (with the **Stop** button) and rotate to a pre-defined angle (with the **Turn** button) (Figure 6-32).

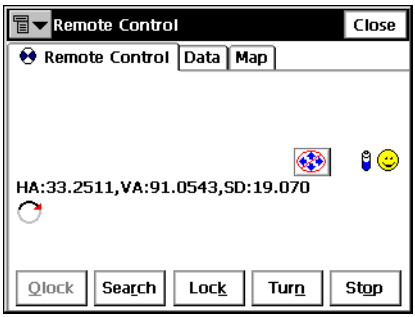


Figure 6-32. Remote Control

3. Tap the **Turn** button and enter the rotation angles in the ***Rotate*** screen (Figure 6-33 on page 6-30).
   - Tapping the **Turn** button in the *Rotation Angles* box will cause the instrument to rotate. The instrument can also be made to rotate to a point.
   - In the *Rotate to Point* box, select a point by typing its name, or choosing from the map or a list, and tap the **Turn** button.
   - To Plunge the instrument (rotate the telescope and the body by 180 degrees), tap the **Plunge TS** button.

   All the observations can be done in the remote mode as well if the instrument chosen is robotic.

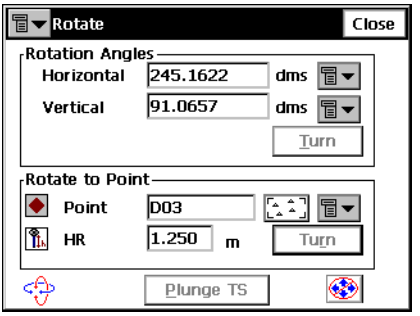


Figure 6-33. Rotate

Cross-Section

A cross-section survey is performed to obtain the coordinates of points that lie on a plane perpendicular to a center line. This type of survey is typically performed by moving from one side of a road to the other in the cross-sectional plane, and then crossing back in the opposite direction at a different location along the road. This process is repeated at different stations along the centerline until all the desired cross-sectional points have been observed.

1. To start working, tap **Survey ▸ X-Section**.
2. In the ***Cross Section*** screen (Figure 6-34), apply parameters for the station where the survey will be performed and tap **OK**: the road name, the code and attributes of the center line, the station where the cross section is surveyed, and the interval distance to the next station. If the road has not been created, define the plane.

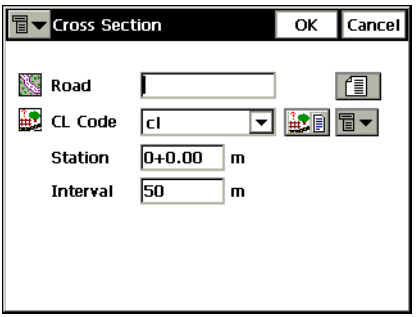


Figure 6-34. Cross Section

NOTICE

The Station and Interval fields appear only if the road is selected.

3. In the ***XSect-Direct*** screen perform the usual observation work relative to the cross section, as described in "Sideshot Sets" on page 6-24. The only difference lies in the presence of the **Cur Stn** button, which makes the measurement, but unlike the **Meas** button does not store the point (Figure 6-35).
4. Cross-sectional points at the same station should have different codes, with at least one of them having the centerline code. For example codes for cross-sectional points could be A, B, C, cl, D, E, F, in the order of survey. After the **Close** button is taped, the station number automatically changes. Also, the application automatically uses same codes but in the opposite order for the next station (F, E, D, cl, C, B, A).The station and the codes can be changed.

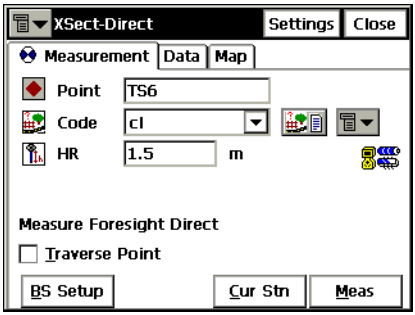


Figure 6-35. XSect-Direct

Find Station

The Find Station task is used for the identification of the station by computing the distance from the beginning of the road to the projection of the station to the road, and the offset of the station from the center line of the road.

1. To start working, select **Survey ▸ Find Station** menu.
2. If needed, set the backsight point. tap the **BS Setup** button and follow the instructions in “Backsight Setup” on page 6-20.
3. Enter the road, the name and the code of the point and the height of the rod (target) (Figure 6-36).

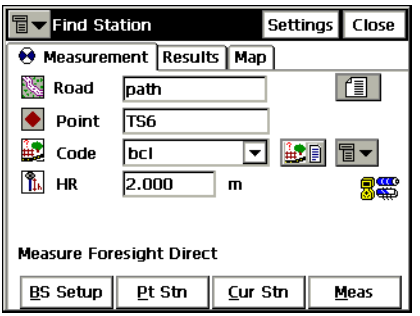


Figure 6-36. Find Station – Measurement Tab

4. To compute the result with an existing point, tap the **Pt Stn** button.
5. To compute the result with the coordinates of the current location without storing the point, tap the **Curr Stn** button.
6. To take a sideshot and store the coordinates to a point, and compute the result with this point, tap the **Meas** button.

Tape Dimension

Using the *Tape Dimension* task, calculate the periphery of structures such as buildings that have features perpendicular to each other. This is done using tape measurements, relative to the two known points that belong to one side of the structure (wall of the building), forming the so called *reference line*.

1. To start working, select the **Survey ▸ Tape Dimension** menu.

2. In the *Ref Line* tab enter the information about the two points comprising the reference line: the names and codes (Figure 6-37). To observe the reference line points, tap the **Meas** button in the corresponding fields.

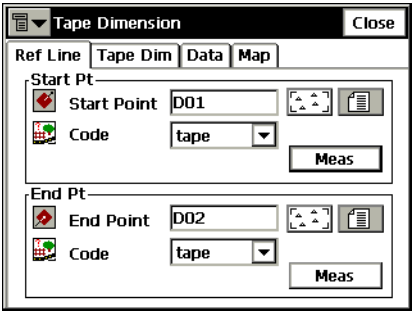


Figure 6-37. Tape Dimension – Ref Line Tab

3. In the *Tape Dim* tab set the parameters for performing the survey: the name and code of the surveyed point, and the direction (left or right of the previous line) and the distance of the movement from the previous point (Figure 6-38).

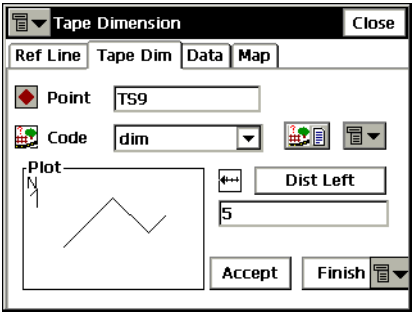


Figure 6-38. Tape Dimension – Tape Dim Tab

4. To apply the taped distance to the perimeter line, tap the **Accept** button.
5. Closing the Tape Dimension work is available in two ways:
   - To connect the first and the last point with a line, tap **Finish** and select *Close Polygon* from the menu.
   - To calculate the difference between the first and last point, tap **Finish** and select *Calc Closure* from the menu.

Missing Line

The *Missing Line* task emulates the total station measurement from one point to another and stores the result to the Raw Data database.

1. To start working, select **Survey ▸ Missing Line** menu.
2. Enter the *Start* and *End* points names and codes (Figure 6-39). To measure the point, tap the **Meas** button in the corresponding field.

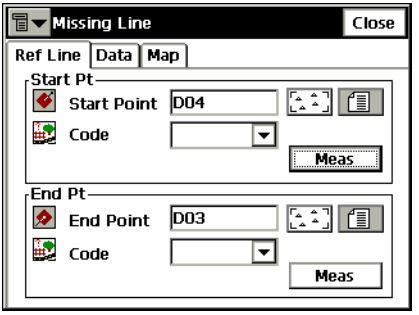


Figure 6-39. Missing Line – Ref Line Tab

3. The *Data* tab displays the results of the measurements (the measurement is performed when the *Data* tab is chosen). The same result is reflected in the ***Raw Data*** screen, with the type *MLM*.

Auto Topo

This function is activated only with Robotic instruments, and collects points by Time and Distance.

1. To open the Auto Topo screen, select **Survey ▸ Auto Topo** in the Robotic mode.
2. Enter the point name, code and the height of the rod (Figure 6-40 on page 6-35).
3. To set the Auto Topo method and interval, tap the **Settings** button and enter the desired values in the corresponding values in the second ***Mode*** screen. tap **Finish** to save the changes and return to the ***Auto Topo*** screen.

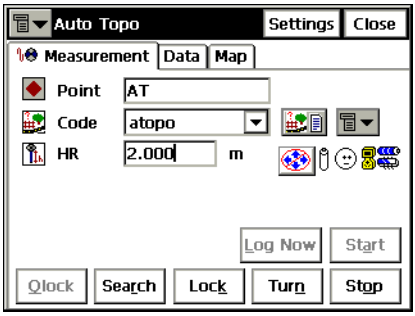


Figure 6-40. Auto Topo

4. Tap the **Start** button (after tapping, the button changes to "Stop") and begin moving.
5. To store the current position, tap the **Log Now** button.
6. To send the "Quicklock" or "Turn Around" command, which will cause the Total Station to search for the RC-2[1], tap the **Qlock** button.
7. To make the instrument search for the prism, tap the **Search** button.
8. To lock onto the prism or "track" it, tap the **Lock** button.
9. To turn the Total Station, tap the **Turn** button and enter the desired horizontal and vertical angles, or the direction point in the ***Rotate*** screen. tap **Turn** in the corresponding field to perform the rotation (Figure 6-41 on page 6-36). Tap **Close** to return to the ***Auto Topo*** screen.
10. To stop tracking the prism and take the "Standby" mode, tap **Stop**.

1. RC-2 is the Remote Control System 2 for optical communications. For instructions of how to operate the RC-2 device, consult the instruction manual for RC-2.

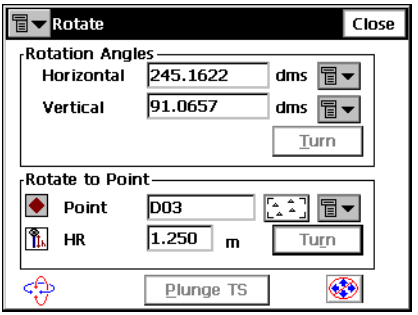


Figure 6-41. Rotate

Scanning...

This function is activated only with Robotic and Motorized reflectorless total stations, and can collect points with or without using images.

To open the ***Scanning*** screen, select **Survey ▸ Scanning** in the Robotic mode.

In the Scanning screen, select a desired scan type, either *Scan with Image* or *Scan w/o Image*, and tap **Next** (Figure 6-42).

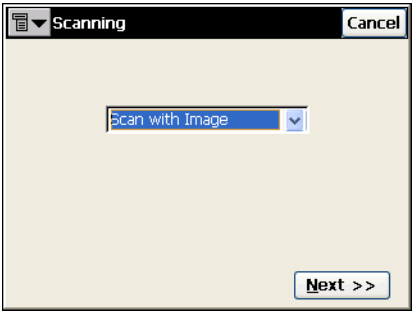


Figure 6-42. Select Scanning Type

In order to import an image into TopSURV to scan, the image must be captured with a calibrated, fixed focal length camera.

...Scanning with Images

1. Enter scan session information in the ***Select Scan*** screen.

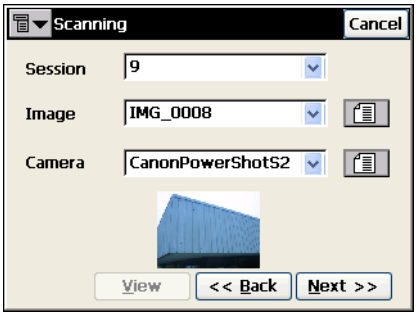


Figure 6-43. Enter Scan Session Information

- Enter a *Session* name.
- Select a previous *Image* or browse for a new one (images are stored as JPEG with file extension *.jpg).
- If the image exists in the Job, then the *Camera* information will be automatically selected. Otherwise, select a previous Camera or browse for a new one (Cameras are stored as a text file with the extension *.cmr).
- Once all fields are filled, click **Next**.
- Clicking **View** will open the View Scan screen. This screen displays the image along with orientation and scanned points for completed scan sessions.

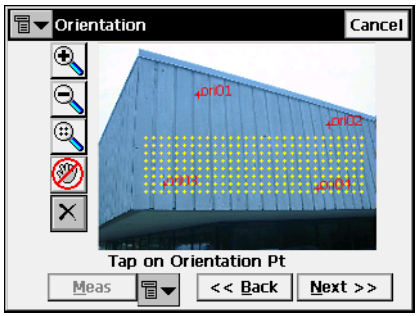


Figure 6-44. View Completed Scan Session

2. Perform image orientation. On the ***Orientation*** screen (Figure 6-45), associate a position on the image (x,y) with a known coordinate (N,E,Z).

Figure 6-45. Perform Orientation

- The Pan button enables drag control of the image. When disabled , tap on the image in a rough area of where the orientation point is located. The image will zoom to this point and show a crosshair (Figure 6-46).

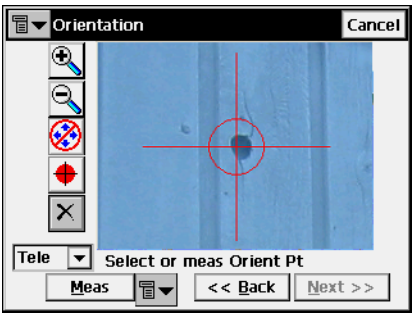


Figure 6-46. Select Orientation Point

- To view the image, select one of the two options from the drop-down list in the bottom left corner of the screen:
  - *Tele* (telescope) is the default zoomed-in view of the crosshair (Figure 6-46)
  - *Wide View* zooms out and shows the area of the image which contains the orientation point (Figure 6-47 on page 6-39).

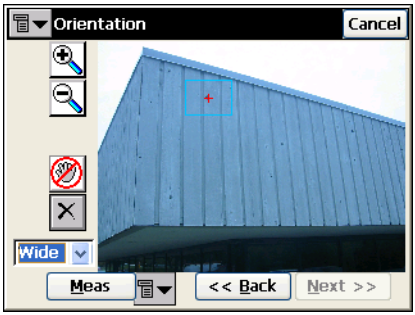


Figure 6-47. Select Orientation Point – Wide View

- Adjust the position of the crosshair.
  - When the Arrow button is enabled , use the arrow keys on the keypad to move the crosshair up, down, left, or right.
  - Use the button to move the crosshair to the center of a circular object on the image. First tap somewhere inside the circular object. The object should be a well-defined circle with high contrast between the inside and outside of the circle.
- Use the bitmap menu options (Meas, From Map, From List) to take a measurement or to select an existing point from a map or list.

- To delete the selected orientation points, tap the  button.

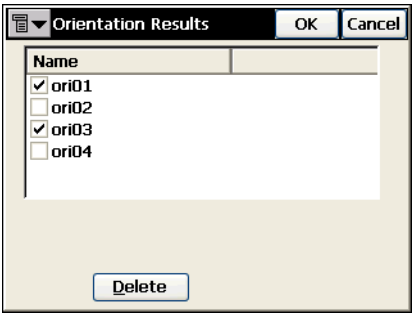


Figure 6-48. Delete Orientation Points

In the ***Orientation Results*** screen (Figure 6-48 on page 6-40), select the points and tap the **Delete** button.

- When four or more orientation points have been established, tap the **Next** button on the ***Orientation*** screen (Figure 6-49) to display the orientation results.

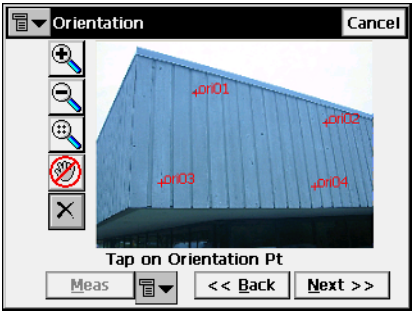


Figure 6-49. Calculate Image Orientation

3. View the image orientation results on the ***Orientation Results*** screen (Figure 6-50). The results for each Orientation Point is displayed as dX and dY in image pixels.

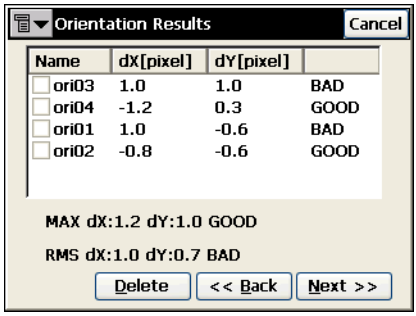


Figure 6-50. Orientation Results

- Tap **Back** to continue to the ***Scan*** screen to select areas for scanning.
- To adjust the orientation calculation, select a point and tap **Delete**. If four points still remain, the new results are displayed. If there are less than four orientation points then the results screen will automatically close and the user will need to continue the orientation procedure.

4. Select one ore more areas to scan using one of the following two methods and then begin the scan.
   - Scanning method A: Draw a rectangle by tapping the stylus on the screen for the start point and dragging to the end point. When the stylus is lifted, the area is set.

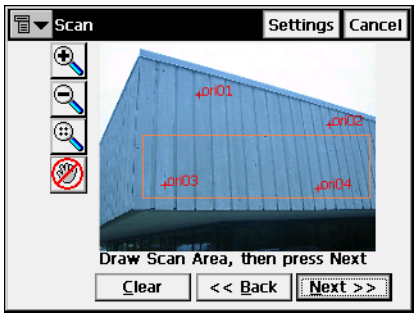


Figure 6-51. Select Rectangular Scan Area

- Scanning method B: Draw a polygon by tapping the stylus down at each vertex. Lines will be drawn connecting each vertex to the previous one. Tap the stylus near the first vertex to close the area.

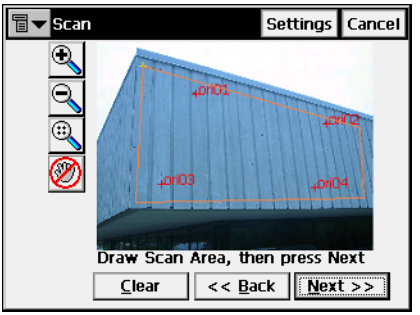


Figure 6-52. Select Polygon Scan Area

- Tap the **Settings** button to set the instrument to "Non-Prism" mode which is required for scanning and also to change the measurement mode (Fine, Coarse).
- When the areas are set, tap **Next** to begin the scan, first this button opens the ***Interval*** screen to set the scanning settings.
- After tapping **Clear**, all drawn areas will be erased.

5. Select a scanning interval. Enter the starting point name and the horizontal and vertical intervals. The intervals can either be entered as angles (Figure 6-53) or number of points. Tap **Next**.

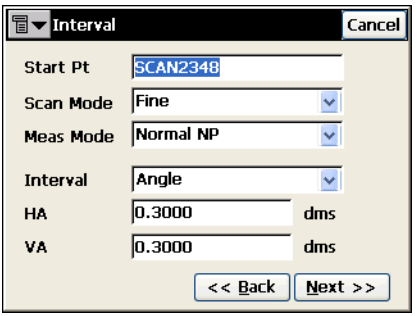


Figure 6-53. Select Scanning Interval

6. View the time estimate. Before scanning begins, the scanning information is displayed including the total number of points to

be scanned and an estimate of the time it will take to complete the scan.

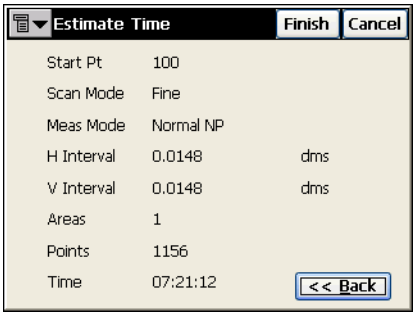


Figure 6-54. Estimate Time

If the estimated time is too long, click **Cancel** and enter larger intervals. Finally, click **Finish** to begin scanning points.

7. View the scanning in progress. As the total station measures points within the pre-defined area, each point will be displayed on the image (Figure 6-55). If necessary, click **Stop** to stop the scan.

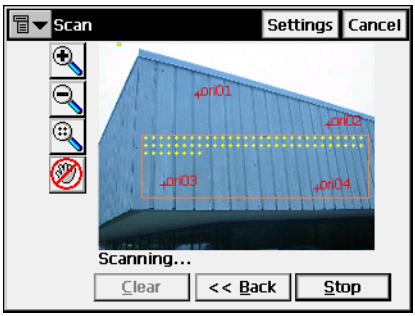


Figure 6-55. Scanning with Images

...Scanning without Images

1. Set the type of scan orientation and tap **Next** to select the scan area on the *Area* screen.

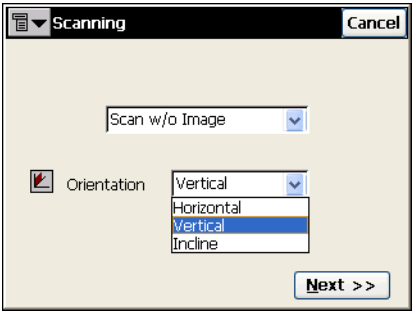


Figure 6-56. Select Orientation Type

2. Select the Scanning Area. The starting and ending points for the scanning area can be selected from the Point List or Map, or measured (Figure 6-57). When finished, click **Next**.

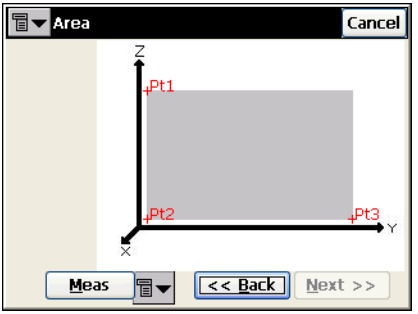


Figure 6-57. Select Area

3. The same ***Interval*** and ***Time Estimate*** screens will be displayed (Figure 6-53 on page 6-42 and Figure 6-54 on page 6-43).

4. View the scanning in progress. As the total station measures points within the pre-defined area, each point will be displayed on the screen (Figure 6-58).

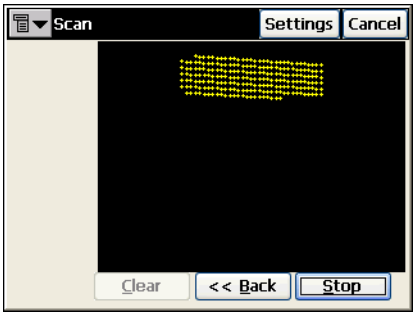


Figure 6-58. Scanning without Images

- Tap **Clear** to remove measured points from the screen and return to the ***Area*** screen.
- Tap **Stop** to immediately stop the scan and return to the ***Area*** screen.

5. After scanning is completed, the screen returns to the ***Area*** screen to set a new area for scanning. The icon denotes the scanned points in the list of points.

NOTICE

To show scan points in the list of job points, make sure the *Show Scan Points* item is checked in the pop-up menu in the upper left corner of the ***Points*** screen.

Monitor

The Monitor function measures one or more prisms repeatedly and uses the measurements to detect changes in the position of the prisms. The measurements are recorded into the raw data file.

1. Set the format and destination for the output file in the ***Monitor Options*** screen which is accessed from the context menu in the upper left corner of the *Configure Instrument* dialog (Figure 6-59).

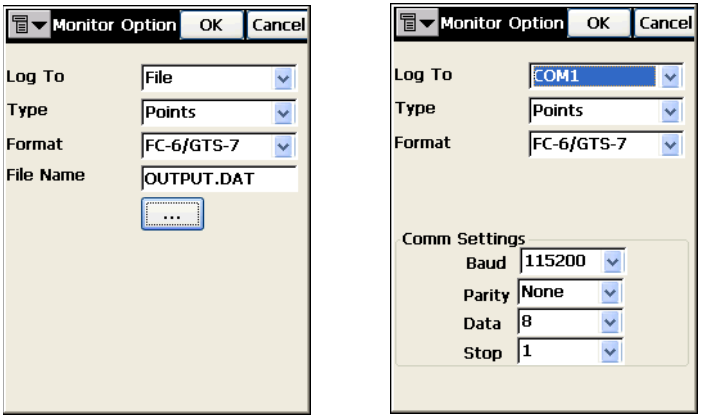


Figure 6-59. Monitor Options

Optionally, the raw measurements or the computed points can be output to a file or communication port in either the FC-6 or GTS-7 formats.

NOTICE

The available options vary, depending on whether a file or a COM port is selected. In the case of file output, one can browse for the destination of the file using the […] button.

2. Add the points to be measured to a point list. The list is then used in monitoring the survey.
3. Select **Survey ▸ Monitor** to open the ***Monitor Pointlist*** screen used for loading the desired point list (Figure 6-60 on page 6-47).

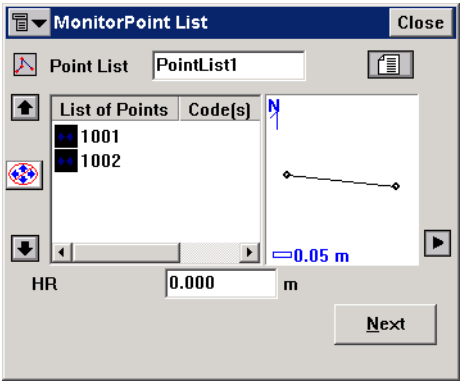


Figure 6-60. Monitor Point List

4. After the point list is selected, tap the **Next** button. The ***Monitor*** screen displays (Figure 6-61).

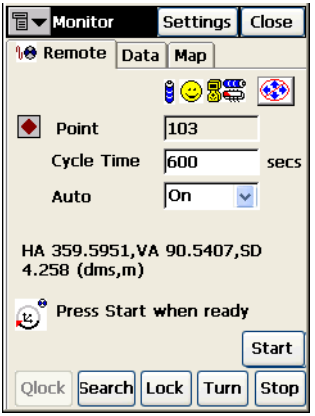


Figure 6-61. Monitor

5. Tap the **Start** button to initiate the sequence of measurements which repeats at the desired interval listed as the *Cycle Time*.

If a prism cannot be found after a period of 15 seconds, the total station will rotate to the next point in the sequence. If the **Auto** combobox is set to "ON", the total station automatically rotates to the next point in the sequence and records a measurement. If it is set to "OFF", the total station rotates to the point, but allows the user to verify or correct the centering to the prism prior to taking

a measurement. The monitor function will always complete the entire sequence, even if the measurements take longer than cycle time.

6. View the data displayed in the *Data* tab. The values listed are the differences between the coordinates of the reference point and the measured point.

Performing Level Surveys

After completing preliminary work (that is, the instrument is leveled in a desired location above the reference point and the controller is connected to the instrument with the cable), the survey can begin.

First, if needed, perform the Two Peg Test to check if the line of sight of the level telescope is horizontal when the instrument is leveled. Then perform Level Run in appropriate sideshot survey mode (single or multiple) (refer to "Config: Survey Parameters – Level" in the *TopSURV Reference Manual* for details).

Two Peg Test

To execute the Two Peg Test, tap **Survey ▸ Two Peg Test**.

The ***Two Peg Test*** screen guides you through a series of measurements to help determine any error.

1. First, take shots to the first point assuming the level is fairly centered between the two points.

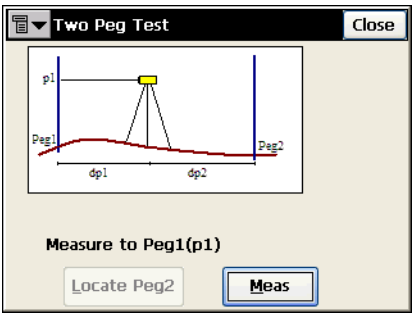


Figure 6-62. Take Peg 1 Reading

2. Then move the instrument to one of the pegs and take the shots again to Pegs 1 and 2.

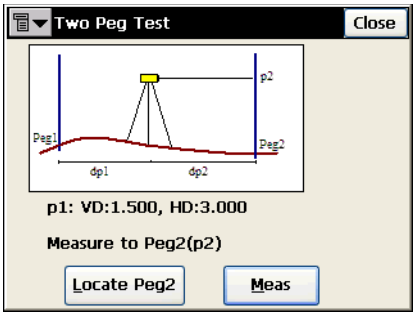


Figure 6-63. Take Peg 2 Reading

- Tap the **Locate Peg2** button to measure the horizontal distance to Peg2 and compare it with the already taken measurement to Peg1. This measurement is not used in the error computations.
- Tap the **Meas** button to take measurements for the displayed prompted Peg.

The ***Two Peg Test Results*** screen displays the results of the test after all measurements are taken. The computed error means inclination of the actual line of sight from true horizontal. This error is proportional to the distance from the level to the rod.

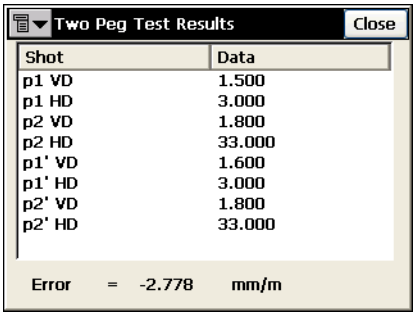


Figure 6-64. Two Peg Test Results

Level Run

To set up a Level Run, tap **Survey ▸ Level Run**.

1. Type in a name for the level run and any additional information on this level, if needed. Tap **Next**.

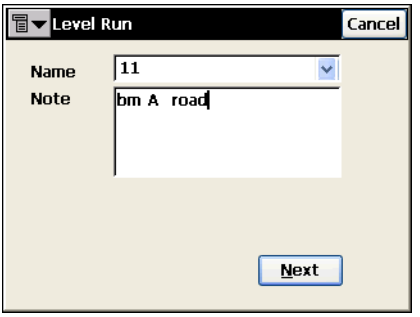


Figure 6-65. New Level Run

The *DL* tab of the screen displays all leveling data in progress.

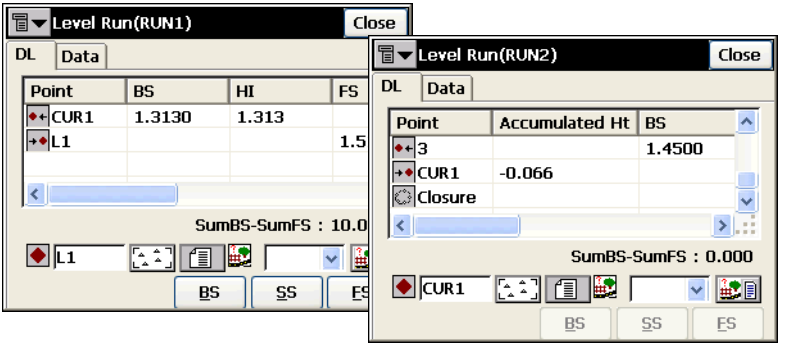


Figure 6-66. Leveling

2. Select the point for rod reading in the field. Select it from the map or the list of points.
3. Set the code for the measured point in the field. Use the bitmap menu next to the field to set a new code.
4. Use an appropriate tool to make leveling measurements:
   - **BS** – usually sighting back along the leveling line, the Level takes a rod reading on a point of known elevation.

- **SS** – the Level takes a sideshot to the point.
- **FS** – the Level takes a rod reading on a point of unknown elevation.

5. Use the *Data* tab to view information related to the current measurement.

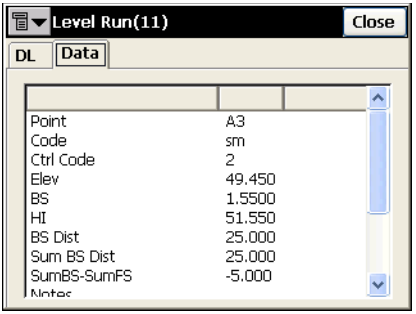


Figure 6-67. Data Level Run

6. Use the *Vertical Offset* option from the bitmap in the upper-left corner of the screen to set the vertical offset to apply at the point.
7. To select the columns and the order of the columns to display in the fieldbook, use the *Display Settings* option from the bitmap in the upper-left corner of the screen.

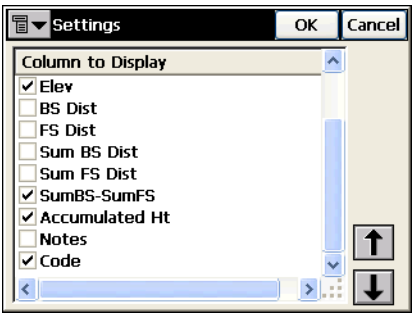


Figure 6-68. Change Display Columns

8. To display the SumBS-SumFS measurement, select the *Show SumBS-SumFS* option from the bitmap in the upper-left corner of the screen.

9. Use the *Inverse* option to perform the Two-Point Inverse cogo computation.
10. Select a stakeout option from the bitmap in the upper-left corner of the screen for DL survey mode to stake a Point, Point List or Elevation. Staked points are not added to the level run, they are independent.

Staking Out Points

The Stakeout process involves finding points near a desired location. The preliminary work for GPS, Total Station, and Digital Level stakeout is similar to that for the Survey work.

The stakeout function can be accessed from the Stakeout menu or from the Main Map.

When in the Main Map, tap the desired object to highlight it. Then hold the stylus on the selected object for until a pop-up menu displays. The menu options depend on the object selected. Select the appropriate item from the pop-up menu.

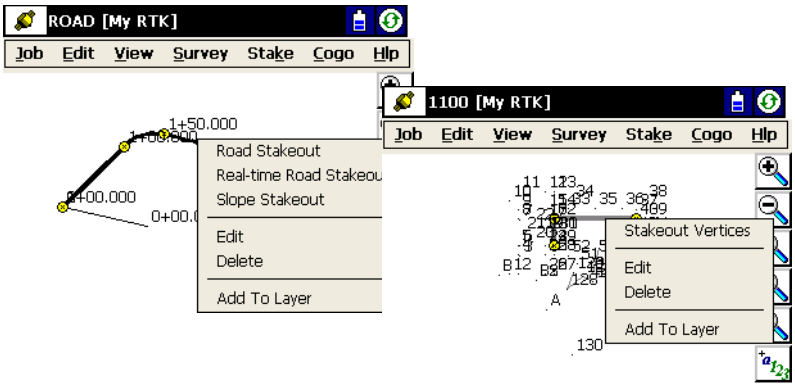


Figure 7-1. Stakeout from Main View

In TS Mode, the Cur Pos button takes a measurement and shows the directions to the design point; whereas the Meas button takes a measurement and computes the coordinates of the stakeout point.

Stakeout a Point

1. Select the **Stake ▸ Points** menu. On the ***Stakeout Point*** screen, tap the **Settings** button (Figure 7-2).

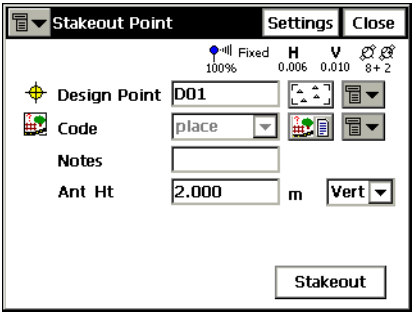


Figure 7-2. Stakeout Point

2. For GPS+: on the ***Stakeout Parameters*** screen, specify the Stakeout parameters: horizontal distance tolerance and reference direction. Specify how the staked point name and Note should be formed and select the Solution Type value. To return to default values, tap the **Defaults** button. Then tap **OK** (Figure 7-3).

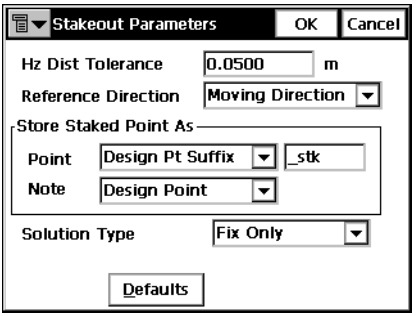


Figure 7-3. Stakeout Parameters - GPS+ mode

3. To display the icon for the staked point on the map, select the *Display* option from the bitmap menu in the upper left corner of the ***Stakeout Parameters*** screen. In the ***Staked Point Icon*** screen, set appropriate parameters for the icon (Figure 3-15 on page 3-12).

4. For TS: set the horizontal distance tolerance and specify how the staked point name and Note should be formed on the ***Stakeout Parameters*** screen. Select the manner in which the Total station should be turned towards the design point and tap **Defaults** button to return to default values. Then tap **OK**.

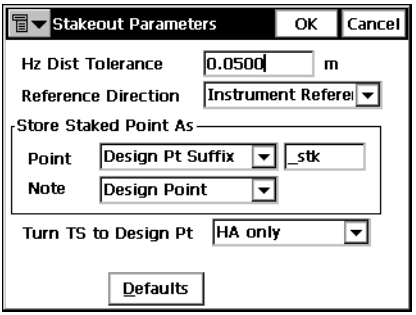


Figure 7-4. Stakeout Parameters - TS mode

5. Select the design point from list or map, or insert the name manually. Specify the antenna parameters: the height value and type or the height of the rod, based on whether in GPS+ mode or TS mode. Check if the PTL Point Stakeout is performed. Tap the **Stakeout** button on the ***Stakeout Point*** screen (Figure 7-2 on page 7-2).
6. For GPS+: use the information on the ***Stakeout*** screen for finding the target point. Tap **Store** after the location is close enough to the design point. Tap the **Next Pt** button to change the design point (increment to the next point in the data set) of the stakeout.

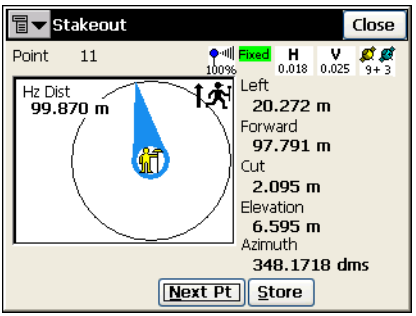


Figure 7-5. Stakeout

7. For TS: sight the prism. On the ***Stakeout*** screen (Figure 7-6), use the **Cur Pos** button to take a measurement and then show the current position relative to the design point. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. The **Meas** button should be tapped once the current location is close enough to the desired point. Tapping the **Meas** button causes a measurement to be taken, and the computed coordinates to be stored to a point. Tap the **Next Pt** button to stakeout the next point in the data set.

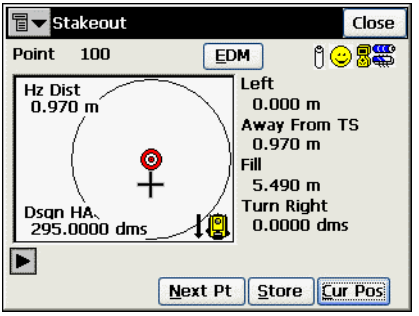


Figure 7-6. Stakeout

8. To open the map of the layout of the target and current position, use the arrow button in the lower left corner of the screen.

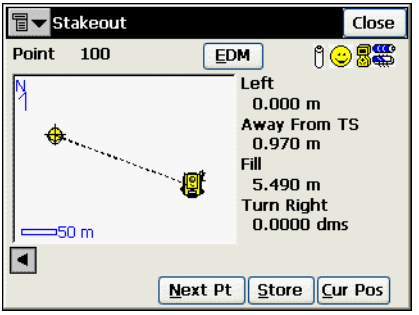


Figure 7-7. Stakeout Map

9. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting this option displays coordinates instead of angle/distance data.

10. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
11. To automatically open the Stakeout screen for the next point after storing a staked point, select the *Auto Advance Pt* option from the pop-up menu on the top left corner of the screen.
12. To store the staked point on a layer, select the *Design Pt/Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen. In the ***Design Pt/Layer*** screen (Figure 7-8), select the layer from the drop down list or tap the ... button to edit layers.

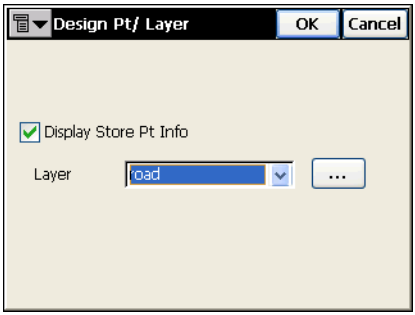


Figure 7-8. Select Layer for Staked Point

The *Display Store Pt Info* box is selected by default to display information on the staked point before storing it. The ***Store Point*** screen displays the point name, code and cut/fill values; photo note; the layer name, plotting parameters; and stakeout information (Figure 7-9 on page 7-6).

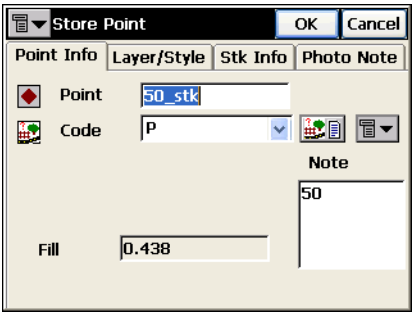


Figure 7-9. Store Point

13. To change the elevation of the staked point, select the *Design Elev* option from the bitmap menu in the upper left corner of the ***Stakeout*** screen. Check the *Design Elev* box in the ***Design Elev*** screen to enable the field to manually edit the elevation value (Figure 7-10).

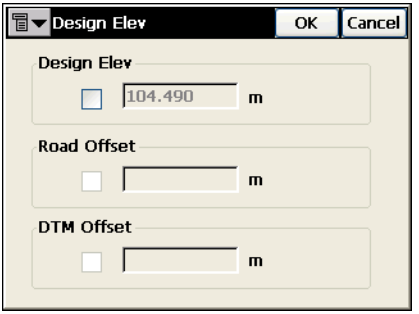


Figure 7-10. Design Elevation

Stakeout a Point in Direction

Perform a Stakeout Point in Direction task when the location of the design point is unknown but can be computed with distance and angle offsets from a known point.

1. To perform a Point and Direction stakeout, select **Stake ▸ Point in Direction**.

2. In the ***Stakeout Point & Direction*** screen, enter the starting point name (known point), the azimuth set by value or as the direction to another known point, the angle offset from the azimuth line, the distance offset along the angle offset line, the height offset, and the parameters of antenna (GPS mode) or the height of the rod (target) (TS mode).

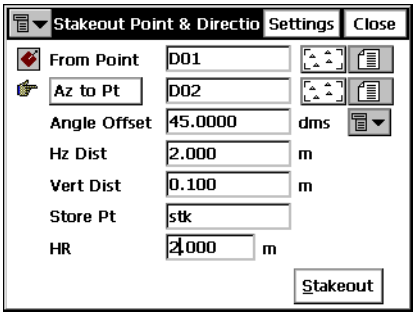


Figure 7-11. Stakeout Point & Direction

Enter the name of the stakeout point in the *Store Pt* field. Tap the **Stakeout** button (Figure 7-11 on page 7-7).

3. Tap the **Settings** button and specify the Stakeout parameters as described in "Stakeout a Point" on page 7-2.
4. For GPS+: use the information on the ***Stakeout*** screen to find the target. Tap **Store** once the position is close enough to the desired one (Figure 7-12).

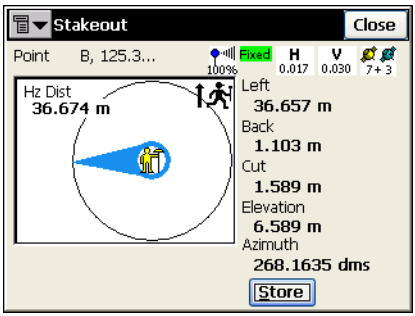


Figure 7-12. Stakeout Point & Direction – Stakeout

5. For TS: sight the prism. In the ***Stakeout*** screen tap the **Cur Pos** button to check the position. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired one, tap **Meas** to store it (Figure 7-13).

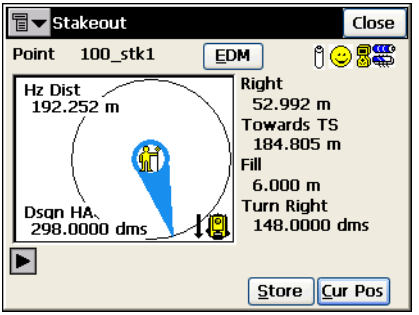


Figure 7-13. Stakeout Point & Direction – Stakeout

6. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
7. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
8. To store the staked point on a layer, select the *Design Pt/Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6).

Stakeout a Point List

1. To stake out points in a point list, select **Stake ▸ Point List**.
2. In the ***Stakeout Point List*** screen, select a pre-existing points list, set the antenna parameters (GPS mode): height of the antenna reference point (ARP) above the mark and the type, or the height of the rod (target) (TS mode). To perform stakeout starting from the end of the Point List, check *Stakeout in Reverse Order*. Use the arrow buttons to modify the order of stakeout. Then tap **Stakeout** (Figure 7-14).

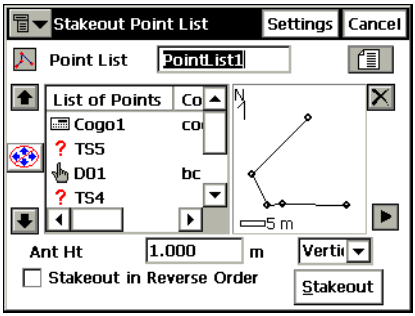


Figure 7-14. Stakeout Point List

3. Tap the **Settings** button and specify the Stakeout parameters as described in "Stakeout a Point" on page 7-2.
4. For GPS+: use the information on the ***Stakeout*** screen for finding the target. tap **Store** after the position is close enough to the designed point. To move to the next point, tap the **Next Pt** button.
5. For TS: sight the prism. In the ***Stakeout*** screen tap the **Cur Pos** button to check the position. Once the position is close enough to the desired one, tap **Meas** to store it. To move to the next point, tap the **Next Pt** button.
6. To stakeout another Point List, tap **Close**, return to the ***Stakeout Point List*** screen and select another point list.

Stakeout a Line

1. To stake out points along a line, select **Stake ▸ Line**.
2. In the ***Stakeout Line*** screen (Figure 7-15), specify the reference line by choosing the start point and either the end point or the azimuth. Currently, the stakeout points have the same height as the starting point. Also, specify the antenna parameters (GPS+ mode), or the height of the rod (TS mode). Tap the **Stakeout** button.

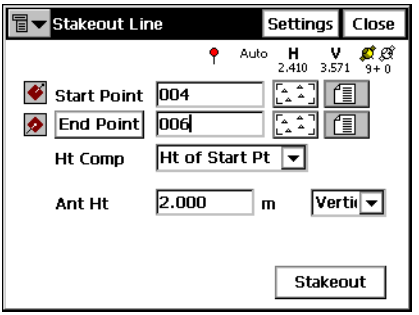


Figure 7-15. Stakeout Line

3. In the ***Stakeout Line*** screen, tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.
4. For GPS+: use the information on the ***Stakeout Line*** screen for finding the target line. Tap **Store** after the point is close enough to the line and at the desired distance from the starting point (Figure 7-16).

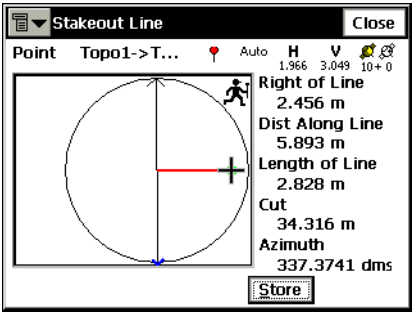


Figure 7-16. Stakeout Line

5. For TS: sight the prism. In the ***Stakeout Line*** screen tap the **Cur Pos** button to check the position (Figure 7-17). Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the line and at the desired distance from the starting point, tap **Meas** to store it.

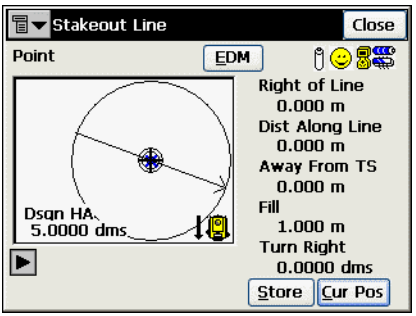


Figure 7-17. Stakeout Line

6. Tap the **Close** button to return to the first ***Stakeout Line*** screen. Enter parameters for the next reference line.
7. To store the staked point on a layer, select the *Design Pt/Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6)

Stakeout Line & Offset

When the desired points lie at regular intervals on a line that is parallel to a known line, and is at a known horizontal and vertical distance from it, the Stakeout Line & Offset task should be performed.

1. Select **Stake ▸ Offsets ▸ Line & Offset**.
2. In the ***Stakeout Line & Offset*** screen, set the direction of the line, the type of height computations for the stakeout point (currently the stakeout point will have the same height as the starting point of the line), the number of subdivisions of the line

(if an end point is specified) and the starting station (chainage) of the line. Tap **Next** (Figure 7-18).

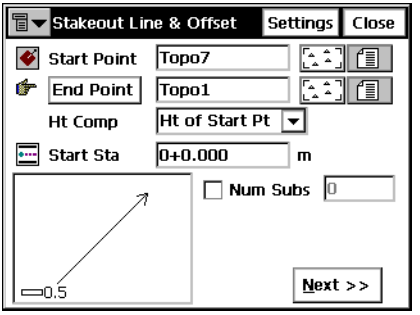


Figure 7-18. Stakeout Line & Offset

3. In the ***Station & Offsets*** screen, set the station along the line being staked, the station staking interval, the right or left offset of the stakeout point with respect to the line, the Up or Down Height offset, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode). If the number of subdivisions has been selected, the station interval is automatically computed and cannot be changed (Figure 7-19).

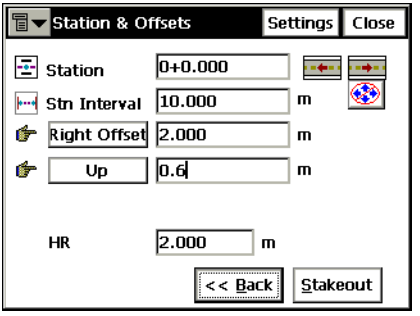


Figure 7-19. Station & Offsets

4. Tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.

5. For GPS+: use the information on the ***Stakeout*** screen for finding the target. Tap **Store** after the position is close enough to the desired point (Figure 7-20).

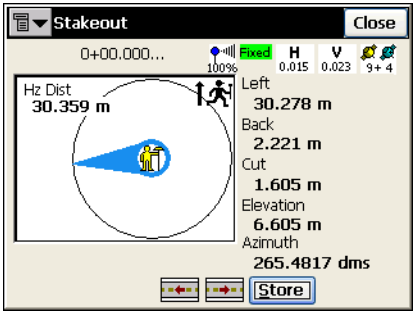


Figure 7-20. Stakeout

Tap the / button to retreat / advance the station by the specified Station Interval, for staking out the previous / next station, respectively. Stations before the beginning and past the end of the alignment can also be staked out.

6. For TS: sight the prism. In the ***Stakeout*** screen tap the **Cur Pos** button to measure the target. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired point, tap **Meas** to store it.

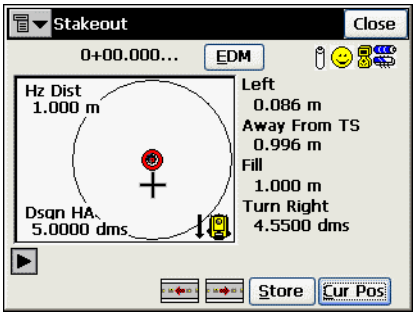


Figure 7-21. Stakeout

Tap the  /  button to retreat / advance the station by the specified Station Interval, for staking out the previous / next station, respectively.

7. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
8. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
9. To change the design point elevation, select the *Design Offsets* option from the pop-up menu on the top left corner of the screen.
10. To store the staked point on a layer, select the *Design Pt/Layer* option from the drop-down menu in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6)
11. Tap the **Close** button to return to the ***Station & Offset***s screen. Enter new offsets or station.

Staking Three Pt Curve & Offsets

When the desired points lie at regular intervals on a curve that is parallel to a curve with three known points, and is at a known horizontal and vertical distance from it, the Stakeout Three Pt Curve & Offsets task can be performed.

1. To stake out Three Pt Curve & Offsets, select **Stake ▸ Offsets ▸ Three Pt Curve & Offsets**.
2. In the ***3 Pt Curve*** screen (Figure 7-22), enter or select from the list or map the following sets of three known points to create a curve and tap **Next**:
   - Either the starting PC (Point of Curvature) and ending PT (Point of Tangency) points on the circle, and a third point on the curve, and the starting station (chainage) of the line.

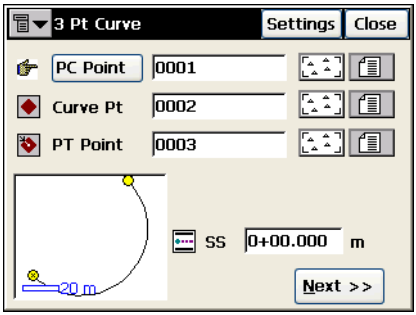


Figure 7-22. Three Point Curve

   - Or the starting PC (Point of Curvature) and ending PT (Point of Tangency) points on the circle, and the center point (also called as Radius Point). For this set of points, the distance between RP Point and PC point should be equal to the distance between RP Point and PT point. The radius and the PC and PT points define two curves, one with delta less than or equal to 180 degrees (Small curve), and the other with delta greater than or equal to 180 degrees (Large curve). Select either *Small* or *Large* from the **Curve** drop-down box

to indicate which of these two curves will be used for staking and the starting station (chainage) of the line.

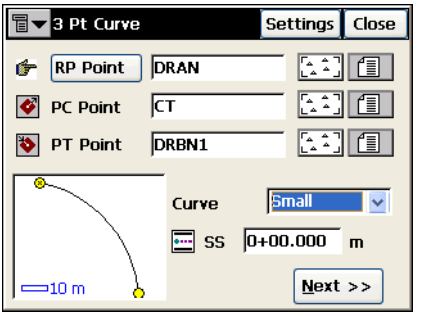


Figure 7-23. Three Points Small Curve

3. In the ***Station & Offsets*** screen (Figure 7-24), set the station along the curve being staked, the station staking interval, the right or left offset of the stakeout point with respect to the curve, the Up or Down Height offset, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode).

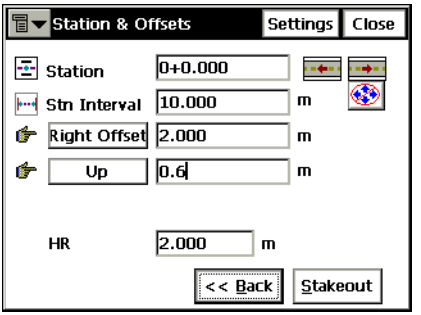


Figure 7-24. Station & Offsets

4. Tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.
5. Tap the **Stakeout** button and perform the stakeout as described in “Stakeout Line & Offset” on page 7-11.

Stakeout Intersection & Offsets

When the design point is the intersection of two lines, that are parallel to two other lines and at known horizontal distances from these, Stakeout Intersection & Offsets task should be performed.

1. To stake out Intersection & Offsets, select **Stake ▸ Offsets ▸ Intersection & Offsets**.
2. In the ***Intersection & Offsets*** screen, define the starting point and azimuth for the first known point; specify the horizontal offset to the first parallel line. Tap **Next** (Figure 7-25).

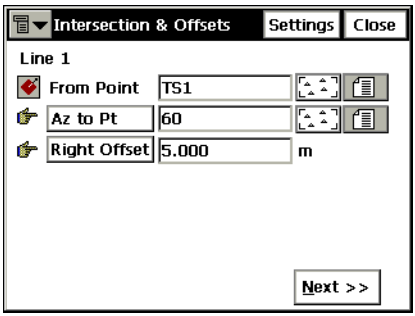


Figure 7-25. Intersection & Offsets – Line 1

3. The second screen defines another line (Line 2) using a point and an azimuth, and to define the horizontal offset to the second parallel line (Figure 7-26).

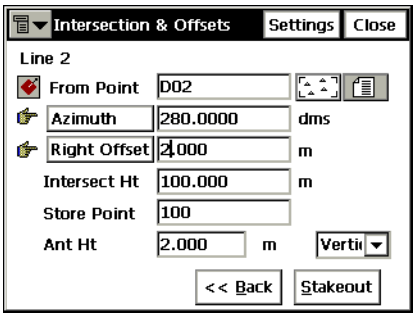


Figure 7-26. Intersection & Offsets – Line 2

The height and name of the intersection point of these two parallel lines (stakeout point) should be specified, along with the height and type of the antenna (GPS+ mode), or the height of the rod (target) (TS mode).

4. Tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.
5. To start the stakeout tap the **Stakeout** button.
6. For GPS+: use the information on the ***Stakeout*** screen for finding the target. Tap **Store** after the target is close enough to the design point (Figure 7-27).

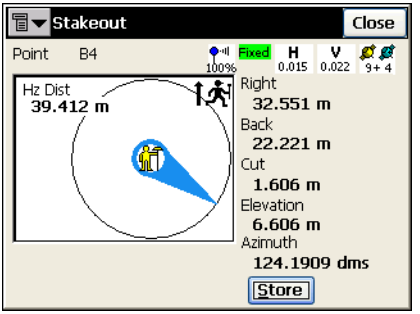


Figure 7-27. Stakeout

7. For TS: sight the prism. In the ***Stakeout*** screen, tap the **Cur Pos** button to check the position. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the design point, tap **Meas** to store it (Figure 7-27).

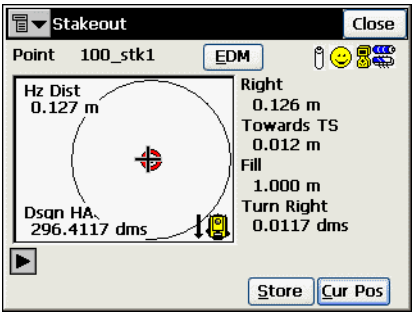


Figure 7-28. Stakeout.

8. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
9. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
10. To change the design point elevation, select the *Design Offsets* option from the pop-up menu on the top left corner of the screen.
11. To store the staked point on a layer, select the *Design Pt/Layer* option from the drop-down menu in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6)
12. Tap the **Close** button to return to the first ***Stakeout Line*** screen. Enter parameters for the next reference line.

Stakeout Curve & Offsets

When the desired points lie at regular intervals on a curve that is parallel to a known curve, and is at a known horizontal and vertical distance from it, the Stakeout Curve & Offset task should be performed.

1. To stake out Curve & Offsets, select **Stake ▸ Offsets ▸ Curve & Offsets**.
2. In the ***Stakeout Curve & Offset*** screen (Figure 7-29 on page 7-20) set the parameters of the known curve: the Point of Curve (the starting point of the curve), the azimuth of the tangent of the curve at the PC point, the radius parameters of the curve, the length parameter of the curve, the turn value of the curve, and the starting station (chainage) of the line. Tap **Next**.

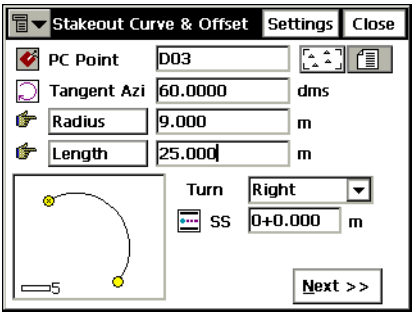


Figure 7-29. Stakeout Curve & Offset

3. In the ***Station & Offsets*** screen (Figure 7-30), set the station along the curve being staked, the station staking interval, the right or left offset of the stakeout point with respect to the curve, **t**he Up or Down Height offset, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode).

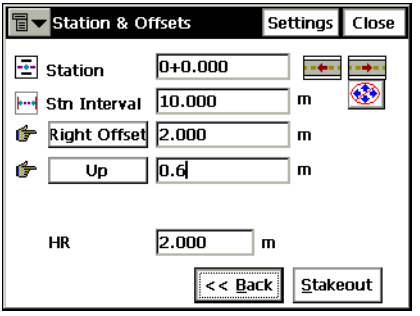


Figure 7-30. Station & Offsets

4. Tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.
5. Tap the **Stakeou**t button and perform the stakeout as described in “Stakeout Line & Offset” on page 7-11.

Stakeout Spiral & Offset

When the desired points lie at regular intervals on a curve that is parallel to a known curve, and is at a known horizontal and vertical distance from it, the Stakeout Curve & Offset task should be performed.

1. To stake out Spiral & Offset, select **Stake ▸ Offsets ▸ Spiral & Offset**.
2. In the ***Stakeout Spiral & Offset*** screen set the parameters of the spiral to be staked out: the starting point of the spiral, the azimuth of the Tangent of the curve at the PC point, the radius parameter of the spiral, the length parameter of the spiral, the direction of turn, direction of movement of the spiral and the starting station (chainage) of the line (Figure 7-31).

   The direction values are: *TS -> SC* (Tangent Spiral -> Spiral Circle), which is the incoming spiral to the internal circle, and *CS -> ST* (Circle Spiral -> Spiral Tangent), which is the exiting spiral from the circle to the Tangent. Tap **Next**.

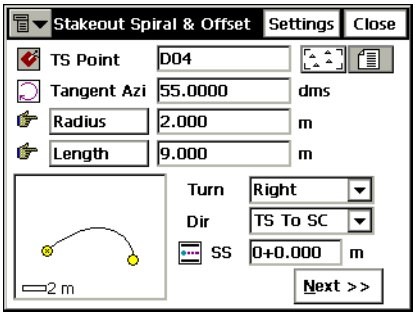


Figure 7-31. Stakeout Spiral & Offset

3. In the ***Station & Offsets*** screen (Figure 7-32 on page 7-22) set the station along the spiral being staked, the station staking interval, the right or left offset of the stakeout point with respect to the spiral, the Up or Down Height offset, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode).

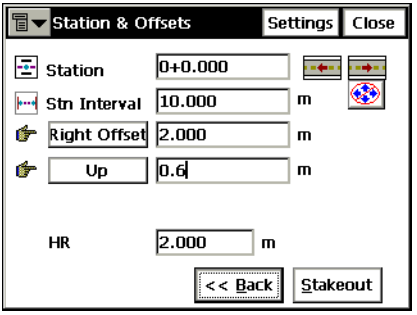


Figure 7-32. Station and Offset

4. Tap the **Settings** button and specify the Stakeout parameters as described in "Stakeout a Point" on page 7-2.
5. Tap the Stakeout button and perform the stakeout as described in "Stakeout Line & Offset" on page 7-11).

Stakeout Roads

1. To stake out points on a road, and on either sides of it, select **Stake ▸ Roads ▸ Road** menu.
2. In the ***Stakeout Road*** screen, set the road to be staked out and the starting station, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode). If staking the transition points (points where horizontal elements of the road change), check the appropriate field (Figure 7-33). Tap **Next**.

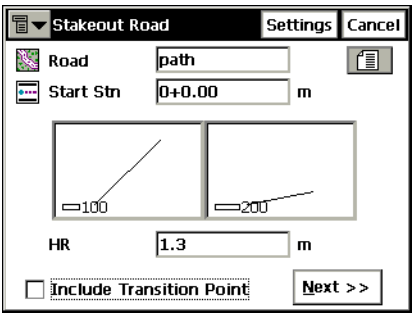


Figure 7-33. Stakeout Road

3. In the ***Stakeout Road*** screen, set the offsets from CL for the stakeout points (Figure 7-34) and tap **Next**.

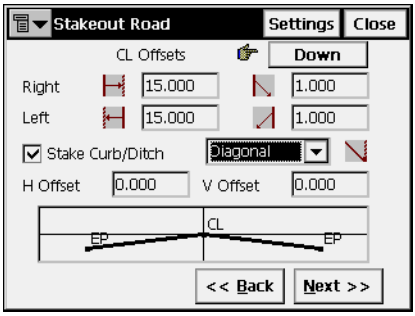


Figure 7-34. Stakeout Road

4. In the ***Stakeout Road*** screen, set the properties of the cross section on the stakeout station: the station where the stakeout is performed, the interval of the station increment, the point code of the current segment (cross section is comprised of various segments), the horizontal offset from the current segment point, the vertical offset from the current segment point, and select the reference line for offsets by selecting the **Centerline/Surface/ Segment** type of template offsets (for details, refer to the *TopSURV Reference Manual*).

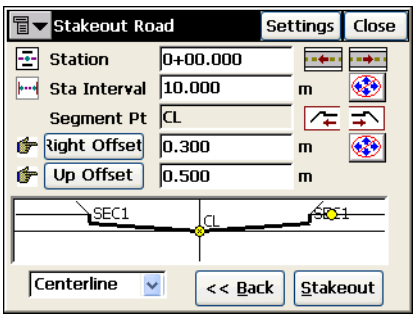


Figure 7-35. Stakeout Road

5. Tap the **Settings** button and specify the Stakeout parameters as described in “Stakeout a Point” on page 7-2.
6. Tap **Stakeout**, then in the ***Initial Point Name*** screen set the starting name for the points and tap **OK**.

7. For GPS+: use the information on the ***Stakeout*** screen for finding the target. Tap **Store** after the position is close enough to the desired one (Figure 7-36).

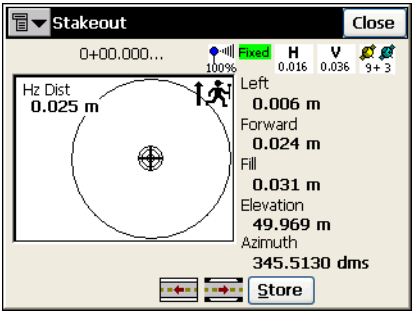


Figure 7-36. Stakeout

Tap the / button to retreat / advance the station by the specified Station Interval, for staking out the previous / next station, respectively. Stations before the beginning and past the end of the alignment can also be staked out.

8. For TS: sight the prism. In the ***Stakeout*** screen, tap the **Cur Pos** button to measure the target. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired one, tap **Meas** to store it. Tap the / button to retreat / advance the station by the specified Station Interval, for staking out at the previous / next station, respectively (Figure 7-37).

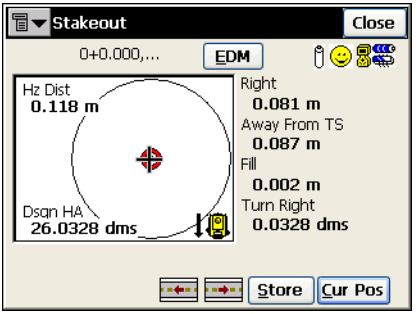


Figure 7-37. Stakeout Road. Stakeout.

9. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
10. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
11. To change the design point elevation, select the *Design Offsets* option from the pop-up menu on the top left corner of the screen.
12. To store the staked point on a layer, select the *Store Design Pt/ Layer* option from the drop-down menu in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6)
13. Tap the **Close** button to return to the ***Stakeout Road*** screen. Enter a new offset or station.

Stakeout Slope

1. To stake out the slope of a road, tap **Stake ▸ Roads ▸ Slope**.
2. In the ***Stakeout Slope*** screen, select a road, the starting point of the stakeout, the height and the type of the antenna height (GPS mode) or the height of the rod (target) (TS mode). Tap **Next**.

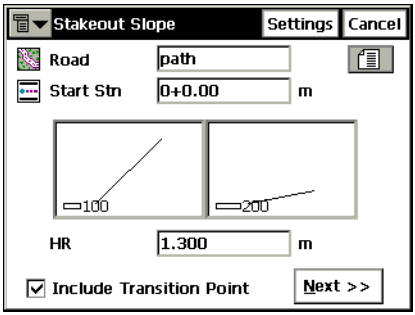


Figure 7-38. Stakeout Slope

3. In the ***Stakeout Slope*** screen, set the properties of the cross section at the stakeout station and the interval of the station increment, the hinge point (point of rotation for the Cut/Fill Slope lines) and the values of the Cut/Fill Slope parameters, and the offset from the catch point (the point where the slope crosses the surface of the terrain) (Figure 7-39).

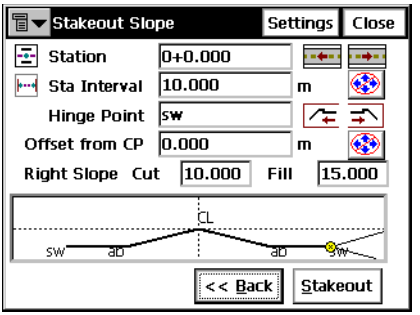


Figure 7-39. Stakeout Slope

4. Tap the **Settings** button and specify the Stakeout parameters as described in "Stakeout a Point" on page 7-2. Tap **Stakeout**.
5. For GPS+: use the information on the ***Stakeout Catch Point*** screen for finding the target. Tap **Store** after the position is close enough to the desired point. Tap the / button to retreat / advance the station by the specified Station Interval, for staking out at the previous / next station, respectively (Figure 7-40).

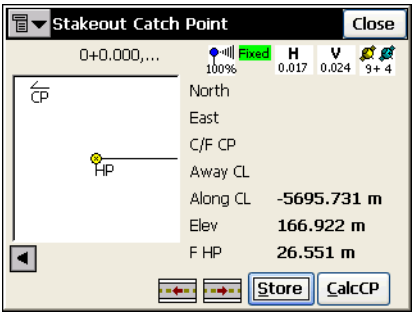


Figure 7-40. Stakeout Catch Point

6. For TS: sight the prism. In the ***Stakeout Catch Point*** screen, tap the **Cur Pos** button to measure the target. Tap the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired point, tap **Meas** to store it. Tap the  /  button to retreat / advance the station by the specified Station Interval, for staking out at the previous / next station, respectively (Figure 7-41).

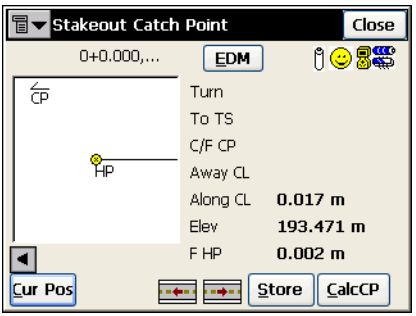


Figure 7-41. Stakeout Slope – Stakeout Catch Point

7. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
8. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.
9. To change the design point elevation, select the *Design Offsets* option from the pop-up menu on the top left corner of the screen.
10. To store the staked point on a layer, select the *Store Design Pt/ Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6).
11. Tap the **Close** button to return to the ***Stakeout Slope*** screen. Enter new offsets, hinge point or station.

Stakeout Real Time Road

1. To stake out points on a road, and on either sides of it, select **Stake ▸ Roads ▸ Real Time Road** menu.
2. In the ***Stakeout Road*** screen, set the road to be staked out and the starting station, the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode). If staking the transition points (points where horizontal elements of the road change), check the appropriate field. Tap **Next**.

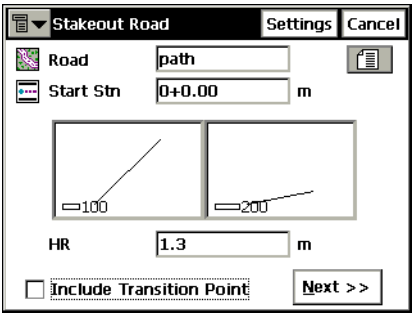


Figure 7-42. Stakeout Road

3. In the ***Stakeout Road*** screen set the offsets from CL for the stakeout points and tap **Next**.

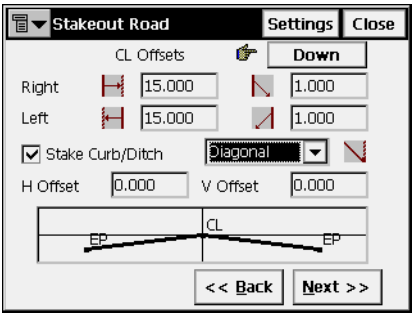


Figure 7-43. Stakeout Road

4. Tap **Stakeout**. In the ***Initial Point Name*** screen, set the starting name for the points and tap **OK**.
5. For GPS+: use the information on the ***Stakeout*** screen for finding the target. Tap **Store** after the position is close enough to the desired point (Figure 7-44 on page 7-29).

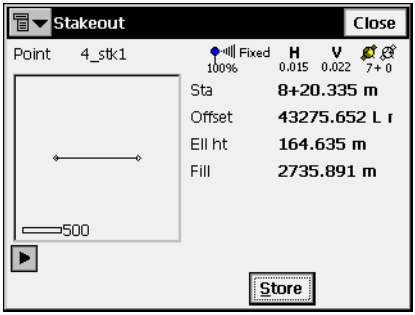


Figure 7-44. Stakeout

6. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
7. To store the staked point on a layer, select the *Store Design Pt/ Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6)
8. For TS: sight the prism. In the ***Stakeout*** screen, tap the **Cur Pos** button to measure the target. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired point, tap **Store** to store it.

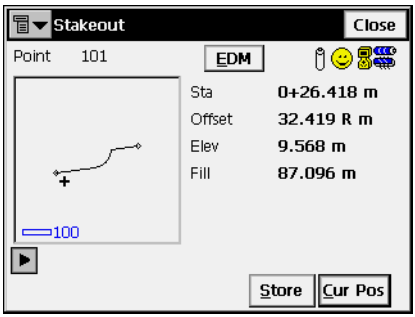


Figure 7-45. Stakeout

Stakeout DTM

1. To stake out points inside of a digital terrain model, select **Stake ▸ DTM**. On the ***DTM Stakeout*** screen (Figure 7-46), tap the List button to select a TN3 file containing the desired DTM.

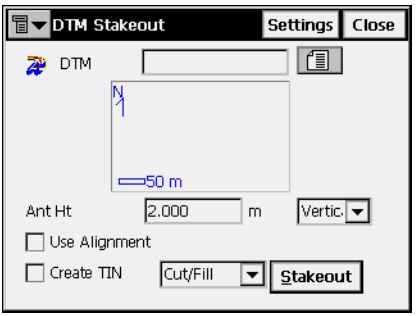


Figure 7-46. Select DTM

Set the height and the type of the antenna height (GPS mode), or the height of the rod (target) (TS mode) and tap **Stakeout**.

2. In the ***DTM Stakeout*** screen, select *Use Alignment* to use station and offset information while staking the DTM, select *Create TIN* to generate a new TIN (TN3) Cut/Sheet model of the points staked. Tap **Stakeout**.

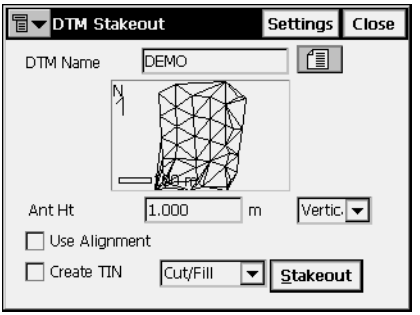


Figure 7-47. DTM Stakeout

3. In the ***Initial Point Name*** screen, set the starting name for the points, and tap **OK**.

4. For GPS+: use the information on the ***Stakeout*** screen for finding the target. Tap **Store** after the position is close enough to the desired point (Figure 7-48).

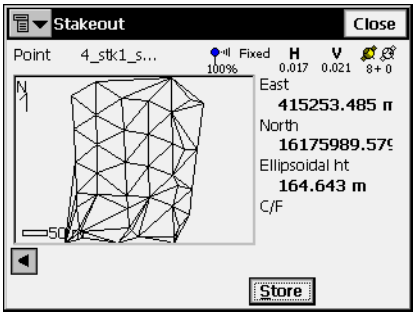


Figure 7-48. GPS Stakeout

5. For TS: sight the prism. In the ***Stakeout*** screen, tap the **Cur Pos** button to measure the target. Use the **EDM** button to select distance measurement mode: Coarse, Fine or Coarse Tracking. Once the position is close enough to the desired one, tap **Store** to store it.

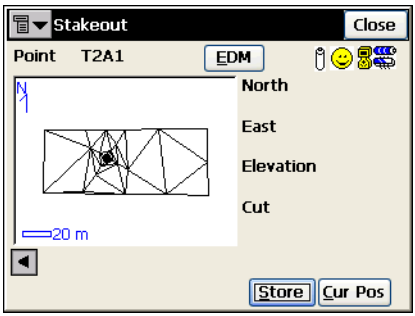


Figure 7-49. TS Stakeout

6. To display coordinates instead of stakeout directions, use the *Display Coords* option from the pop-up menu on the top left corner of the screen. For a Robotic survey, selecting the *Display Coords* option displays coordinates instead of angle/ distance data.
7. To change the rod height during stakeout in TS mode, select the *Rod Height* option from the pop-up menu on the top left corner of the screen.

8. To change the design point elevation, select the *Design Offsets* option from the pop-up menu on the top left corner of the screen.
9. To store the staked point on a layer, select the *Store Design Pt/ Layer* option from the menu popped up after tapping the bitmap in the upper left corner of the ***Stakeout*** screen (see Figure 7-8 on page 7-5 and Figure 7-9 on page 7-6).

Stakeout Code Strings

1. To stake out points with code strings, select **Stake ▸ Code String**. On the ***Code Strings*** screen (Figure 7-50), tap the **Settings** button and specify the Stakeout parameters as described in "Stakeout a Point" on page 7-2.

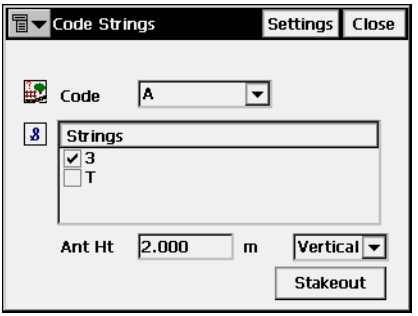


Figure 7-50. Code Strings

2. In the ***Code Strings*** screen, select a code from the drop-down list, and check necessary strings (Figure 7-50). To view the strings, click the *Strings* item in the bitmap menu. Specify the antenna parameters: the height value and type, or the height of the rod, based on whether in GPS+ mode or TS mode. tap **Stakeout**.
3. For GPS+: use the information on the ***Stakeout*** screen (Figure 7-5 on page 7-3) for finding the target point. tap **Store** after the location is close enough to the design point. tap the **Next Pt** button to move to the next point in the data set.

4. For TS: sight the prism. On the ***Stakeout*** screen (Figure 7-6 on page 7-4), use the **Cur Pos** button to take a measurement and then show the current position relative to the design point.

   The **Meas** button should be tapped when the current location is close enough to the desired point. A measurement will be taken and the computed coordinates will be stored to a point. Tap the **Next Pt** button to stakeout the next point in the data set.
5. Tap **Close** to return to the ***Code Strings*** screen.

Level Stakeout

The Level Stakeout process involves finding elevations of points close to a desired elevation.

Digital Level Stakeout of design points, and elevations can be accessed from the main menu for a Level survey type or from the top left menu in the Level Run screen.

DL Staking a Point

1. To stake out elevations of design points, select **Stake ▸ Points** menu.
2. In the ***Stake Point*** screen, enter or select from the map or list the backsight point for the stake measurement and a design point to stake. Tap the **BS** button to take the BS measurement before staking if it is not already measured. Tap the **Stakeout** button.

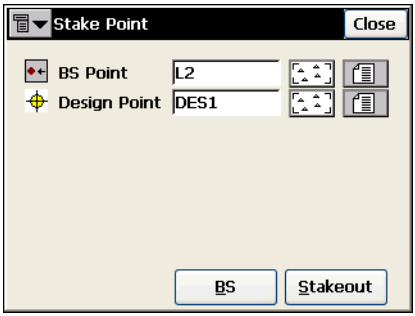


Figure 7-51. DL Stake Point

3. In the level ***Stakeout*** screen, tap the **Meas** button to measure the elevation and compute a cut/fill value. Tap **Store** to set a code for the point, the name, a photo note; the layer name and plotting parameters, to view the point information and save the staked point. Staked points are not added to the Level Run, they are independent. Staked out points are listed as observed points on the ***Points*** screen.

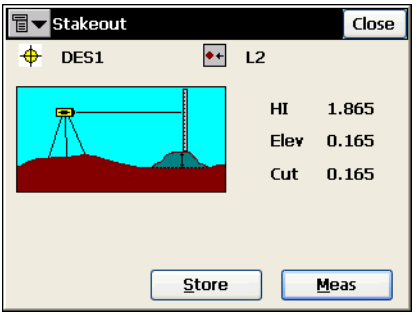


Figure 7-52. DL Stakeout

DL Staking Point List

1. To stake out elevations at design points in a point list, select **Stake ▸ Point List**.
2. In the ***Stake Point List*** screen, select a pre-existing points list, enter manually or select from the map or the list the backsight point for the stake measurement.

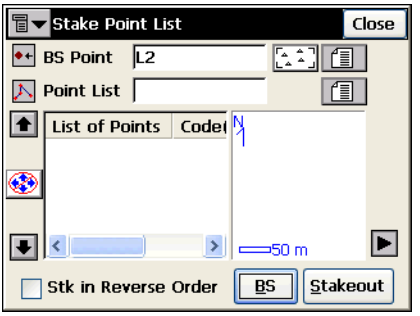


Figure 7-53. DL Stake Point List

To perform stakeout starting from the end of the Point List, check *Stakeout in Reverse Order*. Use the arrow buttons to modify the order of stakeout. Tap the **BS** button to take the BS measurement before staking if it is not already measured. Then tap **Stakeout**.

DL Staking Elevation

1. To stake out elevations, select **Stake ▸ Elevation**.
2. In the ***Stakeout Elev*** screen, enter or select from the map or list the backsight point for the stake measurement and enter an elevation value to stake at points.

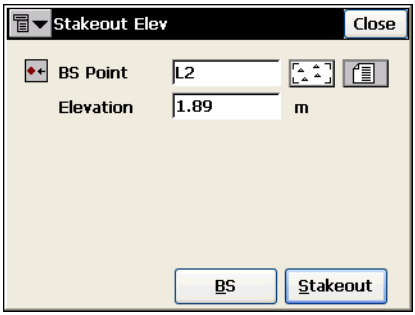


Figure 7-54. DL Stakeout Elevation

Tap the **BS** button to take the BS measurement before staking if it is not already measured. Then tap **Stakeout**.

3. In the level ***Stakeout*** screen tap the **Meas** button to measure the elevation and compute a cut/fill value. Tap **Store** to set a code for the point, the name, a photo note; the layer name and

plotting parameters, to view the elevation information and save the staked point.

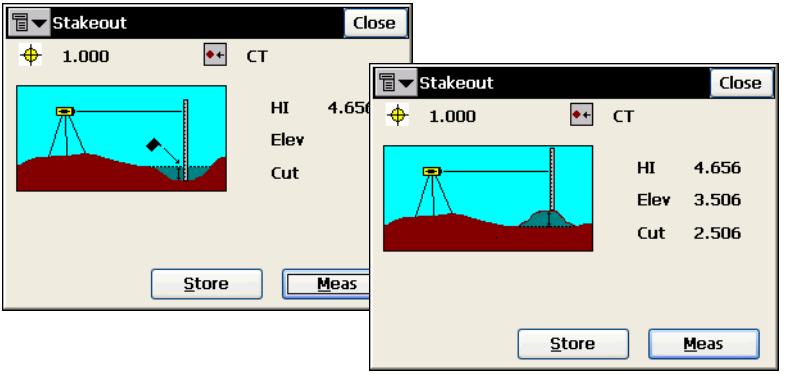


Figure 7-55. Level Stakeout

COGO

The COGO functionality in TopSURV is a comprehensive set of COGO tools to calculate the coordinate geometry to solve the geometry problems encountered in professional surveying and civil engineering applications. For example, use COGO tools including Inverse, Intersection, Traverse, Curve Solutions to design the precise points of boundaries, buildings, or other elements included in a project. A built-in calculator will help to edit input values in the entry fields of all dialog boxes.

Inverse

The ***Two-Point Inverse*** task computes the inverse (azimuth and distance) between two known points.

1. Select the points for the task from map or from the list (Figure 8-1).

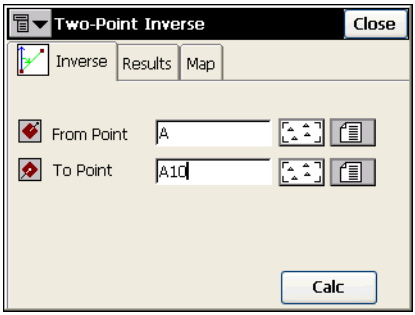


Figure 8-1. Two-Point Inverse

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The *Map* tab shows the results graphically.

3. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Inverse Point to Points List

The ***Inverse Point to Point List*** task calculates the inverse for all the points in the Points list with respect to a known point.

1. Select a point and a point list (Figure 8-2).

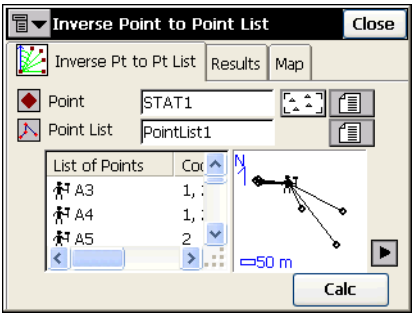


Figure 8-2. Inverse Point to Point List

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The *Map* tab shows the results graphically.
3. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Intersection

Intersection computes the intersection point or points when given two known points and either the direction or distance from the known points.

1. Select the points for the task from map or from the list (Figure 8-3).

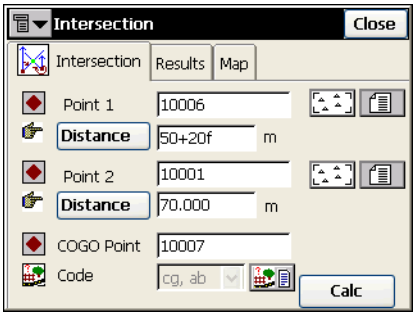


Figure 8-3. Intersection

2. By tapping the **Distance/Azimuth/Az to Pt** button in the corresponding fields, select the parameter for using and input its value.
3. Enter the name and code of the first resulting intersection point.
4. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be tapped to save the checked points. The *Map* tab shows the results graphically.
5. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

To edit angles, azimuths, and distances etc., use the entry fields to add/subtract angle and linear values, directly or use the Calculator. Start the calculator from this field by pressing the F1 button on the controller keyboard, or by tapping the Calculator button on the pop-up keyboard for controllers with the soft input panels.

Inverse Point to Line

The ***Inverse Point to Line*** task calculates the horizontal offset of a point with respect to a known line. The station along the line, where the perpendicular passes though the point, and the height at this station are also computed.

1. Select the point name, and set the line by its start point, azimuth and starting station (Figure 8-4).

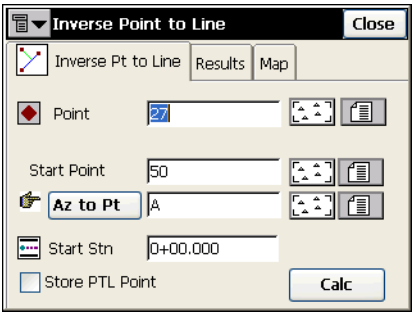


Figure 8-4. Inverse Point to Line.

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The *Map* tab shows the results graphically.
3. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Point in Direction

The ***Point & Direction*** task calculates the coordinates of a point, using a known point, and angle and distance offsets from it.

1. Enter the From point name (known point), the azimuth set by value or as the direction to another known point, the angle offset from the azimuth line, the distance offset along the angle offset line and the height offset. Also select a name and a code for the resulting point (in the direction specified by azimuth and angle offset) (Figure 8-5).

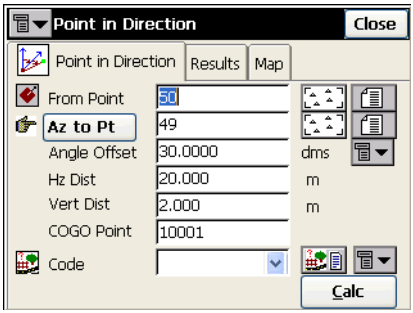


Figure 8-5. Point & Direction

To edit angles, azimuths, and distances etc., use the entry fields to add/subtract angle and linear values, directly or use the Calculator. Start the calculator from this field by pressing the F1 button on the controller keyboard, or by tapping the Calculator button on the pop-up keyboard for controllers with the soft input panels.

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be taped to save the checked point. The *Map* tab shows the results graphically.
3. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Traverse

This function is used to calculate Traverse and Sideshot points, based on horizontal and vertical Offsets along a direction defined by an azimuth, or right, left or deflection angles.

Select the initial data for the traverse task and the name and code for the resulting point (To Point) (Figure 8-6).

The initial data includes the starting point, the azimuth to the calculated point, and the horizontal and vertical distance to it. The azimuth can be entered as is or can be computed from the right or left angles, or deflection entered in this field and Backsight information input with the help of the **BS Point** button.

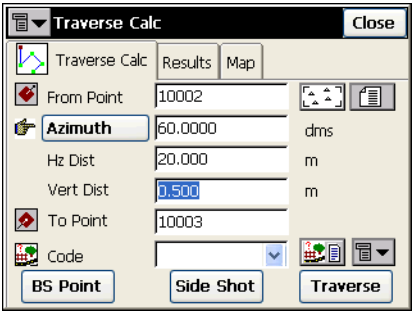


Figure 8-6. Traverse Calc

To edit angles, azimuths, and distances etc., use the entry fields to add/subtract angle and linear values, directly or use the Calculator. Start the calculator from this field by pressing the F1 button on the controller keyboard, or by tapping the Calculator button on the pop-up keyboard for controllers with the soft input panels.

1. To calculate the result point (To Point) without changing the From Point, tap the **SideShot** button. The To Point is incremented to the next new point in the database.
2. To calculate the result point (To Point), changing the From Point to the To Point, tap the **Traverse** button. The To Point changes to the next new name in the database.

Curve Solutions

A curve is a part of a circle and thus can be described through the center point (also called a Radius Point), the radius value and the starting and ending points on the circle, also called a PC (Point of Curvature) and a PT (Point of Tangency). Using these values can help you find other curve parameters. For detailed explanations on the different curve parameters, refer to the *TopSURV Reference Manual*.

The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Curve Solution

The curve solution COGO task calculates the full set of parameters for any curve, given one each, of the length and curvature parameters.

1. Select the curvature parameters of the curve (Radius, Deg Chord, or Deg Curve) and the length parameter of the curve (Length, Chord, Tangent, Mid Ord, External or Delta), and the turn direction (Figure 8-7).

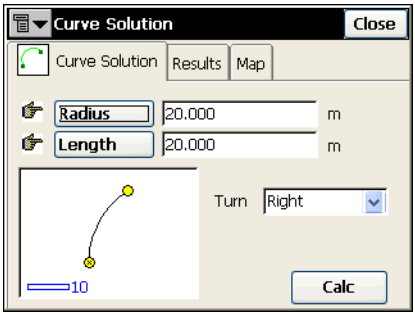


Figure 8-7. Curve Solution.

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The *Map* tab shows the results graphically.

PI & Tangents

The PI & Tangents task computes the PC point, the PT point, and the center (Radius Point) of a Curve, given the Point of Intersection (PI), the radius, and the azimuths from the PI point to the PC and PT points respectively.

1. Select the initial data for the task and the names and codes for the result points (Figure 8-8).

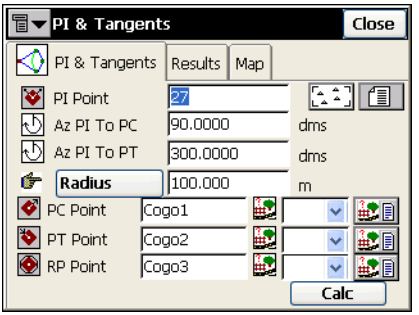


Figure 8-8. PI & Tangents

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be taped to save the checked points. The *Map* tab shows the results graphically.

Three Pt Curve

The *Three Pt Curve* task defines the curve using three points: the PC and PT points, and either the RP point, or any point on the curve. If the curve point is defined then the RP Point will be computed, and can be saved.

1. Select the initial data for the task (Figure 8-9 on page 8-9). The screen changes its appearance depending upon the first point chosen. Select the name of the name and code for the RP point, if applicable.

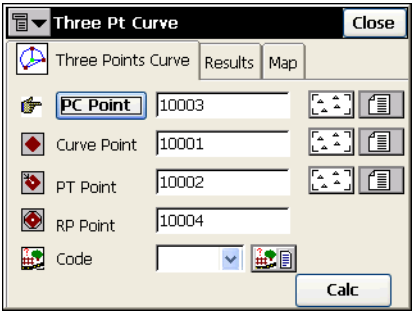


Figure 8-9. Three Pt Curve

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be taped to save the checked point. The *Map* tab shows the results graphically.

Radius & Points

The Radius & Points task defines a curve using the PC and PT points and a radius parameter, and computes the RP point coordinates.

1. Select the initial data for the task: the curve points, the radius parameter, the direction of turn and whether the smaller (less than 180 degrees) or the larger curve (more than 180 degrees) between the curve points is to be considered. Also, enter the resulting RP point name and code (Figure 8-10).

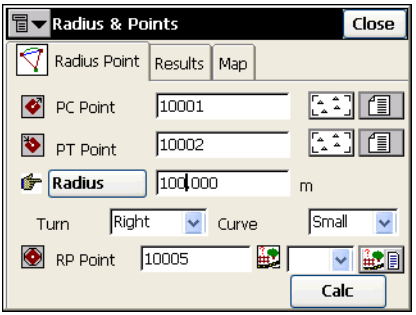


Figure 8-10. Radius & Points

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be taped to save the checked point. The *Map* tab shows the results graphically.

Area

The Area task calculates the area of a polygon.

1. Select a point list that contains the points constituting the vertices of the polygon (Figure 8-11). Use the arrow buttons to change the order of the points (and thus the shape of the polygon).

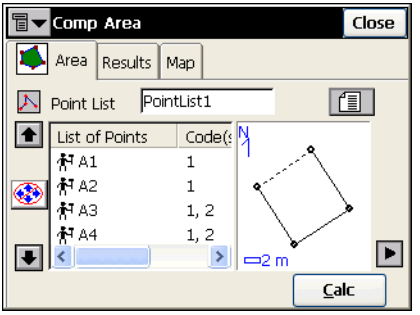


Figure 8-11. Area

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The *Map* tab shows the results graphically.
3. The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

Known Area

The Known Area tasks calculate the coordinate of a point/points that after being added to Point List form a polygon of known area. There are two methods: *Hinge* and *Line*.

The icon in the upper left corner of every COGO screen displays graphically the task being performed. Tap this bitmap to open the greater map. Tap the screen area to hide it.

To edit angles, azimuths, and distances etc., use the entry fields to add/subtract angle and linear values, directly or use the Calculator. Start the calculator from this field by pressing the F1 button on the controller keyboard, or by tapping the Calculator button on the pop-up keyboard for controllers with the soft input panels.

Known Area - Hinge

The Hinge method calculates the coordinates of a point that meets the following conditions:

- The point is located on a known azimuth taken from the first point of Point List.
- When the point is added to the Point List between the first and the last points, a polygon of known area is formed.

1. Select the point list, use the arrow buttons to change the order, as desired and tap the **Next** button (Figure 8-12 on page 8-12).

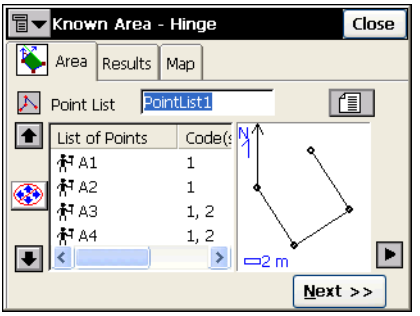


Figure 8-12. Known Area - Hinge – Area Tab 1

2. In the second screen under *Area* tab select the known azimuth from the first point in the list, where the hinge point is located, the known area, and the name and code of the resulting point.

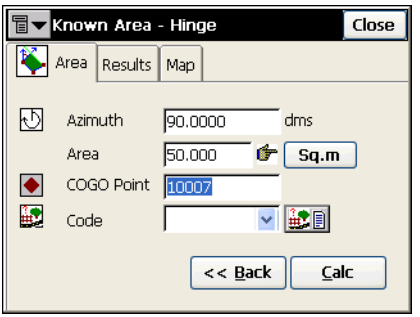


Figure 8-13. Known Area - Hinge – Area Tab 2

3. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be tapped to save the checked point. The *Map* tab shows the results graphically.

Known Area - Line

The Line method computes the coordinates of two points that satisfy the following conditions:

- The points are located on known azimuths, taken from the two known points.
- The azimuth of the line formed by the points is known.
- Along with two other known points, the points form a quadrilateral of known area.

1. Select the initial data for the task: the start and the end points, the azimuths from the points, the reference azimuth and the known area value, and the names and codes of the resulting points.

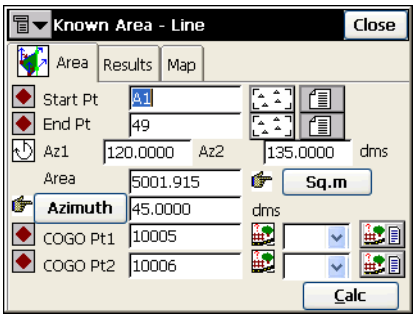


Figure 8-14. Known Area - Line – Area Tab

2. Tap the **Calc** button. The result of the calculation will be displayed on the *Results* tab. The **Save** button in the *Results* page should be taped to save the checked points. The *Map* tab shows the results graphically.

Transformations

The transformations process includes three tasks: *Rotate, Translate* and *Scale*.

Rotate

The ***Rotate*** task rotates the selected points around one specific point.

1. Select the points for the task. In the *Select points* field tap the **By Range** button and set the range of the point names, or select points for scaling task on the map or from the list (Figure 8-15).

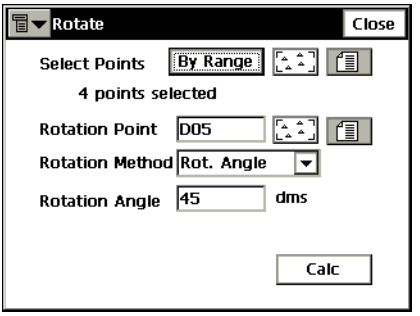


Figure 8-15. Rotate

2. Set the Rotation Point (the point at the center of rotation).
3. Specify whether the rotation angle will be input directly to the Rot. Angle field, or as a difference between the new and old azimuths (to the Old Bearing/Azimuth and New Bearing/ Azimuth fields).
4. Tap the **Calc** button to rotate the selected points.

Translate

The ***Translate*** task moves a group of points together.

1. Select the points for the task. In the *Select points* field tap the **By Range** button and set the range of the points names, or select points for scaling task on the map or from the list (Figure 8-16).

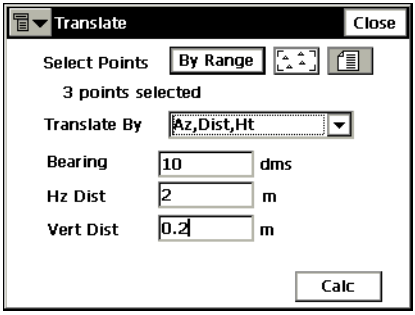


Figure 8-16. Translate

2. Set the method of translation using the *Translate By* field, to either Coords/Pts or Az,Dist,Ht.
   - When the *Coords/Pts* method is selected, it means that all the selected points will be moved in the same direction and distance as between the points (locations), set by the next two fields: **From Pt (From Crd)** and **To Pt (To Crd)**. In the first case, define only the point name. In the second case, the local coordinates and the height of the location is needed.
   - The *Az,Dist,Ht* method means that all the selected points move in a specified direction by a specified distance. These parameters are set through the *Bearing (Azimuth)*, *Horiz Dist*, and *Vert Dist* fields.
3. Tap the **Calc** button to achieve the result.

The limit for translation of points is 20,000 meters.

Scale

The ***Scale*** task scales the distances of a range of points relative to a Base Point.

1. Select the points for the task. In the *Select points* field tap the **By Range** button and set the range of the points names, or select points for scaling task on the map or from the list (Figure 8-17).

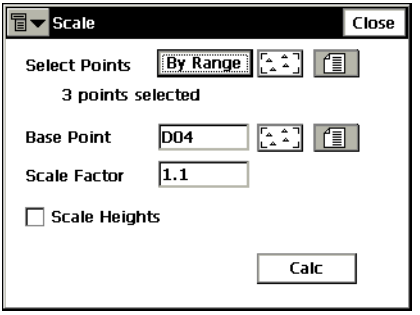


Figure 8-17. Scale

2. Set the Base Point name.
3. Set the Scale Factor.
4. Check the *Scale Heights* field if the height values should be scaled also.
5. Tap the **Calc** button to achieve the result.

mmGPS Operations

In the event that a point has been lost, the resection operation can measure an unknown point based on the measurements of three or more surrounding points. The self-levelling mechanism may also need to be measured and the transmitter calibrated to ensure correct grade.

The following operations require that the transmitter and sensor have already been setup as seen in Chapter 6.

Resection

The resection function measures an unknown transmitter location using the rover and three or more points.

When performing a resection, use the following guidelines to ensure accurate measurements of the Rover points:

- take measurements at 3 or more points around the Base transmitter in a balanced, symmetrical pattern (not clustered in one area)
- have the sensor facing towards the transmitter during each measurement
- angle the sensor between 6° higher or lower than the transmitter's beam, not straight on

1. With the controller and sensor connected, tap **SRV ▸ Init mmGPS+**.
2. On the ***Init mmGPS+*** screen and *Position* tab, select the transmitter and tap **Resect** (Figure A-1 on page A-2).

3. On the ***Resect*** screen and *Sensor* tab, tap **Init Sensor** (Figure A-1).

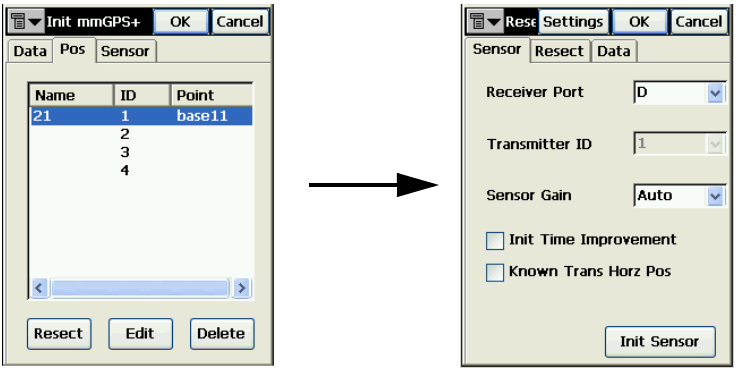


Figure A-1. Select Transmitter and Enter Resect Screen

4. If *Known Trans Horz Pos* was selected, the Known Point screen displays. Select the point over which the transmitter was setup using the **map** or **list** buttons and tap **OK** (Figure A-2).

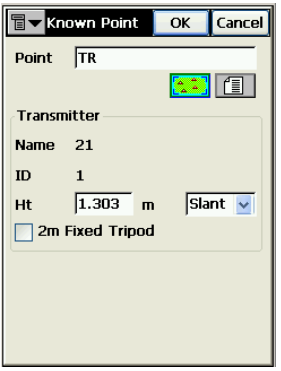


Figure A-2. Transmitter Over Known Point

When the sensor is successfully initialized, TopSURV displays the setup successful screen. Tap **Close** to continue.

5. Tap the **Resect** tab (Figure A-3 on page A-3).
   - If using an unknown point, tap **Start**.
   - If using a known point, enable *Known Point* and select a point to occupy using the **map** or **list** buttons and enter the antenna's height. Then tap **Start**.

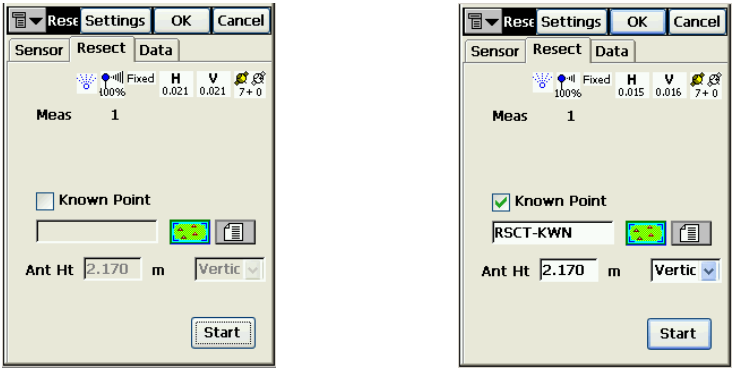


Figure A-3. Use Unknown or Known Point

When the sensor receives the transmitter's beam, the mmGPS icon displays (Figure A-4 on page A-3).

During the measurement, the *Resect* tab displays the number of GPS epochs used in the resection calculation (Figure A-4 on page A-3).

6. When the desired amount of time has passed, tap **Stop** (Figure A-4).

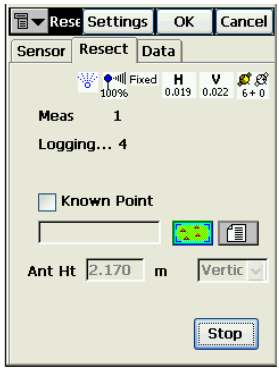


Figure A-4. Measure Point

7. Move to the next point and repeat steps 4 and 5 for three or more points.

8. Tap the *Data* tab to view the results (Figure A-5).
   - Only after three or more points have been measured will data display. The first two points will not display any data.
   - Tap **Re-Meas** to clear all data and restart he resection process.

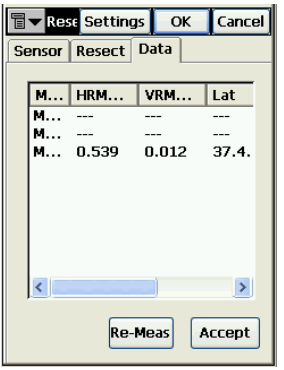


Figure A-5. Resection Data Results

9. If the resection values are acceptable, tap **Accept** and view the point information for the transmitter (Figure A-6). tap **OK** to save the transmitter's point information.
   - Enter any other desired information (such as, codes or notes).
   - If the transmitter is over a control point, enable *Control Point*.

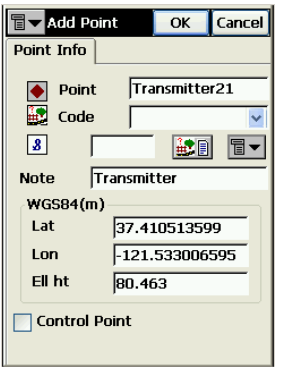


Figure A-6. View Point Information

10. After the resection (Figure A-7), initialize the sensor. See “Sensor Initialization” on page 6-10 for details.

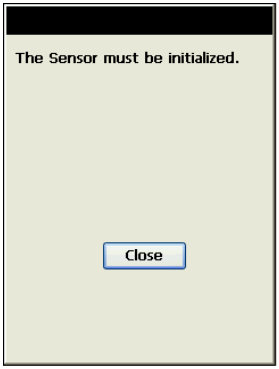


Figure A-7. Initialize Sensor after Resection

After performing a resection, check the results using the Known Point Offset function. This function also provides an option to adjust the transmitter’s height using the new offset.

1. On the ***Init mmGPS+*** screen, tap the **menu bitmap** in the upper left corner of the screen and tap **Known Point Offset** (Figure A-8).

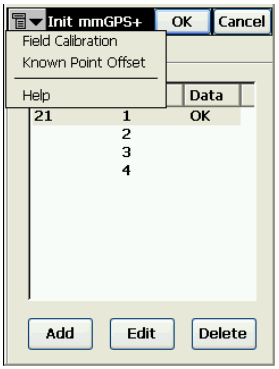


Figure A-8. Open Known Point Offset

2. Select the Rover's known point using the **map** or **list** buttons and tap **Start** (Figure A-9).

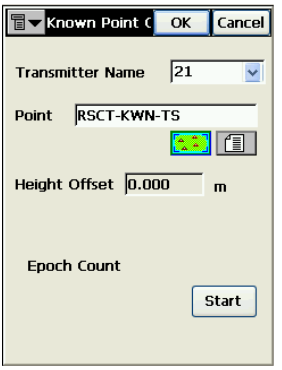


Figure A-9. Select Rover's Point and Begin Averaging

When the averaging completes, the screen displays the height offset for the transmitter's height (Figure A-10).

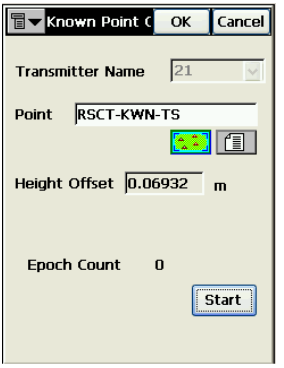


Figure A-10. Transmitter's Height Offset Averaged

3. tap **OK**, then tap **Yes** at the ***warning*** screen to adjust the transmitter height using the results (Figure A-11). The offset will be automatically added to the transmitter's height.

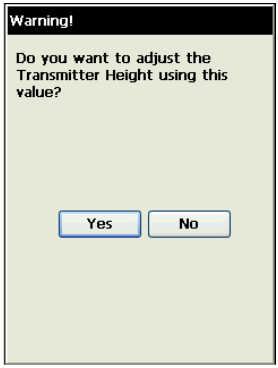


Figure A-11. Adjust Transmitter's Height

4. When finished, initialize the sensor. See "Sensor Initialization" on page 6-10 for details.

Field Calibration

The field calibration function fixes errors in incline in the self-leveling mechanism of the transmitter.

1. At the transmitter, hold the **plumb beam key**, then tap and release the **power key** to put the transmitter into calibration mode.
2. With the rover, walk over 30 meters away from the transmitter and face the sensor towards the transmitter.

Use a bi-pole to ensure the sensor remains steady throughout the calibration process.

3. With the controller and sensor connected, tap **SRV ▸ Init mmGPS+**.

4. On the ***Init mmGPS+*** screen, tap the **menu bitmap** in the upper left corner of the screen and tap **Field Calibration** (Figure A-12).

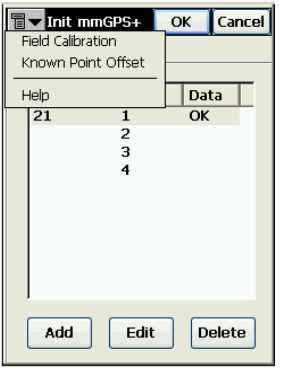


Figure A-12. Open Field Calibration

5. On the ***Calibration*** screen, select the transmitter that will be calibrated and tap **Next** (Figure A-13).

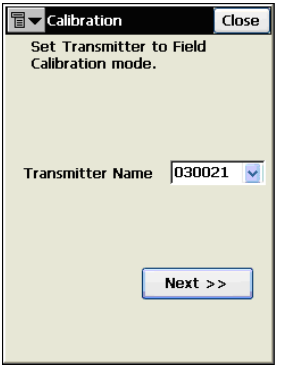


Figure A-13. Select Transmitter to Calibrate

6. Adjust the height of the sensor so the angle is less than 1°. Once the angle is ok, tap **Next** (Figure A-14).

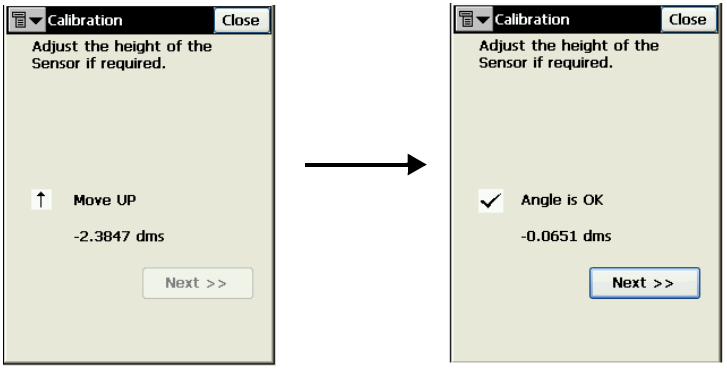


Figure A-14. Check Angle of Sensor

If the sensor experiences excessive movement during any stage of the calibration, an error message will display. tap Close

7. tap **Calibrate** after the auto-levelling process completes (Figure A-15).

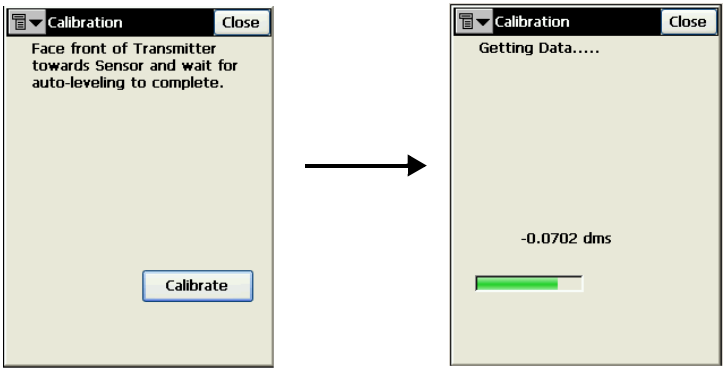


Figure A-15. Begin Field Calibration

8. Turn the transmitter 180° so the back faces the transmitter. tap **Calibrate** (Figure A-16).

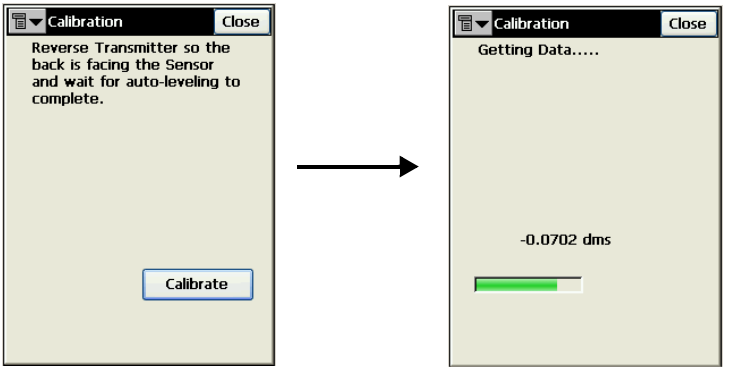


Figure A-16. Turn Transmitter to Back and Collect Data

9. Turn the transmitter 90° so the left side faces the transmitter. tap **Calibrate** (Figure A-17).

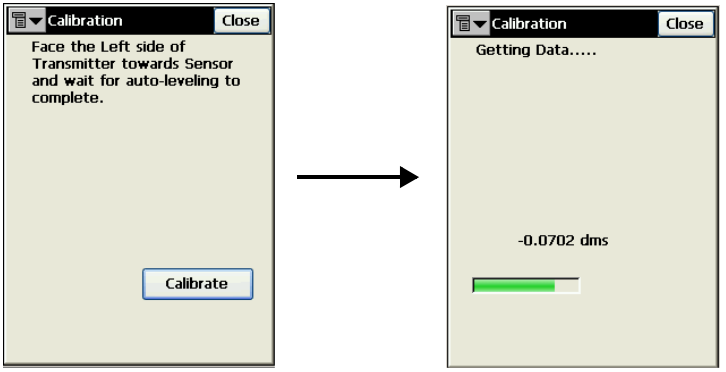


Figure A-17. Turn Transmitter to Left and Collect Data

10. Turn the transmitter 180° so the right side faces the transmitter. tap **Calibrate** (Figure A-18).

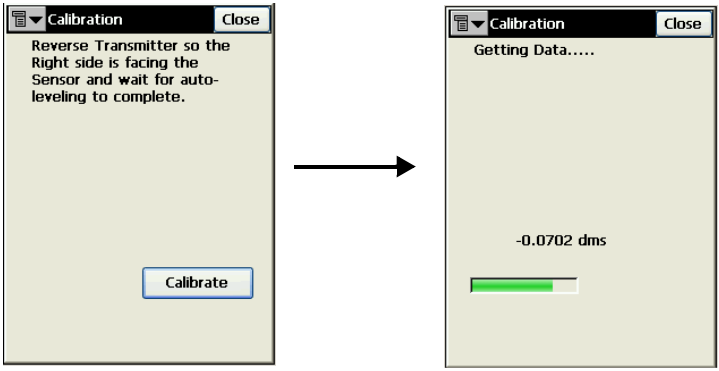


Figure A-18. Turn Transmitter to Right and Collect Data

When the calibration completes, the ***Update Calibration Data*** screen displays the offsets (Figure A-19).

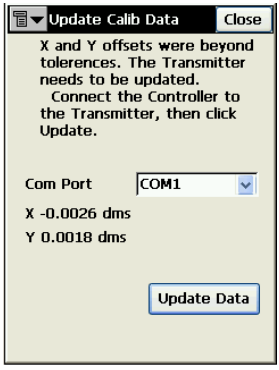


Figure A-19. Field Calibration Results

If the offsets were outside the tolerance range, TopSURV will indicate that the transmitter needs to be updated (Figure A-20).

11. Disconnect the controller and sensor. At the transmitter, connect the controller and transmitter.

12. On the ***Update Calibration Data*** screen, select the *Com Port* that connects the controller and transmitter and tap **Update Data** (Figure A-20).

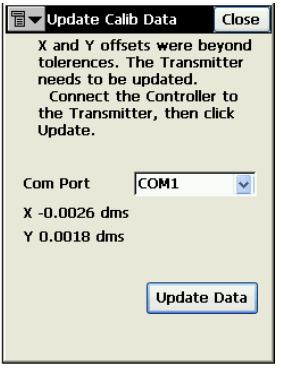


Figure A-20. Field Calibration Results

TopSURV uploads the calibration data to the transmitter and automatically turns off the transmitter. When finished, tap **Close** on the ***Message*** screen (Figure A-21).

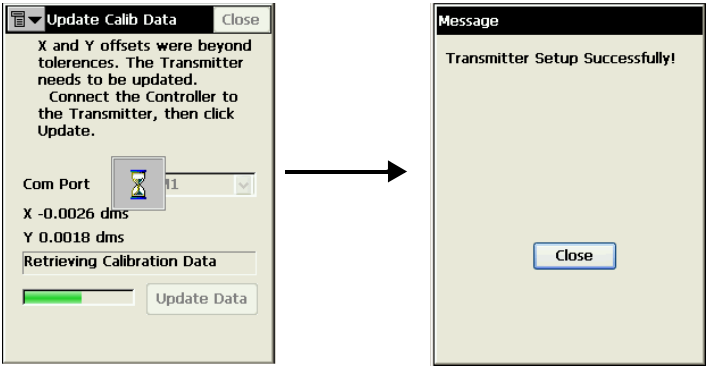


Figure A-21. Uploading Calibration Data

13. Initialize the sensor according to "Sensor Initialization" on page 6-10.

After loading the new calibration data into the transmitter, re-calibrate to check the system. The transmitter may need to be calibrated a couple of times depending on site conditions.

mmGPS Options

When configured for mmGPS, an options menu selection provides further functionality for applying height differences and selecting whether or not to use mmGPS and weighted height computations.

1. On the ***Status*** screen (**SRV ▸ Status**), tap the **menu bitmap** in the upper left corner of the screen and tap **mmGPS+ Options** (Figure A-22).

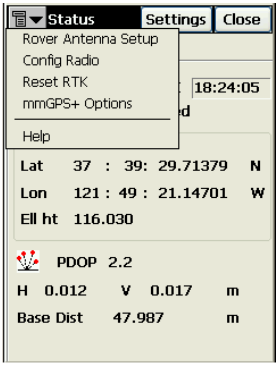


Figure A-22. mmGPS+ Options

2. On the ***mmGPS+ Options*** screen, select the following options (Figure A-23 on page A-14):
   - Use mmGPS+ – tap to enable the use of mmGPS.
   - Use weighted height computations – tap to enable the use of weighted height computations
3. Enter a *Height Difference Limit* between the GPS result and the mmGPS result (Figure A-23 on page A-14). tap **OK**.

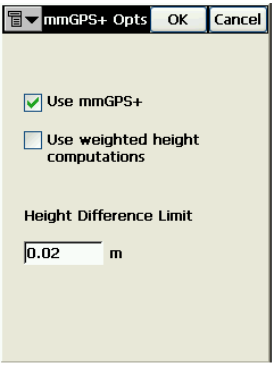


Figure A-23. Select mmGPS+ Options

If the difference between the measured GPS height and the mmGPS height is greater than the entered value, the mmGPS icon changes (Figure A-24).

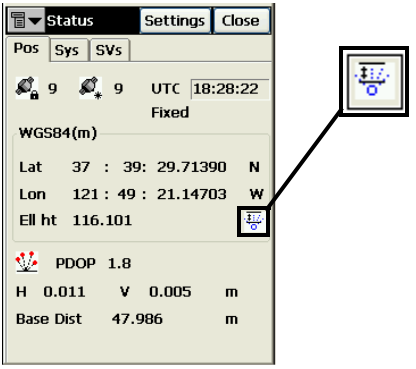


Figure A-24. mmGPS Icon with Height Difference Limit

Topcon Link Getting Started Guide

Topcon Link is an import/export utility that aids in the transportation of data between Topcon instruments and a computer. Topcon Link is available on the Topcon Tools CD, the TopSURV CD, and the Topcon GPS website.

For details on installing Topcon Link, refer to the *Topcon Link Reference Manual* or the Topcon Tools online help.
For further details on using Topcon Link, refer to the online help for Topcon Link or the *Topcon Link Reference Manual*.

The following sections provide quick steps to being using Topcon Link. This getting started guide is organized into the following sections:

- Total Stations
- TPS Receivers
- TopSURV PC Job

Each section describes typical functions for working with files from these sources in Topcon Link.

Using Topcon Link with Total Stations

The following pages describe the typical process for creating, editing, exporting, importing, and calculating data between Topcon Link and Total Stations. The example applied below uses the GPT 3005W total station and the GTS-7 Points file format.

Before beginning the field job with the Total Station, perform the following functions:

- ☐ Create a control points file.
- ☐ Edit the file in Topcon Link and save it as a GTS-7 Points file (or the file for the Total Station).
- ☐ Export this file to the GPT 3005W (or the Total Station).

After completing the field job with the Total Station, perform the following functions:

- ☐ Import the raw data into Topcon Link.
- ☐ Edit the file and calculate the coordinate points.
- ☐ Convert the raw data file to an XML file (or another format in preparation for post processing).

Creating a Control Points File

1. Using a text editor (such as, Microsoft Notepad), create a control points file for export to a Total Station.

   Use the format “Name of Point, Northing, Easting, Height” when entering data to make the file compatible with Topcon Link.
2. Save the file as “Control_data1.csv”.

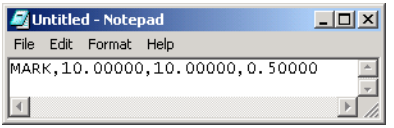


Figure B-1. Create a Control Points File

Editing a Control Data File

1. Open Topcon Link and click **Open** on the toolbar.
2. Select the *Format name* as Name,N,E,Z,Code (*.csv).
3. Navigate to and select the "Control_data1.csv" file and click **Open**.

The file opens in Topcon Link (Figure B-2).

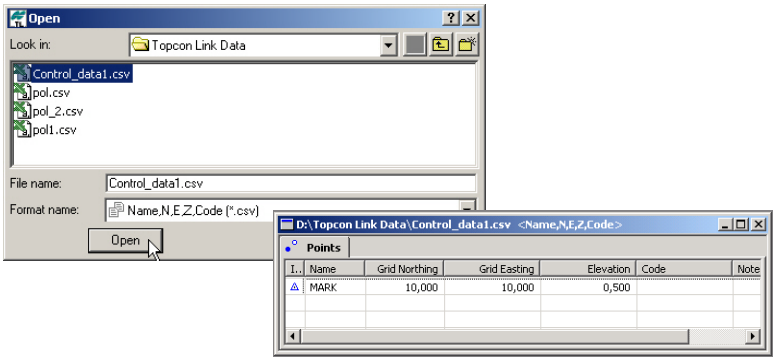


Figure B-2. Select Format Name and File

Add a Point

1. To add a new point to the open file, click **Add point** on the toolbar.
2. Enter the point's *Name* and *Coordinates*, and click **Ok** (Figure B-3).

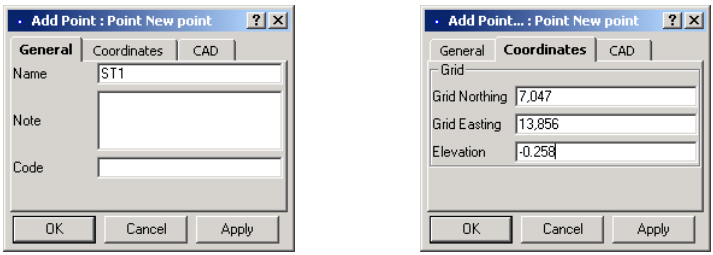


Figure B-3. Add Point – Enter Name and Coordinates

Save the File to the GTS-7 Points Format

1. Click **File ▸ Save As**.
2. Select the "GTS-7 Points" format as the *Format name*.
3. Enter a *File name* and click **Save** (Figure B-4).

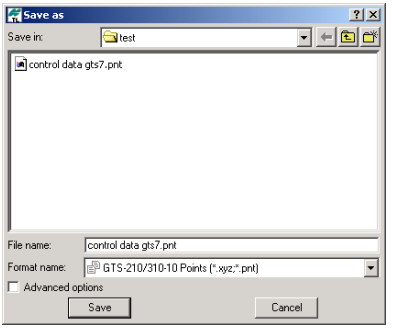


Figure B-4. Save File for Total Stations

Exporting Control Data Files

1. Connect the Total Station and computer. Refer to the total station's documentation for details.
2. Open Topcon Link and click **Export to device** on the toolbar.
3. In the left panel, navigate to the location of the file to export.
4. In the right panel, select "Topcon Total Station" from the Look in drop-down list. Click **Add New Station** in the right panel (Figure B-5).

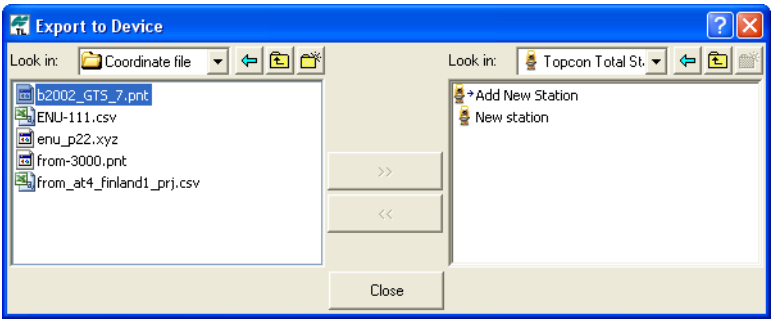


Figure B-5. Add New Station

5. Set the following information (Figure B-6):
   - *General* tab – enter a name and select the model for the total station; select the port through which the total station and computer are connected.
   - *Advanced* tab – select communication parameters identical to those set in the Total Station (in this example, the GPT3005W): Baud Rate (9600), Data Bits (CHAR. - 8), Parity (NONE), Stop Bits (1), and Protocol (when you receive data in *GTS-7 Points* format use **ONE-WAY**).
6. Click **OK** to create the new station.

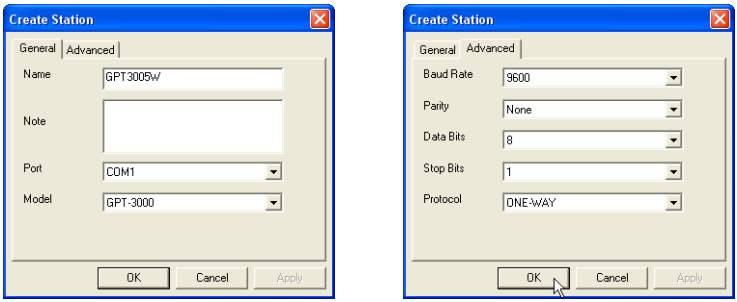


Figure B-6. Set Properties for Connection to GPT3005W TS

7. Follow the steps shown in the *Upload File(s) to Total Station* dialog box to prepare the Total Station for importing the GTS-7 Points file. Table B-1 summarizes these steps for the GPT 3005W.

Table B-1. Preparing the TS for Data Transfer

Procedure	TS Screen Illustration
1. Turn on the total station. 2. Press the MENU button. 3. Press the **F3** button for Memory Manager.	MENU 1/3 F1:DATA COLLECT F2:LAYOUT F3:MEMORY MGR. P↓
4. Press the **F4** button twice to page down. 5. Press the **F1** button for data transfer. 6. Press the **F2** button for other formats.	MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INI DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT

Table B-1. Preparing the TS for Data Transfer (Continued)

Procedure	TS Screen Illustration
7. Press the **F2** button to load data. 8. Press the **F1** button and enter the name of the file to load. 9. Press **F4** to enter.	DATA TRANSFER F1:SEND DATA F2:LOAD DATA F3:COMM. PARAMETERS COORD. FILE NAME FN:_____ INPUT --- --- ENTER
10. Press **F3** to load the data.	LOAD COORD. DATA >OK ? --- --- [YES] [NO] LOAD COORD. DATA < Wating Data! > STOP

When the transfer process begins, the *Upload File(s) to Total Station* dialog box displays a "Performing the transfer..." message.

11. Wait while the exported file is saved in the total station.
12. After a successful export, Topcon Link will display a "successful export" message and the Total Station will return to the Data Transfer menu (Figure B-7).

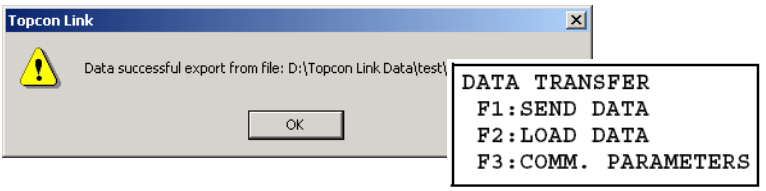


Figure B-7. Successful Export to the Total Station

Importing Raw Data Files

After finishing the field job, import measurement data from the Total Station to Topcon Link. Measurement data in the example below was collected in GTS-7 Raw file format using a GPT 3005W.

1. Click **Import from Device** on the toolbar.

2. In the left panel, double-click the *My Computer* icon and double-click the *Topcon Total Stations* icon. Double-click the total station connected to the computer.

   Topcon Link applies the communication parameters defined earlier in the Export to device process.

3. In the right panel, navigate to and select the folder in which to save the imported data.
4. Select the file to import (file.txt) in the left panel and click the **move right** (**>>**) button.

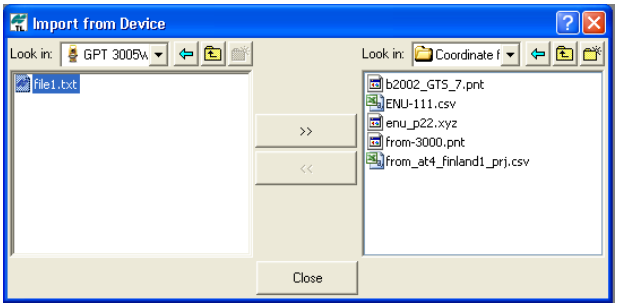


Figure B-8. Select Total Station and File

5. Follow the instructions listed in the *Download File From Total Station* field. Table B-2 summarizes these steps for the GPT 3003W.

Table B-2. Preparing the TS for Data Transfer

Procedure	TS Screen Illustrations
1. Turn on the total station. 2. Press the MENU button. 3. Press the **F3** button for Memory Manager.	MENU 1/3 F1:DATA COLLECT F2:LAYOUT F3:MEMORY MGR. P↓
4. Press the **F4** button twice to page down. 5. Press the **F1** button for data transfer. 6. Press the **F2** button for other formats.	MEMORY MGR. 3/3 F1:DATA TRANSFER F2:INI… DATA TRANSFER F1:GTS FORMAT F2:SSS FORMAT

Table B-2. Preparing the TS for Data Transfer (Continued)

Procedure	TS Screen Illustrations
7. Press the **F1** button to send data. 8. Select the type of data to send. For this example, press the **F1** button. 9. Press the **F1** button and enter the name of the file to send. 10. Press **F4** to enter.	DATA TRANSFER F1:SEND DATA F2 F3 SEND DATA F1:MEAS. DATA F2 F3 SELECT A FILE FN:_____ INPUT LIST --- ENTER
11. Click **Next** on the *Import from Device* dialog box. 12. Press the **F3** button to send the data.	SEND MEAS. DATA >OK ? --- --- [YES] [NO] LOAD COORD. DATA < Wating Data! > STOP

When the transfer process begins, the *Upload File(s) to Total Station* dialog box displays a “Downloading...” message.

13. Wait while the exported file is saved to the computer.
14. After a successful import Total Station will return to the Data Transfer menu.

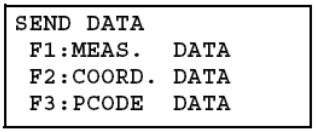


Figure B-9. Data Transfer Menu

Opening, Viewing, and Editing Raw Data Files

The examples in this section use the following survey project (Figure B-10 on page B-9). Measurements were conducted from the three stations (ST1, ST2 and MARK). The coordinates of ST1 and MARK are known and stored in the coordinate file exported to the Total Station. Measurements to ST2 were done from the stations MARK and ST1.The coordinates of ST2 were obtained from MARK.

On each station, the measurements were performed to obtain unknown points. When measuring, the vertical angle were within 45 degrees.

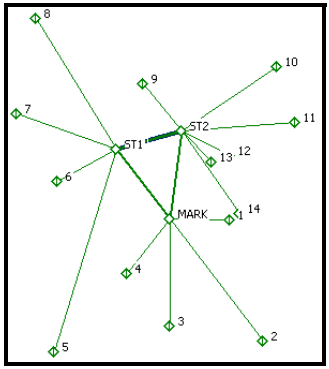


Figure B-10. Survey Project Used

To open the raw data file:

1. Click **File ▸ Open File**.
2. Select or enter the name of the file imported from the TS; for example, “02_04_05_GTS-7.raw”.
3. Select the *Format name* and view the *Advanced options*.
4. Select the following advanced options (Figure B-11):
   - Projection field – “none”
   - Coordinate order – “Northing,Easting,Height”
   - Vertical angle is – “Horizontal level”

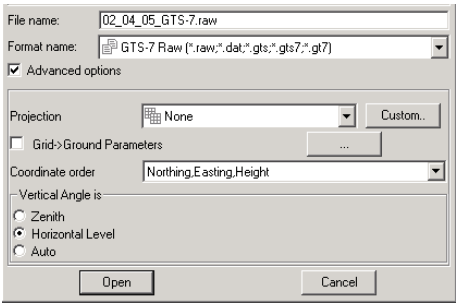
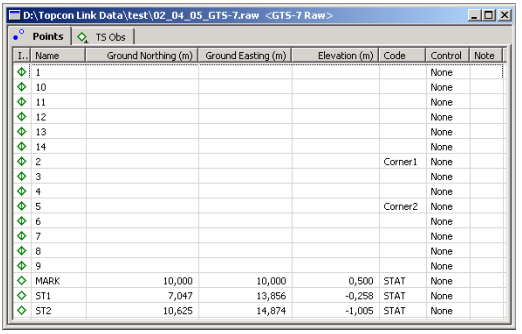


Figure B-11. Open Raw Data File

For a Raw Data files, the information displays in the following tabs:

- The *Points* tab lists all points and stations in the file (Figure B-12).
  - – Point icon:
  - – Station icon:

  For the GTS-7 Raw file format, the *Ground Northing*, *Ground Easting*, *Elevation* coordinates display only for stations.

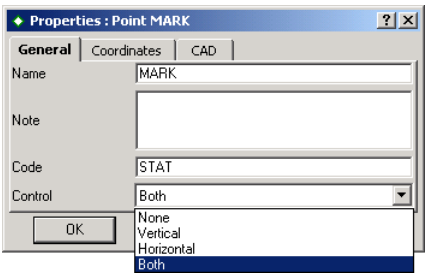


I..	Name	Ground Northing (m)	Ground Easting (m)	Elevation (m)	Code	Control	Note
	1					None	
	10					None	
	11					None	
	12					None	
	13					None	
	14					None	
	2				Corner1	None	
	3					None	
	4					None	
	5				Corner2	None	
	6					None	
	7					None	
	8					None	
	9					None	
	MARK	10,000	10,000	0,500	STAT	None	
	ST1	7,047	13,856	-0,258	STAT	None	
	ST2	10,625	14,874	-1,005	STAT	None	

Figure B-12. Points Tab

The following data processing and adjustments will be performed from MARK. To adjust the plane and vertical coordinates of the station, take the following steps (Figure B-13):

1. Right-click the point and click **Properties**.
2. On the *General* tab, select the *Control* as “Both”.
3. Click **Ok**. The icon for the station will change to a “Fixed point” icon (Figure B-13).



Fixed point Icon

Figure B-13. Set Control for Point; Fixed Point Icon

- The *TS Obs* tab (Figure B-14) has two panels.

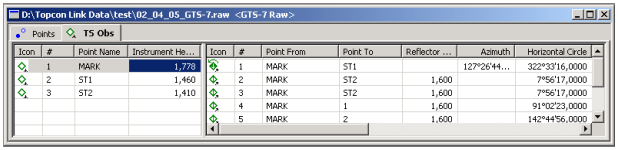


Figure B-14. TS Obs Tab

– The left panel contains information on the station/points with known positions where the Total Station was placed.

To edit the instrument height for MARK (Figure B-15):

1. Click-pause-click the station's height
2. Type a new height value
3. Press **Enter** on the keyboard.

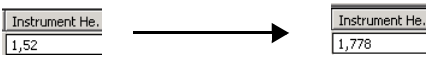


Figure B-15. Editing an Instrument Height

– The right panel contains information on the points relevant to the station selected in the left panel. These points have unknown positions where the Reflector was placed.

To edit the azimuth to BKB point (Point From Mark – Point To ST2) (Figure B-16):

1. Click in the *Point to* column and select "no name" from the drop-down list.
2. Click-pause-click a *Azimuth* column and edit the value azimuth.
3. Press **Enter**.

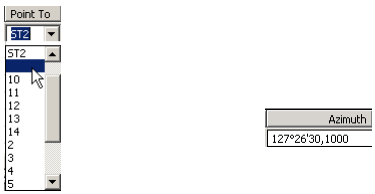


Figure B-16. Editing the Azimuth

To change the type of point 5 (Point From Mark – Point To2) from SS to FS (Figure B-17):

1. Double-click in the *Type* column of the point and select the *FS* type.
2. Press **Enter**.

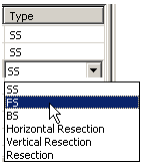


Figure B-17. Editing Point Type

NOTICE

When editing data (point coordinates, control, antenna/instrument/reflector heights, point types, BKB azimuths, offsets), press the Calculate Coordinate button to recompute coordinates.

Computing and Adjusting Points Coordinates

By default, Topcon Link obtains coordinates without adjusting them. But it is possible to compute the positions by performing adjustment of points.

1. To select a network adjustment, click **Process ▸ Process Properties**.
2. Click the *Compute Coordinates* tab and select an adjustment type (Least Squares for this example of a network). Click **OK** (Figure B-18 on page B-13).

Refer to the *Topcon Link Reference Manual* for a description of each adjustment type.

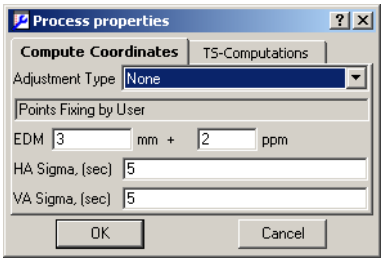
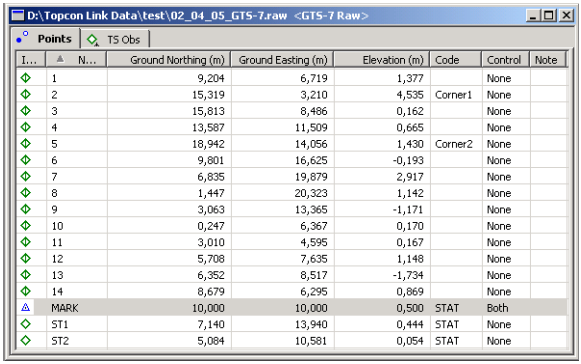


Figure B-18. Process Properties – Compute Coordinates Tab

3. Click **Compute coordinates of points** on the toolbar. The *Points* tab displays the adjusted coordinates (Figure B-19).



I...	N...	Ground Northing (m)	Ground Easting (m)	Elevation (m)	Code	Control	Note
	1	9,204	6,719	1,377		None	
	2	15,319	3,210	4,535	Corner1	None	
	3	15,813	8,486	0,162		None	
	4	13,587	11,509	0,665		None	
	5	18,942	14,056	1,430	Corner2	None	
	6	9,801	16,625	-0,193		None	
	7	6,835	19,879	2,917		None	
	8	1,447	20,323	1,142		None	
	9	3,063	13,365	-1,171		None	
	10	0,247	6,367	0,170		None	
	11	3,010	4,595	0,167		None	
	12	5,708	7,635	1,148		None	
	13	6,352	8,517	-1,734		None	
	14	8,679	6,295	0,869		None	
	MARK	10,000	10,000	0,500	STAT	Both	
	ST1	7,140	13,940	0,444	STAT	None	
	ST2	5,084	10,581	0,054	STAT	None	

Figure B-19. Adjusted Coordinates

4. Click **Save** on the toolbar to save the coordinates obtained.

Converting Raw Data Files to Design Format

1. Click **Save as** on the toolbar. Select the DXF format from the Design group and enter the file name ‘MGIS’ (Figure B-20).

Figure B-20. Select DXF File Format

2. Click **Save** to convert the Raw Data file to the DXF format.

Using Topcon Link with GPS Receivers

The following pages describe the typical process for importing data to Topcon Link from a GPS receiver and converting the data files to another format (the example below uses the RINEX file format).

After completing the field job with the GPS receiver, perform the following functions:

- ☐ Connect the computer and TPS GPS receiver. Refer to the receiver's documentation for details.
- ☐ Import the raw data into Topcon Link.
- ☐ Convert the raw data file to a RINEX file (or another format in preparation for post processing).

Importing GPS Receiver Files

The import process is also shown in Figure B-21 on page B-15.

1. Connect the receiver and computer. Refer to the receiver's documentation for details.
2. Open Topcon Link and click **Import from device** on the toolbar.
3. In the right panel, navigate to and select the folder in which to save the imported data.
4. In the left panel, double-click the *My Computer* icon and double-click the *Topcon Receivers* icon. Topcon Link will search for connected receivers.
5. Double-click the desired receiver to view collected raw data files.
6. Select the file(s) to import and click the **move right** (**>>**) button.

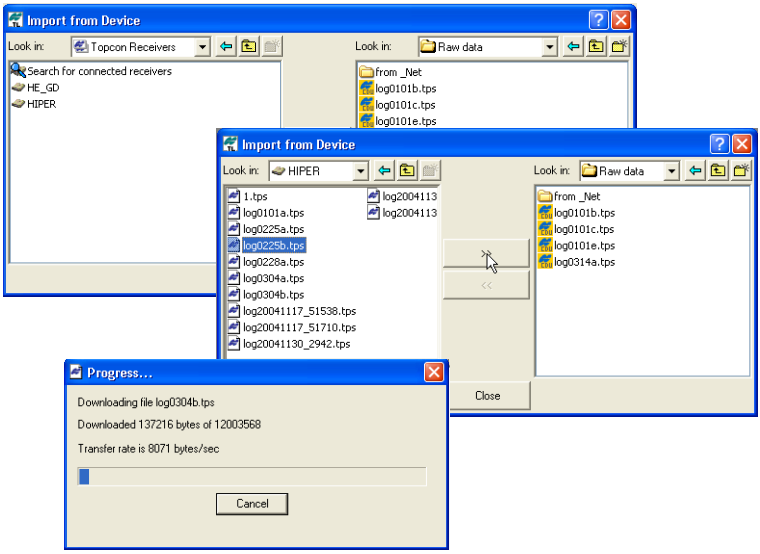


Figure B-21. Import Files from Receiver

Converting Raw Data Files to RINEX Format

1. Click the **Convert** icon on the toolbar; the ***Convert File*** dialog box displays (Figure B-22).

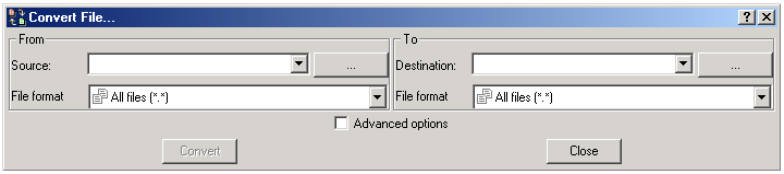


Figure B-22. Click Convert Icon

2. In the *From* panel, select the *File format* of the raw data file (Figure B-23).

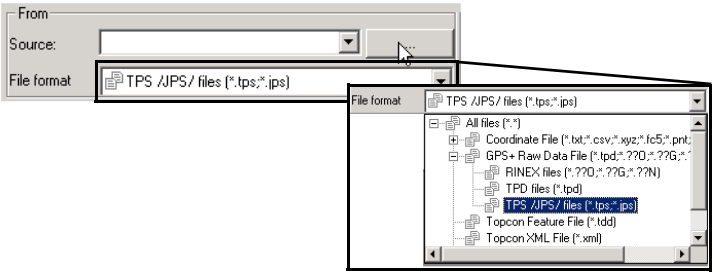


Figure B-23. Select Raw Data File Format

3. Click the **Browse** ("**...**"). Select the file to import and click **Open** (Figure B-24).

The full path of the file displays in the Source field (Figure B-24).

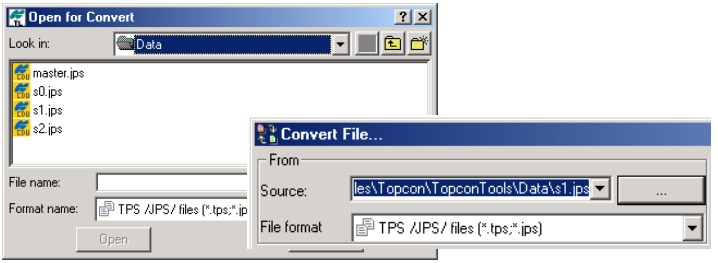


Figure B-24. Select Files to Convert

4. In the right panel, click the **Browse** ("**...**") button.
5. Create a folder in which to store the file, select the RINEX format and enter the name of the file (for example, "standard").
6. Click **Select**. The full path of the file displays in the *Destination* field (Figure B-25).

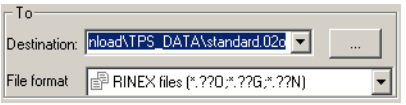


Figure B-25. Destination for Converted File

7. Click **Convert** to begin converting the selected file into RINEX.

Using Topcon Link with TopSURV Files

The following pages describe the typical process for importing, editing, calculating, and reporting TopSURV data in Topcon Link. The example applied below performs simple viewing and editing process after importing TopSURV data.

Before importing data from TopSURV, perform the following actions:

- ☐Install Microsoft® ActiveSync® onto the computer.
- ☐Connect the TopSURV controller and computer using Microsoft ActiveSync.

After importing data from TopSURV, perform the following functions:

- ☐Import TopSURV data (*.tsv file) into Topcon Link.
- ☐View points coordinates in WGS-84 and a local system.
- ☐Edit the antenna height and measurement method.
- ☐View the vectors.
- ☐Edit a new control point into localization.
- ☐Recalculate the points coordinates
- ☐Report coordinates in a local system.

Importing TopSURV Jobs

TPS controllers store data in the *.tsv file format. When importing *.tsv files, use only Topcon Link to guarantee against data loss. Topcon Link transforms the *.tsv file to a *.tlsv file that can be read on a computer.

1. Connect the computer and controller using a serial cable or Bluetooth® wireless technology and Microsoft ActiveSync.

2. Open Topcon Link and click **Import from device** on the toolbar.
3. In the right panel, navigate to and select the folder in which to save the imported data.
4. In the left panel, double-click the *My Computer* icon and double-click the *Mobile Device* icon. Topcon Link will search for a connected controller.
5. In the left panel, navigate to the folder where the desired *.tsv file(s) is saved in the controller.
6. Select the file(s) to import and click the **move right** (>>) button.

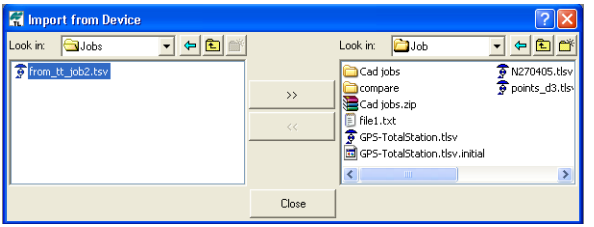


Figure B-26. Import TopSURV File

During the import, Topcon Link will convert the *.tsv file to a computer-friendly TopSURV PC Job (*.tlsv file).

Opening, Viewing, and Editing TopSURV GPS Files

The examples used in the following pages are from the GPS RTK project shown in Figure B-27 on page B-19.

Measurements were conducted from the base station ‘Pion1’ in RTK survey mode using mmGPS+ configuration ‘My mmGPS+ RTK and PP’ in TopSURV. Four measured points have coordinates in the local system.

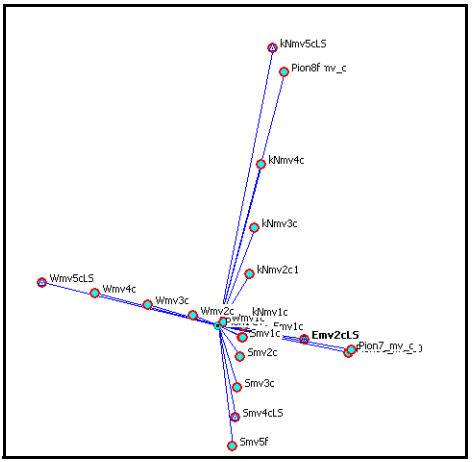


Figure B-27. GPS RTK Project Used

To open an imported TopSURV PC Job...

1. Click **File ▸ Open File**.
2. Enter the name of the TopSURV file (1014C.tlsv).
3. Select the "TopSURV PC Job" format name.

The TopSURV PC Job displays information in the five tabs (Figure B-28).

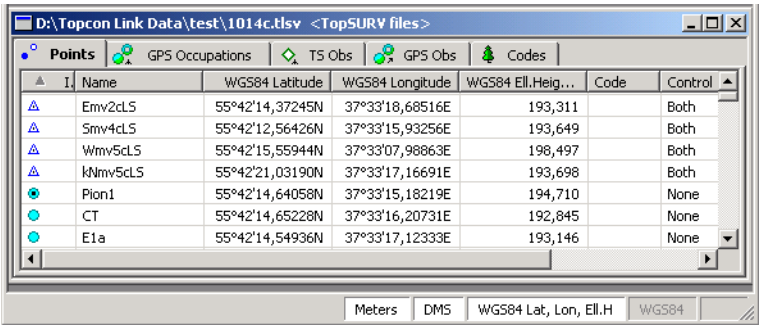


Figure B-28. Points Tabs

View Points Coordinates

The *Points* tab (Figure B-28) lists all points stored in the file.

TopSURV calculated the localization parameters for the example used here after the operator determined four pairs of points with coordinates in the Local System and WGS-84. All points of this file have coordinates in two systems.

To view the points coordinates in the local system, double-click the *coordinates* box on the Status Bar and select 'Grid' (Figure B-29).

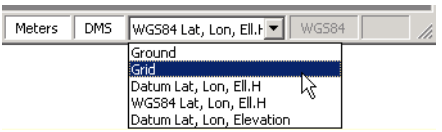


Figure B-29. Status Bar – Coordinate Type List

Edit Antenna Height and Measurement Method

1. To edit GPS antenna height, click the *GPS Occupations* tab, right-click the point 'PION1' and click **Properties**.
2. Click the *Antenna* tab and enter the new antenna height value (for example, 1.555m). Change the method of measurement for antenna height from slant to vertical (Figure B-30).
3. Click **Ok**.

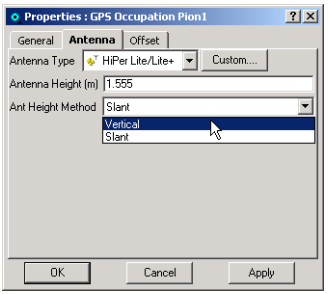


Figure B-30. Edit Antenna Properties

NOTICE

When editing data (point coordinates, antenna heights, antenna types, antenna height measurement methods), the point coordinates must be recomputed.

Compute Coordinates

To calculate (or re-calculate with new settings) coordinates, click the **Compute coordinates of points** icon on the toolbar (Figure B-31). The updated coordinates display in the *Points* tab.

Figure B-31. Compute Coordinates

View Vectors

The *GPS Obs* tab displays information about vectors contained in the TopSURV GPS file.

1. To display the vector components and their errors, right-click the vector and click **Properties**.

   The horizontal and vertical precisions and components in XYZ and NEH coordinate systems of the vector will be displayed in the *Observation* tab of the ***Properties*** dialog box (Figure B-32).
2. Click **OK** to exit.

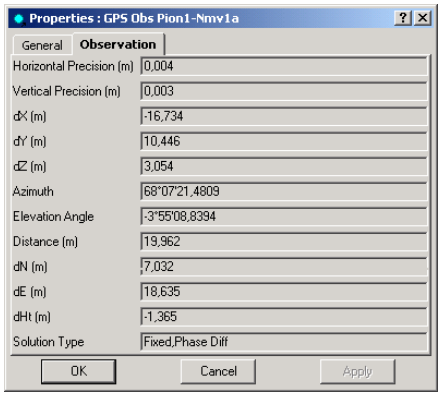


Figure B-32. Horizontal and Vertical Accuracies

Add New Control Point into Localization Parameters

Before edit localization parameters add a new control point in the local system into the file. Make sure that the coordinate type box of the status bar is sets to '*Grid*'.

1. To add a new point to the file, click **Add point** on the toolbar.
2. Enter a point's *Name* (Wmv2aLS) and *Coordinates* in the Local System (Figure B-33). Click **OK**.

   For this example, this point corresponds to point 'Wmv2a' in WGS-84.

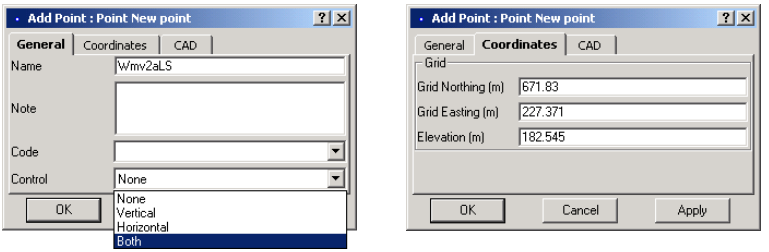


Figure B-33. Add Point Dialog Box - General and Coordinates Tabs

3. To edit localization parameters, click **Perform a localization** on the toolbar. On the *Localization* dialog box, click **Add point**.
4. Select the point 'Wmv2a' from the drop-down list in *WGS Point* column (Figure B-34).
5. Select the point 'Wmv2aLS' from the drop-down list in *Local Point* column (Figure B-34).
6. Since this point will be used only in horizontal localization, select 'Horizontal" to change the point's status (Figure B-34).

   The new localization parameters will calculate automatically.

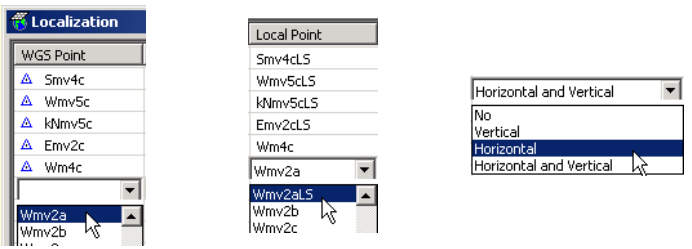


Figure B-34. Localize Point

Save the File

To save all changes in the file click **Save** on the toolbar (Figure B-35).

Figure B-35. Save File

Topcon Link creates a backup of the original file with an additional extension (*.initial; for example, 1014C.tlsv.initial). This backup file remains in the same folder as the *.tlsv file (1014C.tlsv). Any further changes will be made to the *.tlsv file.

Converting a TopSURV file to a Coordinate File

This section describes converting the active TopSURV '1014C.tlsv' database file to the 'Name,N,E,Z,Code' coordinates file format.

1. Click **Save As** on the toolbar. Select the 'Name,N,E,Z,Code' format and enter the name of the created file '1014C.tlsv' (Figure B-36).

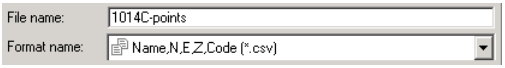


Figure B-36. Select the Coordinate File Format

2. Click **Advanced options**. Enter the parameters required after the conversion (Figure B-37):
   - Select 'Localization' for the *Projection* type.
   - Select the *Linear Unit* for horizontal and vertical positions.

Figure B-37. Select Advance Options

3. Click **Save** to convert the TopSURV file to a coordinate file.

Viewing Converted Files

1. Click **Open** on the toolbar.
2. Select coordinate file format, select the file '1014C_Points.csv', and click **Open**.

The file's content displays in the Topcon Link work area (Figure B-38).

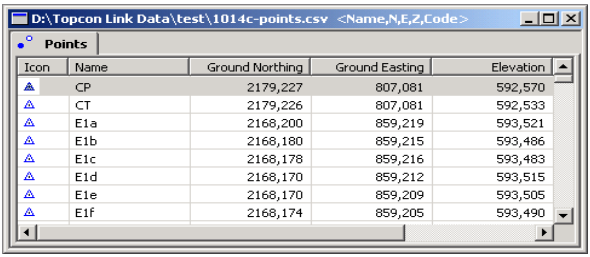


Figure B-38. Converted File's Content

Notes:

Notes:

Topcon Positioning Systems, Inc.
7400 National Drive, Livermore, CA 94551
800·443·4567 www.topcon.com

ISO 9001:2000
FM 68448

TopSURV User's Manual
P/N: 7010-0493 Rev I 02/07 1000