TOPCON

TopSURV

Integrated Controller Software

Reference Manual

TopSURV
Reference Manual

Part Number 7010-0492
Rev. K

©Copyright Topcon Positioning Systems, Inc.
October, 2008

All contents in this manual are copyrighted by Topcon Positioning Systems, Inc. All rights reserved. The information contained herein may not be used, accessed, copied, stored, displayed, sold, modified, published, distributed, or otherwise reproduced without the expressed written consent from Topcon Positioning Systems, Inc.

Table of Contents

Preface xv
Terms and Conditions xv
Manual Conventions xviii

What's New with TopSURV xix

Chapter 1
Introduction 1-1
Security 1-1
Open Job 1-3
Opening Old Jobs 1-4
Main Screen 1-6
Help Icon's Pop-up Menu 1-8
Help 1-8
Activate Modules 1-9
Port Data Logging 1-9
Switch Menus 1-11
About 1-122

Chapter 2
Working with a Job 2-1
Creating a New Job 2-2
Select Survey Configuration 2-3
Coordinate System 2-5
Units 2-6
Display 2-8
Alarms 2-9
Opening a Job 2-10
Deleting a Job 2-11
Viewing Job Information 2-12

Chapter 3

Configuring a Job 3-1
Configuring the Survey 3-2
GPS+ Configuration 3-3
Configuring the Survey 3-4
Base Receiver 3-7
Base PP Setup 3-10
Base Radio 3-11
Base Radio Configuration 3-13
Base Radio Parameters 3-14
Rover Receiver 3-21
Rover PP Setup 3-25
Modem Connection 3-27
Laser Config 3-27
Rover Radio 3-29
Rover Radio Input 3-30
Rover Radio Parameters 3-30
RE-S1 FH915 Repeater 3-31
Output Radio 3-33
Config: Output NMEA 3-33
Config: Beacon 3-34
Config: BR1 3-35
SBAS Setup 3-37
CDGPS Radio 3-38
Config: OmniSTAR 3-38
mmGPS+ Parameters 3-39
Initialization (Occupation) Times 3-40
Survey Parameters 3-41
Point Numbering 3-44
Stake Parameters 3-45
Staked Point Icon 3-47
Advanced 3-48
RTK Settings 3-49
Miscellaneous 3-50
Total Station Configuration 3-51
Configuring the Survey 3-52
Instrument 3-53
Monitor Options 3-55

Connection Mode 3-56
Cable 3-57
Radio 3-58
Mode 3-59
Search/Track 3-60
Survey Parameters 3-62
Edit Prisms 3-66
Stakeout Parameters 3-66
Miscellaneous 3-68
Miscellaneous (Level Survey) 3-70
Setting Coordinate System Parameters 3-72
Projections 3-74
Custom Projections 3-75
From Grid-to-Ground/Ground-to-Grid Transformation 3-78
Compute Rotation 3-81
Compute Azimuth 3-82
Custom Datums 3-83
Geoid List 3-84
Add a Geoid File 3-85
Setting Global Parameters for Job 3-87
Setting Units 3-89
Customizing Data Display 3-89
Setting Alarms 3-90
Modifying Menus 3-9

Chapter 4
Exporting Data 4-1
Exporting To a Job 4-2
Select a Job 4-2
Export To the Job 4-3
Select Point Types To Export 4-4
Select Points to Export 4-5
Select Code 4-6
Select Point List to Export 4-7
Export Status 4-8
Duplicate Objects 4-9
Exporting to Device 4-10

Selecting Port 4-10
Select File To Export 4-11
Exporting to File 4-12
Points and Point Lists 4-13
Topcon Text Custom 4-14
Text Custom Report 4-20
Topcon Text Custom QC 4-22
AutoCAD DXF and AutoCAD Drawing 4-22
ESRI Shape 4-24
TDS Coordinates 4-26
Lines 4-26
Code Library 4-26
Raw Data 4-27
Horizontal Alignments 4-28
Vertical Alignments 4-29
X-Section Sets 4-30
Roads 4-30
X-Section Templates 4-31
Localization 4-32
Scanning Data 4-32
Roads Survey 4-32
Job History 4-32
TINs Data 4-33
Layers 4-34
Multiple 4-34
Exporting GPS Session 4-37

Chapter 5
Importing Data 5-1
Importing From Job 5-2
Select a Job 5-2
Import From the Job 5-3
Select Point Types To Import 5-4
Select Points to Import 5-5
Code 5-6
Select Point List to Import 5-7
Import Status 5-8
Duplicate Objects 5-9

Importing From Device 5-10
Selecting Port 5-11
File Import Directory 5-12
Importing From a File 5-13
Points and Point Lists 5-14
Topcon Text Custom 5-15
AutoCAD DXF and AutoCAD Drawing 5-19
TDS Coordinates 5-21
Lines 5-22
Code Library 5-22
Horizontal Alignments 5-23
Vertical Alignments 5-23
X-Section Sets 5-23
Roads 5-23
X-Section Templates 5-24
Localization 5-25
Scanning Data 5-25
TINs 5-25
Layers 5-26
Multiple Data 5-26

Chapter 6
Editing Job Data 6-1
Points 6-2
Display Settings 6-4
Finding Point by Name 6-4
Finding Point by Code 6-5
Editing a Point 6-6
Edit Point Information 6-6
Layer and Style 6-11
PTL Point 6-12
Photo Note 6-13
Check Points 6-14
Weighted Average 6-14
Codes 6-16
Edit Code 6-17
Edit Attributes 6-19
Edit Layers 6-23

View Objects on the Layer 6-24
Layer Name 6-24
Style Tab 6-24
Objects Tab 6-25
Edit Multiple Layers 6-26
Linework 6-27
Edit Line 6-28
Points in Line 6-28
Layer/Style 6-30
Area 6-30
Edit Area 6-31
Points in Area 6-32
Edit a Layer/Style 6-32
Point Lists 6-33
List of Point Lists 6-33
Edit Point List 6-34
Raw Data 6-36
Edit Raw Data 6-38
Background Images 6-41
Add Image 6-43
Properties 6-44
Sessions 6-45
Session Setup 6-46
Simulation Setup 6-47

Chapter 7
Editing Roads 7-1
Roads 7-2
Edit Road 7-4
Horizontal Alignment 7-5
Edit the Horizontal Alignment 7-6
Add a Line 7-11
Add a Curve 7-12
Add a Spiral 7-13
Intersection Point 7-14
Vertical Alignments 7-16
Add Vertical Alignments 7-17
Edit Vertical Alignments 7-18

Elements 7-18
Vertical Grade 7-22
Edit a Curve 7-23
Long Sections 7-24
Cross Section Templates 7-26
Edit X-Section Template 7-27
Cross Section Segments 7-28
Cross Section Sets 7-29
Edit Cross Section Set 7-30
Cross-Section 7-32
Calculate Road Points 7-33
Centerline Points Parameters 7-34
Right Offset Points Parameters 7-35
Left Offset Point Parameters 7-37

Chapter 8
Setting up GPS 8-1
Starting the Base 8-2
Correct the Base 8-4
Multi Base 8-5
Grid to Ground 8-6
Starting Static Occupation 8-6
Localization 8-8
Add Localization Point 8-10
Localization Details 8-11
GPS+ Survey Status 8-13
Position 8-14
Elevation Mask 8-15
System 8-16
Log History 8-17
Multi Base 8-17
Position Plots 8-18
Properties 8-19
Satellites 8-20
Help Icon Options 8-22
Configure OmniSTAR 8-23
Configure Beacon 8-25
BR-1 Configuration 8-26

Configure Radio 8-27
Configure RE-S1 Repeater 8-32
mmGPS+ Options 8-33
Known Point Initialization 8-34
Initialize mmGPS+ 8-35
Transmitter Data 8-35
Transmitter 8-36
Transmitter Position 8-37
Known Point 8-38
Resection 8-39
Sensor 8-42
Field Calibration 8-43

Chapter 9
GPS Survey 9-1
Topo Survey 9-2
The Topo Menu 9-3
Data 9-7
Offsets 9-9
Line 9-10
Azimuth-Distance-Height 9-12
Laser Configuration 9-13
Grid Setup 9-16
Auto Topo Survey 9-18
Auto Topo 9-19
Data 9-21
Map 9-21
X-Section 9-22
Find Station 9-22
Tape Dimension 9-23

Chapter 10
Setting up TS Survey 10-1
Backsight Survey 10-2
Multi-Point Backsight 10-6
Check Backsight 10-8
Station and Offset 10-8
Set Measurement Mode 10-9

Resection 10-11
Occupation Point 10-11
Resection 3D 10-12
Store Point 10-14
Resection Options 10-15
Remote Benchmarks 10-16
Remote Control 10-18
Rotate 10-20

Chapter 11
Total Station Survey 11-1
Topo 11-2
Sideshot-Direct 11-4
PTL Mode 11-6
Offsets 11-9
Horizontal Angle Offset 11-10
Horizontal/Vertical Angle 11-13
Distance Offset 11-14
Hidden Point 11-16
Two Line Intersection 11-17
Line and Corner 11-18
Line and Offset 11-19
Plane and Corner 11-20
Auto Topo 11-22
Cross-Section 11-25
XSection - Direct 11-26
Find Station 11-27
Tape Dimension 11-29
Reference Line 11-29
Tape Dimension Points 11-30
Missing Line 11-31
Scanning 11-32
Scanning with an Image 11-32
View Scan 11-33
Orientation 11-34
Orientation Results 11-37
Selecting Scan Area 11-38
Interval 11-39

Time Estimate 11-40
Scanning without an Image 11-41
Area 11-42
Scan 11-43
Monitor 11-44
Monitor PointList 11-44
Monitor 11-45

Chapter 12
Digital Level Survey 12-1
Level Run 12-2
DL Level Run 12-3
Display Settings 12-6
Two Peg Test 12-6
Two Peg Test Results 12-8

Chapter 13
Staking out 13-1
Points 13-2
Stakeout Point 13-2
GPS+ Stakeout 13-4
TS Stakeout 13-5
Configure Link 13-7
Store Design Pt/Layer 13-7
Design Offsets 13-8
Store Point 13-9
DL Stakeout 13-12
Stake Point 13-12
Stakeout 13-13
Lines 13-14
GPS+ Stakeout 13-15
TS Stakeout 13-16
Offsets 13-17
Line & Offsets 13-17
Station & Offsets 13-19
GPS+ Stakeout 13-20
Initial Point Name 13-21
TS Stakeout 13-22

Stakeout Intersections & Offsets 13-23
GPS+ Stakeout 13-25
TS Stakeout 13-26
Three Point Curve & Offsets 13-27
Curves & Offsets 13-29
Spiral & Offset 13-30
Digital Terrain Model Stakeout 13-32
Open DTM 13-33
GPS+ Stakeout 13-34
TS Stakeout 13-34
Point in Direction 13-35
GPS+ Stakeout 13-36
TS Stakeout 13-37
Point List 13-38
Stakeout (GPS and TS) 13-40
Select Point for the Stakeout 13-40
Digital Level Stakeout 13-41
DL Stakeout of Elevations 13-42
Curve 13-43
GPS+ Stakeout 13-44
TS Stakeout 13-45
Real Time Road 13-46
GPS+ Stakeout 13-47
TS Stakeout 13-48
Road 13-49
GPS+ Stakeout 13-51
TS Stakeout 13-52
Slope 13-53
GPS+ Stakeout 13-56
TS Stakeout 13-56
Linework 13-58

Chapter 14
COGO Calculations 14-1
Inverse 14-3
Point to Point 14-3
Point to Line 14-7
Point to Points List 14-9

Point in Direction 14-11
Compute the Intersection Point 14-14
Calculator 14-17
Curve Solutions 14-18
Calculating the Parameters of a Curve 14-19
Three-Points Curve 14-22
PI & Tangents 14-24
Radius & Points 14-27
Area 14-29
By Points 14-29
The Hinge Method 14-31
The Line Method 14-34
Corner Angle 14-37
Line Offset 14-39
Station & Offset 14-40
Curve Offset 14-42
Calculating a Road Offset 14-44
Adjusting Points 14-46
Rotate 14-46
Select Points by Range 14-47
Translate 14-48
Scale 14-50
2D Transform 14-51
Point Pair Info 14-53
Traverse Adjustment 14-53
Adjustment Parameters 14-54
Adjustment 14-55
Traverse 14-56
BS Point 14-58

Chapter 15
Viewing Map 15-1
Toolbar 15-2
Select Point 15-3
Properties 15-3
Actions on the Map 15-4

Chapter 16
Switching Instruments 16-1
Observation Mode 16-1

Appendix A
File Formats A-1
Point Coordinate Formats A-1
Text (Custom Format) A-1
FC-4 ..... A-2
FC-5 ..... A-3
GTS-6 ..... A-3
FC-6/GTS-7 ..... A-4
GTS-7 with strings A-4
GT A-5
GT-FIN A-5
MMH360 ..... A-6
DXF A-7
KOF A-7
SHP A-12
Cut Sheet Standard A-13
Cut Sheet User Defined A-13
Check Sheet A-14
PTL Sheet A-15
CMM A-15
Land XML A-15
CR5 ..... A-15
MOSS GENIO A-16
NEZ A-17
NEZ with strings A-17
Custom Format with Quality Control information A-18
Code Libraries A-19
Topcon Data Dictionary Format (TDD) A-19
XML File as Storage of the Code Library (XML) A-20
Data Base Format as Storage of the Code Library (DBF) A-22
Roads Formats A-22
SSS Road A-22
TDS Road A-23

MC Road A-27
LandXML Road A-27
TopSURV Road format v.2.0 ..... A-27
CLIP A-29
ISPOL A-30
MX GENIO A-31
Tekla XRoad & XStreet (VGP) A-33
Horizontal Elements A-33
Vertical Elements A-35
X-sect Templates Formats A-36
SSS Template A-36
TDS X-section Template A-36
TopSurv Template A-37
Localization Format A-38
GC3 ..... A-38
Roads Survey Formats A-38
X-Section Surveys A-38
Find Station Report A-38
Raw Data Formats A-39
FC-5 ..... A-39
GTS-6 ..... A-39
FC-6/GTS-7 ..... A-40
Land XML A-43
TDS RawData A-43
MOSS Survey A-43
Field Book A-44
Berlin GNSS A-46
Scanning Data Format A-46
DI-3000 ..... A-46
Job History A-48
CSV A-48
Report A-48

Index

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 Product. 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® and ActiveSync® are registered trademarks of the 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, THE PRODUCT, AND ANY ACCOMPANYING SOFTWARE 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, THE SOFTWARE, OR THE PRODUCT. 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 PORDUCT.

LICENSE AGREEMENT Use of the Software and any other computer programs or software supplied by TPS or downloaded from a TPS website (the “Software”) to be used with a Topcon Product 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 Product or single computer. You may make one (1) backup copy of the Software. Otherwise, the Software may not be copied or reproduced. 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 Product. 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 the 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 than 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 Product. 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 Agreement, Disclaimer of Warranty and limitation of liability).

SAFETY Improper use of a Topcon Product can lead to injury to persons or property and/or malfunction of the Product. The Product should only be repaired by authorized TPS warranty service centers.

Users should review and heed the safety warnings in the manual accompanying the Product.

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:

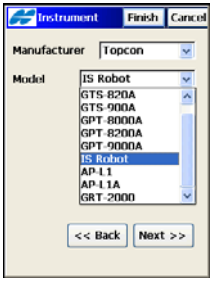
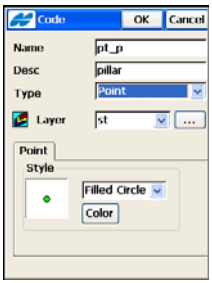
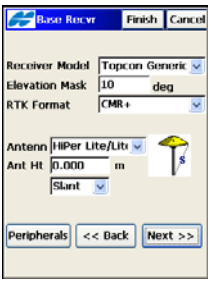
Example	Explanation
File ▸ Exit	tap the File menu and tap Exit.
Enter	Indicates the button or key labeled Enter.
Notes	Indicates a field on a dialog box or screen, or a tab within a dialog box or screen.
Topo	Indicates the name of a dialog box or screen.

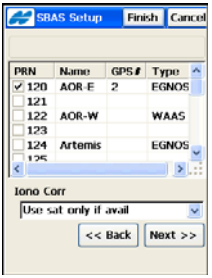
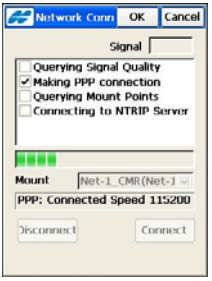
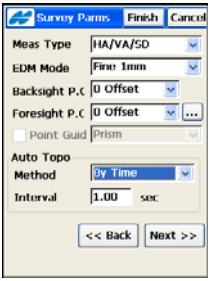
Supplementary information that can help you configure, maintain, or set up a system.

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

What's New with TopSURV

The chapter briefly describes new features and functions for version 7.2 of TopSURV.

IS Robot IS Robot is added to the list of Robotic instruments in the TS configurations. For details on TS configurations, see "Total Station Configuration" on page 3-50.	
Point Line Area Editing of codes is updated to include a Code Style of Point, Line or Area. For details on editing codes, see "Edit Code" on page 6-17.	
Option to Select Receiver Type Option to select receiver type for GPS survey. For details on GPS configurations, see "Base Receiver" on page 3-7.	

SBAS setup Setup of a satellite-based augmentation system is updated. For details on the setup, see "SBAS Setup" on page 3-37.	
Internal CDMA/GPRS Network Connection Now automatic connection is available for internal CDMA and GPRS network connection. For details on network connection, see the *TopSURV User's Manual*.	
Prism Constant Separate BS/FC prism constant is now available for setting. For details on the setting TS survey parameters, see "Survey Parameters" on page 3-41.	
Traverse Adjustment Traverse adjustment of a surveyed traverse is added. For details on traverse adjustment in COGO calculations, see "Traverse Adjustment" on page 14-53.	

Introduction

TopSURV is Topcon's survey software available for hand-held controllers. When installed on a hand-held controller that runs the Windows® CE operating system, such as Topcon's FC-2000, FC-200, FC-2200, FC2500, and the integrated controller of GMS-2 and GMS-2 Pro. TopSURV is used for:

- Field data collection with Topcon GPS receivers, Topcon, Sokkia, Nikon, and Leica total stations, and Topcon digital levels
- Stakeout and control work
- Data conversions
- Advanced COGO

Also, TopSURV 7.2 for Windows PC is available from the Topcon website. It will operate in 'demo' mode, allowing 25 points to be added to a job. To fully activate, a separate license must be purchased.

Security

Upon initial startup, a ***Security*** screen displays (Figure 1-1 on page 1-2).

TopSURV requires an access code to start. Contact a Topcon representative to acquire the necessary codes.

- *Key Value* – the device's number; given to a Topcon representative to receive activation IDs.
- *Activation IDs* – the fields in which to enter the security codes received from a Topcon representative to activate purchased modes: *TS, Contractor, Robotic, GPS+*, *GIS (RT DGPS and PP DGPS)*, *Roads,* and *mmGPS.*

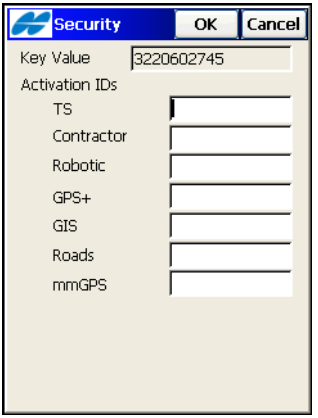


Figure 1-1. Security

NOTICE

If upgrading existing TopSURV to TopSURV 7.2, the updated security key is required to complete the installation of this upgrade. For help in acquiring this security key, contact *topsurv_updates@topcon.com*.

To run a demo version of TopSURV, tap **OK**; a confirmation message displays (Figure 1-2). Tap **OK** to confirm using TopSURV in the Demo Mode.

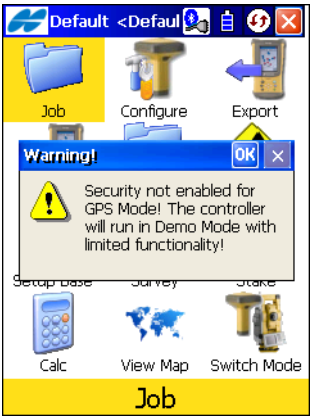


Figure 1-2. Run Demo Mode?

Open Job

Initially, TopSURV opens only a Default job created upon program installation (Figure 1-3). On the ***Open Job*** screen do the following:

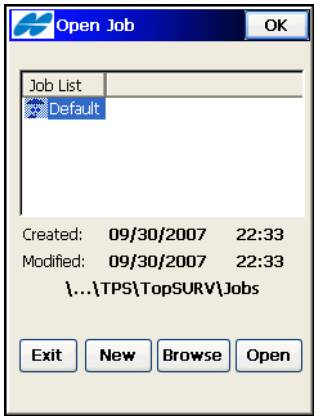


Figure 1-3. Open Job

- **Open –** press to create the Default (current) job and returns to the main screen.
- **New –** press to create a new job.
- **Exit –** press to quit the program.
- **Browse** – press to display browse directories to open a job from a remote directory. Highlight the file and press **OK** (Figure 1-4).

Figure 1-4. Open a New Job

Opening Old Jobs

Starting from Version 7, TopSURV job files are made universal to be compatible on both controllers and personal computers. They have the ***tsj*** extension and need no conversion.

- To open a job created in a previous version of TopSURV, tap **Job ▸ Open Job**, then tap the **Browse** button in the ***Open Job*** screen (Figure 1-3 on page 1-3). Then select the *Ts6 Job Files (*.tsv)* type, navigate to the desired tsv job, highlight it, and press **OK**.

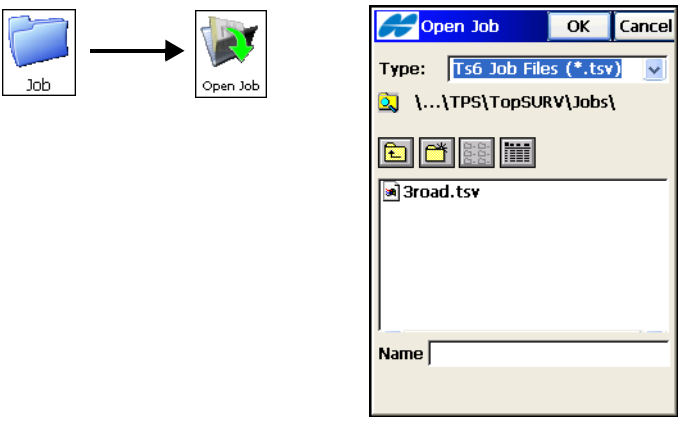


Figure 1-5. Open Job Created in Previous Version of TopSURV

- **OK** – starts upgrading the job.

  The progress bar shows the upgrading in progress.
- **Cancel** – aborts upgrading of software. When the process is complete, the **Cancel** button turns into the **Done** button (Figure 1-6 on page 1-5).
- **Done** – closes the screen and opens the upgraded job.

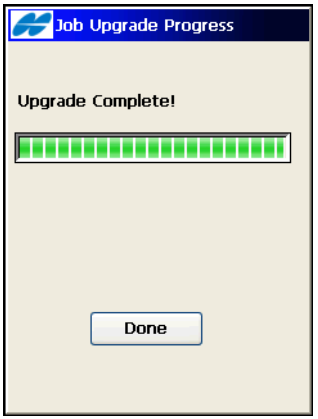


Figure 1-6. Job Upgrade Progression Bar

After pressing the **Done** button, the *.tsv file turns into the *.tsj file and the *Archive* folder is created in the directory, where the *.tsv file was located. This folder stores the tsv jobs.

Also, if the job had job history, a directory called by the same name as the job, is created to store the *.xml file with the job history (Figure 1-7).

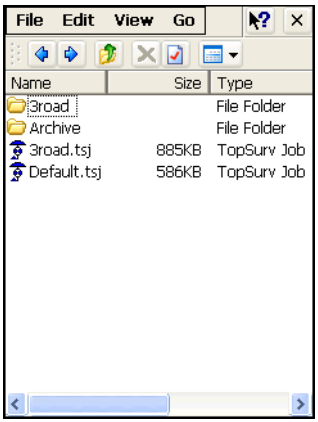


Figure 1-7. Upgraded Jobs

Main Screen

The TopSURV main screen consists of a title bar and a main menu.

Figure 1-8. TopSURV Main Screen

NOTICE

TopSURV has two implementations of the graphical user interface: Icon-based and List-based. By default, TopSURV uses the Icon-based interface for fast and easy program operation.

The title bar of the main menu screen shows the name of the job that is open and the following icons (Table 1-1).

Table 1-1. Title Bar Icons

Icon	Description
	Topcon Logo Help Icon – opens a pop-up menu giving access to the help files and some options specific to the current open screen
	Controller Power Status Icon – shows power status
	Reconnect Icon – reconnects other Bluetooth enabled devices to the controller
	Connection Status Icon – shows connection status
	Exit Icon – closes TopSURV. When in a submenu, it turns into the button to return to the main menu.

Within a menu option, the title bar displays the Help Icon, the name of the open screen, and any system buttons (e.g., **OK**, **Cancel**, **Finish**) required for various operations (Figure 1-4 on page 1-3).

The TopSURV Icon Menu of the main screen contains the following icons to provide access to job configuration, setup, display, and other jobsite functions, and to control data (Table 1-2):

Table 1-2. Main Menu Icons

Icon	Description
	Job – opens a submenu to create, open, delete a job or get information about an active job. For details on the options, see “Working with a Job” on page 2-1.
	Configure – opens a submenu to create or change a configuration for a job. For details on the options, see “Configuring a Job” on page 3-1. The icon changes its appearance and reflects the instrument set for use in the current job.
	Export – opens a submenu to export job data to a new job, controller or a file. For details on the options, see “Exporting Data” on page 4-1.
	Import – opens a submenu to import data from a job, controller or a file. For details on the options, see “Importing Data” on page 5-1.
	Edit Job – opens a submenu to edit the job data. For details on the options, see “Editing Job Data” on page 6-1.
	Edit Roads – opens a submenu to edit roads. For details on the options, see “Editing Roads” on page 7-1.
	Setup Base – is used to set up GPS surveying. For details on the options, see “Setting up GPS” on page 8-1.
	Setup – is used to set up backsight and occupation points to start a Total Station survey. For details on the options, see “Setting up TS Survey” on page 10-1.
	Survey – opens a submenu to conduct a survey. For details on the options, see “GPS Survey” on page 9-1, “Total Station Survey” on page 11-1 and “Digital Level Survey” on page 12-1.

Table 1-2. Main Menu Icons (Continued)

Icon	Description
	Stake – opens a submenu to stake out objects. For details on the options, see “Staking out” on page 13-1.
	COGO – opens a submenu to calculate cogo tasks. For details on the options, see “COGO Calculations” on page 14-1.
	Map – opens the map for the current job. For details on the options, see “Viewing Map” on page 15-1.
	Mode – switches between GPS and Total Station instruments for a survey. For details on the options, see “Switching Instruments” on page 16-1.

Help Icon’s Pop-up Menu

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about TopSURV.

Help

The *Help* option opens the ***TopSURV Help*** topics screen (Figure 1-9).

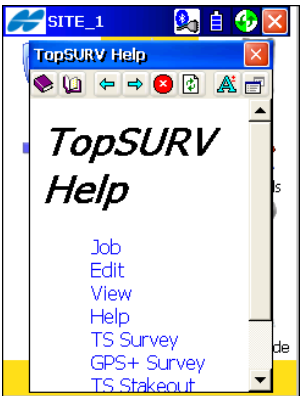


Figure 1-9. Help Topics

Activate Modules

To view or to add the ID's for activating the main features in TopSURV, select the *Activate Module*s option.

The ***Security*** screen (Figure 1-10) displays the following device numbers and the IDs that have been entered.

- **Key Value 1,2** – the default key values of the controller.
- **Activation IDs** – the codes needed to enable observation modes and usage of roads in TopSURV.
- **OK** – saves the ID values, and if allowed, provides access to the observation modes and creating and using roads.

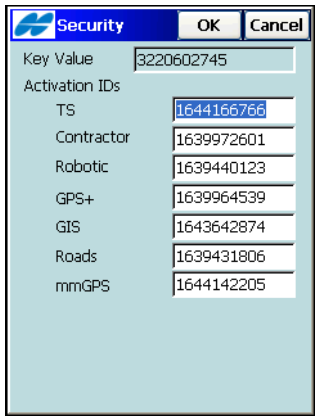


Figure 1-10. Security

Port Data Logging

To view incoming and outgoing traffic information of a controller port connected to TopSURV and to save this data to a file, select the *Port Data Logging* option.

The ***Port Logging*** screen displays (Figure 1-11 on page 1-10) but initially shows no data. Tap the *Help* Icon in the upper-left corner of the screen to view data. The *Help* icon opens a pop-up menu that contains the following options:

- *Show incoming port data* – check mark to view incoming data.
- *Show outgoing port data* – check mark to view outgoing data.

- *Pause logging to screen* – check mark to freeze showing port traffic.
- *Help* – gives access to *Help* files.

Help Icon

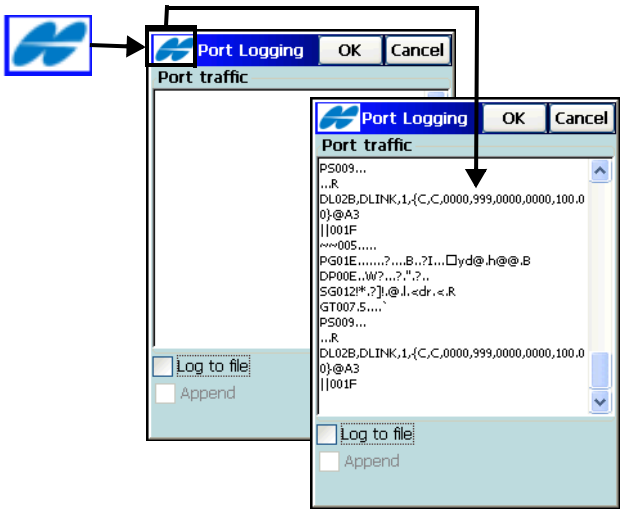


Figure 1-11. Port Logging

- *Log to file* – check mark this box to save the data to a file. The ***Save File*** screen displays (Figure 1-12). Assign a name and select a desired directory in which to save the file on the controller.

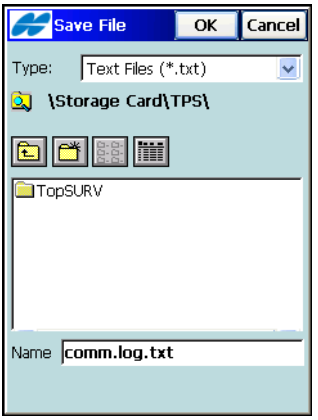


Figure 1-12. Save File

- **OK** – returns to the *Port Logging* screen to view the data being saved to file. The file name is also shown on the screen (Figure 1-13).

Figure 1-13. Logging to File

- *Append* – check mark this box to add new data to the existing file on every start of TopSURV. Press the **OK** button to confirm the operation.

Switch Menus

TopSURV has two implementations of menu interface: the Icon Menu and the List Menu. Use the *Switch Menus* option to toggle between the Icon and List Menu interfaces. TopSURV defaults to the Icon Menu interface (Figure 1-14 on page 1-12).

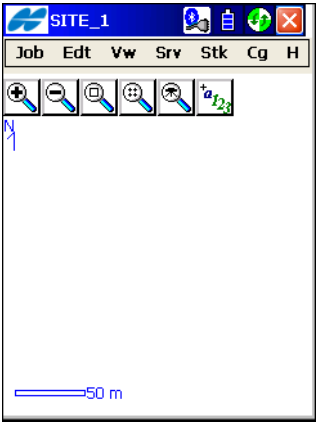


Figure 1-14. List Menu

About

To view basic information about TopSURV, tap the *About* option. The ***About TopSURV*** screen (Figure 1-15) displays the software name, version, copyright, and build date.

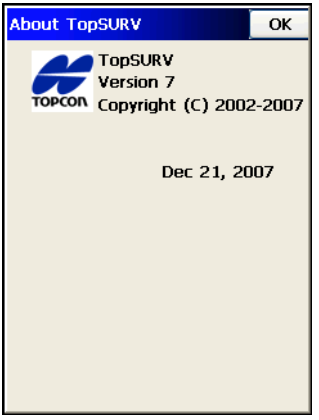


Figure 1-15. About TopSURV

Working with a Job

To work with job files, tap the **Job** icon in the main menu (Figure 2-1)

The **Job** folder contains the following options:

1. New (create) a job
2. Open a job
3. Delete a job
4. Job Information (Print information from an active job)

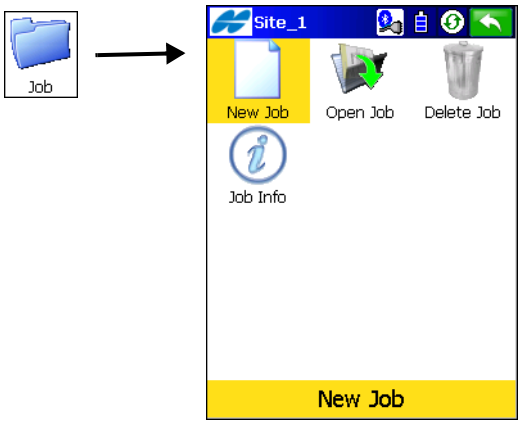


Figure 2-1. Job Menu

If the menu options you need are not visible, tap **Configure/Menus** icons and enable these options in the ***Config Menus*** screen.

The *Help* Icon  opens a pop-up menu, giving access to the Help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see "Help Icon's Pop-up Menu" on page 1-8).

Creating a New Job

To create a new job, tap the **New Job** icon.

The ***New Job*** screen (Figure 2-2) starts the new job creation process, which is performed with the help of a Wizard.

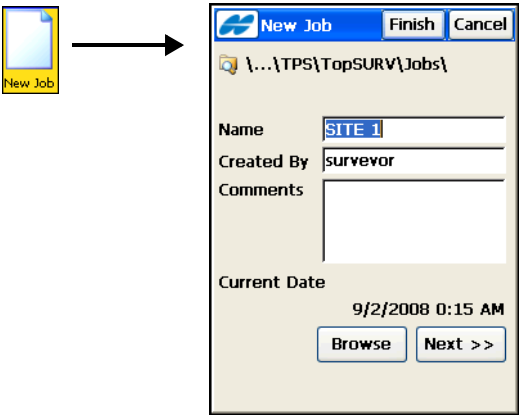


Figure 2-2. New Job

Fill in the fields on the ***New Job*** screen (only the Name is mandatory). On controllers with pop-up soft keyboards, place the cursor in the field to have the soft keyboard open on-screen (Figure 2-3).

Figure 2-3. On-screen Soft Keyboard

- *Name* – the name of the new job.
- *Created By* – the name or some other identifier of the surveyor.
- *Comments* – any additional information about the project, for example, the conditions of survey.
- *Current Date* – displays the current date and time.
- **Browse** – changes the directory in which to look for a job. By default, job files are stored in the Jobs folder in the directory where the application was installed. The path to the job file displays in the upper-part of the screen. The last specified file path is retained.
- **Next** – opens the ***Survey Style*** screen (Figure 2-4).
- **Finish** – saves the information and returns to the main screen. The new job becomes the current job and uses the settings from the previously open job, unless changed.

Select Survey Configuration

On the ***Survey Style*** screen (Figure 2-4 on page 2-3) select a survey configuration for the new job.

Parameters for the survey configuration do not depend on the job. One configuration can be used for several Jobs.

Figure 2-4. Select Survey Configuration

TopSURV contains several pre-defined configurations: *My RTK*, *My Network RTK, My Network DGPS, My RT DGPS, My PP Static*, *My PP Kinematic* and *My PP DGPS* for GPS+ mode; *My Conventional*, *My Reflectorless, My Robotic* and *My Level for TS mode*.

- *GPS+ Config* – shows the GPS+ configuration for the current job. The drop-down list shows the configurations available for the GPS+ mode.
- *TS Config* – shows the total station configuration for the current job. The drop-down list shows the configurations available for the TS mode.
- [...] – opens the ***Configurations*** screen to edit a configuration (see Figure 3-3 on page 3-3 for details).
- **Back** – returns to the previous screen.
- **Next** – opens the ***Coordinate Systems*** screen (Figure 2-5 on page 2-5).
- **Finish** – saves the settings, and returns to the main screen.

The job settings of a survey configuration are applied only after opening a TopSURV screen which can perform and store measurements in the job file.

For more information on how to work with configurations, see “Configuring the Survey” on page 3-2.

Coordinate System

The ***Coordinate System*** screen (Figure 2-5) contains coordinate system information for the new job.

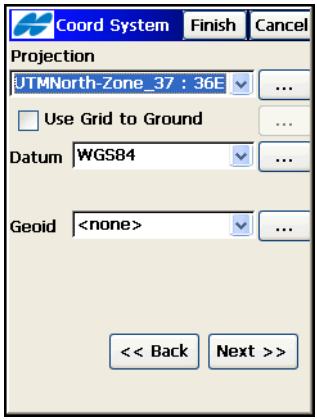


Figure 2-5. Coordinate System

- *Projection* – specifies the projection to be used. The Browse [...] button opens the ***Projections*** screen.
- *Use Grid/Ground* – only available if a grid projection is selected. If this box is check marked, the **Browse** [...] button is activated to open the ***Grid to Ground Param*** screen.
- *Datum* – shows the datum for the selected projection. The drop-down list of datums is available only when the current grid projection allows datum selection. The **Browse** [...] button opens the ***Custom Datum*** screen.
- *Geoid Model* – shows the geoid selected (if any). The **Browse** [...] button opens the ***Geoids List*** screen (see "Geoid List" on page 3-84).
- **Back** – returns to the previous screen.
- **Next** – opens the ***Units*** screen (Figure 2-6 on page 2-6).
- **Finish** – saves the settings and returns to the main screen.

See "Setting Coordinate System Parameters" on page 3-72 for more information.

Units

On the ***Units*** screen, the default units that are used in the job display. Set the following measurement units (Figure 2-6).

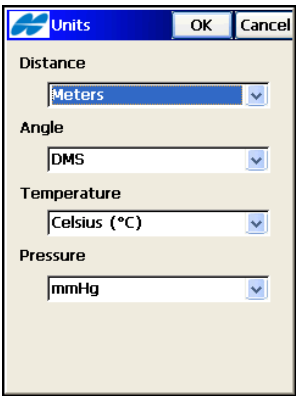


Figure 2-6. Units

- *Distance* – units of linear measurements; select either *Meters*, *IFeet* (International Feet, 1 Ifoot = 0.3048 Meters), *US Feet* (1 USFt = 1200/3937 Meters); *IFeet and Inches,* or *US Feet* and inches formula).

If the selected units are *US Feet*, linear values can be entered as meters, or international feet by appending “m” or “if” to the entered value.

If the selected units are in meters, then a linear value in *US Feet* or *International Feet* is entered by appending “f”or “if” to the end of the entered value.

If the selected units are in *International Feet*, enter linear values in meters or USfeet by appending “m”or “f” to the entered value. The appended characters “m”, “f”, or “if” are not case insensitive. You can also enter “M”, “F”, or “IF”.

If the selected units are US or International *Feet and Inches*, you can enter feet and inches in the following formats:

- feet.inches.fracNumerator.fracDenominator (displays as the next format)

- feet'inches''fracNumerator/fracDenominator

(where the fracDenominator can be either 2, 4, 8, or 16)

- *Angle* – units of angle measurements and parameters; select either *DMS (degrees, minutes, seconds)*, *Grads (Gons), Radians* (for Cogo use only), or *Mils* (for Cogo use only). *(*360 degrees = 400 grads = 2π radians = 6400 mils.)

Azimuth and distances can be entered as two points separated by "-", "," or ";". Certain angles can be entered as three points separated by "-", "," or ";". For instance, a value of 100-101 indicates the Azimuth or Distance from Point 100 to Point 101.

- *Temperature* (for TS mode only) – units of temperature, used only for the raw measurements; select either *Celsius (C)* or *Fahrenheit (F)*.
- *Pressure* (for TS mode only) – units of atmosphere pressure, used only for the raw measurements: *mmHg*, *hPa, inHg,* or *bbar.*
- **Back** – returns to the previous screen.
- **Next** – opens the ***Display*** screen (Figure 2-7 on page 2-8).
- **Finish** – saves the settings, and returns to the main screen.
- **Cancel** – closes the screen without saving the settings.

Display

The ***Display*** screen (Figure 2-7) customizes the software interface. Set the following parameters and press **OK** to save the settings.

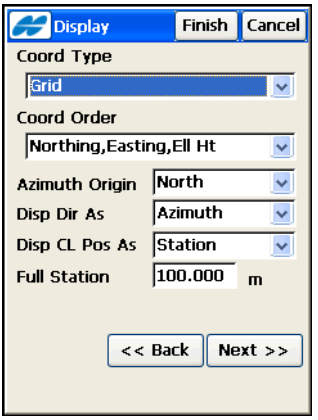


Figure 2-7. Display

- *Coord Type* – selects the coordinate type for the coordinate system selected.
- *Coord Order* – selects the *Northing/Easting* order and displays the height type for the coordinate system selected.
- *Azimuth Origin* – selects the reference direction of azimuth.
- *Disp Dir As* – selects whether to display the direction as *bearing* or *azimuth*.
- *Disp CL Pos As* – selects how to display the position on the center line; select either station or chainage.
- *Full Station* – available if *Station* is selected for *Disp CL Pos As*; sets the measurement units used for the full station value and is usually 100 units.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Alarms*** screen (see Figure 2-8).
- **Finish** – saves the settings, and returns to the main screen.

Alarms

The ***Alarms*** screen sets sound alerts for situations of low power, low memory, poor radio link, and loss of fixed/float solutions. These alarms may occur for the controller, GPS+ receiver, or Total Station.

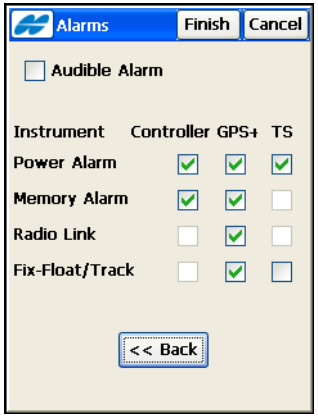


Figure 2-8. Alarms

- *Audible Alarm* – check mark this box to automatically sound an alert when an alert situation occurs. Check mark available boxes to select alerts for various instruments and situations: low power, memory limited, loosing/gaining radio link, or fixed solution with GPS receiver, or tracking with Robotic Total Station.
- **Back** – returns to the previous screen.
- **Finish** – saves the settings and returns to the main screen.
- **Cancel** – closes the screen without saving the settings.

Opening a Job

To open a job, tap the **Open Job** icon. The ***Open Job*** screen (Figure 2-9) displays. Select a job from the list or create a new one.

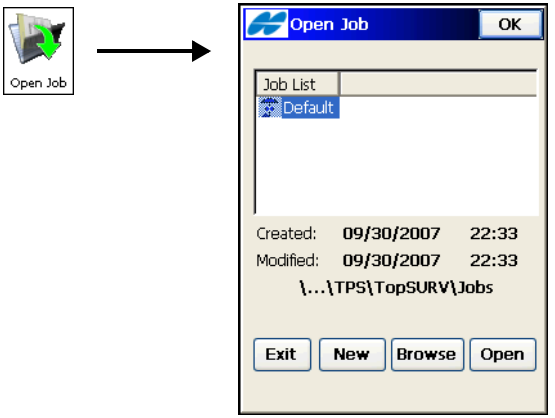


Figure 2-9. Open Job

The *Job List* field contains the names of all existing jobs created/ opened using TopSURV. Initially, the *Job List* contains only a Default job created upon TopSURV installation. The icon indicates a TopSURV job.

When a job is selected from the list, the *Created* and *Modified* fields shows the date that the job was created and when it was last modified.

The path below the Job List shows the directory where the selected job is located (Figure 2-10 on page 2-11).

- **Open** – opens a new job and returns to the main screen.

Make sure you select the appropriate Instrument Type to correctly show the name of the opened job in the title bar. Use the *Switch Mode* Icon to select.

- **Browse** – displays the screen to browse directories to select a job to open. Use the standard navigation buttons to move up or down to the directory where the desired file resides. Highlight the file and press **OK**.

Figure 2-10. Browse Jobs

The job files created in TopSURV have the ".tsjob" extension.

To see the job files created in an earlier version of TopSURV, select the Ts6 Job Files (*.tsv) or All Files (*.*) type.

Deleting a Job

To delete a job, tap the **Delete Job** icon. Once deleted from the Job List, the file is deleted from the controller (Figure 2-11 on page 2-12).

When a job is selected from the list, the *Created* and *Modified* fields reflect when the job was created and last modified.

- The path under the Job List displays the directory where the selected job was created.
- **Browse** – if a job is not listed in the job list, browse through the directories to select the job you want to delete.
- **Delete** – deletes the job.
- **Close** – closes the screen.

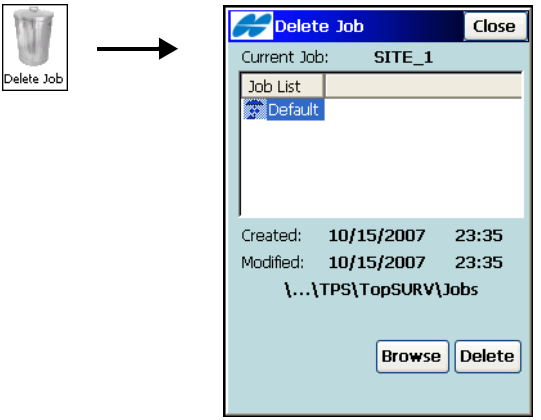


Figure 2-11. Delete Job

NOTICE

When a job is deleted, the job history file, images, etc., are also deleted.

Viewing Job Information

To view job information, tap the **Job Info** icon. The ***Job Info*** screen contains information about the current job (Figure 2-12).

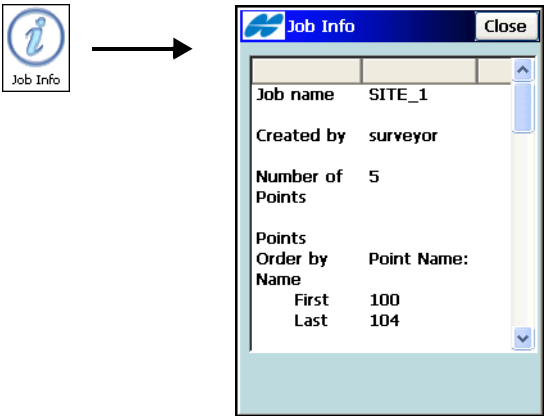


Figure 2-12. Job Information

- *Job name* – the name of the job.
- *Created by* – the name or some other identifier of the surveyor.
- *Number of Points* – the amount of points stored in the job.
- *Points* – the names of the first point and the last point from the list of the points ordered by name.
- *Job size on disk* – the space that the job takes up on the disk.
- *Job created* – the time and date of job creation.
- *Job modified* – the time and date of job modification.
- *Survey Configurations* – the GPS and TS configurations set for the job.
- *Coordinate Systems, Datum, Geoid Model* – the coordinate system, datum, and geoid model defined for the job.
- *Units of Measurements* – the units set for the job.
- *Display Settings* – the customized interface settings for the job.
- *OAF expire on* – the date of OAF expiration for a given GPS receiver. Tap **Clk to expand** under the date to display the Current, Purchased, and Leased status for all OAF options (Figure 2-13 on page 2-14).

- *Firmware version* – lists the number and build date of the firmware loaded into the GPS receiver.

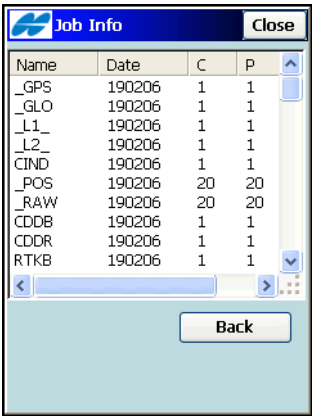


Figure 2-13. Job Info – OAF

Configuring a Job

To set up a job, tap the **Configure** icon in the main menu. The icon reflects the instrument used in survey. The **Configure** menu (Figure 3-1) includes options to:

1. Create or edit a survey configuration.
2. Set a coordinate system for a job.
3. Log job history to a file, and set global parameters.
4. Set default units to be used in a job.
5. Customize the interface to display data in a job.
6. Set alarm parameters.
7. Show/hide functions in the menus.

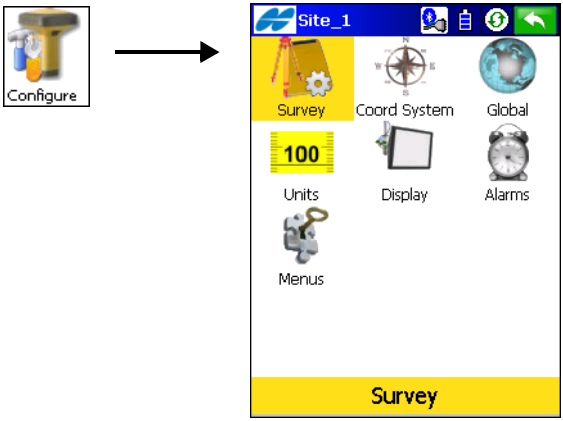


Figure 3-1. Configure Menu

The *Help* Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for details see “Help Icon’s Pop-up Menu” on page 1-8).

Configuring the Survey

To configure a survey, tap the **Survey** icon or use the New Job Wizard (see "Creating a New Job" on page 2-2). The ***Survey Style*** screen displays (Figure 3-2).

- *GPS+ Config* – shows the GPS+ configuration for the current job. The following configurations for GPS+ mode are available from the drop-down list: *My RTK*, *My Network RTK, My Network DGPS, My RT DGPS, My PP Static*, *My PP Kinematic,* and *My PP DGPS.*
- *TS Config* – shows the total station configuration for the current job. The following configurations for TS mode are available from the drop-down list: *My Conventional*, *My Reflectorless, My Robotic,* and *My Level*. In the Contractor Module, only *My Conventional* and *My Reflectorless* are available.
- The **List** [...] button **–** opens the ***Configurations*** screen to edit parameters for the each configuration.
- **OK –** sets the selected configuration for the current job and returns to the main screen.

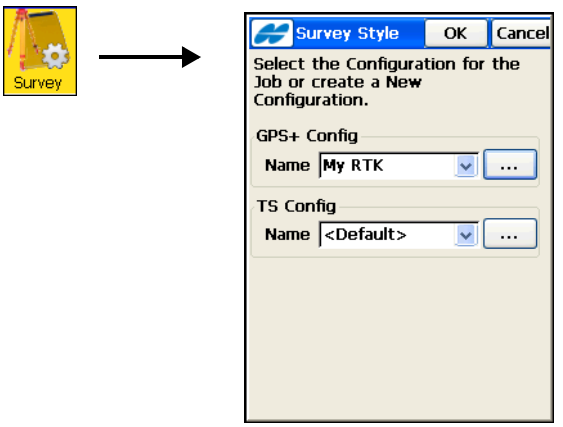


Figure 3-2. Survey Style

Configurations are stored in a file called *Styles.tsstyles* in the TopSURV directory.

The job settings of a survey configuration are applied only after opening a TopSURV screen, which enables you to perform and store measurements in the job file.

GPS+ Configuration

To configure a GPS+ survey, press the **List** ... button in the *GPS+ Config* field of the ***Survey Style*** screen (Figure 3-3). On the ***Configurations*** screen, a new configuration is performed with the help of a Wizard.

The ***Configurations*** screen (Figure 3-3) contains a list of pre-defined configurations. Either edit an existing configuration or create a new configuration.

- **Delete** – deletes the highlighted configuration.
- **Edit** – opens the ***Survey*** screen to edit the configuration settings.
- **Add** – opens the ***Survey*** screen to create a new configuration.
- **OK** – saves configuration settings and returns to the ***Survey Style*** screen.

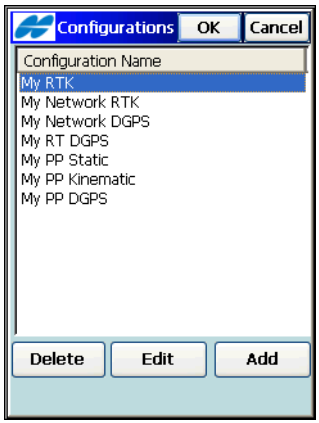


Figure 3-3. GPS+ Configurations

Configuring the Survey

The ***Srv*** screen (Figure 3-4 on page 3-6) contains general settings for the configuration.

- *Name* – the name of the configuration that is displayed in the ***Configurations*** screen (Figure 3-3 on page 3-3).
- *Type* – the type of configuration; select either *RTK*, *Network RTK*, *Network DGPS, Real Time DGPS*, *PP Static*, *PP Kinematic*, or *PP DGPS*. ("PP" means Post-Processing.)
  - RTK (Real Time Kinematic): implies, first, a pair of receivers operating simultaneously and, secondly, a radio link has been established between the two receivers. From a functional point of view, the two receivers differ from each other. One of the receivers (usually referred to as the Base Receiver) is located at a fixed point with known coordinates. The Base receiver collects carrier measurements, generates RTK corrections, and sends this data to the other receiver (usually referred to as the Rover Receiver) via a radio link. To establish proper connection between the two receivers, specify necessary communication parameters first. The Rover processes this transmitted data with its own carrier phase observations to compute its relative position with centimeter accuracy.

    A mmGPS aided RTK survey uses the usual RTK GPS+ survey system, but with a wireless PZS-1 sensor at the Rover to pick up the signal from the PZL-1 transmitter for (millimeter) accurate elevations.
  - Network RTK (Network Real Time Kinematic): implies that the Rover uses RTK correction data received from operating reference station networks to compute its position.
  - Real Time DGPS (Real Time Differential GPS): implies that the Rover uses differential pseudorange correction data transmitted from DGPS services.
  - Network DGPS (Network Differential GPS): implies the usage of pseudorange corrections received from operating differential GPS reference station networks.

  - PP Static (Static Post Processing): implies two receivers that collect data at stationary locations during a long period of time. In the office, the software operator processes the GPS data collected in the field (usually “differential processing”), and calculates the relative position of the receivers. Differential processing takes place when data from two or more receivers are processed together in order to compute the ‘receivers’ relative position. If the coordinates of one receiver are known, then the coordinates of the other can be calculated.
  - PP Kinematic (Kinematic Post Processing): implies two receivers. One is fixed, the other is moving along some trajectory. The processing of the collected data is performed later, the same as it is for the PP Static type.
  - PP DGPS (Post Processing Differential GPS): implies that the raw observations made by the Rover and the Base receiver has to be written to files for further processing.

- *Post Processing* – check mark this box for additional screens to become available for post processing options in *RTK*, *Network RTK, RT DGPS*, and *Network DGPS* (see Figure 3-9 on page 3-11, Figure 3-24 on page 3-26, and on page 3-41).
- *mmGPS+* – available only in a RTK configuration, check mark this box to enable a mmGPS aided RTK survey.
- *Simulation mode* – check mark this box to run TopSURV GPS mode in a GPS simulation mode. When the mode is selected, the *Simulation Setup* icon appears on the Edit Job menu (see “Simulation Setup” on page 6-47).
- *Corrections* – available only in a Network RTK (select either *VRS, FKP, Single Base* or *External Config)*, *Network DGPS*, or *Real Time DGPS* configuration (select the service to receive differential correction data (either a *User Base, Beacon, SBAS, CDGPS, OmniSTAR-VBS,* or *OmniSTAR-HP*, (Figure 3-4).

NOTICE

To use the differential corrections receiver BR-1, select the Beacon differential service.

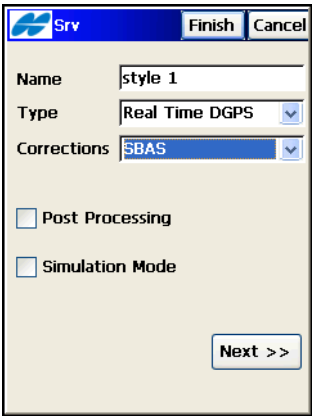


Figure 3-4. Survey - Real Time DGPS

The *Help* Icon on the upper-left corner of the ***Srv*** screen (Figure 3-5) displays a pop-up menu that contains the *Help* item to access the Help files.

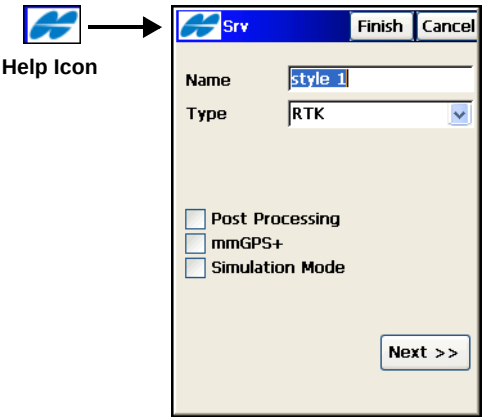


Figure 3-5. Survey – RTK Parameters

- **Next** – opens the ***Base Recvr*** screen (Figure 3-6 on page 3-7).

  For *Network RTK, Network DGPS,* and *Real Time DGPS* (except User Based mode) without the post processing option, the ***Rover Receiver*** screen displays (see Figure 3-20 on page 3-22). If a PP Static survey type is selected, the ***Static Recvr*** screen opens (see Figure 3-8 on page 3-9).

Base Receiver

The ***Base Receiver*** screen contains Base settings.

For RTK and RT DGPS (with a User Base) surveys, the ***Base Recvr*** screen contains the following parameters for configuring a Base receiver and antenna (Figure 3-6).

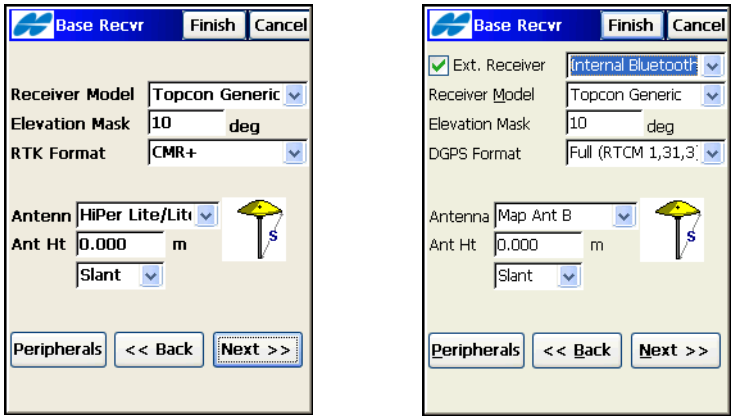


Figure 3-6. Base Receiver

NOTICE

TopSURV 7.2 on the GMS-2 allows the selection of an external receiver with connection mode: cable, external, or internal Bluetooth Module (Figure 3-6).

- *Receiver Model* – the model of the Topcon receiver being used for survey. Select either *GR-3, GMS-2/GMS-2 Pro, GMS X, NET G3,* or *Topcon Generic* for any other Topcon receiver.
- *Elevation Mask* – data from satellites below this elevation are not used.

- *RTK Format / DGPS Format* – the format of the Base receiver corrections transmitted to the Rover.
- *Ant Type* – the type of the Topcon antenna being used for survey. Select either *CR-3*, *CR-3 with Cone*, *CR-3 with SCIGN, CR-4*, *CR-4 RD*, *CR-4 with cone, CR-G3, CR-G3 (TPSH), G3-A1, G3-A1 with ground plane, G3-A1 with ground plane RD, GMS-2, GR-3, HiPer Ga/Gb, HiPer GD/GGD*, *HiPer Lite/Lite+*, *HiPer Pro*, *HiPerXT, HiPer+*, *Legant 2*, *Legant E*, *Legant L1*, *Legant3 with UHF*, *MapAnt B*, *MG-A1*, *MG-A2*, *MG-A5, MG-B5, Odyssey*, *PG-A1*, *PG-A1 with ground plane, PG-A1 with ground plane RD, PG-A2*, *PG-A5, Regant-DD*, *Regant-SD*, *Regency-DD*, *Regency-SD*, or *Unknown*.
- *Ant Ht* – the height of the antenna, and the type of antenna height measurement; either *Vertical* (measured to *ARP*, antenna reference point) or *Slant* (measured to the edge of the antenna). The screen also illustrates the measurement type.
- **Peripherals** – if needed, check and enable the *Multiple Ports* option to configure the Base to transmit data from different ports used for peripherals (Figure 3-7).

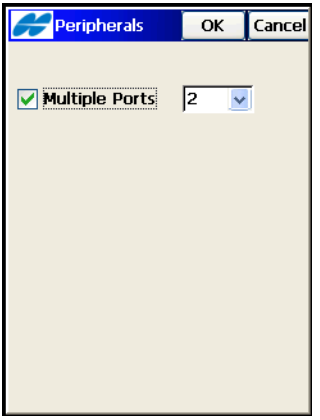


Figure 3-7. Peripherals

- **Back** – returns to the previous screen.

- **Next** – opens the ***Base Radio*** screen (Figure 3-10 on page 3-12). For PP enabled RTK survey the Next button opens the ***Base PP Setup*** screen (Figure 3-9 on page 3-11).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen.
- **Cancel** – closes the screen without saving the settings.

The *Help* Icon in the upper-left corner of the ***Base Receiver*** screen displays the pop-up menu that contains three options:

- *Receiver Setting* – check mark the box on the ***Receiver Settings*** screen appear to turn the charger mode off.
- *Use relative calibrations* – select the option if needed to use Relative antenna model at the base station that transmits CMR+ data. By default, TopSURV 7.2 uses Absolute calibration offsets for antennas. Also, you can select this option when editing the base.
- *Help* – to access the Help files.

For PP Static, or PP Kinematic, and PP DGPS surveys, the ***Static Recvr*** screen (Figure 3-8) contains the same parameter fields as for *RTK* survey type, except for the *RTK Format* field.

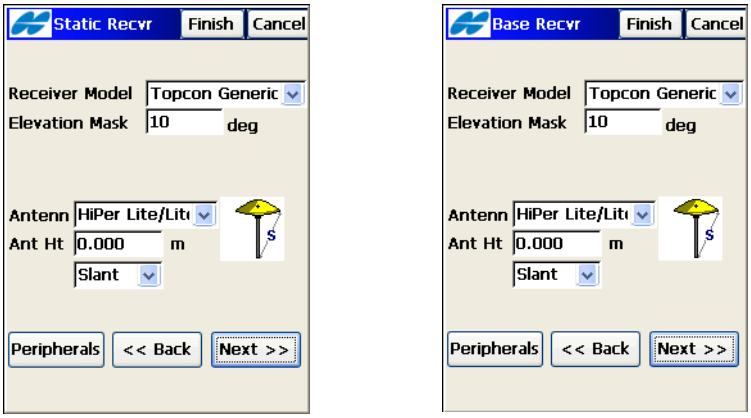


Figure 3-8. Static (Base) Receiver Settings

The Help Icon in the upper-left corner of the ***Static (Base) Recvr*** screen displays a pop-up menu containing two items:

- *Receiver Setting* – check mark the box on the ***Receiver Settings*** screen to turn the charger mode off.
- *Help* – accesses the Help files.
- **Next** – opens the ***Base PP Setup*** screen.

Base PP Setup

On the Base PP Setup screen raw data logging parameters for the base are set up (Figure 3-9 on page 3-11).

- *Raw Data Logging* – set raw data logging parameters:
  - File Name: select a file name.
  - Log To: select if the name of the receiver file is automatically set or user-defined (the corresponding dialog box is displayed at the logging start).
  - Logging Rate: enter a logging rate.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Base Radio*** screen (Figure 3-10 on page 3-12).
- **Cancel** – closes the screen without saving the settings.
- **Finish** – saves the settings and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2).

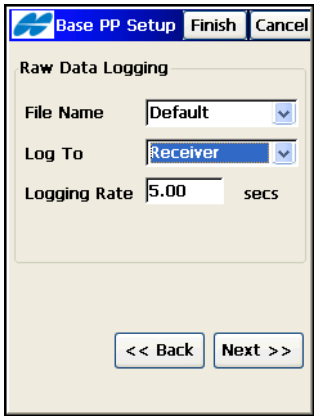


Figure 3-9. Base PP Setup

NOTICE

Raw data always records into the receiver memory. TopSURV allows logging data to the controller when in PP DGPS survey mode only.

Base Radio

The ***Base Radio*** screen (Figure 3-10 on page 3-12) contains the settings for configuring the radio modem connected to the Base receiver for RTK and RT DGPS (user base) surveys.

- *Radio Modem* – select a modem type from the list of pre-defined modem types; contents, will vary, depending upon the job configuration selected.
- *Receiver Port Connected to Radio* – contains parameters for the connection port (i.e., *Port, Parity, Data, Baud, Stop*), which are specific to the connected modem. For example, Siemens cell phones need a 19200 baud rate.

  Internal GR-3 FH915+, *Internal HiPer Lite*, and *Internal HiPer Lite+ FH915+* modems require a 57600 baud rate.
- **Defaults** – returns all the values in the *Receiver Port Connected to Radio* fields to the default value.
- **Back** – returns to the previous screen.

- **Next** – opens the ***Base Radio*** screen to set parameters for the chosen modem (Figure 3-10 and Figure 3-11 on page 3-13).

  AirLink GPRS, AirLink CDMA, AirLink CDPD[1]*, CDMA2000, Generic, Sierra Wireless MP200 CDPD, Internal HiPer Pro* radios do not require additional settings.

- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2).

  All settings are transmitted only when using the configuration.

- **Cancel** – closes the screen without saving the settings.

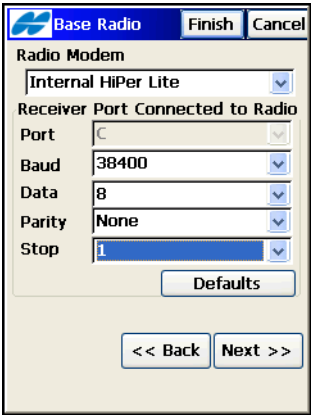


Figure 3-10. Base Radio Parameters

If Multiple Ports are set for peripherals (Figure 3-5 on page 3-6), several ***Base Radio*** screens display to configure the radio for data output, depending on the job configuration (Figure 3-11 on page 3-13).

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.

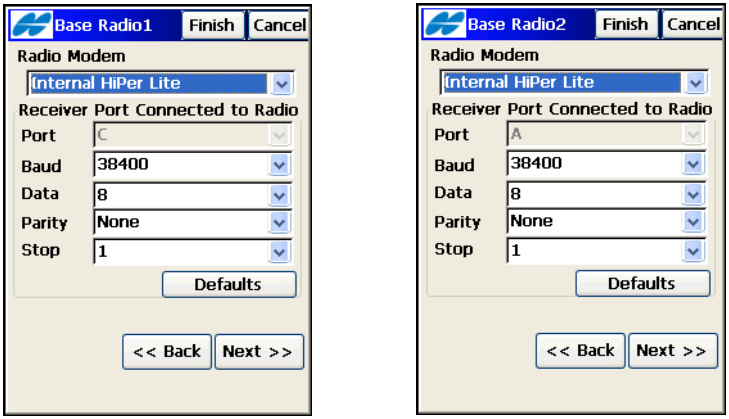


Figure 3-11. Base Radio Output

Base Radio Configuration

Depending on the radio modem selected, one of the following screens display after pressing **Next** on the ***Base Radio*** screen (Figure 3-10 on page 3-12).

- For Cell Phone Modems – *Internal HiPerXT (GSM), Internal HiPer (GSM), Internal GR-3(GSM), Internal GR-3 Satel(GSM), Motorola V60 Cell Phone, Motorola V710 Cell Phone, MultiTech GSM/GPRS Modem, Siemens TC35 Modem, Siemens M20 Modem, Nextel i58sr Cell Phone, Nokia Cell Phone and Wavecom Fastrack GSM.* The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-12 on page 3-15).
- For Digital UHF Modems – *Internal GR-3 Digital UHF, Internal HiPer Digital UHF, TRL-2* and *TRL-35 External Digital UHF.* The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-13 on page 3-16).
- For UHF Modems – *Internal HiPerXT (UHF).* The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-14 on page 3-17).

- For FH915 Modem – *Internal Hiper Lite*. The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-15 on page 3-17).
- For FH915Plus Modem – *Internal Hiper Lite+ FH915 Plus, Internal GR-3 FH915 Plus* and *RE-S1 modem*. The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-16 on page 3-18).
- For Pacific Crest and Internal HiPer (Pac Crest) Radio Modem. The **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-17 on page 3-19).
- For Satel modems, the **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-18 on page 3-20).
- For AirLink CDMA, Multicast UDP, the **Next** button on the ***Base Radio*** screen opens the ***Base Radio Parameters*** screen (see Figure 3-19 on page 3-20).

Base Radio Parameters

The ***Base Radio Parameters*** screen contains the following parameter settings for the radio:

For the cell phone the screen contains the following parameters (Figure 3-12 on page 3-15):

- *Base Pin* – a PIN number for a cell phone.
- **Back –** returns to the previous screen.
- **Next** – opens the ***Rover Receiver*** screen (if the selected modem type does not require additional settings).
- **Finish** – saves the change and returns to the ***Base Radio*** screen.

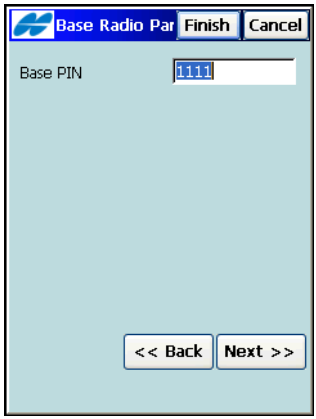


Figure 3-12. Base Cell Phone Parameters

For a Digital UHF Modem: Internal GR-3 Digital UHF, Internal HiPer Digital UHF, TRL-2 and TRL-35 External Digital UHF the screen contains the following parameters (Figure 3-13 on page 3-16):

- *Protocol* – sets the following protocol for data transmission:
  - Simplex: ArWest's proprietary protocol. Only works with other ArWest (Digital UHF) radios.
  - TRMB: works with Trimble Trim Talk and Trim Mark Radios.
  - PDL: works with existing PDL radios and Hiper XTs set in PDL mode.
- *Modulation* – selects a modulation type for the base radio-modem; select either *DBPSK (Differential Binary Phase Shift Keying)* if using the Simplex protocol or *GMSK (Gaussian Minimum Shift Keying)* if using Trimble or PDL.
- **Back –** returns to the previous screen.

- **Next** – opens the ***Rover Receiver*** screen (if the selected modem type does not require additional settings).

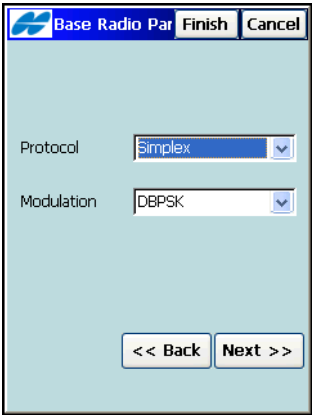


Figure 3-13. Parameters for Digital UHF Modems

For UHF Modems: the Internal HiPerXT (UHF) and Internal MapHP (UHF) the screen contains the following parameters (Figure 3-14 on page 3-17):

- *Protocol* – selects the protocol for data transmission: either *TPS*, *Topcon FSCS* mode to scan for the best channel on which to communicate or *PDL* to communicate with the Rover PDK radio.
- *Channel* – selects a dedicated channel for the PDL protocol.
- *Power* – selects the level of power for RF transmissions: either *1W* or *2W*.

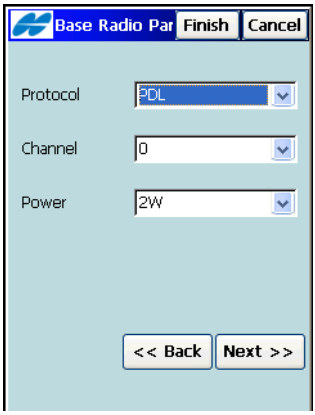


Figure 3-14. UHF Modem

For the FH915 Modem: Internal HiPer Lite the screen sets the operating channel for the modem (Figure 3-15).

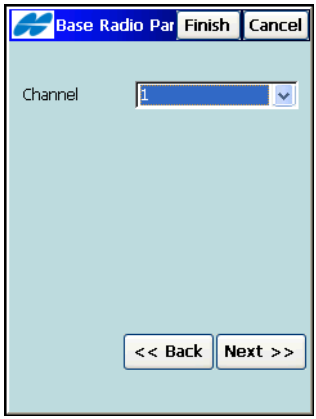


Figure 3-15. Parameters for the FH915 Modem

For FH 915Plus Modems: the Internal Hiper Lite+ FH915Plus, the Internal GR-3 FH915Plus and RE-S1 radios the screen contains the following parameters (Figure 3-16 on page 3-18):

- *Location* – selects the territory (North America, Australia, or New Zealand) to adjust the frequency range and RF power level for the modem.

- *Protocol* – selects the operation protocol: either FH915 Ext, recommended if all receivers on the jobsite are equipped with FH915Plus radios only, or FH915: recommended if there is a mixture of receivers with FH915 and FH915Plus radios on the jobsite.
- *Channel* – selects the operating channel.

Figure 3-16. Parameters for FH915+ Modems

For Pacific Crest and Internal HiPer (Pac Crest) Radio Modem

the screen contains the following parameters (Figure 3-17 on page 3-19):

- *Channel* – selects the operating channel to the radio modem.
- *Sensitivity* – selects the sensitivity level for the radio modem; either *low*, *moderate*, *high*, or *off*.

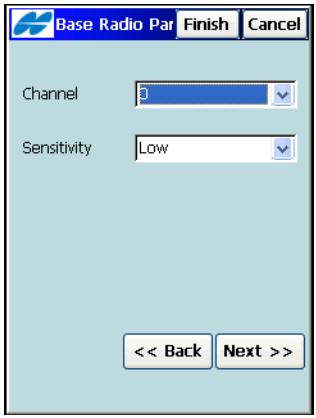


Figure 3-17. Pacific Crest Radio Parameters

For Satel Radio modems the screen contains the following parameters (Figure 3-18 on page 3-20):

- *Model* – select the model of the radio.
- *Channel* – select the channel of the radio.
- *Frequency* – shows the frequency of the radio.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Rover Receiver*** screen (Figure 3-20 on page 3-22).
- **Finish** – saves changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.

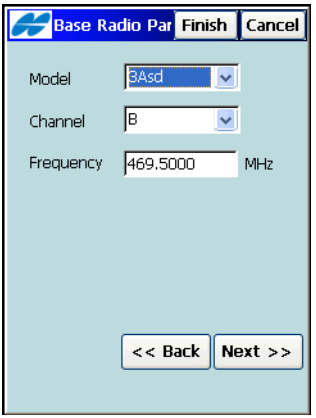


Figure 3-18. Satel Radio Parameters

For Airlink Multicast CDMA (Multicast UDP) the screen contains the following parameters (Figure 3-19):

- *Address to Add* – the field for IP address input
- *IP Addresses list* – displays all available IP addresses

Figure 3-19. Base Multicast Parameters

- **Delete** – deletes the highlighted IP address.
- **Add** – adds a new address from the *Address to Add* field to the list of IP addresses below.
- **Back** – returns to the previous screen.

- **Next** – opens the ***Rover Receiver*** screen (Figure 3-20 on page 3-22). For PP enabled surveys, the ***Rover PP Setup*** screen displays first (Figure 3-24 on page 3-26). In the PP Static case, the ***Occupation Times*** screen is opened (Figure 3-41 on page 3-41).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.

The *Help* Icon in the upper-left corner of the ***Base Radio Parameters*** screens displays the pop-up menu containing the *Help* item to access the Help files.

Rover Receiver

The ***Rover Recvr*** screen contains Rover settings (Figure 3-20 on page 3-22).

For RTK surveys, the screen contains the following parameters (Figure 3-20 on page 3-22) for configuring a Rover receiver and antenna.

- *Receiver Model* – the model of the Topcon receiver being used for survey. Select either *GR-3, GMS-2/GMS-2 Pro, GMS X, NET G3,* or *Topcon Generic* for any other Topcon receiver.
- *Elevation Mask* – data from satellites below this elevation are not used.
- *RTK Format* – the format of the corrections received from the Base.
- *Ant Type* – the type of the Topcon antenna being used for survey. Select either *CR-3*, *CR-3 with Cone*, *CR-3 with SCIGN, CR-4*, *CR-4 RD*, *CR-4 with cone, CR-G3, CR-G3 (TPSH), G3-A1, G3-A1 with ground plane, G3-A1 with ground plane RD, GMS-2, GR-3, HiPer Ga/Gb, HiPer GD/GGD*, *HiPer Lite/Lite+*, *HiPer Pro*, *HiPerXT, HiPer+*, *Legant 2*, *Legant E*, *Legant L1*, *Legant3 with UHF*, *MapAnt B*, *MG-A1*, *MG-A2*, *MG-A5, MG-B5, Odyssey*, *PG-A1*, *PG-A1 with ground plane, PG-A1 with ground plane RD, PG-A2*, *PG-A5, Regant-DD*, *Regant-SD*, *Regency-DD*, *Regency-SD*, or *Unknown*.

- *Ant Ht* – the height of the antenna, and the type of antenna height measurement; either *Vertical* (measured to *ARP*, antenna reference point) or *Slant* (measured to the edge of the antenna). The screen also illustrates the measurement type.

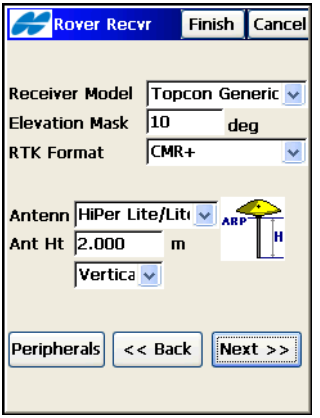


Figure 3-20. Rover Receiver

- **Back** – returns to the previous screen.
- **Next** – opens the ***Rover Radio*** screen (see "Rover Radio" on page 3-29). For PP enabled RTK survey the **Next** button opens the ***Rover PP Setup*** screen (Figure 3-24 on page 3-26).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.
- **Peripherals** – opens the ***Peripherals*** screen with three options to select (Figure 3-21 on page 3-23):
  - *NMEA Ports*: check mark this box to set the number of ports available to output NMEA messages.
  - *Multiple Ports*: check mark this box to set the number of ports to input data from peripherals.
  - *External Laser*: check mark this box to use an external laser. When selected, the *Laser Connect* field displays to set the device the laser is connected to: either *Receiver* or *Controller*. The **Parameters** button opens the ***Laser Config*** screen to

configure the laser device (Figure 3-26 on page 3-28).

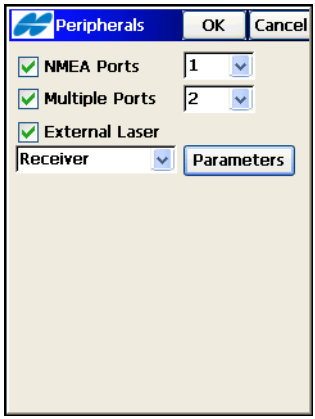


Figure 3-21. Rover Receiver Options

The Help Icon in the upper-left corner of the ***Rover Receiver*** screen displays the pop-up menu containing four options:

- *Receiver Setting* – check mark the box on the ***Receiver Settings*** screen appear to turn the charger mode off.
- *Relative calibrations on Base* – (only for RTK surveys) select the option if needed to use Relative antenna model at the base station that transmits CMR+ data. By default, TopSURV 7.2 uses Absolute calibration offsets for antennas. Also, you can select this option when editing the base.
- *RTK Protocol* – adds the *RTK Protocol* field to the ***Rover Receiver*** screen to set the *CSD Data* protocol through a cellular phone used as modem.
- *Help* – to access the Help files.

For Real Time DGPS survey type the screen allows a selection of DGPS correction format.

- *DGPS Format* – the format of the differential corrections received either from the user base (*RTCM 2.1, RTCM 2.2, or RTCM 2.3*) or from a Beacon station (in addition *RTCM 3.0* can be selected). This field disappears when any other differential service is chosen on the ***Survey*** screen.

- **Next –** depending on the differential service selected on the ***Survey*** screen (Figure 3-4 on page 3-6), this button opens one of the following screens:
  - ***Config: Rover Radio*** (Figure 3-27 on page 3-29),
  - ***Config: Beacon*** (Figure 3-34 on page 3-35),
  - ***Config: SBAS*** (Figure 3-37 on page 3-37),
  - ***CDGPS Radio*** (Figure 3-38 on page 3-38),
  - ***Config: OmniSTAR*** screen (Figure 3-39 on page 3-39).
- **Finish –** saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.

For Network RTK and Network DGPS surveys the screen contains contains the same parameter fields as for *RTK* survey type, except for the *RTK Format* field. In addition the *Protocol* field is turned on by default (Figure 3-22).

- *Protocol* – selects the protocol to receive the corrections:
  - *NTRIP*: from a NTRIP Caster
  - *TCP/IP*: through the Internet
  - *CSD Data*: through a cellular phone used as a modem

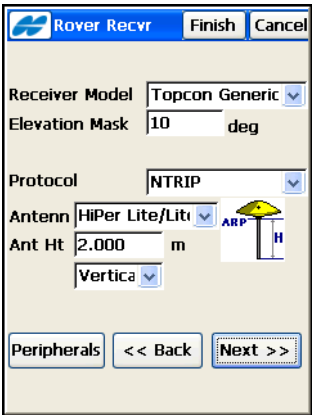


Figure 3-22. Rover Receiver Options for Network RTK and Network DGPS

- **Back** – returns to the previous screen.
- **Next** – opens the ***Config: Modem Connect*** screen (Figure 3-25 on page 3-27).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.

For PP Kinematic and PP DGPS surveys, the screen contains the same parameter fields as for *RTK* survey type, except for the *RTK Format* field (Figure 3-23).

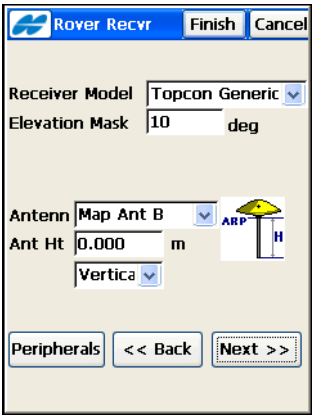


Figure 3-23. Rover Receiver Options for PP Kinematic and PP DGPS

The Help Icon in the upper-left corner of the ***Rover Receiver*** screen displays the pop-up menu containing two items:

- *Receiver Setting* – check mark the box on the ***Receiver Settings*** screen appear to turn the charger mode off.
- *Help* – accesses the Help files.

The **Next** button opens the ***Rover PP Setup*** screen.

Rover PP Setup

The screen contains parameters for logging rover raw data (Figure 3-24 on page 3-26).

- *Raw Data Logging* – the set of logging parameters; log to the receiver, set the logging rate, and select if the name of the receiver file is automatically set or user-defined. In the latter case, the corresponding dialog box displays at the logging start.

  The *Start Log* option selects whether to start logging manually or automatically as data are being collected. This option is absent for PP Kinematic and PP DGPS surveys, the selection of manual start of logging is not allowed.

- **Back** – returns to the previous screen.
- **Next** – opens the ***Rover Receiver*** screen (Figure 3-22 on page 3-24).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2).

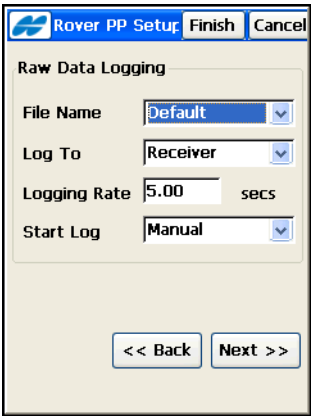


Figure 3-24. Rover PP Setup

Modem Connection

The ***Config: Modem Connect*** screen (Figure 3-25) displays for the Rover receiver configuration in Network RTK or Network DGPS surveys.

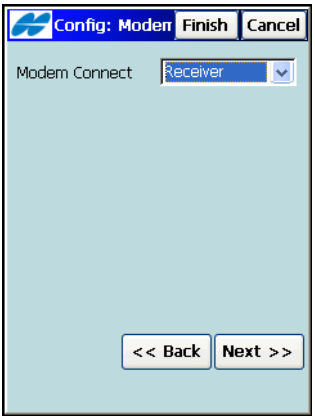


Figure 3-25. Config: Modem Connect

- *Modem Connect* – select either *Receiver* or *Controller* to connect the modem to.
- **Next** – opens the ***Rover Radio*** screen (Figure 3-27 on page 3-29).

Refer to the *TopSURV User's Manual* for details on configuring a Network RTK survey.

Laser Config

The ***Config: Laser*** screen contains typical laser parameters and settings (Figure 3-26 on page 3-28).

- *Manufacturer* – the manufacturer for the laser device.
- *Model* – the model of the laser device.
- *Type* – the type of laser measurement system.
- *Laser Port Setting* – the settings (*port, parity, data, baud rate*, the number of *stop bits*) for the laser device's connection port to output raw and calculated data to the peripheral device.

- **Back** – returns to the previous screen.
- **OK** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.

Table 3-1 lists supported manufacturers and models of laser devices.

Table 3-1. Laser Device Manufacturer and Model

Manufacturer	Model	Type of Laser measurement system
MDL	LaserAce 300	Range Finder Only Range Finder with Encoder
Laser Technology, Inc.	Impulse 200	Impulse Only Impulse with Compass
Laser Technology, Inc.	TruPulse 200	TruPulse Only TruPulse with Encoder
Laser Technology, Inc.	TruPulse 360	TruPulse Only TruPulse with Compass

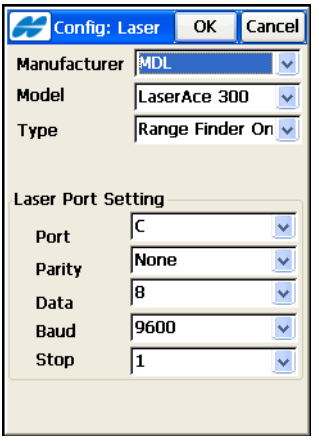


Figure 3-26. Laser Configuration

Rover Radio

The ***Rover Radio*** screen contains parameters for the radio modem connected to the Rover receiver (Figure 3-27).

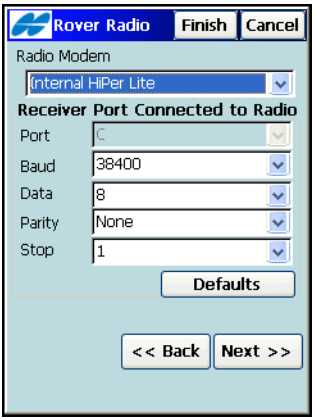


Figure 3-27. Rover Radio

- *Radio Modem* – the type of modem. The contents of the drop-down list depends upon a style used.
- *Receiver Port Connected to Radio* – contains the parameters of the connection port.
- **Defaults** – returns all the values to defaults in the *Receiver Port Connected to Radio* fields.
- **Back** – returns to the previous screen.
- **Next**: – displays the parameters for the chosen modem (see "Rover Radio Parameters" on page 3-30). Opens the ***Survey Parameters*** screen if the selected modem type does not require additional settings.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen.

  All settings are transmitted only when the configuration is used.

The Help Icon in the upper-left corner of the ***Rover Radio*** screen displays the pop-up menu that contains an option:

- *Config RE-S1 Repeater* – enables using the RE-S1 radio as repeater (see "RE-S1 FH915 Repeater" on page 3-31).

Rover Radio Input

If Multiple Ports mode is selected, depending on the number of ports selected (Figure 3-23 on page 3-25), there can be two ***Rover Radio*** screens to configure radios for data input (Figure 3-28).

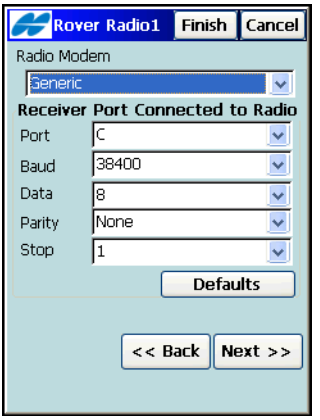


Figure 3-28. Rover Radio Input

Use only one radio to receive corrections from the Base.

Rover Radio Parameters

Modem parameters for the Rover receiver are the same as for the Base receiver (for details, see "Base Radio Configuration" on page 3-13) except as provided for cell phones (Figure 3-29 on page 3-31).

- *Rover PIN* – a personal identification number for the Rover.
- *Base Phone Number* – the phone number for the Base.
- **Add** – adds it to the *Phone number list*.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Survey Parameters*** screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2).

All settings are transmitted only when the configuration is used.

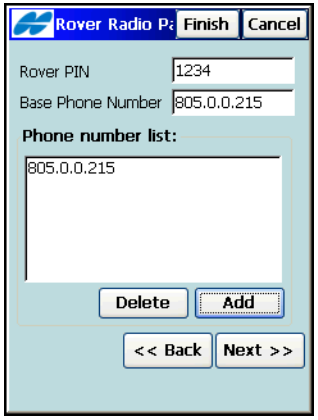


Figure 3-29. Rover Cell Phone Parameters

RE-S1 FH915 Repeater

The RE-S1 is a transmit/receive/repeat FH915+ spread spectrum radio modem.

The ***RE-S1 FH915 Repeater*** screen configures the RE-S1 modem as a stand-alone repeater to increase the range between a Base and Rover in spread spectrum systems such as with the GR-3 or HiPer Lite+ GPS systems (Figure 3-30 on page 3-32). This screen opens by selecting the *Config RE-S1 Repeater* option from the pop-up menu on the *Rover Radio* screen.

- *Enable RE-S1 Repeater Configuration* – enables using the RE-S1 as repeater.
- *Connect Type* – selects the connection of the modem either to the receiver or the controller to setup the modem.
- *Connect Port Setup* – sets the properties of the connection port.
- **Defaults** – sets the port properties to the default values.
- **OK** – returns to the ***Rover Radio*** screen (Figure 3-27 on page 3-29).

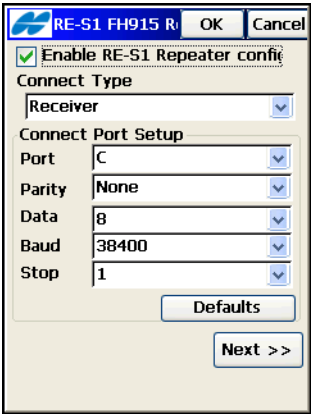


Figure 3-30. Using RE-S1 as Repeater

- **Next** – opens the next ***RE-S1 FH915 Repeater*** screen to choose the location, protocol and operating channel for the RE-S1 radio (Figure 3-31).

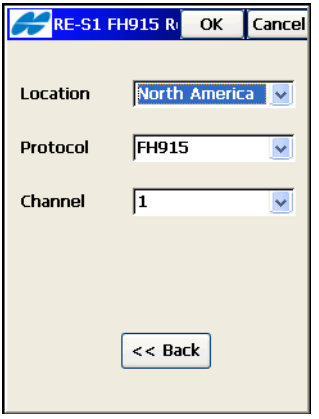


Figure 3-31. Configure RE-S1 Repeater

After enabling the usage of the RE-S1 as a repeater, the *Config RE-S1* option becomes available for selection from the Help Icon menu in the *Status*, *Start Base* and *Topo* screens (“RE-S1 FH915 Repeater” on page 3-31).

Output Radio

If NMEA Ports mode is selected (see Figure 3-22 on page 3-24), depending on the number of output ports set, there can be several ***Output Radio*** screens to configure radios for NMEA data output (Figure 3-32).

The **Output Radio** screen contains parameters for the radio modem connected to the Rover (Figure 3-32 on page 3-33). For details, see "Rover Radio" on page 3-29.

- **Next**: opens the ***Config: Output NMEA*** screen. If needed the ***Rover Radio Param*** screen displays first.

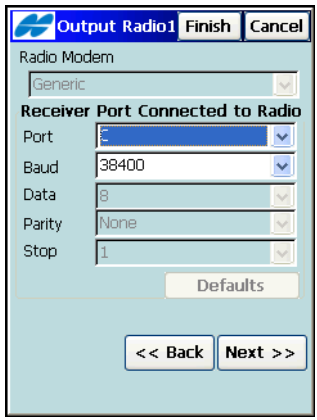


Figure 3-32. Output Radio

Config: Output NMEA

The ***Config: Output NMEA*** screen (Figure 3-33 on page 3-34) contains a list of NMEA messages. Select the types of messages to issue via the specified receiver port at the interval set in seconds (up to 0.1 sec).

- *GGA* – outputs data on time, position and positioning.
- *GLL* – outputs data on the current latitude/longitude and positioning state.
- *GNS* – outputs data on time, position, and positioning of GPS+GLONASS (GNSS).

- *GRS* – outputs the residual error of distance, is used to support RAIM.
- *GSA* – outputs the operation mode of the GNSS receiver, the satellite used for positioning, and DOP.
- *GST* – outputs the statistics of position errors.
- *GSV* – outputs the number of satellites, satellite number, elevation angle, azimuthal angle, and SNR.
- *HDT* – outputs the direction (heading).
- *RMC* – outputs time, date, position, course and speed data provided by a GNSS navigation receiver.
- *VTG* – outputs the traveling direction and velocity.
- *ZDA* – outputs UTC, day, month, year, and local time zone.

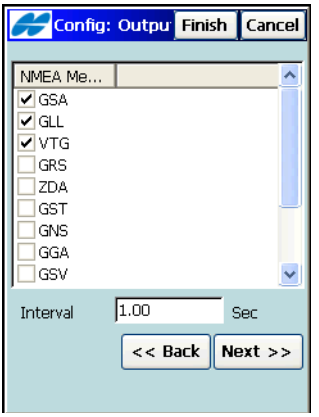


Figure 3-33. Config: Output NMEA

Config: Beacon

The ***Config: Beacon*** screen (Figure 3-34 on page 3-35) contains settings for a radio-beacon source of differential GPS corrections.

- *Country* – the country where the radio-beacon differential service is located.
- *Station* – the station that provides broadcasting differential corrections for the Rover.

- *Beacon Corrections from BR-1* – check mark this box to enable the BR-1 receiver as a source of differential corrections for the rover. If selected, makes the *Automatic Scan Mode* available (Figure 3-34).
- *Automatic Scan Mode* – when set to Automatic Scan mode, a manual selection of the beacon station becomes not available. The BR-1 automatically scans broadcasting frequencies to get the Beacon Signal and output RTCM corrections from the best signal.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Config: BR-1*** screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. All settings are transmitted only when the configuration is used.

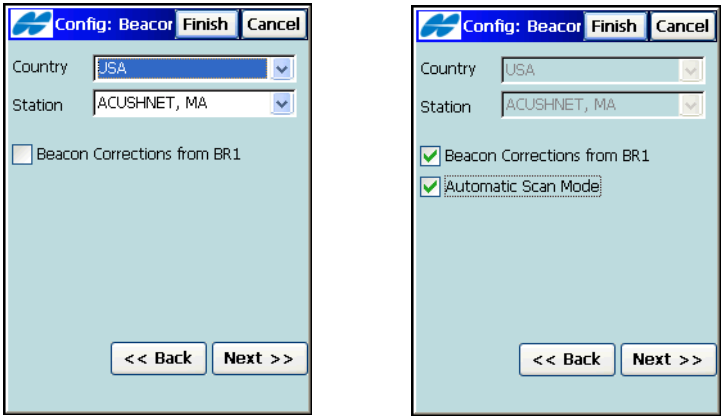


Figure 3-34. Config: Beacon

Config: BR1

The ***Config: BR1*** screen (Figure 3-35 on page 3-36) contains settings for the connection with the BR-1.

- *Connected to* – selects the device to which the BR1 is connected: either *Receiver* or *Controller*.
- *Port connected to BR1* – sets the parameters of the connection port.
- **Back** – returns to the previous screen.

- **Next** – opens the ***Survey Parameters*** screen. In case of Controller connection, the ***Config: BR-1 Receiver Info*** displays first (Figure 3-36).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. All settings are transmitted only when the configuration is used.

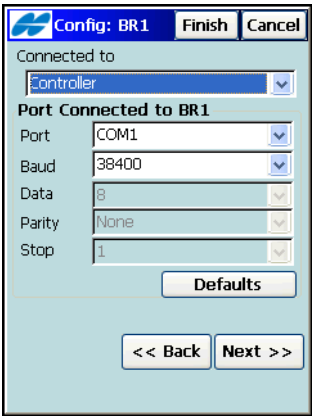


Figure 3-35. Config: BR-1

- *Virtual Radio Port* – sets the receiver port on which the receiver receives the RTCM messages from the controller. This port on the receiver is used in addition to the receiver port that is connected to the controller (Figure 3-36).

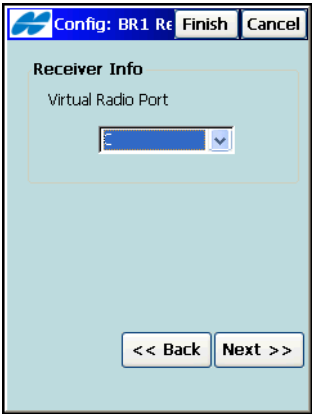


Figure 3-36. BR-1 Virtual Radio Port

SBAS Setup

The ***SBAS Setup*** screen (Figure 3-37) selects satellites of a satellite-based augmentation system (WAAS/EGNOS/MSAS) to use to improve accuracy of DGPS solutions. To select satellites, check the boxes near the PRN numbers of the satellites . All satellites can be selected. The most available satellite from the selected ones will be used in Code DGPS solution.

- *PRN* and *Name* – the SBAS satellite's PRN number and name.
- *GPS #* – the GPS satellite's PRN number, which is associated with the SBAS PRN number.
- *Iono corr* – enable/disable the use of ionospheric corrections from the SBAS 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.

For GMS-2, SBAS PRN# and Ionospheric corrections are available.

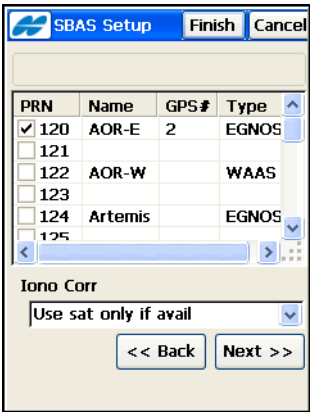


Figure 3-37. SBAS Setup

- **Next** – opens the ***Survey Parameters*** screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2).

CDGPS Radio

The ***CDGPS Radio*** screen (Figure 3-38) contains settings for the receiver port connected to the CDGPS radio.

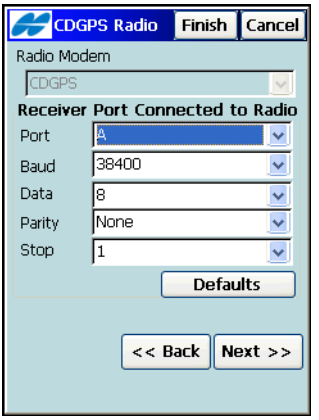


Figure 3-38. CDGPS Radio

- *Receiver Port Connected to Radio* – contains parameters for the connection port: port, parity, number of data bits, baud rate, and the number of stop bits.
- **Next** – opens the ***Survey Parameters*** screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen.

  Settings are transmitted only when the configuration is used.

Config: OmniSTAR

The ***Config: OmniSTAR*** screen (Figure 3-39 on page 3-39) contains settings for an OmniSTAR source of differential correction data.

- *Satellite* – the satellite that delivers differential GPS corrections.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Survey Parameters*** screen.

- **Finish** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.

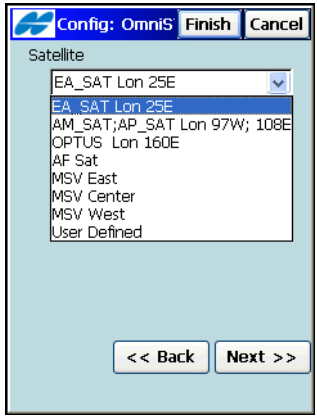


Figure 3-39. Config: OmniSTAR

mmGPS+ Parameters

For mmGPS aided RTK survey types (see Figure 3-5 on page 3-6), the configuration screens are the same as for the standard RTK survey types. A mmGPS survey (RTK or Network RTK) uses the usual RTK GPS+ survey system, but with a wireless PZS-1 sensor at the Rover to pick up the Lazer Zone signal from the PZL-1 transmitter for accurate (millimeter) elevations.

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

The ***mmGPS+ Parameters*** screen adds a millimeter GPS+ selection to the RTK survey (Figure 3-40 on page 3-40):

- *Receiver port* – selects the port used for communication between the receiver and PZS-1 sensor (typically port D).
- *Sensor Gain* – select Auto to automatically control the mmGPS receiver's detection level of the transmitter's signal.
- *Height Difference Limit* – sets the threshold for the difference between GPS and mmGPS+ height measurements.

- **Back** – returns to the previous screen.
- **Next** – proceeds to the ***Survey Parameters*** screen. For RTK and Network RTK surveys with enabled post processing, and PP Kinematic surveys, the ***Init Times*** screen (Figure 3-41 on page 3-41) displays.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. All the settings will be transmitted only when the configuration is used.

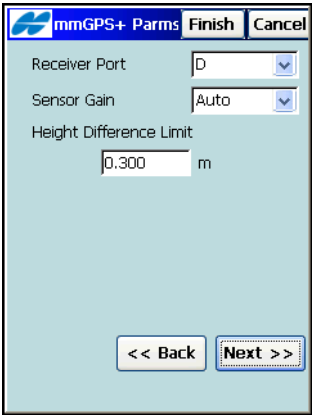


Figure 3-40. mmGPS+ Parameters

Initialization (Occupation) Times

The ***Init Times/Occupation Times*** screens (Figure 3-41 on page 3-41) contains timing settings for receiver loggings, used in automatic mode during a PP Static Survey, and depends upon the number of satellites available and the number of frequencies used.

- *Initialization (Occupation) Time in minutes* – these are time values, dependent upon numbers of satellites and frequencies. For example, the default for six GPS/GLONASS (6+) dual frequency satellites is ten minutes. This means that for PP enabled RTK and PP Kinematic surveys, the complete Rover file should be at least this long. Individual occupations can be different. For Static surveys, this means that each station (Occupation) should be occupied for at least ten minutes.
- **Back** – returns to the previous screen.

- **Next** – proceeds to the next screen (for PP Static, ***Stakeout Parameters***; for PP enabled RTK and PP Kinematic, ***Survey Parameters***).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.

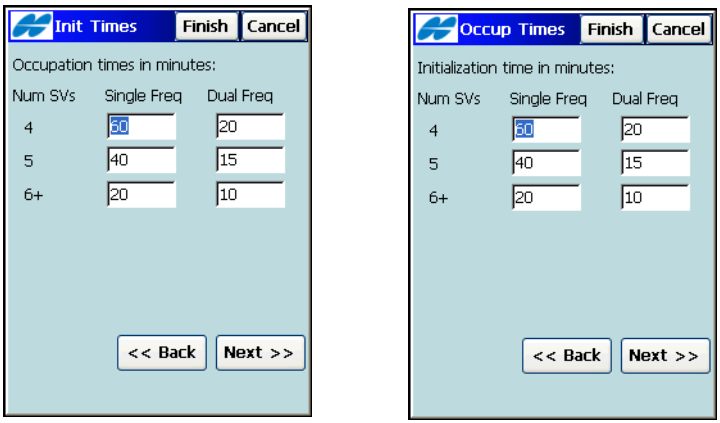


Figure 3-41. Initialization / Occupation Times

Survey Parameters

The ***Survey Parameters*** screen (Figure 3-42 on page 3-43) sets the parameters used by default during the survey. These parameters can be changed with the help of the **Settings** button from any ***Survey*** screen in GPS+ mode.

- *Solution Type* – sets the solution type for each epoch. Depending on the survey type chosen, select either *"Fix mmGPS+"*, *"Fix Only"*, *"Fix and Float mmGPS+"*, *"Fix and Float"*, *"Fix, Float, DGPS"*, *"DGPS"*, *"DGPS, Auto"*, or *"All"*.
  - *Fix mmGPS+*: positions are computed by the RTK engine using the carrier phase measurements from the Base receiver and mmGPS aided Rover receiver. Integer ambiguities are fixed.
  - *Fix*: positions are computed by the RTK engine using the carrier phase measurements from Base and Rover receivers. Integer ambiguities are fixed.

  - *Float*: positions are computed by the RTK engine using the carrier phase measurements from Base and Rover receivers. Integer ambiguities, however, are NOT fixed (use float estimates instead).
  - *DGPS*: positions are determined using only the pseudo-range measurements or carrier-phase pseudo-ranges.
  - *All*: positions are computed using all epochs accepted, including autonomous solutions.
  - *Auto*: autonomous positions when differential corrections are not available.
- The *Auto Accept* field sets the following parameters for automatic acceptance during a stationary survey.
  - *Num Meas to Avg*: sets the number of measurements used for averaging, as needed.
  - *Precision (m) Hz*: sets Horizontal and Vertical precision values, if taken into account. If both the *Precision* and *Num Meas To Avg* boxes are checked, both these conditions must be satisfied before the coordinates are accepted.
- The *Auto Topo* field sets the following parameters for kinematic surveys.
  - *Method*: defines the method for measuring the interval between the received epochs; by time, by horizontal distance, or by slope distance.
  - *Interval*: sets the value of this interval.
- The Help Icon in the upper-left corner of the screen opens the pop-up menu that contains two options:
  - *Point Properties*: opens the ***Point Properties*** screen to define the point increment value for Survey points (Figure 3-44 on page 3-44).
  - *Help*: accesses the Help files.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Stake Parameters*** screen.

- **Finish** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.

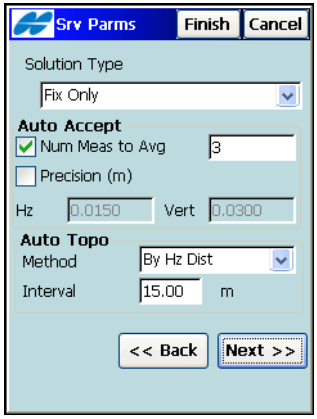


Figure 3-42. Survey Parameters

When configuring PP Kinematic or PP DGPS survey, the ***Survey Parameters*** screen sets the following parameters (Figure 3-43).

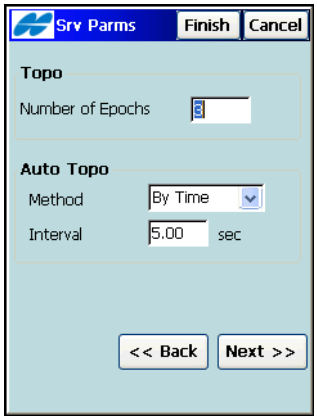


Figure 3-43. Survey Parameters for PP Kinematic and PP DGPS

- *Topo* – enter the number of epochs to log on each location (for stop-and-go survey).
- *Auto Topo* – sets the time interval between locations (for continuous kinematic survey). The only method currently available.

Point Numbering

The ***Point Properties*** screen sets a user-defined value to increment/ decrement the survey point number (Figure 3-44).

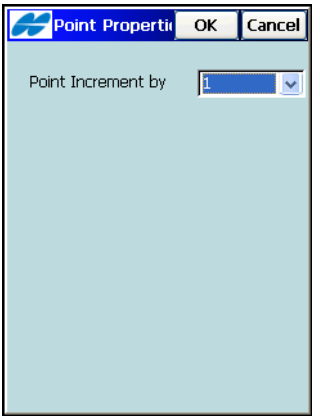


Figure 3-44. Point Numbering

Stake Parameters

The ***Stk Parms*** screen (Figure 3-45) sets the parameters that are used by a job during a stakeout. These parameters can be changed with the help of the **Settings** button from any Stakeout screen in GPS+ mode.

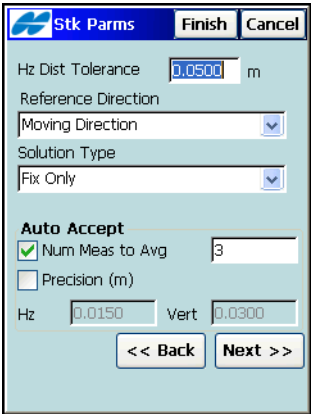


Figure 3-45. Stake Parameters

- *Hz Dist Tolerance* – sets when the graph switches to a bull's eye in Stakeout.

- *Reference Direction* – sets the reference direction for stakeout. The reference direction can be North, moving direction, moving direction +North, the direction to the reference point, or a reference azimuth. Moving Direction +North is similar to the Moving Direction option, but displays the North direction when the user is within three meters of the design point.
- *Solution Type* (for real time surveys only) – defines the type of position solutions that should be used for the stakeout: *Fix Only*; *Fix and Float*; *Fix*, *Float, DGPS; DGPS, Auto*; or *All*.
- The *Auto Accept* field sets the parameters for automatic acceptance during a stakeout.
  - *Num Meas to Avg*: sets the number of measurements used for averaging, as needed.
  - *Precision (m) Hz*: sets Horizontal and Vertical precision values, if taken into account.

  If both the *Precision* and *Num Meas To Avg* boxes are checked, both these conditions must be satisfied before the coordinates are accepted.
- **Next** – opens the next ***Stake Parameters*** screen (see Figure 3-45 on page 3-44).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen.
- The Help Icon in the upper-left corner contains two items:
  - *Display*: opens the ***Staked Point Icon*** screen (Figure 3-47 on page 3-47) to set an icon for the staked point.
  - *Help*: accesses the Help files.

The next ***Stake Parameters*** screen sets the rule for naming staked points (Figure 3-46 on page 3-46).

- The *Store Staked Point As* field defines:
  - *Point*: sets the rule for defining names for the staked-out points; either design point name, next point name, design point with a pre-defined prefix (that is, stk_01, where “stk_” is the prefix), or design point with a pre-defined suffix. The choice of the prefix or suffix appears only when the

corresponding item is chosen from the drop-down menu. Also, a specified numerical constant can be added to automatically generate the staked point name.

For instance, if the constant specified is 1000, and the design point is 100, the staked point would be named 1100 (that is, 100+1000). If the design point is alphanumeric, the constant is appended to the name. For example, for the design point ALPHA, the corresponding staked out point is named ALPHA1000.

– *Note*: sets the rule for setting Notes for the staked out points; either design point name, design point with a prefix, or design point with a suffix. Also, it can be Station & Offset information.

If the Station & Offset option is activated, an edit box for entering alphanumeric prefix appears. For the United States, this prefix is "Sta", for the international markets the prefix is "Cha", and for the Korean/Japanese markets the prefix is "No". With this option activated, depending on the choice for the prefix, TopSURV automatically generates one note for each stakeout point: *Sta5+5.5R5.0*, *Cha505.5R5.0*, or *No.5+5.5R5.0* respectively.

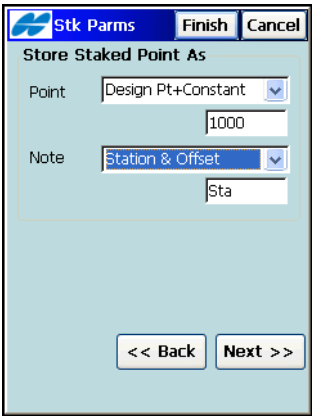


Figure 3-46. Design Point Name + Constant

- **Back** – returns to the previous screen.
- **Next** – opens the ***Advanced*** screen.

- **Finish** – saves the changes and returns to the ***Survey Style*** screen.

Staked Point Icon

The ***Staked Point Icon*** screen selects options to display the icon for the staked point on the map (Figure 3-47).

- *Use icon for staked point* – displays the icon for the staked point on the map.
- *Staked point* – specifies a colored icon for the staked point.
- **OK** – saves the changes and returns to the ***Stakeout Parameters*** screen.

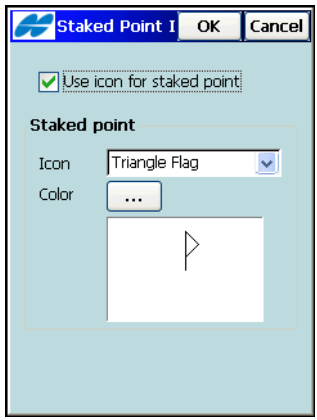


Figure 3-47. Staked Point Icon

Advanced

The ***Advanced*** screen sets several additional parameters for the GPS+ mode (Figure 3-48).

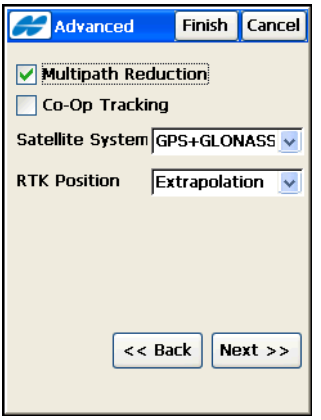


Figure 3-48. Advanced

- The *Multipath reduction* – enable when a signal received includes multiple reflections from nearby objects. Check mark the *Multipath Reduction* field to use this mode during survey.
- *Co-Op tracking* – enable to involve additional resources for acquisition of the signal, phase-lock, and delay-lock loops.
- *Satellite system* – defines the system of satellites to use.
- *RTK Position* (only for real time surveys) – selects the method of RTK corrections definition; either *Extrapolation* or *Matched Epoch* (sometimes described as asynchronous or synchronous, respectively).
- **Back** – returns to the previous screen.
- **Next** – opens the ***Miscellaneous*** screen (Figure 3-50 on page 3-50.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.
- The Help Icon in the upper-left corner contains two items:

– *RTK Settings*: opens the ***RTK Settings*** screen (Figure 3-49) to set ambiguity resolution parameters for RTK engine.

– *Help*: accesses the Help files.

RTK Settings

The ***RTK Settings*** screen (Figure 3-49) sets parameters to govern the RTK engine.

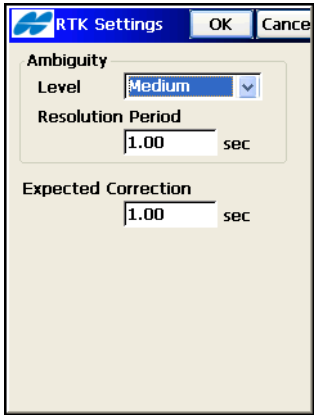


Figure 3-49. RTK Settings

- *Ambiguity Level*: select Low, Medium or High. The higher the specified level, the longer the ambiguity search time.
- *Resolution Period:* defines the period at which the ambiguities estimation is performed.
- *Expected Correction Period*: sets differential correction update interval for base station, effective only in the RTK Matched Epoch mode.

  The value should be set to the exact rate at which the base station transmits its differential correction data. This parameter will instruct the rover receiver to output the RTK position at the same rate at which differential corrections are updated.

Miscellaneous

The ***Miscellaneous*** screen (Figure 3-50) is used to customize the user interface using the following options:

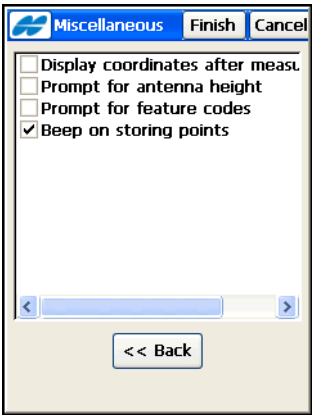


Figure 3-50. Miscellaneous

- *Display Coordinates after Measurement* – if enabled, the ***Store Point*** screen automatically displays computed coordinates after a GPS measurement is performed and the point information before the point coordinates are stored into the database.
- *Prompt for antenna height* – if enabled, the ***Antenna Setup*** screen appears to set the antenna parameters.
- *Prompt for feature codes* – if enabled, the ***Point Attributes*** screen appears to specify the code and attributes, and notes before a surveyed point is stored.
- *Beep on Storing Points* – if enabled, makes a sound every time a point is stored.

Total Station Configuration

On the ***Survey Style*** screen (Figure 3-51 on page 3-51), select a TS configuration from the drop-down list; either *My Conventional*, *My*

Reflectorless, My Robotic, or *My Level*. The ***Configurations*** screen displays (Figure 3-52 on page 3-52).

NOTICE

In the Contractor Module, only *My Conventional* and *My Reflectorless* are available.

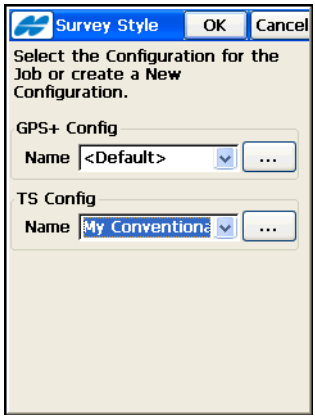


Figure 3-51. Survey Style

- [...] **–** opens the ***Configurations*** screen for editing parameters for the configurations.
- **OK –** sets the selected configuration for the current job and returns to the main screen.

The ***Configurations*** screen shows the list of available configurations.

- **Delete** – deletes the configuration.
- **Edit** – changes the configuration settings.
- **Add** – adds a new configuration.
- **OK** – returns to the ***Survey Style*** screen (Figure 3-51 on page 3-51.

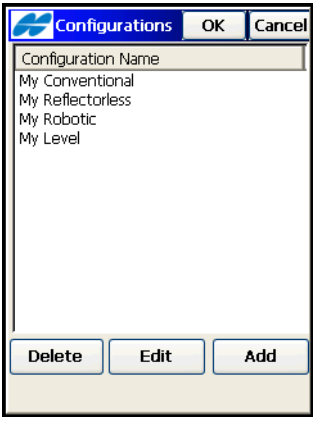


Figure 3-52. TS Configurations

If the *Contractor Module* is selected in the TS mode (see "Observation Mode" on page 16-1), only Conventional, Reflectorless and Default-TS configurations are available for use by non-surveyors doing construction stakeout with total stations.

Configuring the Survey

The ***Survey*** screen selects a survey type (Figure 3-53 on page 3-53).

- *Name* – the name of the configuration that is displayed in the ***Configurations*** screen.
- *Type* – the type of the Configuration; either *Conventional*, *Reflectorless*, *Robotic*, or *Level*.
- **Next** – opens the ***Instrument*** screen.
- **Finish** – saves the changes and returns to the Survey Style screen. Settings are transmitted only when the configuration is used.

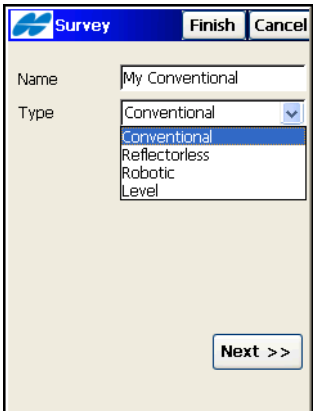


Figure 3-53. Survey Screen

Instrument

The ***Instrument*** screen (Figure 3-54) contains typical total station parameters and communication settings.

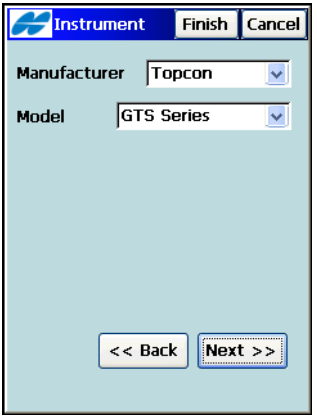


Figure 3-54. Instrument Screen

- *Manufacturer* – defines if a Topcon instrument is used. For Conventional and Reflectorless surveys also Sokkia, Nikon and Leica instruments can be defined. For survey emulation, Manual Mode can be used.

- *Model* – sets the model of the instrument, taking into account the type of the configuration. For Robotic types, only motorized models are displayed in the drop-down menu.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Connection Mode*** screen for Total Stations and the ***Cable*** screen for Levels.
- **Finish** – saves the changes and returns to the Survey Style screen. Settings are transmitted only when the configuration is used.

Table 3-2 gives Topcon instrument models and their available functionality.

Table 3-2. Instrument Model and Functionality

Topcon Instrument Models:	
GTS Series – Conventional	GTS 1/GTS 3 – Conventional
GTS-100N	GRT 2000 – Conventional and Robotic
GTS-220 – Conventional	GPT 1000 – Reflectorless
GTS-230/230W – Conventional (Bluetooth)	GPT 2000 – Reflectorless
	GPT 3100W – Reflectorless
GTS-600 – Conventional	GPT 6000 – Reflectorless
GTS-720/720W – Conventional	GPT 3000/3000W/3000L – Reflectorless
GTS-800/810 – Conventional	GPT 7000/7000W/7000L – Reflectorless
GTS-800A/810A – Conventional and Robotic	GPT 8000 – Reflectorless
	GPT 8200 – Reflectorless
GTS-820A – Conventional and Robotic	GPT 9000 – Reflectorless
GTS-900A – Robotic	GPT 8000A/8200A/9000A – Reflectorless and Robotic
GTS 3000 – Reflectorless	
AP-L1A – Conventional and Robotic	IS Robot – Reflectorless and Robotic
AP-L1 – Conventional and Robotic	DL-101 – Level
GMT100 – Conventional	DL-102/102C – Level
Sokkia instrument models are: SET3, SET4, SET5, SET300, SET400, or SET500	
Nikon instrument model is: DTM (SET)	
Leica instrument models are: TCR400 or TCR700	

In Robotic mode, the Help Icon in the upper-left corner of the screen opens a pop-up menu that contains two options:

– *Monitor*: opens the ***Monitor Options*** screen (Figure 3-55 on page 3-55) to set a Monitor survey.

– *Help*: accesses the Help files.

Monitor Options

Selecting the *Monitor* item opens the ***Monitor Options*** screen (Figure 3-55) to set the parameters for data output in the Monitor survey. Available options vary, depending on whether a File or a COM port is selected for data output.

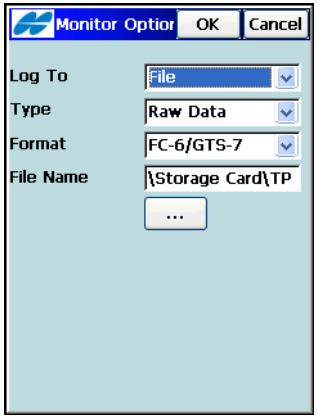


Figure 3-55. Monitor Option – File Selected

- *Log To* – sets whether the data is output to a File, COM1 port, COM2 port, Bluetooth, Bluetooth2, or None.
- *Output Type* – currently sets only the Raw data to output.
- *Output Format* – sets the format in which to output the data: *FC-5*, *FC-6/GTS-7* or *GTS-6*.
- *File Name* – sets the file name.
- [...] – browses for the destination of the file and sets the default file extension.
- *Comm Settings* – sets the communication parameters for the port (Figure 3-56 on page 3-56).
- **OK** – saves the settings and returns to the ***Instrument*** screen (Figure 3-54 on page 3-53).

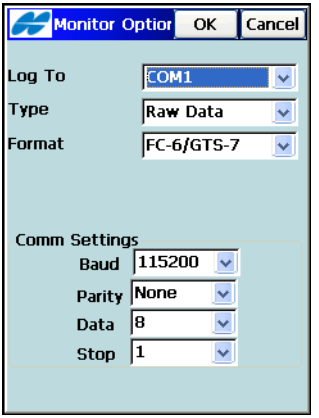


Figure 3-56. Monitor Options - COM1 Port selected

Connection Mode

On the ***Conn Mode*** screen (Figure 3-57 on page 3-57), select the connection mode to manage communication between the Total Station and the data controller.

- *Initial TS Connection* – selects a communication course between the total station and the data controller depending on the optional device used. Depending upon the type of the instrument, select one of the following optional devices:
  - *Cable:* for connection using the RS-232 cable
  - *Radios:* for radio communication
  - *RC2 Only:* for optical communication using the remote controller RC-2
  - *Bluetooth TS:* for establishing a Bluetooth connection
- *Optical* – selects the connection course (either *RC2 Cable*, *RC2 Bluetooth,* or *None)* between the field controller and the remote controller RC-2 in case carrying out optical communication with the Total Station.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Cable*** screen.

- **Finish** – saves the changes and returns to the Survey Style screen. Settings are transmitted only when the configuration is used.

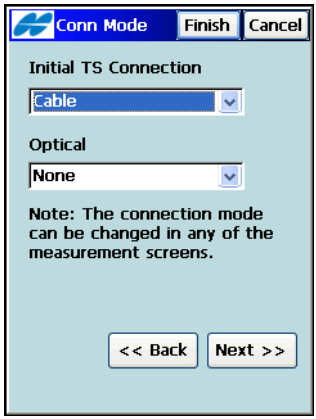


Figure 3-57. Connection Mode

Cable

The ***Cable*** screen contains the parameters of the cable connection (see Figure 3-58 on page 3-58).

- *Cable Comm Settings* – the parameters for the cable connection: *Baud* (baud rate), *Parity, Data* (number of the data bits), and *Stop* (number of the stop bits).
- **Default** – restores settings to default values if they have been modified.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Radio*** screen (for Robotic surveys), the ***Mode*** screen (for motorized Conventional or Reflectorless surveys), or the ***Survey Parameters*** screen (for *Conventional*, *Reflectorless*, or *Level* surveys).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-51 on page 3-51). Settings are transmitted only when the configuration is used.

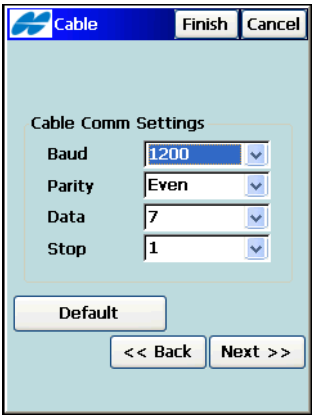


Figure 3-58. Cable

Radio

The ***Radio*** screen sets the parameters of the modem connected to the total station (see Figure 3-59 on page 3-59).

- *Type* – the type of modem; either *Satel*, *Pacific Crest* or *Generic*.
- *Radio Comm Settings* – sets radio communication parameters: parity, number of data bits, baud rate, and the number of stop bits.
- **Configure Radio** – opens the ***Radio Parameters*** screen for a Satel or Pacific Crest radio (Figure 3-17 on page 3-19 and Figure 3-18 on page 3-20).
- **Back** – returns to the previous screen.
- **Next** – opens the ***Search/Track*** screen (see "Search/Track" on page 3-60).
- **Finish** – saves the changes and returns to the ***Select Survey Config*** screen. Settings are transmitted only when the configuration is used.

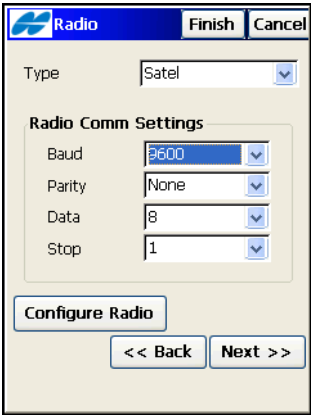


Figure 3-59. TS Radio

Mode

The ***Mode*** screen contains the parameters defining the turning ability of conventional total stations. This mode is available only for motorized instruments in Conventional and Reflectorless modes of operation (Figure 3-60 on page 3-60).

Table 3-3 lists Motorized total stations that support Auto Tracking and Auto Aiming mode.

Table 3-3. Motorized Total Stations

GTS-800/810/900 – Motorized GTS-800A/810A/820A/900A – Motorized and Auto Tracking/Aiming GPT-8000 – Motorized GPT-8000A/8200A – Motorized and Auto Tracking/Aiming	AP-L1 – Motorized and Auto Tracking AP-L1A – Motorized and Auto Tracking GRT-2000 – Motorized and Auto Tracking GMT-100 – Motorized

- *Enable Motor Turning* – sets the motor to active mode if enabled.
- *Auto Tracking* – if motor turning is enabled, sets the motorized total station into remote control, or a fully automatic mode of operation. Select one of the following modes of auto tracking:
  - *Auto Tracking*: causes the total station to track the reflector as the surveyor moves from point to point.

  - *Auto Tracking/Auto Aiming*: causes the instrument to find the prism in a pre-defined region.
  - *No Aiming/No Tracking*: disables the total station operation program.

- **Back** – returns to the previous screen.
- **Next** – opens the ***Search/Track*** screen (Figure 3-61 on page 3-61).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.

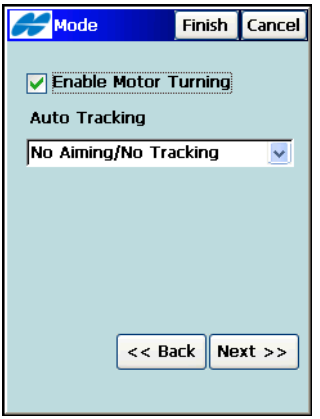


Figure 3-60. Mode

Search/Track

The ***Search/Track*** screen (Figure 3-61 on page 3-61) contains parameters for signal tracking for motorized total stations. Parameter values and accessibility depend on the selected total station model.

- *Turning Speed* – sets the turn speed of a total station in revolutions per minute.
- *Start Search After* – sets the delay between signal loss and the start of searching.
- *Pattern* – sets the program for tracking and searching.

– *Normal* (for AP-L1A and GRT-2000) or *Pattern 1* mode: searches for the prism at the point where the prism was lost. The instrument gradually searches in up and down directions, and continues until the prism is found.

– *High* (for AP-L1A and GRT-2000) or *Pattern 2* mode: searches for the prism for a set amount of time. The instrument searches from up to down and continues until the prism is found, or after a maximum of six attempts.

Auto tracking mode changes to manual mode when the prism cannot be found within six attempts, and returns to the point where the prism was lost.[1]

- *Trk Speed* – sets the speed for tracking; either *slow*, *medium*, or *fast*. For TS models with *Auto Tracking,* sets the speed mode according to the purpose of measurement: *Survey* (for fixed point observation), *Machine Control 1, 2* (to control construction machinery), or real time surveying of various traveling objects.

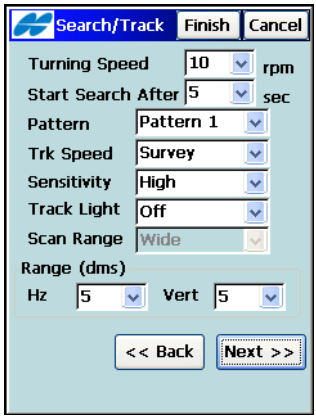


Figure 3-61. Search/Track Parameters

- *Sensitivity* – sets the detection sensitivity of the accepted signal; either *low*, *medium*, or *high*.
- *Track Light* – enables/disables the light on the line of sight.

1. For details, refer to the "Automatic Tracking Total Stations. GTS-800A Series" Instruction Manual.

- *Scan Range* – sets the width of the tracking signal; either narrow, middle, or wide. Available only in the AP-L1A and GRT-2000 total stations.
- *Range (dms)* – sets the range of searching or tracking, in degrees, for vertical and horizontal planes.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Config: Survey Parms*** screen (Figure 3-62).
- **Finish** – saves the changes and returns to the ***Select Survey Config*** screen. Settings are transmitted only when the configuration is used.
- **Cancel** – closes the screen without saving the settings.

Survey Parameters

The ***Survey Parms*** screen (Figure 3-63 on page 3-63) contains the default parameters that are used during the survey. They can be changed with the help of the **Settings** button from any ***Survey*** screen (Figure 3-62).

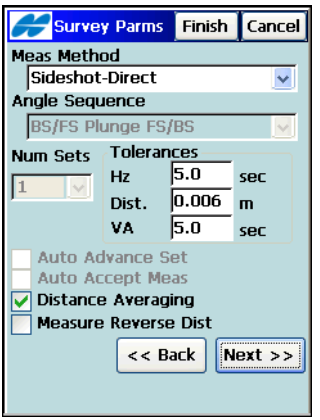


Figure 3-62. Survey Parameters – First Screen

- *Meas Method* – sets the mode of side-shot measurements; either *Sideshot-Direct*, *Sideshot Direct/Reverse*, or *Angle/Dist Sets-Dir/Rev.* See “Topo” on page 11-2 for a description of these methods.

In the Contractor Module, the only measurement supported is *Sideshot-Direct* (Figure 3-63).

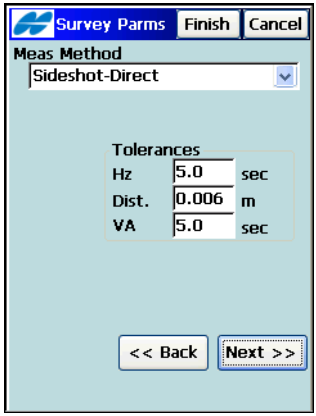


Figure 3-63. Survey Parameters in the Contractor Module

- *Angle Sequence* – sets the sequence of measured angles. (Available in the *Angle/Dist Sets-Dir/Rev* mode.) Here, *BS* is backsight point (the previous occupation point), *FS* is foresight point (the next occupation point), and *Plunge* stands for flipping and rotating the total station telescope by 180 degrees. These are used for the reduction of the angle errors. Possible sequences are *BS/FS Plunge BS/FS; BS/FS Plunge FS/BS; FS/BS Plunge BS/FS; FS/BS Plunge FS/BS; BS Plunge BS/FS Plunge FS;* and *FS Plunge FS/BS Plunge BS*.
- *Num Sets* – the number of measurement sets participating in the average. Here, the Num Sets defaults to 1 and cannot be changed if *Sideshot-Direct* or *Sideshot Direct/Reverse* is selected in the *Meas Method* field. Selecting *Angle/Dist Sets-Dir/Rev* in the *Meas Method* field allows NumSets to be greater than 1.
- *Tolerances* – the admissible deviation values of the horizontal and zenith angles and the distance.
- *Auto Advance Set* – sets the Automatic Repetition of the measurements to active mode, the survey automatically advances to the next set. Enabled only for motorized surveys and only if a *Meas Method* of Angle/Dist Sets-Dir/Rev is selected.

- *Auto Accept Meas* – activates the review of automatic repetition needed to accept each measurement. Enabled only for Robotic, non-RC2 surveys and only when a *Meas Method* of Angle/Dist Sets-Dir/Rev is selected.
- *Distance Averaging* – defines if the distance used is measured using one signal or the average of several signals, if enabled.
- *Measure Reverse Dist* – reverse distance measurements (if enabled). These are used for the reduction of the distance measurement errors.
- **Next** – opens the second (additional) ***Survey Parameters*** screen (Figure 3-64 on page 3-65).
- **Finish** – saves the changes and returns to the Survey Style screen.

The second (additional) ***Survey Parameters*** screen contains the following survey parameters (Figure 3-64 on page 3-65).

- *Meas Type* – sets the order and the type of the measurements in one set. There are five types:
  - *HA*: horizontal angle
  - *HD*: horizontal distance
  - *VA*: vertical angle
  - *VD*: vertical distance
  - *SD*: slope distance
- *EDM Mode* – sets distance measuring mode, either *coarse* or *fine*, that determines the sensitivity of the distance measurements. Select **Fine** for a normal mode or **Coarse** mode to measure in a shorter time.
- *Backsight/Foresight P.C. (Prism Constant)* – select a backsight and foresight prism from the drop-down list. Prism Constant is the parameter of the prism, characterizing the difference between the reflection plane and the center of the prism.
- **List**  **Button** – opens the ***Edit Prisms*** screen to add a new prism or change a prism existing in the list (Figure 3-65 on page 3-66).
- *Point Guide* – check and enable to operate the tracking lights.

Prism/Non-Prism: select the appropriate prism mode, either Prism or Non-Prism (Enabled only if the *Point Guide* box is check marked).

- *AutoTopo* (only for robotic total stations) – the parameters of the automatic survey.
  - *Method*: select a method for taking auto measurements; either by *time*, or by *horizontal* or *slope distance*.
  - *Interval*: enter the interval for taking auto measurements.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Stakeout Parameters*** screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen. Settings are transmitted only when the configuration is used.
- **Cancel** – close the screen without saving the settings.

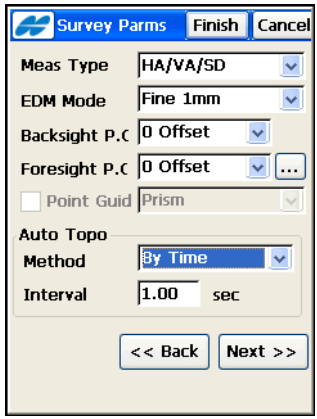


Figure 3-64. Survey Parameters – Second Screen

- The *Help* Icon in the upper-left corner of the screen opens the pop-up menu that contains the following two items:
  - *Point Properties*: opens the ***Point Properties*** screen to define the point increment value for Survey points ("Point Numbering" on page 3-44).
  - *Help*: accesses the Help files.

Edit Prisms

The ***Edit Prisms*** screen (Figure 3-65) allows the user to change the prism constant selected in the list.

- *Prism* – list of prisms.
- *Prism Info* – displays editable information on the prism selected.
  - – Name: enter a name for the prism.
  - – Constant: enter a constant value for the prism.
- **Delete** – removes the prism from the list.
- **Update** – updates for new information on the prism.

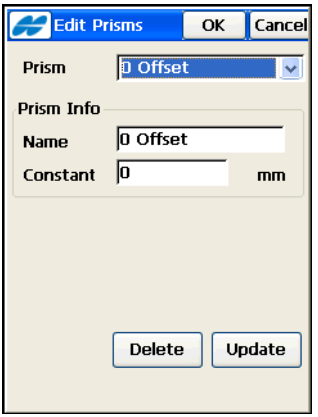


Figure 3-65. Edit Prisms

Stakeout Parameters

The ***Stkt Parms*** screen sets the default stakeout parameters. These parameters can be changed using the **Settings** button from any ***Stakeout*** screen in TS mode (Figure 3-66 on page 3-67).

- *Hz Dist Tolerance* **–** enter a time to set for when the graph switches to a bull's eye in Stakeout.
- *Reference Direction* – sets the direction assumed to be the referenced direction during the stakeout. Select **Instrument Reference** only.

- *Turn TS to Design Pt* – controls the way the total station turns toward the design point.
- *Search After Turn* – causes the instrument (only for motorized surveys) to search for the prism after turning to the design point (when enabled).
- **Back** – returns to the previous screen.
- **Next** – opens another ***Stk Parms*** screen (Figure 3-67 on page 3-68).
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-51 on page 3-51). Settings are transmitted only when the configuration is used.
- **Cancel** – closes the screen without saving the settings.

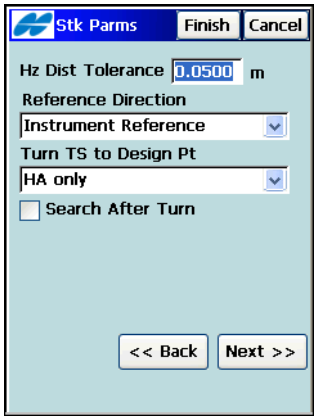


Figure 3-66. Stakeout Parameters - First Screen

The *Help* Icon in the upper-left corner displays the pop-up menu containing two items:

- *Display* – opens the ***Staked Point Icon*** screen to set an icon for the staked point as in GPS configurations (see "Staked Point Icon" on page 3-47).
- *Help* – accesses the Help files.

The second (additional) ***Stk Parms*** screen (Figure 3-67 on page 3-68) sets parameters to save staked points.

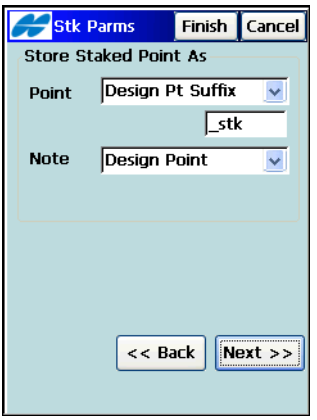


Figure 3-67. Stakeout Parameters - Second Screen

- *Store Staked Point As* – sets the rules for naming staked points. The only field needed for a Level survey.
  - *Point*: sets the rule for defining names for the staked-out points; either *design point name*, *next point name*, *Design Pt Suffix*, *design point with a pre-defined prefix* (that is, stk_01, where "stk_" is the prefix), *design point with a pre-defined suffix*, or *design point with a specified numerical constant added automatically* (for details on staked point name generation, see page 3-45).
  - *Note*: sets the rule for defining Notes for the staked-out points; either *Design Point*, *Design PT Prefix, Design PT Suffix,* or *Station & Offset* (for details, see page 3-45).
- **Back** – returns to the previous screen.
- **Next** – opens the ***Miscellaneous*** screen (Figure 3-68 on page 3-70).

Miscellaneous

The ***Miscellaneous*** screen is used to customize the user interface (Figure 3-68 on page 3-70):

- *Prompt for Rod Height* – if enabled, prompts you for a height of a Rod (Target) before a point is stored.

- *Prompt for BS Check* – if enabled, prompts to check the backsight.
- *Prompt for Feature Codes* – if enabled, the ***Code-Attributes*** screen displays to specify the code and attributes before a surveyed point is stored
- *Stakeout Sound* – if enabled, makes a sound each time a point is staked-out.
- *Manual Stakeout Update (Robotic Only)* – the **Meas** button on a ***Stakeout*** screen must be pressed to make a measurement to the Robotic Total Station. If this option is disabled, the measurements are recorded continuously. This applies to ***Stakeout*** screens only.
- *Beep on Storing Points* – if enabled, beeps each time a point is stored.
- *VA Zero at Level* – if enabled, vertical angle measurements are oriented to be zero at the Horizontal ("Level") direction. If this option is disabled, vertical angle measurements are oriented to be zero at the vertical ("Zenith") direction (default). Only certain Total Stations allow TopSURV to set this value. For this reason, ensure that this option is set to the same value in the total station as that set in TopSURV.
- *Use Horizontal Angle Left* – if enabled, the horizontal angle measurements are shown in a counter-clockwise ("Left") direction. If this option is disabled, the horizontal angle measurements are shown in a clockwise ("Right") direction (default). TopSURV automatically sets the Total Station to "*HR*" or "*HL*" depending on the selection.
- *Automatically display BS Setup screen* – if enabled, the ***Backsight Setup*** screen displays automatically when attempting to access any of the screens involving total station observations (see *Prompt for Feature Codes*).
- *Hold Offset Measurement* – if enabled, the screen to measure an offset point with the help of the selected offset tool displays automatically after each measurement (see *Prompt for Rod Height*).

- *BS Is Always Required* – if enabled, a warning to set the Backsight to always display when attempting to access any of the screens involving total station and level observations.
- **Back –** returns to the previous screen.
- **Finish –** saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.
- **Cancel** – closes the screen without saving the settings.

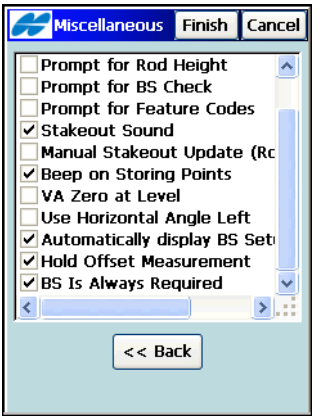


Figure 3-68. Miscellaneous

Miscellaneous (Level Survey)

For the Level survey type, the ***Miscellaneous*** screen contains the following specific user interface parameters (Figure 3-69 on page 3-71).

- *Display Coordinates after Measurement* – if enabled, automatically displays computed coordinates after a total station measurement is performed and before the point coordinates are stored into the database.
- *Apply Earth Curvature and Refraction* – if enabled, corrects the computed heights for the Earth's Curvature (Vertical Distance) and slope distances and vertical angles for atmospheric refraction.

- *Prompt for Feature Codes* – if enabled, the ***Code-Attributes*** screen displays to specify the code and attributes before a surveyed point is stored.
- *Stakeout Sound* – if enabled, makes a sound each time a point is staked-out.
- *Beep on Storing Points* – if enabled, makes a sound each time a point is stored.
- *Hold Vertical Offset* – if enabled, the vertical offset is added automatically to each measurement. Available only for the digital level.
- **Back** – returns to the previous screen.
- **Finish** – saves the changes and returns to the ***Survey Style*** screen (Figure 3-2 on page 3-2). Settings are transmitted only when the configuration is used.
- **Cancel** – closes the screen without saving the settings.

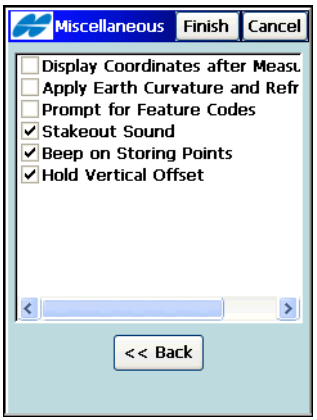


Figure 3-69. Miscellaneous – Level

Setting Coordinate System Parameters

To set coordinate system parameters for the job, tap the *Coord System* icon. The ***Coord System*** screen displays coordinate system information for the job (Figure 3-70 on page 3-74).

- *Projection* – specifies the projection used. The **List** ... button opens the ***Projections*** screen (see Figure 3-71 on page 3-75) where active projections can be manipulated (added from a list of pre-defined projections, deleted).
- *Use Grid/Ground* – when a grid projection is selected, this box is available. If enabled, the **List** ... button is activated to open the ***Grid to/from Ground Param*** screen where transformation parameters are set to place grid coordinates to a near ground reference surface and vice versa.
- *Datum* – shows the datum for the selected projection. The drop-down list of datums is available only when the current grid projection allows appropriate datum selection. The **List** ... button opens the ***Custom Datums*** screen to add/edit user-defined datums.

  The NAD83 datum has three independent realizations in TopSURV with respect to the WGS84 datum: *NAD83, NAD83(ITRF96)* and *NAD83_NO_TRANS* to reflect the updates to these datums.

  The original intent was for WGS 84 and NAD 83 to be identical. The mathematical definition of the ellipsoids (WGS 84 and GRS 80) differs slightly due to the choice of defining constants and number of significant figures. The maximum discrepancy between a Cartesian X,Y,Z coordinate projected onto both ellipsoids is 0.1 mm at 45 degrees latitude. So, for all intents and purposes, consider the ellipsoids to be identical.
  The confusion arises when we start to talk about the realization of the WGS 84 and NAD 83 datums. When NAD 83 was first realized in 1986, it used the same control stations as WGS 84,

some of which were Doppler stations, which were accurate to about one meter. Consider the datums to be identical.

Since this time, there have been several realizations of WGS 84, the latest being WGS 84 (G1150), which was performed using data from IGS tracking stations collected during GPS Week 1150. Recent studies have shown that WGS 84 (G1150) is essentially identical to the International Terrestrial Reference Frame of 2000 (ITRF00). Also, during this time there have been no new realizations of NAD 83.

What this means is that WGS 84 and NAD 83 can no longer be considered identical and are in fact different by more than one meter. This is because the WGS 84 datum has been updated over time, using GPS while the NAD 83 datum has remained constant since 1986. However, most software manufacturers still consider WGS 84 to be identical with NAD 83.

To be compatible with other manufacturers, Topcon provides transformation parameters from WGS 84 to NAD 83 where all the parameters are zero. This means WGS 84 equals NAD 83. This set of datum transformation parameters is called NAD 83 No_Trans.

Topcon also provides another set of datum transformation parameters called NAD 83 which reflects the updates to WGS 84. These parameters are taken from the National Geodetic Survey.

Topcon only uses the first seven parameters, three translations, three rotations, and scale.

- *Geoid Model* – shows the geoid selected (if any). The **List** [...] button opens the ***Geoids List*** screen where geoids can be added, deleted, or their properties viewed. See “Geoid List” on page 3-84 for more information.
- **OK –** saves the settings and returns to the main screen.
- **Cancel** – returns to the main screen without saving changes.

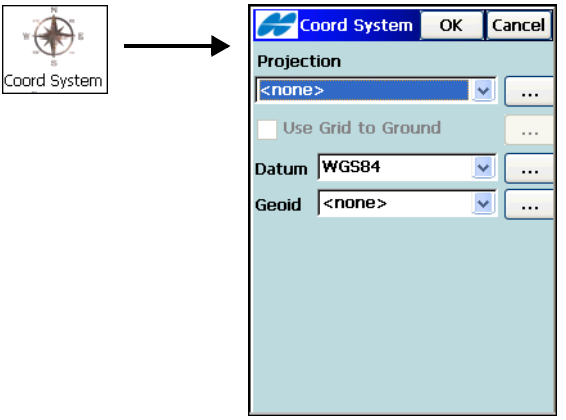


Figure 3-70. Coordinate System

Projections

The ***Projections*** screen contains a list of cataloged projections to select for the job (Figure 3-71 on page 3-75).

- *Pre-Defined* – contains a tree of available projections divided by regions.
- **Custom** – opens the ***Custom Projections*** screen to add/edit user-defined projections (Figure 3-72 on page 3-75).
- *Active* – contains a list of selected projections (corresponds to the drop-down list in the *Projections* field of the ***Coordinate System*** screen). The first time the screen is opened, it is empty (Figure 3-71 on page 3-75).
- – selects the chosen projection in the *Pre-Defined* panel and inserts it into the *Active* panel.
- – deletes the highlighted projection from the *Active* panel.
- **OK** – saves the changes and returns to the ***Coord System*** screen (Figure 3-70).
- **Cancel** – closes the screen without saving the settings.

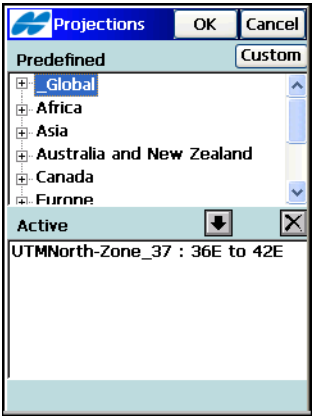


Figure 3-71. Projections

Custom Projections

The ***Custom Projections*** screen (Figure 3-72) contains a list of custom projections (grid systems). Initially, this list is empty.

- **Delete** – press to delete the selected custom grid systems.
- **Edit** – opens the ***Custom Projection*** screen (Figure 3-73 on page 3-76) to edit parameters of the selected custom grid system.
- **Add** – opens the ***Custom Projection*** screen (Figure 3-73 on page 3-76) to enter parameters for the new custom grid system.

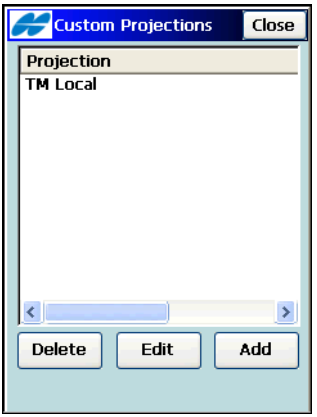


Figure 3-72. Custom Projections – Add New Custom Grid System

On the ***Custom Projection*** screen, enter or select the following parameters for the custom grid (Figure 3-73).

- *Name* – enter the name of the new projection.
- *Type* – select a sample projection to construct a custom projection from the following list of available types:
  - *Albers Equal Area* (orthembadic): conic projection.
  - *Cassini-Soldner:* cylindrical projection.
  - *Double Stereographic:* conformal azimuthal projection.
  - *Lambert:* conformal conic projection.
  - *Oblique Mercator:* conformal cylindrical projection.
  - *Stereographic:* conformal azimuthal projection.
  - *Transverse Mercator:* conformal cylindrical projection (see Figure 3-74 on page 3-77 for more information).

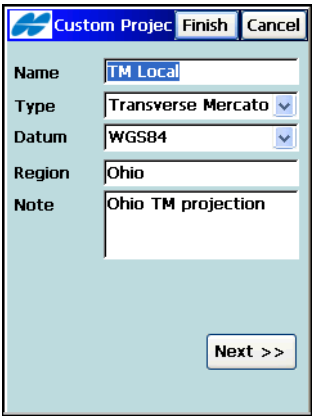


Figure 3-73. Custom Projections – Add New Custom Grid System

- *Datum* – select the datum for the projection from the list of available types.
- *Region* – displays the region.
- *Note* – enter any additional information about the projection, if preferred.

- **Next** – opens another ***Custom Projection*** screen to enter the new projection specifications depending on the selected sample projection.
- **Finish** – saves the changes, closes the screen, and returns to the ***Custom Projections*** screen.
- **Cancel** – closes the screen without saving the settings.

If the *Transverse Mercator* projection is the selected type for constructing a custom projection, the ***Custom Projection*** screen displays the following fields (Figure 3-74):

- *Central (Meridian)* – sets the longitude of the central meridian of a zone. The central meridian is a line of constant longitude (zero eastings) at the center of a graticule of a zone of custom projection. The central meridian is usually used as a base for constructing the other lines of the graticule.
- *Scale* – sets a constant scale factor along the central meridian. By this number, a distance along the central meridian of custom projection is multiplied to obtain the actual distance on the datum of the projection.
- *Lat0* – latitude of a point chosen as the origin on the central meridian of the zone grid.

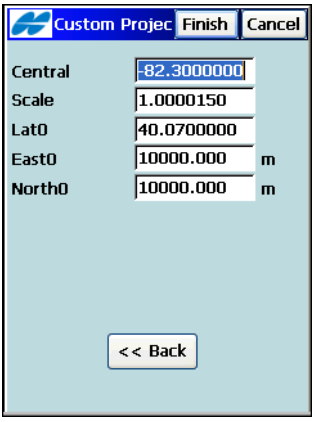


Figure 3-74. New Projection Specifications

- *East0, North0* – false Easting and Northing of the origin. These constant values are added to all negative eastings and northings so that only positive values of easting and northing are recorded.

Latitudes is entered as a positive number in the Northern Hemisphere, and as a negative number in the Southern Hemisphere.

Longitudes are positive for Eastern directions and negative for Western directions from the GMT line.

- **Back** – returns to the previous screen.
- **Finish** – creates the custom projection and returns to the ***Custom Projection*** screen with the new projection added.
- **Cancel** – closes the screen without saving the settings.

From Grid-to-Ground/Ground-to-Grid Transformation

A ground projection is a grid mapping projection rescaled to convert point coordinates to another reference surface (up to the average project elevation) to produce near ground distance values. The ground system can be rotated and shifted relative to the grid system. The ground coordinates can be converted back to the grid projection.

TopSURV has three modes to set up grid-to-ground parameters. Select one of these modes from the *Parameters* field (Figure 3-75 on page 3-79):

- *Scale Factor*
- *Average Job Height*
- *Origin Point*

For Scale Factor, the ***Grid to/from Ground*** screen (Figure 3-75) sets the *Combined Scale Factor* for *Grid-to-Ground* or *Ground-to-Grid* coordinate transformation.

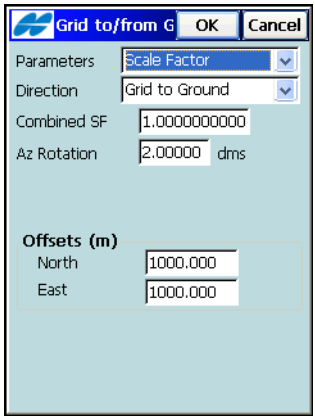


Figure 3-75. Grid to/from Ground - Scale Factor

- *Direction* – switches between the *Grid to Ground* and *Ground to Grid* coordinate transformation types.
- *Combined SF* – sets the combined scale factor.
- *Az Rotation* – sets the angle between the North directions of the grid and the ground coordinate systems. This angle defines the reference direction for ground azimuths.
- *Offsets* – enter offset values of the grid origin along the North and East axes to reduce ground coordinates to manageable values.

For Average Job Height, the ***Grid to Ground*** screen (Figure 3-76 on page 3-80) sets the *Average Height* of the job points for *Grid-to-Ground* coordinate transformation.

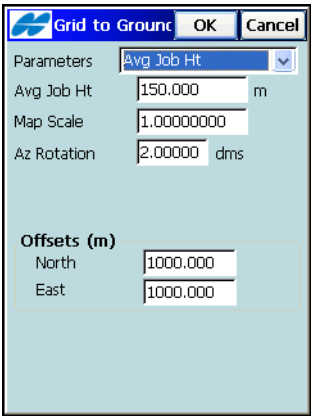


Figure 3-76. Grid to Ground - Average Job Height

- *Avg Job Ht* – sets the average job height to compute the elevation scale factor. An elevation factor is determined by using a constant value for the mean radius of the earth. An approximation of the earth's radius used in TopSURV is 6,371,000 meters.
- *Map Scale* – sets the value of the zone scale factor (how many grid distance units correspond to one distance unit on the ellipsoid).
- *Az Rotation* – sets the angle between the axes of the grid and the ground coordinate systems. This angle defines the reference direction for ground azimuths.
- *Offsets* – enter offset values of the origin along the North and East axes to reduce ground coordinates to manageable values.

For Origin Point, the ***Grid to Ground Params*** screen displays the parameters to set the origin of the ground coordinates (Figure 3-77 on page 3-81).

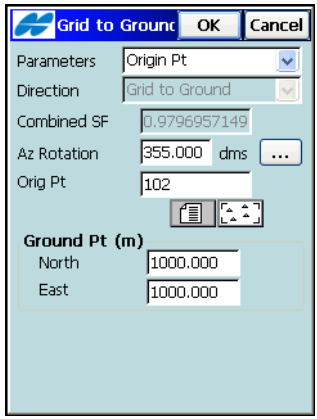


Figure 3-77. Grid to Ground - Origin Point

- *Direction* – always show the *Grid to Ground* coordinate transformation type.
- *Combined SF* – shows the combined scale factor.
- [...] – opens the ***Compute Rotation*** screen (Figure 3-78 on page 3-82) to compute the *Azimuth Rotation* value. For details, see Figure 3-79 on page 3-83.
- *Orig Point* – sets a desired grid point from the job as a ground origin; can be selected from a map, a list, or entered manually.
- *Ground Pt* – sets the ground coordinates for the origin point.
- **OK** – calculates all needed transformation parameters (offsets, scale factor, rotation) and returns to the ***Coord System*** screen. The scale factor for this mode is a calculated value. The value (not equal to "1") depends on the height of the origin point.

Compute Rotation

The ***Compute Rotation*** screen (Figure 3-78 on page 3-82) computes azimuth rotation using ground and grid azimuths.

- *Azimuth* – sets the azimuths in the ground and grid systems.
- **Compute** – opens the ***Compute Azimuth*** screen to compute azimuths in the ground and grid systems, respectively.

- *Rotation* – shows the azimuth rotation after pressing **OK**.
- **OK** – saves the results and returns to the ***Grid to Ground Parameters*** screen.
- **Cancel** – closes the screen without saving the settings.

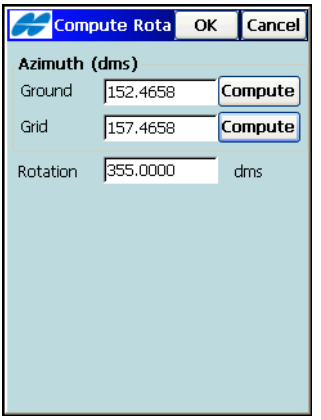


Figure 3-78. Compute Rotation

Compute Azimuth

The ***Compute Azimuth*** screen (Figure 3-79 on page 3-83) computes the azimuth of the direction using two points.

- *From* – sets the start point for the direction.
- *To* – sets the end point for the direction.
- *Add to Azimuth* – adds an additional value to the azimuth.
- *Azimuth* – displays the result after pressing the **OK** button for the first time.
- **OK** – saves the results and returns to the ***Compute Rotation*** screen (Figure 3-78).
- **Cancel** – closes the screen without saving the settings.

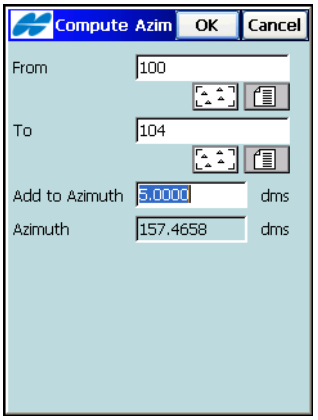


Figure 3-79. Compute Azimuth

Custom Datums

The ***Custom Datums*** screen (Figure 3-80) contains a list of custom datums. Initially, the list is empty.

- **Delete** – deletes the selected custom datum.
- **Edit** – opens the ***Custom Datum*** screen to edit parameters of the selected custom datum.
- **Add** – opens the ***Custom Datum*** screen to enter parameters for a new custom datum (Figure 3-81 on page 3-84).

Figure 3-80. Custom Datums

To set parameters for a new custom datum, press the **Add** button (Figure 3-80 on page 3-83).

The ***Custom Datum*** screen (Figure 3-81) displays to enter or select parameters for a new custom datum.

- *Name* – sets the name of the new datum.
- *Ellipsoid* – selects the ellipsoid for the datum from the list of available types.
- *Note* – any additional information about the datum.
- **Next** – opens another ***Custom Datum*** (Figure 3-81) screen to set offsets, rotations, and scale for the new datum.

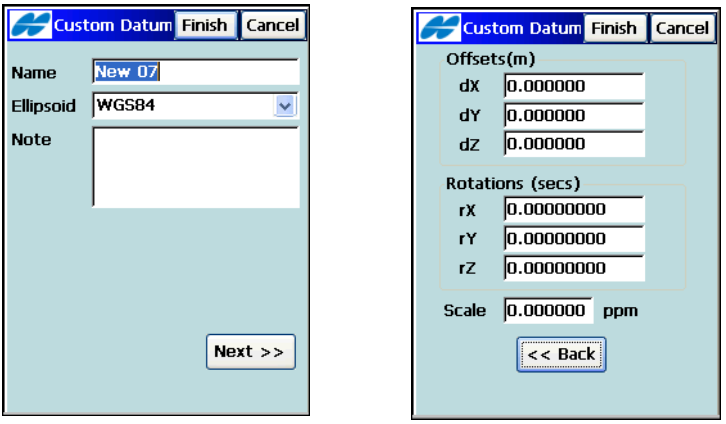


Figure 3-81. Custom Datum

- **Back** – returns to the previous ***Custom Datum*** screen.
- **Finish**: creates the custom datum and returns to the ***Custom Datums*** screen with the new datum added.
- **Cancel** – closes the screen without saving the settings.

Geoid List

Geoid is a physical reference surface. Its shape reflects the distribution of mass inside the earth. Geoid undulations are important for converting GPS-derived ellipsoidal height differences to orthometric height differences.

The ***Geoids List*** screen (Figure 3-82) contains a list of active *Geoids* available for selection.

- **Remove** – deletes the geoid from the list.
- **Edit** – opens the ***Add Geoid*** screen (Figure 3-83 on page 3-86) to change the geoid.
- **Add** – opens the ***Add Geoid*** screen (Figure 3-83 on page 3-86) to add a geoid file to the list. Install the geoid file on the controller prior to adding it to the list. Some geoid files can be installed on the controller during TopSURV installation. They are provided to the user with the TopSURV installation program as '.gff' files.
- **OK** – the job refers to the selected geoid file when performing calculations.
- **Cancel** – closes the screen without saving the settings.

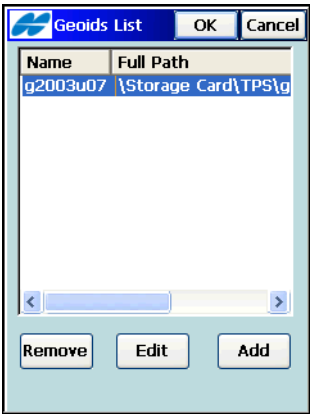


Figure 3-82. Geoid List

Add a Geoid File

On the ***Add Geoid*** screen (Figure 3-83 on page 3-86), select a Geoid file from the controller to view the boundaries of the geoid application.

- *Geoid Format* – the format of the geoid; either *Geoid 99/2003*, *Australian*, *Canadian 2000*, *Canadian 95*, *Geoid File Format*, *Mexico 97, Sweden*, *Denmark*, *Dutch2004 Files*, or *Norwegian Files*.

- – displays the directory where the geoid file is stored in the controller. Usually, the geoid files are stored in the Geoids folder in the directory where the application was installed.
- **Browse** – navigates to the geoid file previously downloaded to the controller.

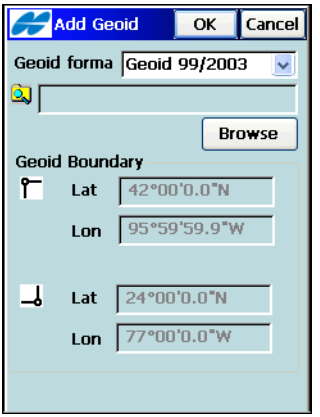


Figure 3-83. Geoid Parameters

- *Geoid Boundary* – displays the boundary of the geoid application after pressing the **OK** button.

  (Lat/Lon): the longitude and latitude of the point that sets the north-west boundary of the geoid.

  (Lat/Lon): the longitude and latitude of the point that sets the south-east boundary of the geoid.
- **OK** – returns to the ***Geoid List*** screen (Figure 3-82 on page 3-85.
- **Cancel** – closes the screen without saving the settings.

Setting Global Parameters for Job

To set global parameters in TopSURV, tap the **Global** icon. The ***Global Settings*** screen (Figure 3-84 on page 3-88) sets the mode for collecting data.

- *Use Bold Font* – if enabled, creates bold fonts on the controller display.
- *Enable Job History* – if enabled, saves the job history of every surveyor's operation on the job.
- *Data Entry* – select either *codes* or *notes* to enter in the field during survey.
- *Code File* – sets a Global Data Dictionary file to use the file's codes and layers with the currently selected job.
- **Browse** – tap to select a file to use for the Code File above.
- *Code with Description* – if this box is check marked, the drop-down menu for Code selection check marks the displays descriptions along with code names to select during survey.
- *Allow Custom Control Code* – if this box is check marked, TopSURV will not use it's linework package. In this case, the user can enter any string to mark it as a control code. TopSURV will not interpret these control codes.
- *Allow Persistent Control Codes* – if this box is check marked, the control codes will be persistent between recorded points and not cleared when surveying. This option available, only if the *Allow Custom Control Code* option is turned on above.
- *Control Code Delimiter* – when surveying, if the selected mode is either *Line* or *Area*, then this option selects a delimiter for entering control codes, along with codes in a single field, separated by the delimiter.
- **OK –** saves the changes and returns to the main screen.
- **Cancel** – closes the screen without saving the settings.

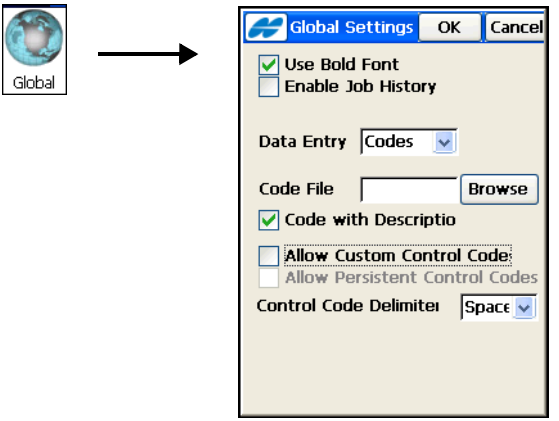


Figure 3-84. Global Screen

NOTICE

When using a Global Data Dictionary file, the codes immediately become available for selection from the Code drop-down list.

The layers from the Global Data Dictionary file display in the Layer list of the current job only as points are saved with the file's codes selected.

Setting Units

Tap the **Units** icon, to set default units for a job. The ***Units*** screen (Figure 3-85) displays. For details, see “Units” on page 2-6.

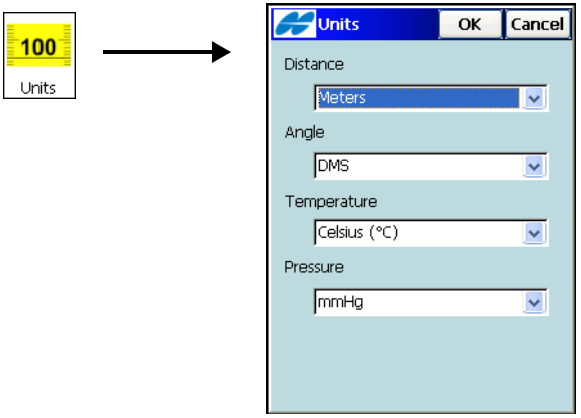


Figure 3-85. Units Screen

Customizing Data Display

The **Display** icon opens the ***Display*** screen (Figure 3-86) to customize the software interface. For details on this screen, see “Display” on page 2-8.

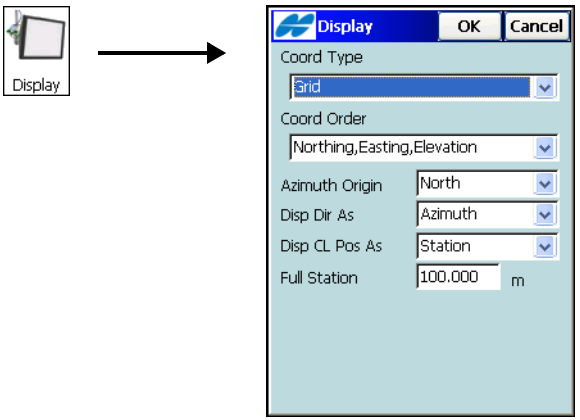


Figure 3-86. Display

In the Contractor Module, the ***Display*** screen does not contain the *Coordinate Type* field because this module works only with ground coordinates.

Setting Alarms

The **Alarms** icon opens the ***Alarms*** screen (Figure 3-87). For details, see “Setting Alarms” on page 3-90.

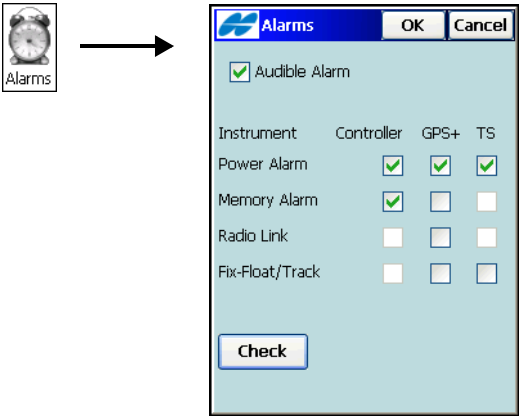


Figure 3-87. Alarms

- **Check –** pressing this button checks the status of selected situations for the instruments being used (Figure 3-88).

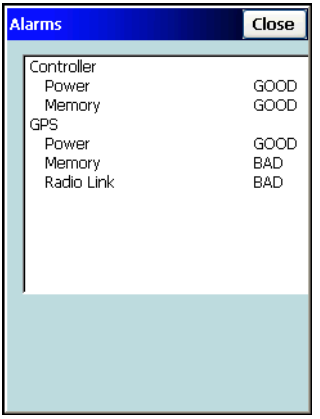


Figure 3-88. Checking Status

Modifying Menus

Tap the **Menus** icon to modify the appearance of the menus. Some rarely used functions are not displayed. If the menu optioins you need are not visible (available), enable these options in the corresponding menu in the ***Config Menus*** screen (Figure 3-89).

The ***Config Menus*** screen displays a list of menus and submenus for each special submenu for the current job configuration (Figure 3-89).

- *Menu* – shows the list of available menus.
- *Sub Menu to Display* – shows the list of the selected menu items available for display. Place a check mark next to the item you want to display in the menu.

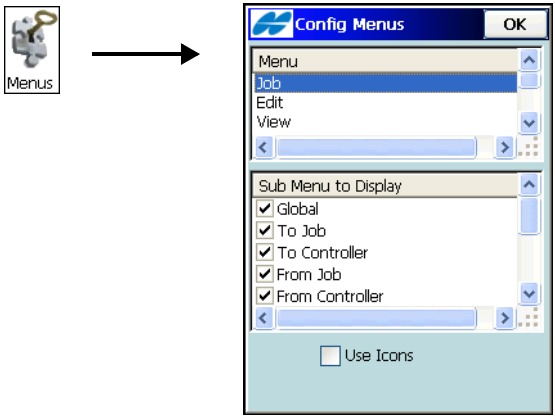


Figure 3-89. Config Menu Options

- **OK** – press to save the settings made and return to the main screen.
- *Use Icons* – check and enable this box to use the icon main menu instead of the list of names (Figure 3-90 on page 3-92).

  This operation makes sense only when TopSURV is in the List menu mode (For details on switching to the List Menu, see “Switch Menus” on page 1-11.)

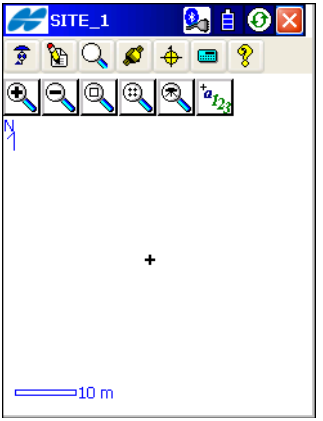


Figure 3-90. List Menu Icons

Exporting Data

To export data, tap the **Export** icon in the main menu.

The Export function is used to save points, codes and attributes, Code Libraries, Roads, Cross Section Templates, Point Lists, Localization, Road Survey, and Raw Data in another job, controller, or file.

The **Export** menu (Figure 4-1) includes options to:

1. Export data from an active job to a new job
2. Export job data to another controller
3. Export data to a file
4. Export GPS session settings to the receiver

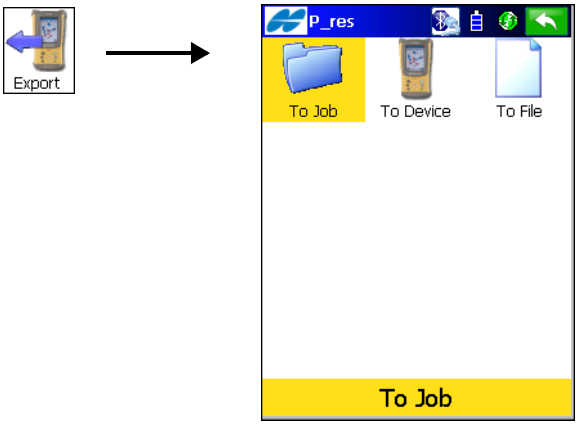


Figure 4-1. Export Menu

Tap the Help Icon to open a pop-up menu, giving access to the help files, module activation codes, port data logging, changing menu interface, and information about TopSURV (for details see “Help Icon’s Pop-up Menu” on page 1-8).

Exporting To a Job

To export data to a job, tap the **To Job** icon.

Select a Job

The ***Select Job*** screen (Figure 4-2) selects the destination job to export to.

- *Current Job* – list the job that is currently open.
- *Job List* – a list of jobs to open.
- *Created/Modified* – shows the date the file was created and when it was last modified.
- **Browse** – tap to select a job from the disk. if there is no job in the Job List that you want.
- **Select –** starts the export process wizard. Follow the wizard's **Next** button until the **Finish** button is available.
- **Close** –

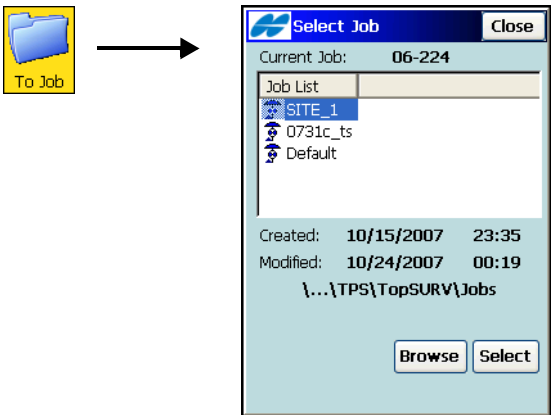


Figure 4-2. Select Job

Export To the Job

On the ***To <Job name>*** screen (Figure 4-3), select the data that you want to have exported along with the point data.

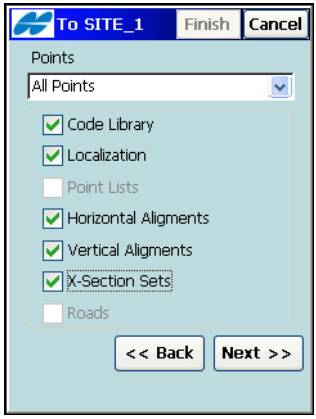


Figure 4-3. Export To Job

- *Points* – select the points to import from the drop-down list; either *All Points, By Type, By Range and Code, By Type, Range and Code,* or *None*.
- Check mark the data to be imported along with the points; either *Code Library, Localization, Point Lists, Horizontal Alignments, Vertical Alignments, X-Section Sets* or *Roads.*
- **Back** – returns to the previous screen.
- **Next** – depending on data selections, opens an appropriate screen to select either ***Point Types Point, Point List, Horizontal Alignments, Vertical Alignments, X-Section Sets*** or ***Roads*** to export.
- **Finish** – starts the export process only if *Code Library* and/or *Localization* items are chosen and *All Points* is selected. Otherwise, the option becomes available after all data are selected by the **Next** button.
- **Cancel** – closes the screen without saving the settings.

Select Point Types To Export

The ***Pt List To Export*** screen (Figure 4-4) selects the types of points to export if *Code Library*, *Localization,* or *Roads* are checked (if points filter by type has been enabled in the ***Export*** screen). Place check marks near the desired point types.

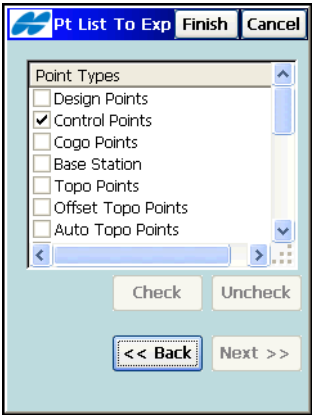


Figure 4-4. Select Point Type(s) to Export

- *Point Types* – the point types available for import: either *Design Points, Control Points, Cogo Points, Base Station, Topo Points, Offset Topo Points, Auto Topo Points, Sideshot, Offset, Remote, Reflectorless, BackSight, Stake Points, Stake Line, Check Points, Manually Typed,* or *Tape Dimension.*
- **Check** – marks the highlighted entries.
- **Uncheck** – removes the mark from the highlighted code.
- **Back** – returns to the previous screen.
- **Next** – if available, opens the next screen to select objects; once the button becomes grayed out, tap the **Finish** button to start the export process.
- **Cancel** – closes the screen without saving the settings.

Select Points to Export

The ***Points to Export*** screen (Figure 4-5) filters the exported points.

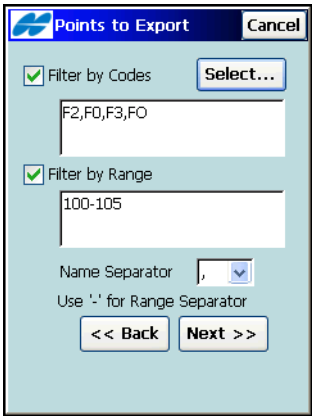


Figure 4-5. Points to Export

- *Filter by Codes* – export all points with the selected codes.
- **Select** – opens the ***Code*** screen (Figure 4-6 on page 4-6).
- *Filter by Range* – selects a range of points to export. These can be set by range ("-", ";" or "," can be used as range separators) or by enumeration.
- *Name Separator* – selects a parameter to use as a name separator,
- *Use '-' for Range Separator* – shows the separator used as a range separator.
- **Back** – returns to the previous screen.
- **Next** – opens the next screen to select data. The button is available until all data of chosen types is selected, and the **Finish** button appears to open the ***Export Status*** screen.
- **Cancel** – closes the screen without saving the settings.

Select Code

The ***Code*** screen (Figure 4-6) contains a list of available codes. All codes that have been check marked are imported.

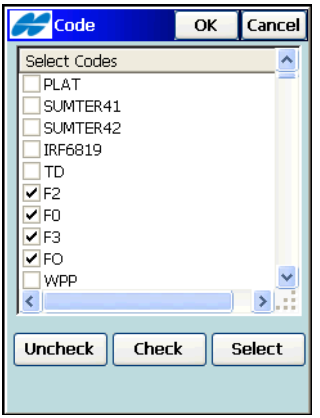


Figure 4-6. Select Code

- **Uncheck** – removes the mark from the highlighted code.
- **Check** – marks the highlighted codes.
- **Select** or **OK** – returns to the ***Points to Export*** screen with the codes selected.
- **Cancel** – closes the screen without saving the settings.

Select Point List to Export

The ***Pt List To Export*** screen (Figure 4-7) selects the point lists to export along with the data chosen.

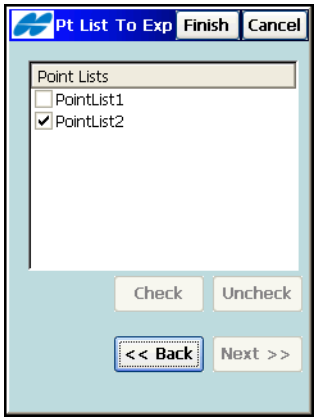


Figure 4-7. Select Point List to Export

- *Point Lists* – the list of available point lists in the job.
- **Check** – marks the highlighted entries.
- **Uncheck** – removes the mark from the highlighted entries.
- **Back** – returns to the previous screen.
- **Next** – available if other data is chosen to export on the ***To Job*** screen (Figure 4-3 on page 4-3). Opens the next screen to select other objects (horizontal alignments, vertical alignments, roads or x-section sets) which are similar to the ***Point List to Export*** screen. Once the button becomes grayed out, tap the **Finish** button to start the export process.
- **Finish** – if available, opens the ***Export Status*** screen and starts the export process.
- **Cancel** – closes the screen without saving the settings.

Export Status

The ***Export Status*** screen (Figure 4-8) reflects the export process and contains a progress bar and a comments window. The progress bar displays the percentage of the data being exported.

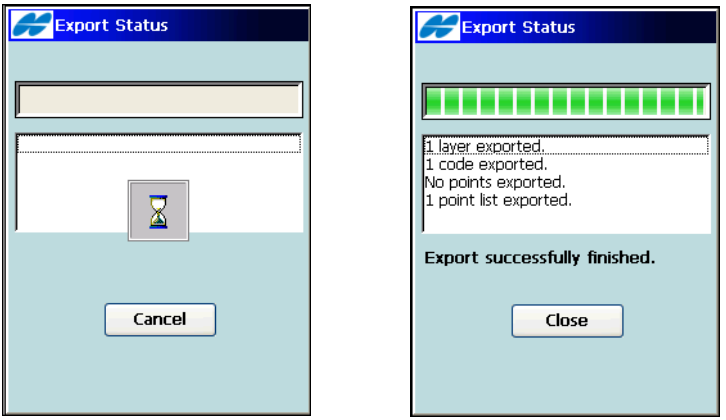


Figure 4-8. Export Status

- **Cancel** – cancels the export process.
- **Close –** returns to the main screen.

Duplicate Objects

If the existing job contains objects with the same names as the job that the objects are exported to, the ***Duplicate <Objects>*** screen displays (Figure 4-9) a warning that the code already exists.

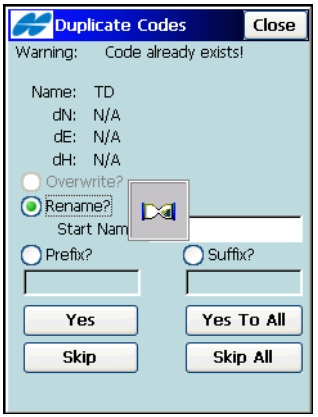


Figure 4-9. Duplicate <Objects>

The ***Duplicate <Objects>*** screen issues a warning that prevents the loss of points, roads, or point lists when names of these exported objects coincide with existing ones. Select from the following options:

- *Overwrite* – the exported object overwrites the existing one.
- *Rename* – the imported object is renamed. The new name should be noted in the corresponding field (*Start Name*).
- *Prefix/Suffix* – the imported object differs from the existing object by prefix or suffix. The prefix/suffix should be noted in the corresponding field.
- **Yes** – press to accept the decision.
- **Yes To All –** press to accept the same decision for all similar cases.
- **Skip** – press to skip the object without exporting.
- **Skip All** – press to skip all the objects with names that coincide with the names of existing objects, without exporting.

- **Close** – disables the export process and opens the ***Export Status*** screen to remove all the objects already exported.

Exporting to Device

To export a file to a controller, tap the **To Device** icon.

Selecting Port

On the ***Settings*** screen (Figure 4-10) you can select the port for data transfer with another controller.

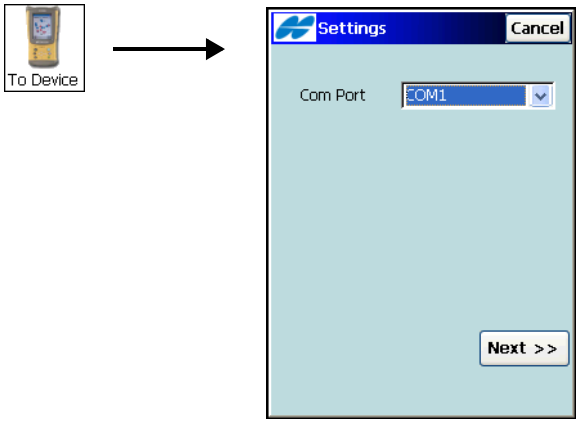


Figure 4-10. Select Port

- *Com Port* – selects the Communication port; select either *COM1, COM2*, *Ethernet* or *Bluetooth*.
- **Next** – opens the ***Select File*** screen (Figure 4-11 on page 4-11).

Select File To Export

On the ***Select File*** screen, you can navigate to the file to export (Figure 4-11).

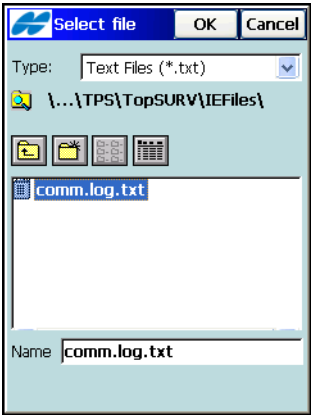


Figure 4-11. Select File to Export

- **OK** – opens the ***Export File*** screen reflecting the status of exporting the selected file (Figure 4-12), then returns to the main screen if successful.
- **Cancel** – returns to the main screen.

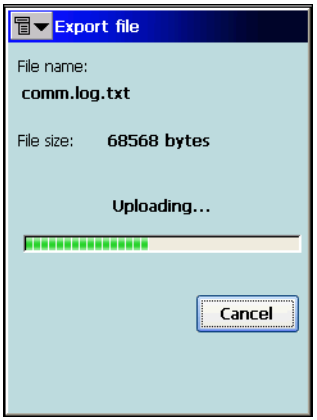


Figure 4-12. Export File

Exporting to File

To export data to a file, tap the **To File** icon.

The ***To File*** screen selects data type from the current job to export to files of either pre-defined or custom formats. For a description of these formats, see Appendix A (Figure 4-13).

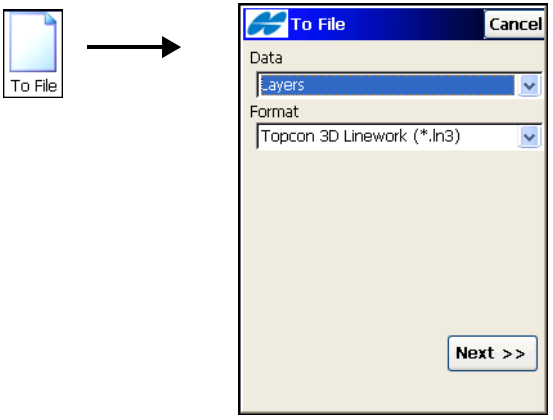


Figure 4-13. Export To File

- *Data* – select the data type to export: either *Points, Lines, Point Lists, Code Library, Raw Data, Horizontal Alignments, Vertical Alignments, X-Section Sets, Roads, X-Sect Templates, Localization, Scanning Data, Roads Survey, Job History, TINs, Layers,* or *Multiple*.
- *Format* – select the file type to export data to.
- **Next** – opens the ***To < name of Format>*** screen to specify the file name and the directory where the file will be saved.
- **Cancel** – returns to the main screen.

Follow up the export process with the help of the export wizard.

Points and Point Lists

For Point and Point Lists data, the following exports are allowed for the formats:

Topcon Text Custom (.txt)*, *Text Custom Report (*.txt)*, *Topcon Text Custom QC (*.txt)*, *Topcon FC-4 (*.fc4)*, *Topcon FC-5 (*.fc5), Topcon GTS-6 (*.gts6), Topcon FC-6/GTS-7 (*.pnt), Topcon GTS-7 with strings (*.txt), Topcon GT (*.pnt), Topcon GT Finland (*.gt), MOSS GENIO (*.mgn), AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg), ESRI Shape (*.shp), Cut Sheet Standard (*.txt), Cut Sheet User Defined (*.txt), Check Sheet (*.txt), TDS Coordinates (*.cr5), PTL Sheet (*.txt), LandXML (*.xml), NEZ (*.txt), NEZ with strings (*.txt), CMM (*.cor), MMH360 (*.360), KOF (*.kof), MMH360_Z000 (*.360), Microstation 95/ISFF (*.dgn), MicroStation V8 (*.dgn), SBG Pxy (*.PXY)* or *SBG Geo (*.Geo)*

For Points or Point Lists data and for most formats the ***To File*** screen (Figure 4-14 on page 4-14) has the following options.

- *Select Types of the Points* (for *Points* and *Point Lists* data types) – check mark this field if not all types of points should be exported. In this case the ***Point Types to Export*** screen first displays (see Figure 4-4 on page 4-4).
- *Use Filters* (for *Points* and *Point Lists* data types) – check mark this field if filters (by code and by range) should be used for exported points.

  In this case, the ***Points to Export*** screen first displays (see Figure 4-5 on page 4-5).

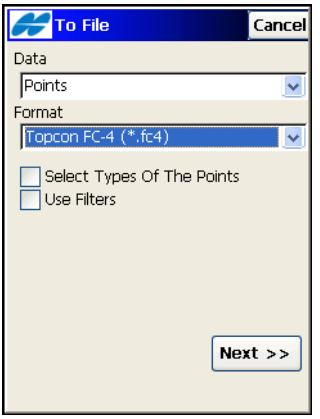


Figure 4-14. Points to File

- **Next** – opens the ***To < name of Format>*** screen to set the destination file.
- **Cancel** – returns to the main screen.

The options, which are available on the *To File* screen, depend on the format selected. Refer to the following sections for detail.

Topcon Text Custom

If the *Text Custom* format is selected, the ***To File*** **screen (Figure 4-15)** shows the *ASCII File Properties* field.

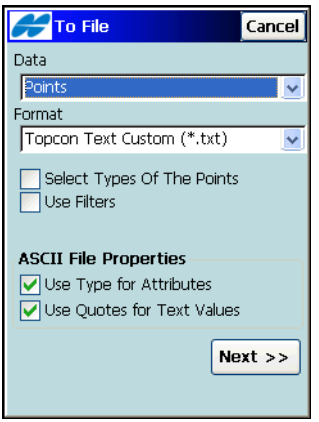


Figure 4-15. Points to Text File

- *ASCII File Properties* (this field appears only for the text format of the exported file) – defines the conditions of the exported file interpretation.
- **Next** – opens the ***To Text*** screen (Figure 4-16).

On the To Text screen (Figure 4-16), select a destination directory and the name of the created file.

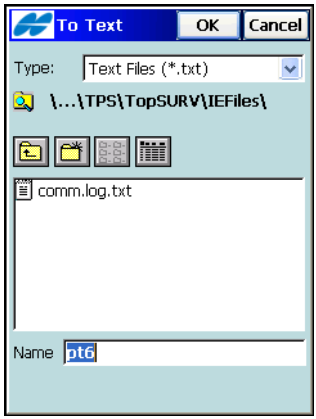


Figure 4-16. Select the File

- *Type* – specifies the file extension (file type).
- *Name* – the name of the created file.
- **OK** – opens the ***Text File Format*** screen.
- **Cancel** – returns to the main screen.

On Text File Format screen (Figure 4-17), select a desired text format.

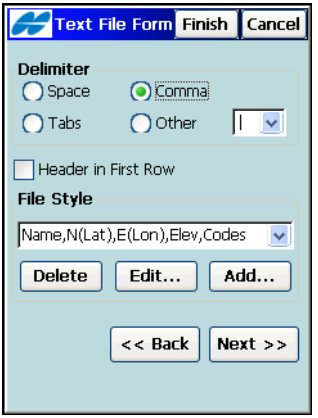


Figure 4-17. Text File Format

- *Delimiter* – enables the delimiting symbol between the data in the exported file; either *space*, *comma*, *tabs* or *Other* delimiter selected from the list.
- *Header in First Row* – enable to output a header in the file.
- *File Style* – selects the order of fields in the exported file.
- **Delete** – deletes an existing file format.
- **Edit (Format)** – edits an existing file format. The ***Custom Style*** screen displays (Figure 4-18 on page 4-17).
- **Add (Format)** – adds a new file format. The ***Custom Style*** screen (Figure 4-18 on page 4-17) displays.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Coordinate System*** screen (Figure 4-19 on page 4-18).
- **Finish** – press to start the export process (Figure 4-21 on page 4-19).
- **Cancel** – closes the screen without saving the settings.

On the Custom Style screen (Figure 4-18), using the arrows, move items at the bottom of the *Available* column to the *Order* column and arrange in the preferred order with the *Up* and *Down* arrows to the right of the *Order* column.

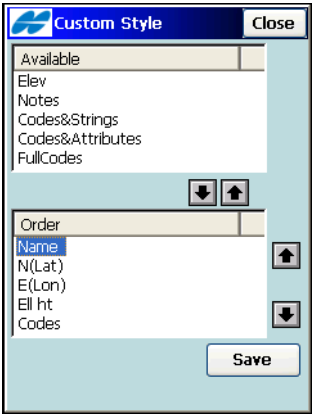


Figure 4-18. Custom Style

- **Save** – saves the custom file format and returns to the *Text File Format* screen. A new entry appears in the *File Style* drop-down menu.
- **Close** – returns to the previous screen without changes being made.

On the Coord System screen (Figure 4-19 on page 4-18) select the coordinate type and distance units for the data in the file exported:

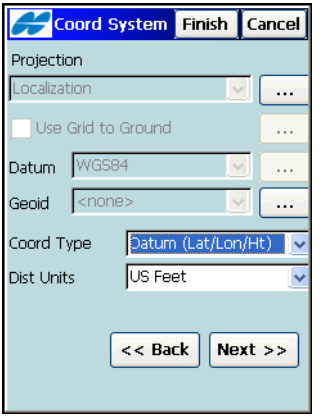


Figure 4-19. Coordinate System

- *Coord Type* – select either *WGS84 (Lat/Lon/Ht), Datum (Lat/Lon/Ht), Grid,* or *Ground*.
- *Dist Units* – recalculate to either *Meters, IFeet*, or *USFeet*.

This screen also displays information about the coordinate system in the job whose data is exported.

- **Back** – returns to the previous screen.
- **Next** – opens the ***Lat/Lon Record Format*** screen if the type of geodetic coordinates is selected (Figure 4-20 on page 4-19).
- **Finish** – opens the ***Export Status*** screen and starts the export process. (See Figure 4-21 on page 4-19.)
- **Cancel** – close the screen without saving the settings.

On the Latitude/Longitude Record Format screen (Figure 4-20 on page 4-19), select from the drop-down list the format you want to represent the degrees of Latitude and Longitude in the file exported.

- **Back** – returns to the previous screen.
- **Finish** – opens the ***Export Status*** screen and starts the Export process (see Figure 4-21.)
- **Cancel** – closes the screen without saving the settings.

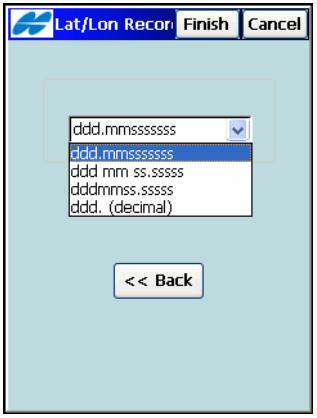


Figure 4-20. Select Latitude/Longitude Format

On the Export Status screen (Figure 4-21), tap the **Close** button to return to main screen.

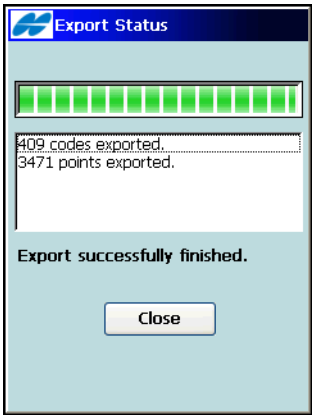


Figure 4-21. Export Status

Text Custom Report

If the *Text Custom Report* format is selected, the ***To File*** screen displays the **Code Style** button (Figure 4-21).

Note that report files cannot be imported back to TopSURV.

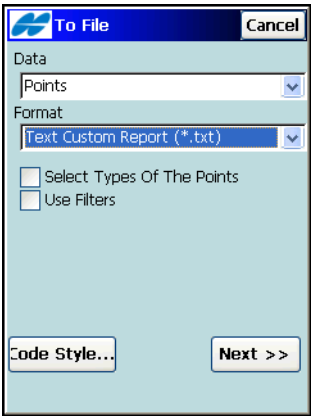


Figure 4-22. To Text Custom Report

- **Code Style** – opens the ***Code Style*** screen to set a format for point properties (codes, control codes, strings and notes) to export to the file.
- **Next** – with the help of the export wizard, follow next screens which are similar to those for the Topcon Text Custom format.
- **Cancel** – closes the screen without saving the settings.

On the Code Style screen (Figure 4-23 on page 4-21), select or create a desired format for information on every point to arrange it on one line in the exported file.

- *Style* – selects a defined format style. The pre-defined styles are: *Topcon*, *Carlso*n and *Eagle Point*.
- Using the arrows, move items from the *Available* column to the *Order* column and arrange in the preferred order.
- **Separators** – opens the ***Separators*** screen to display separators for a selected style.
- **Close** – returns to the previous screen without changes made.

- **Delete** – deletes the selected style from the list.
- **Save** – saves the custom report format and a new entry appears in the *Style* drop-down menu.

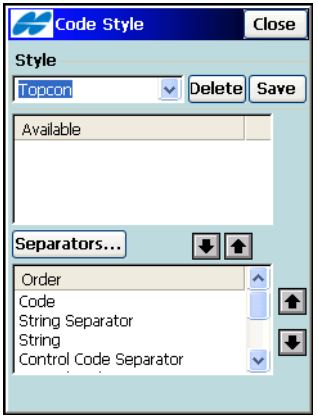


Figure 4-23. Code Style

On the Separators screen (Figure 4-24), you can enter *Code*, *String*, *Control Code*, and *Note* separators for a new style.

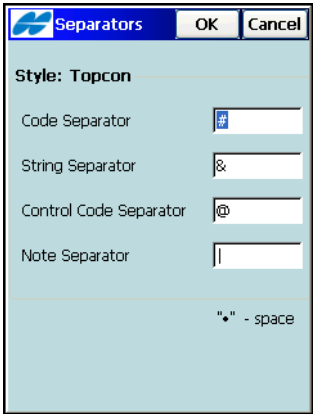


Figure 4-24. Separators

Topcon Text Custom QC

The procedure of exporting points and point lists to the Topcon Text Custom QC format is the same as for the Topcon Text Custom format. For details, see “Topcon Text Custom” on page 4-14. The only difference is that this format allows selection of parameters of Quality Control in the ***Custom Style*** screen (Figure 4-25).

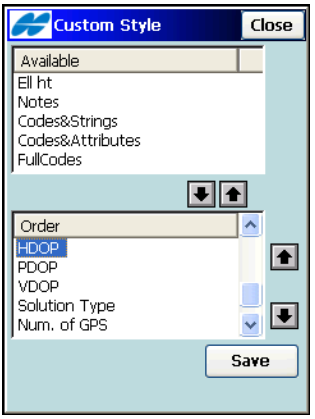


Figure 4-25. Custom Style with QC

AutoCAD DXF and AutoCAD Drawing

If the *AutoCAD DXF* or *AutoCAD Drawing* format is selected, the ***To File*** screen has the following additional options for point export (Figure 4-26 on page 4-23).

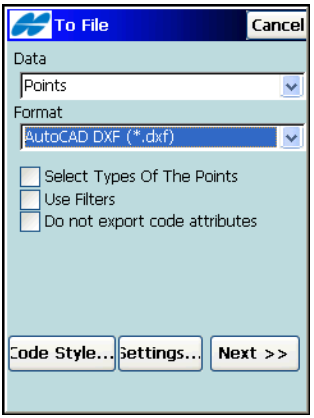


Figure 4-26. AutoCAD DXF

NOTICE

TopSURV only exports AutoCAD 2000 format DWG files.

- *Do not export code attributes* – enable to not export code attributes.
- **Code Style** – opens the *Code Style* screen to set a format for point properties (codes, control codes, strings and notes) to export to the file. For details, refer to "On the Code Style" on page 4-20.
- **Settings** – opens the ***Settings*** screen to select point and line styles.
- **Next** – with the help of the export wizard, follow next screens to export points.
- **Cancel** – closes the screen without saving the settings.

On the Settings screen, you select desired drawing styles to represent points and lines.

- *Point Style* – selects the style for points; either *TopSURV Point Blocks*, *AutoCAD Points*, *AutoCAD Points with Text Fields*, or *Carlson Point Blocks*.
- *Line Style* – selects the style for lines; either *TopSURV Line Blocks*, *AutoCAD Lines*, or *AutoCAD Lines with Text Fields.*

- *Use 3D coordinates* – check mark this box to use 3D coordinates.
- OK – saves the settings and returns to the previous screen.
- **Cancel** – closes the screen without saving the settings.

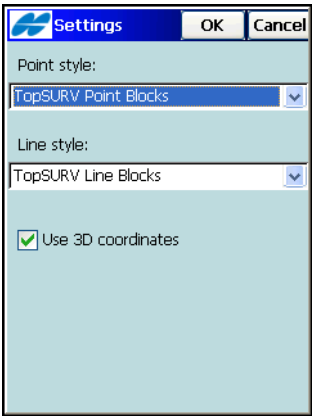


Figure 4-27. Settings

ESRI Shape

If the *ESRI Shape* format type is selected, the ***To File*** screen has the Store Description as Attribute option for point export available. Enable this option to save point descriptions as attributes in the file (Figure 4-28 on page 4-25).

- *Store Description as Attribute* – check mark this box to save point descriptions as attributes in the file.

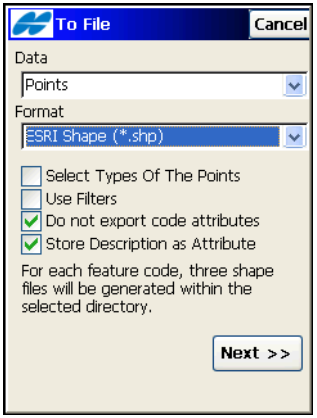


Figure 4-28. ESRI Shape

- **Next** – with the help of the export wizard, follow next screens to export points. Note that while exporting, TopSURV creates three files for every code in the selected directory (Figure 4-29).

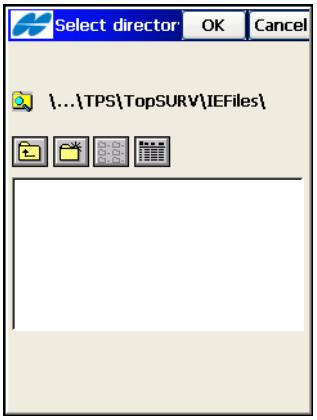


Figure 4-29. Select Directory

TDS Coordinates

If the *TDS Coordinates* format is selected, the *To File* screen has the following additional option to export points.

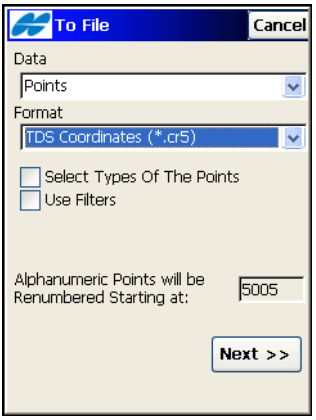


Figure 4-30. To TDS Coordinates

- When selected, the TDS Coordinate format demands points have only numerical names. The screen displays a number at which TopSURV will start renaming points with alphanumeric names.
- **Next** – with the help of the export wizard, follow next screens to export points.

Lines

For Lines data, the export is allowed for the formats: *Topcon Text Custom (*.txt)*, *AutoCAD DXF (*.dxf)*, *AutoCAD Drawing (*.dwg)*, *ESRI Shape (*.shp)*, *LandXML (*.xml)*, *KOF (*.kof)*, *Topcon 3D Linework (*.ln3)*, *Microstation 95/ISFF (*.dgn)*, *MicroStation V8 (*.dgn)*, *MX GENIO (*.txt)*, *SBG Pxy (*.PXY)* or *SBG Geo (*.Geo)*.

Code Library

For Code Library data, the export is allowed for the formats: *Topcon XML (*.xml)*, or *DBF (*.dbf)*.
Code Library is a set of codes with attributes used in the job. Once created, it can be saved as a file with *.xml, or *.dbf file extensions.

Raw Data

For Raw Data, the following formats are available on the ***To File*** screen (Figure 4-31):

LandXML (.xml), Topcon FC-5 (*.fc5), Topcon GTS-6 (*.gts6), Topcon FC-6/GTS-7 (*.gts7), TDS Raw Data (*.RAW), MOSS Survey (*.txt), Field Book (*fbk), KOF (*kof), Topcon Vector Format (*.tvf), TVF with Code Style (*.tvf), Berlin GNSS-Messprotocoll (*.txt)* or *Berlin GNSS- Mittelwerte (*.txt)*.

When choosing *LandXML*, *TDS Raw Data*, *Field Book* or *KOF* file, select the type of raw data to export: *Export TS Raw Data* and/or *Export GPS Raw Data*.
In addition to being exported to a TDS Raw Data file, raw data can be saved in a format compatible with the *FBK* format. Selection of the FBK Compatible option is available if control codes are saved as notes. When selected, the *FBK Compatible* option demands points have only numerical names. The screen displays a number at which TopSURV will start renaming points with alphanumeric names.

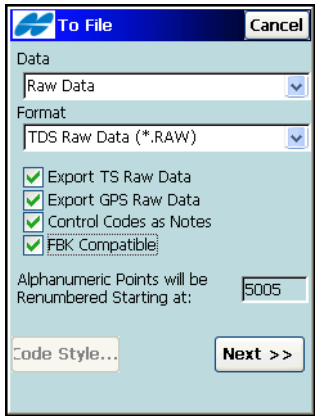


Figure 4-31. Export Raw Data To TDS Raw Data

Horizontal Alignments

For Horizontal Alignments data, you can export the following formats: *SSS H. Alignment (*.hal), TopSURV H. Alignment (*.thl), CLIP H. Alignment (*.PLT),* or *ISPOL H. Alignment (*.ALI)* (Figure 4-32) from the *Format* drop-down list.

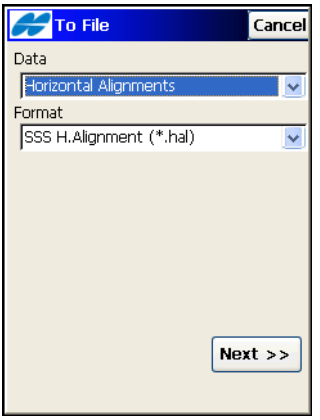


Figure 4-32. Horizontal Alignments

- **Next** – opens the ***H.Alignments to Exp*** screen to select alignments (Figure 4-33).

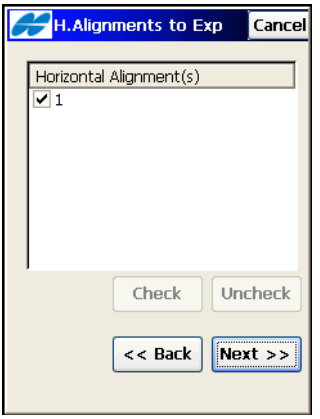


Figure 4-33. Select Horizontal Alignments

- *Horizontal Alignment(s)* – lists the available horizontal alignments in the job.

- **Check** – marks the highlighted entries.
- **Uncheck** – removes the mark from the highlighted alignment.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Select directory*** screen (Figure 4-34) to select the directory to save the file. The file will have the same name of the exported alignment .

NOTICE

When exporting, TopSURV opens similar screens, to select other objects (vertical alignments, roads, x-section sets or x-sections templates.

- **OK** – opens the ***Export Status*** screen and starts the export process.
- **Cancel** – closes the screen without saving the settings.

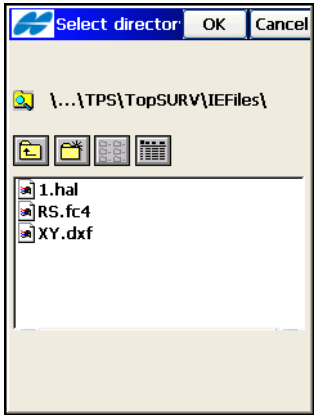


Figure 4-34. Select Directory

Vertical Alignments

For Vertical Alignments data, you can export the following formats: *SSS V. Alignment (*.val), TopSURV V. Alignment (*.tvl), CLIP V. Alignment (*.ALZ),* or *ISPOL V. Alignment (*.RAS).*

X-Section Sets

For X-Section Sets data, you can export the following formats: *SSS Cross Section Set (*.rd), TopSURV Cross Section Set (*.trd), CLIP Cross Section Set (*.TRV), ISPOL Cross Section Set (*.SC1),* or *Custom X-Sections (*.cxs).*

Roads

For Roads data, you can export the following formats: *Land XML (*.xml), SSS Road (*.hal; *.val; *.rd), TDS Road (*,rd5), Topcon 3D Road (*.rd3), TopSURV Road (*.thl; *.tvl; *.trd), CLIP Road (*.PLT; *.ALZ; *.TRV), ISPOL Road (*.ALI; *.RAS; *.SC1), Tekla Roads (*.vgp), MX GENIO Road (*.txt), or SBG Road (*.LIN).*

In LandXML file, X-Sections are stored as Zones when the *Use Zone elements for x-sections* box is check marked (Figure 4-35).

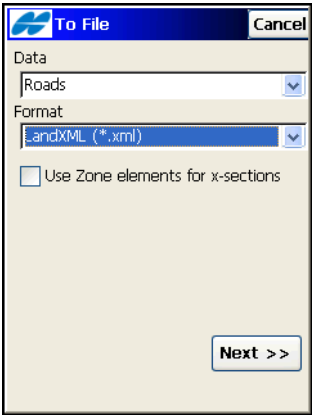


Figure 4-35. Roads to LandXML

In TopSURV or TDS Road format, also select the desired distance units (Figure 4-36 on page 4-31).

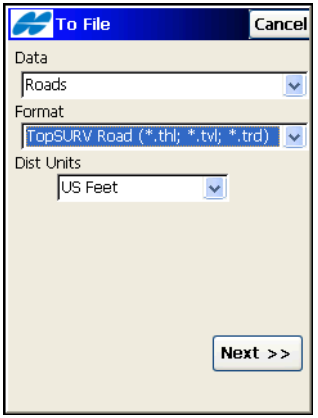


Figure 4-36. Roads to TopSURV Road

The header of the TopSURV Road format contains the starting azimuth if the Road is not a straight line.

X-Section Templates

For X-Section Templates data, you can export the following formats: *SSS X-Section Templates (*.xtl), TDS X-Section Templates (*.tp5),* or *TopSURV X-Section Templates (*.xst).*

When exporting to TopSURV or TDS Road format, also select the desired distance units (Figure 4-37 on page 4-32).

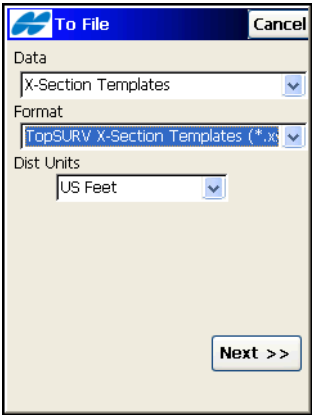


Figure 4-37. X-Section Templates to TopSURV Templates

Localization

For *Localization* data, you can export the following formats: *Topcon 3D Localization (*.gc3),* and *TDS Raw Data (*.RAW).* Control Points are exported together with Localization data.

Scanning Data

For *Scanning* Data, you can export the following formats: all scanning data are exported for *DI-3000 Project (*.fsc).*

Roads Survey

For *Roads Survey* data, you can export the following formats: *TopSURV X-Section Survey (*.xss)* or *Find Chainage/Station Report (*.txt).*

Job History

For Job History data, you can export the following formats: *CSV (Comma delimited) (*.csv),* and *Text report (*.txt).*

The Job History file is formed if the Enable Job History box is check marked on the ***Global Settings*** screen (see “Setting Global Parameters for Job” on page 3-87).

TINs Data

For *TINs* data, you can export the following formats: *AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg),* or *LandXML (*.xml)*.

When exporting to AutoCAD DXF or Drawing file, tap the **Settings** button to select desired drawing styles to represent points and lines (for details, see “On the Settings” on page 4-23).

TopSURV stores surfaces in TN3 files (in the DTM directory). Select a desired TN3 file to export in the ***Select TN3*** screen (Figure 4-38).

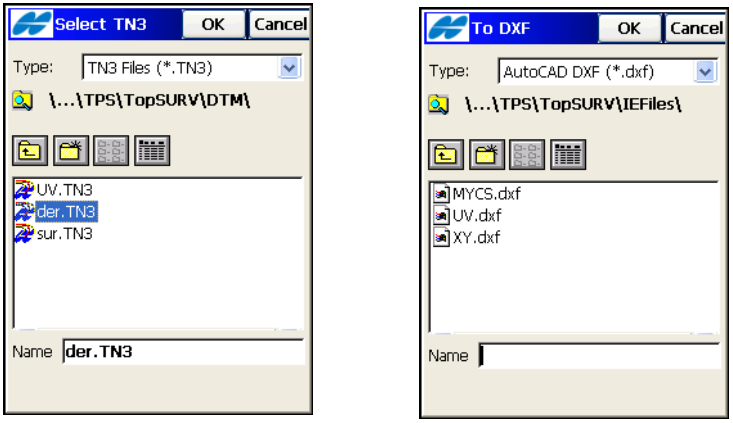


Figure 4-38. Select TN3/Select File

- **OK** – opens the ***To <Format>*** screen to select a destination directory and the name of the created file.
- **Cancel** – closes the screen without saving the settings.

Layers

For *Layers* data, you can export the following formats: *Autodesk Layer States* (*.las)*, Topcon 3D Linework (*.ln3).*

Multiple

For *Multiple* data, you can export the following formats: *Topcon Text Custom (*.txt), AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg), ESRI Shape (*.shp), LandXML (*.xml), KOF (*.kof), Microstation 95/ISFF (*.dgn), MicroStation V8 (*.dgn), SBG Pxy (*.PXY),* or *SBG Geo (*.Geo).*

TopSURV only exports AutoCAD 2000 format DWG files.

TopSURV exports layers to DWG/DXF files, along with the appropriate data types.

The **Next** button on the ***To File*** screen opens the ***Data Selection*** screen (Figure 4-39 on page 4-35).

On the Data Selection screen (Figure 4-39 on page 4-35), select a specific data group in the job available to export to a specified format. For the LandXML as an example, Points, Lines, Alignments, Codes, Surfaces, X-sections, TS and GPS Raw Objects are available for selection.

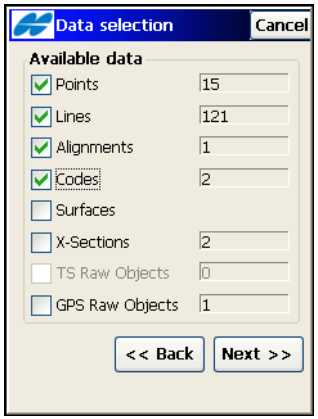


Figure 4-39. Export Multiple Data

- **Next** – depending on the data selected for export, opens different screens:
  - – ***Points Selection*** for Points (Figure 4-40 on page 4-36)
  - – ***Roads to Export*** for Alignments (Figure 4-33 on page 4-28 which is similar to this one)
  - – ***Select TN3*** for Surfaces (Figure 4-41 on page 4-36)
  - – ***X-Sections to Export*** for X-Sections (Figure 4-33 on page 4-28) which is similar to this one)
  - – ***To <name of Format>*** screen (Figure 4-16 on page 4-15).

On the Point Selection screen (Figure 4-40 on page 4-36), select the filter type to select the exported Points (Figure 4-40).

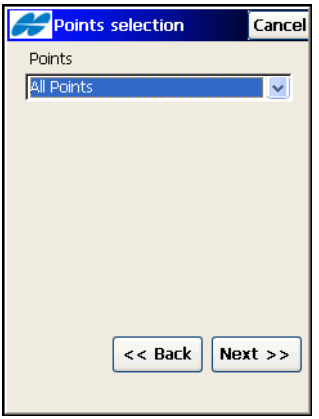


Figure 4-40. Points Selection

On the Select TN3 screen (Figure 4-41), select a destination directory and the name of the created file.

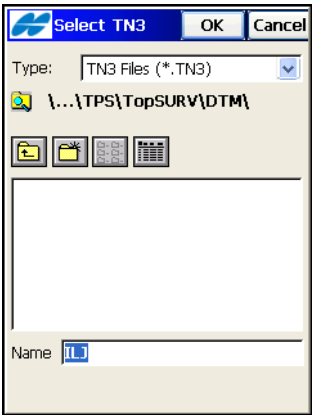


Figure 4-41. Select TN3

- **OK** – starts the export process.
- **Cancel** – closes the screen without saving the settings.

Exporting GPS Session

To export a session settings to the receiver, tap the **GPS Session** icon.

In the ***Sessions*** screen, the *Receivers* panel contains a tree of the available receivers and their session plans. The *Active Sessions* panel contains a list of sessions to export (Figure 4-42).

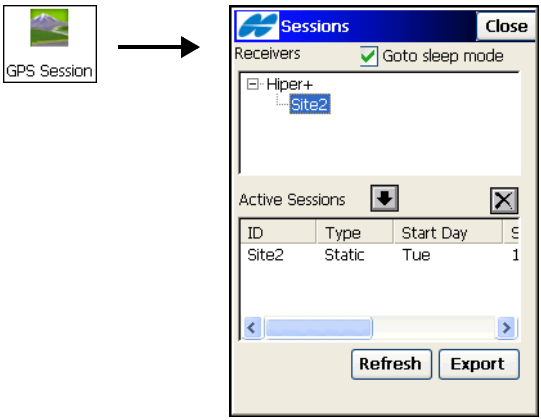


Figure 4-42. Job Sessions

- – selects the highlighted session to export.
- – deletes the session from the export list.
- *Goto sleep mode* – puts the receiver into sleep mode (if the box is check marked).
- **Refresh** – refreshes the export list.
- **Export** – starts the connection with the receiver.
- **Close** – closes the screen without performing export.

The Help Icon in the upper left corner of the screen opens the pop-up menu that consists of two items:

- *Edit Session* – opens the ***Sessions*** screen to edit the sessions. For details see “Sessions” on page 6-45.
- *Help* – accesses the Help files.

Notes:

Importing Data

To import data, tap the **Import** icon.

The Import function is used to add points, codes and attributes, Code Libraries, Roads, Cross Section Templates, Point Lists and Localization from another job, controller, or file.

The **Import** menu (Figure 5-1) includes options to:

1. Import data from a job (From Job)
2. Import data from another controller (From Device)
3. Import data from a file (From File)

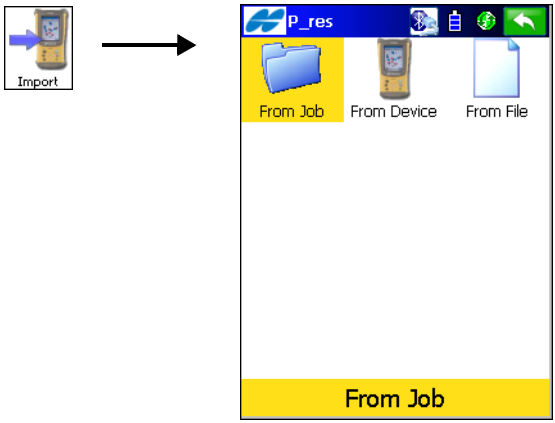


Figure 5-1. Import Menu

The *Help* Icon opens a pop-up menu, giving access to help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see "Help Icon's Pop-up Menu" on page 1-8).

Importing From Job

To import data from a job, tap the **From Job** icon. The ***Select Job*** screen (Figure 5-2) displays.

Select a Job

The ***Select Job*** screen (Figure 5-2) selects the job for import through a wizard-based import process. The wizard guides you through the import process by tapping the **Next** button. At the final stage, press the **Finish** button to complete the process.

- Current Job – shows the name of the job selected from the job list.
- Created – shows the date the selected job was created.
- Modified – shows the last date the selected job was modified.
-  – displays the directory where the job file is stored in the controller.
- **Browse** – opens the browse ***s***creen for choosing the job file from files previously downloaded to the controller.
- **Select** – selects the job file highlighted in the job list.
- **Close** – returns to the previous screen without changes being made.

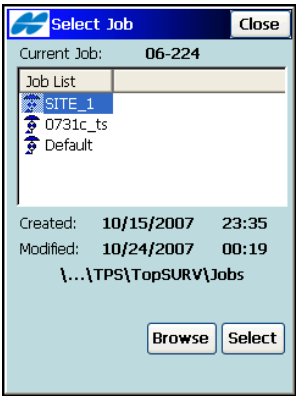


Figure 5-2. Select Job

Import From the Job

On the ***From <name of Job>*** screen, select the data to import and, if necessary, filter the imported points (see Figure 5-3).

- *Points* – select the points to import from the drop-down list; either *All Points, By Type, By Range and Code, By Type, Range and Code,* or *None*.
- Check mark the data to be imported along with the points; either *Code Library, Localizaiton, Point Lists, Horizontal Alignments, Vertical Alignments, X-Section Sets,* or *Roads.*
- **Back** – returns to the previous screen.
- **Next** – becomes available, depending on the data selection and opens the screens:
  - ***Point Type(s) To Import*** if the points are filtered *By Type* (see Figure 5-4 on page 5-4)
  - ***Points To Import*** if the points are filtered *By Range and Code* (see Figure 5-5 on page 5-6)
  - ***Point List(s)*** (or ***Horizontal Alignments***, ***Vertical Alignments***, ***X-Section Sets***, ***Roads***) ***To Import*** if the corresponding data are check marked in the *From Job* screen

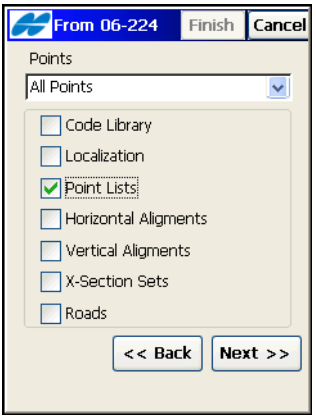


Figure 5-3. Import From Job

- **Finish** – starts the import process if only *Code Library* and/or *Localization* items are selected and *All Points* is selected. Otherwise, the option becomes available after all data are selected by the **Next** button.
- **Cancel** – closes the screen without saving the settings.

Select Point Types To Import

On the ***Pt Type(s) To Import*** (Figure 5-4), select the types of points to be imported; only if the *Code Library*, *Localization,* or *Roads* box is check marked and if the *points filter by type* has been enabled in the ***Import From Default*** screen. Place a check mark next to the point type that you want (Figure 5-3 on page 5-3).

- *Point Types* – check mark the point types for import; either *Design Points, Control Points, Cogo Points, Base Station, Topo Points, Offset Topo Points, Auto Topo Points, Sideshot, Offset, Remote, Reflectorless, BackSight, Stake Points, Stake Line, Check Points, Manually Typed,* or *Tape Dimension.*
- **Check / Uncheck** – toggles the highlighted item(s) on or off, depending on the button being pressed. To select more than one item, press **Ctrl** while making a selection.

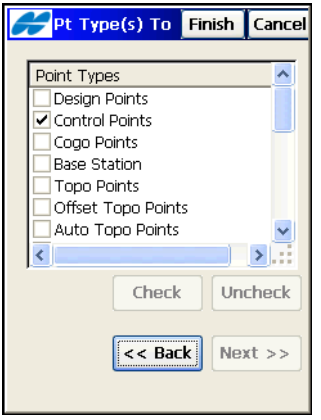


Figure 5-4. Select Point Type(s) to Import

- **Back** – returns to the previous screen.
- **Next** – if available opens the next screen to select objects; once the button becomes grayed out, tap **Finish**.
- **Finish** – opens the ***Import Status*** screen and starts the export process.
- **Cancel** – closes the screen without saving the settings.

Select Points to Import

The ***Points to Import*** screen filters imported points (Figure 5-5 on page 5-6).

- *Filter by Codes* – if enabled, all points with the selected codes are imported.
- **Select** – opens the ***Code*** screen (see Figure 5-6 on page 5-7) for code selection.
- *Filter by Range* – select the points to import. These can be set by range ("-", ";" or "," can be used as a range separator) or by enumeration.
  - *Name Separator*: selects a delimiter to use for point names.
  - *Use '-' for Range Separator*: shows the delimiter being used as a range separator.
- **Back** – returns to the previous screen.
- **Finish** – opens the ***Import Status*** screen and starts the import process.
- **Cancel** – closes the screen without saving the settings.

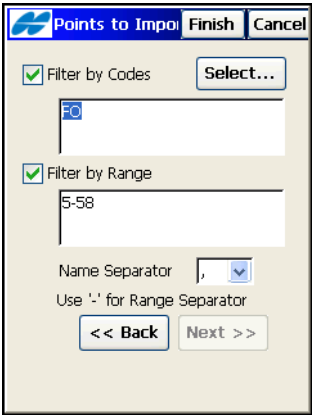


Figure 5-5. Points to Import

- **Next** – if available, opens the next screen to select objects; once the button becomes grayed out, tap the **Finish** button to start the export process.

Code

The ***Code*** screen contains a list of available codes. All points with codes selected here are imported (Figure 5-6 on page 5-7).

- **Uncheck** – deselects the highlighted code.
- **Check** – check marks the highlighted entries.
- **Select** and **OK** – returns to the ***Points to Import*** screen with the selected codes.
- **Cancel** – closes the screen without saving the settings.

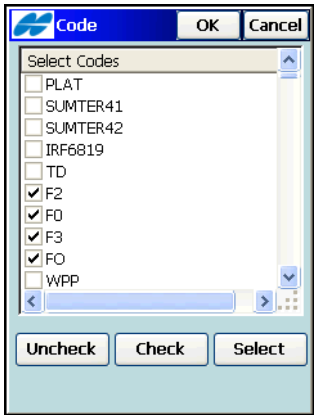


Figure 5-6. Code

Select Point List to Import

The ***Pt List To Imp*** screen (see Figure 5-7 on page 5-8) selects the point list to import. Place a check mark next to the point list you want to import from the list of Point Lists.

- *Point Lists* – the list of available point lists in the selected job.
- **Uncheck** – deselects the highlighted point list.
- **Check** – selects the highlighted entries.
- **Back** – returns to the previous screen.
- **Next** – available if other data is chosen to import in the ***From Job*** screen. Opens the next screen to select other objects (horizontal alignments, vertical alignments, roads or x-section sets) which are similar to the ***Point List to Import*** screen. Once the button becomes grayed out, tap the **Finish** button.
- **Finish** – opens the ***Import Status*** screen and starts the import process.

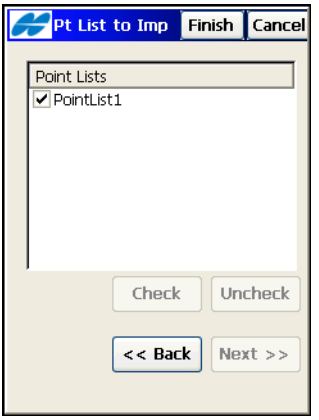


Figure 5-7. Select Point List to Import

Import Status

The ***Import Status*** screen (Figure 5-8) reflects the import process and contains a progress bar and a comments window. The progress bar displays the percentage of the data being imported. Tap **Close** to return to the main screen.

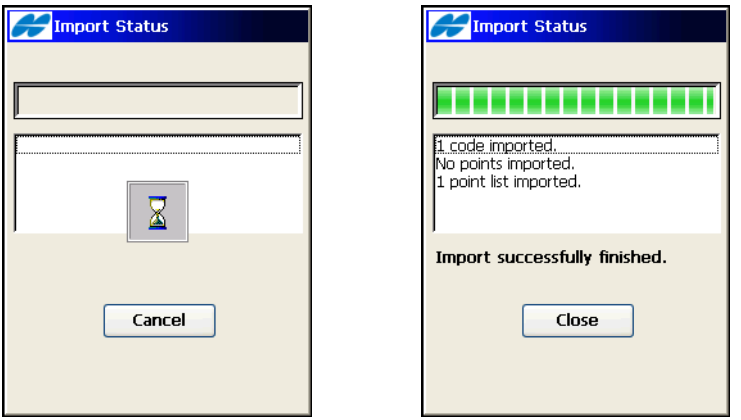


Figure 5-8. Import Status

Duplicate Objects

If the existing job contains objects with the same names as the job they are imported from, the ***Duplicate <Objects>*** screen displays (Figure 5-9).

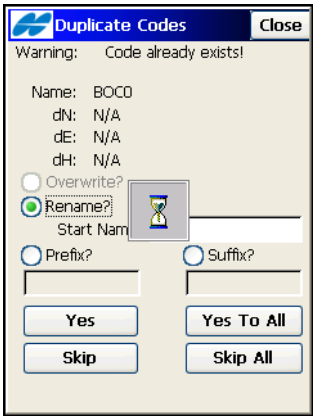


Figure 5-9. Duplicate <Objects>

The ***Duplicate Objects*** screen issues a warning that prevents the loss of points, roads, or point lists when names of these imported objects coincide with existing ones. Select from the following options:

- *Overwrite* – the imported object overwrites the existing one.
- *Rename* – the imported object is renamed. The new name should be noted in the corresponding field.
- *Prefix/Suffix* – the imported object differs from the existing object by prefix or suffix. The prefix/suffix should be noted in the corresponding field.
- **Yes** – accepts the decision.
- **Yes To All –** accepts the same decision for all similar cases.
- **Skip** – skips the object without importing.
- **Skip All** – skips all the objects with names that coincide with the names of existing objects, without importing.
- **Close** – disables the import process and opens the ***Import Status*** screen to remove all the objects already imported (Figure 5-10).

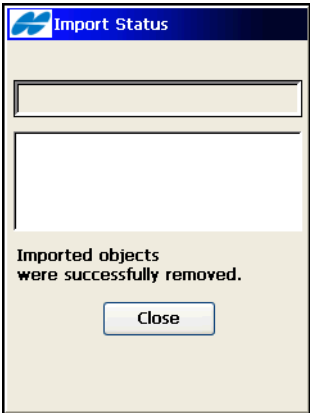


Figure 5-10. Import Status for Removed Objects

NOTICE

The import process cannot skip duplicate templates. These objects must be renamed.

Importing From Device

To import a job (or any other file) from a controller device, tap the **From Device** icon (Figure 5-11 on page 5-11).

Selecting Port

The ***Settings*** screen (Figure 5-11), selects the port for file interchange with another controller.

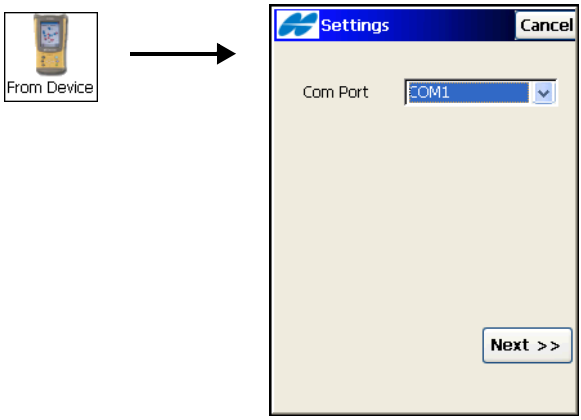


Figure 5-11. Select Port

- *Com Port* – select the Communication port; either *COM1, COM2, IR Port*, or *Ethernet*. Communication via *Bluetooth* is also available.
- **Next** – opens the ***Select Directory*** screen (Figure 5-12 on page 5-12).

File Import Directory

On the ***Select Directory*** screen (Figure 5-12), select the destination directory for data import.

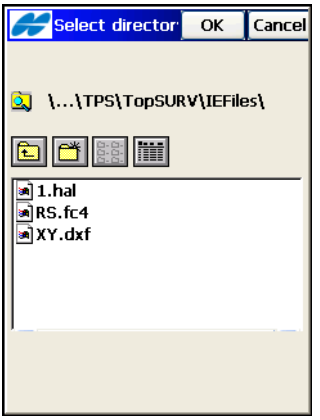


Figure 5-12. Select Directory

- **OK** – opens the ***Import File*** screen reflecting import status to the selected directory (Figure 5-13)
- **Cancel** – returns to the main screen.

Figure 5-13. Import File

A successful completion of the import file operation returns to the main screen.

Importing From a File

To import data from a file, tap the *From File* icon (Figure 5-14).

On the ***From File*** screen (Figure 5-14) you can import points, roads, cross section templates, and localization from files of either pre-defined or custom formats. For a description of these formats, see Appendix A.

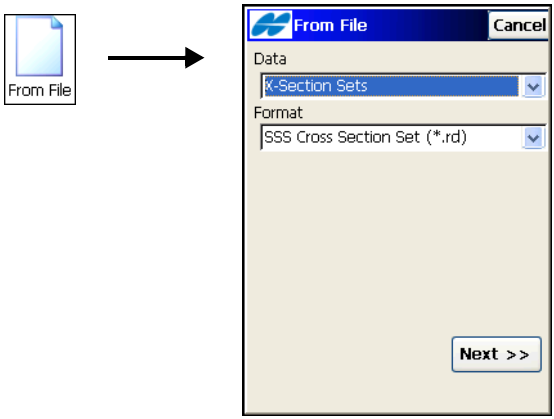


Figure 5-14. Import From File

- *Data* – select the data type to import from the file; either *Points*, *Lines*, *Point Lists*, *Code Library*, *Horizontal Alignments, Vertical Alignments, X-Section Sets, Roads*, *X-Sect Templates*, *Localization, Scanning Data, TINs, Layers,* or *Multiple*.
- *Format* – select the type of file being imported.
- **Next** – opens the ***From < name of Format>*** screen to navigate to the directory where the file is located.
- **Cancel** – closes the screen without saving the settings.

Follow up the export process with the help of the export wizard.

Points and Point Lists

On the ***From File*** screen (Figure 5-15) for *Points* and *Point Lists* data, you can import the following formats: *Topcon Text Custom (*.txt)*, *Topcon FC-4 (*.fc4)*, *Topcon FC-5 (*.fc5)*, *Topcon GTS-6 (*.gts6)*, *Topcon FC-6/GTS-7 (*.pnt)*, *Topcon GTS-7 with strings (*.txt)*, *Topcon GT (*.pnt)*, *Topcon GT Finland (*.gt)*, *MOSS GENIO (*.mgn)*, *AutoCAD DXF (*.dxf)*, *AutoCAD Drawing (*.dwg)*, *ESRI Shape (*.shp)*, *TDS Coordinates (*.cr5)*, *LandXML (*.xml)*, *NEZ (*.txt)*, *NEZ with strings (*.txt)*, *CMM (*.cor)*, *MMH360 (*.360)*, *KOF (*.kof)*, *MMH360_Z000 (*.360)*, *Microstation 95/ISFF (*.dgn)*, *MicroStation V8 (*.dgn)*, *SBG Pxy (*.PXY)* or *SBG Geo (*.Geo)*

For *Points* or *Point Lists* data, the ***From File*** screen has an additional option – *Point Type*.

- *Point Type* – selects a type of the imported points from the drop-down list.
  - *Design Points*: points used as targets for stakeout.
  - *Control Points*: points with coordinates, known from the catalog; used for localization.
  - *Topo Points*: points collected during a stationary survey.
  - *Auto Topo Points*: points collected during a kinematic survey.

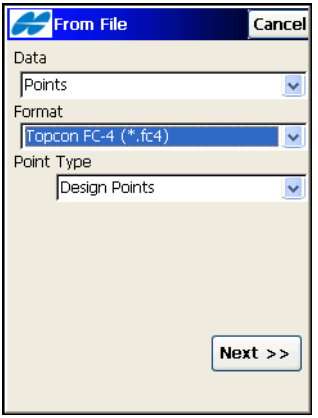


Figure 5-15. Import From File

- **Next** – opens the ***From < name of Format>*** screen.

- **Cancel** – closes the screen without saving the settings.

The options available on the ***To File*** screen depend on the format selected. Refer to the following sections for details.

Topcon Text Custom

If the *Text Custom* format is selected, the ***From File*** screen (Figure 5-16) has an *ASCII File Properties* field.

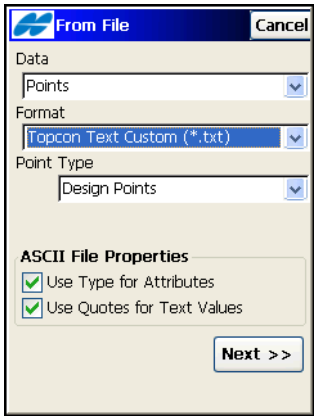


Figure 5-16. Import From Text File

- *ASCII File Properties* – defines the condition of the imported file interpretation. Check and enable *Use Type for Attributes* and *Use Quotes for Text Values* (one or both). These conditions use the same type for the attributes and quotes for the text values (Figure 5-16).

  The *ASCII FIle Properties* field appears for .txt imported files.
- **Next:** opens the ***From Text*** screen (Figure 5-17 on page 5-16).
- **Cancel** – closes the screen without saving the settings.

The From Text screen browses directories from which to select the file to import data (Figure 5-17 on page 5-16).

- *Type* – specifies the .txt extension for the filename.
- *Name* – the name of the selected file from which you want to import points.

- **OK** – approves the selection and opens the ***Text File Format*** screen.
- **Cancel** – closes the screen without saving the settings.

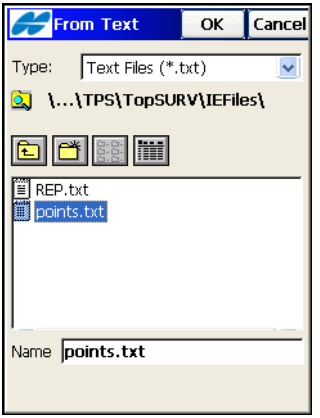


Figure 5-17. Import From Format

The Text File Format screen (Figure 5-18 on page 5-17) imports a file of arbitrary text format.

- *Delimiter* – sets the separator symbol between data in the import file; either a *space*, a *comma*, *tabs* or other (select from the list).
- *Header in First Row* – enable if the text file has a header.
- *File Style* – sets the order of fields in the selected file.
- **Delete** – deletes the selected file format.
- **Edit (Format)** – changes the selected file format with the help of the same ***Custom Style*** screen (see Figure 5-19 on page 5-17).
- **Add (Format)** – creates a new file format with the help of the ***Custom Style*** screen.
- **Back** – returns to the previous screen.
- **Next** – opens the ***Coordinate System*** screen (see Figure 5-20 on page 5-18).
- **Finish** – opens the ***Import Status*** screen and starts the import process (see “Import Status” on page 5-8).
- **Cancel** – closes the screen without saving the settings.

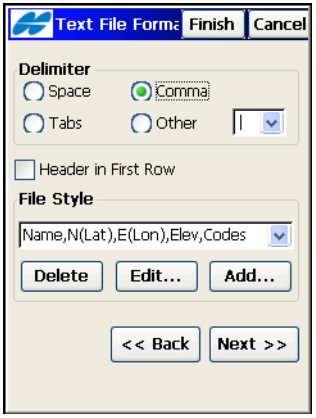


Figure 5-18. Text File Format

On the Custom Style screen (Figure 5-19), use the arrows (up and down) to move the parameters you want from the top (*Available* panel) to the bottom (*Order* panel) of the screen in ascending or descending order.

- **Save** – saves the File Style and returns to the ***Text File Format*** screen. A new string appears in the Select File Format drop-down menu.
- **Close** – returns to the previous screen.

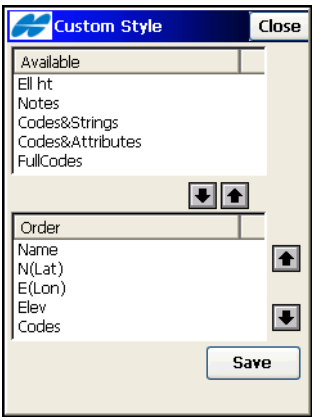


Figure 5-19. Custom Style

On the Coord System screen (Figure 5-20) select the coordinate system, the coordinate type and distance units for the data in the file imported.

- *Coordinate Type* – select either *WGS84, Datum, Grid,* or *Ground*.
- *Dist Units* – recalculate to either *Meters, IFeet*, or *USFeet*.

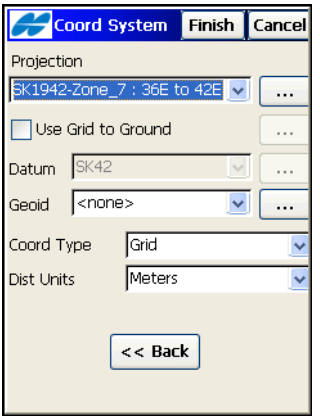


Figure 5-20. Coordinate System

- **Back** – returns to the previous screen.
- **Next** – opens the ***Lat/Lon Record Format*** screen if a type of geodetic coordinate is selected (Figure 5-21 on page 5-19).
- **Finish** – opens the ***Import Status*** screen and starts the import process. See "Import Status" on page 5-8.
- **Cancel** – closes the screen without saving the settings.

On the Latitude/Longitude Record Format screen (Figure 5-21 on page 5-19), select the format you want to represent the degrees of Latitude and Longitude in the exported file from the drop-down list.

- **Back** – returns to the previous screen.
- **Finish** – opens the ***Import Status*** screen and starts the Export process (Figure 5-21 on page 5-19).
- **Cancel** – closes the screen without saving the settings.

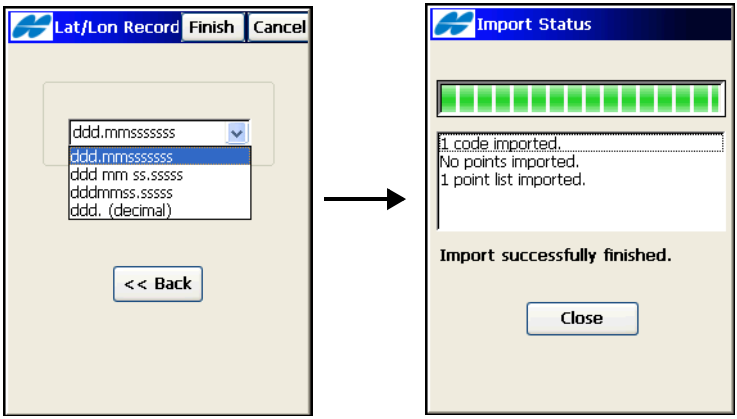


Figure 5-21. Select Latitude/Longitude Format

On the Import Status screen (Figure 5-21), tap the **Close** button to return to the main screen.

AutoCAD DXF and AutoCAD Drawing

If the *AutoCAD DXF* or *AutoCAD Drawing* format is selected, the ***From File*** screen has the following additional options for point import (Figure 5-22 on page 5-20).

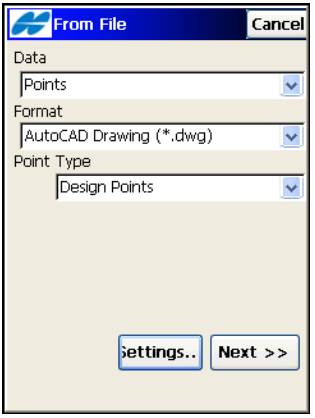


Figure 5-22. AutoCAD DXF

NOTICE

TopSURV only imports AutoCAD 2000 format DWG files.

- **Settings** – opens the ***Settings*** screen to select point and line styles.
- **Next** – with the help of the import wizard, follow next screens to import points.
- **Cancel** – closes the screen without saving the settings.

TopSURV imports layers from DWG/DXF files, along with the appropriate data types.

On the Settings screen (Figure 5-23 on page 5-21), select desired drawing styles to represent points and lines.

- *Import block base points* – enable to import central points in blocks as points.
- *Load as background image* – enable to load data as background.

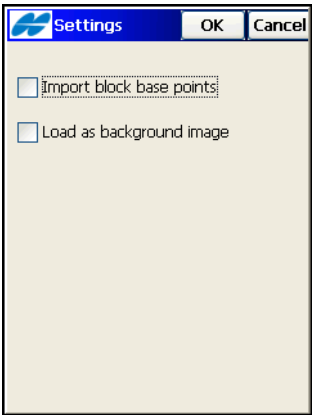


Figure 5-23. Settings Screen

TDS Coordinates

If the *TDS Coordinates* format is selected, the ***From File*** screen has the following additional option to import points.

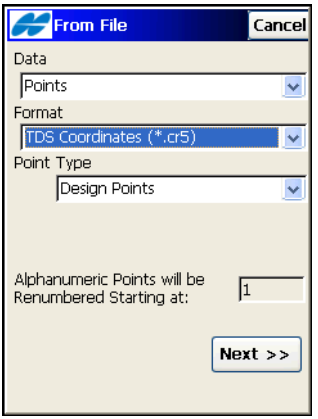


Figure 5-24. From TDS Coordinates

- *Alphanumeric Points will be Renumbered Starting at:* – the TDS Coordinate format demands points have only numerical names. The field displays a number at which TopSURV will start renaming points with alphanumeric names.
- **Next** – follow next screens with the help of the export wizard.

- **Cancel** – closes the screen without saving the settings.

Lines

For *Lines* data, you can import the following formats: *Topcon Text Custom (*.txt)*, *AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg), ESRI Shape (*.shp), LandXML (*.xml), KOF (*.kof), Topcon 3D Linework (*.ln3), Microstation 95/ISFF (*.dgn), MicroStation V8 (*.dgn), MX GENIO (*.txt), SBG Pxy (*.PXY)* or *SBG Geo (*.Geo)*.

On the ***Edit Line*** screen (Figure 5-25), TopSURV linework consists of lines and points, whereas the imported linework contains no points. It includes positions only (names start with a question mark).

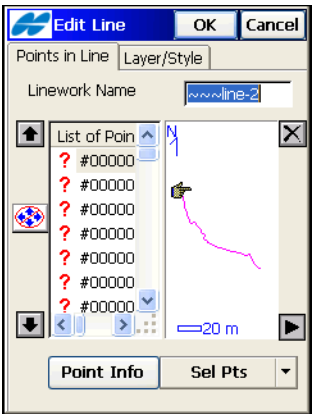


Figure 5-25. Edit Imported Linework

Code Library

For *Code Library* data, you can import the following formats: *Topcon Text (*.tdd)*, *Topcon XML (*.xml),* or *DBF (*.dbf)*.
Code Library is a set of codes with attributes used in the job. Once created, it can be saved as a file with *.tdd, *.xml, or *.dbf extensions.

Horizontal Alignments

For *Horizontal Alignments* data, you can import the following formats: *SSS H. Alignment (*.hal), TopSURV H. Alignment (*.thl), CLIP H. Alignment (*.PLT),* or *ISPOL H. Alignment (*.ALI).*

Vertical Alignments

For *Vertical Alignments* data, you can import the following formats: *SSS V. Alignment (*.val), TopSURV V. Alignment (*.tvl), CLIP V. Alignment (*.ALZ),* or *ISPOL V. Alignment (*.RAS).*

X-Section Sets

For *X-Section Sets* data, you can import the following formats: *SSS Cross Section Set (*.rd), TopSURV Cross Section Set (*.trd), CLIP Cross Section Set (*.TRV), ISPOL Cross Section Set (*.SC1),* or *Custom X-Sections (*.cxs).*

Roads

For *Roads* data, you can import the following formats: *Land XML (*.xml), SSS Road (*.hal; *.val; *.rd), TDS Road (*,rd5), Topcon 3D Road (*.rd3), TopSURV Road (*.thl; *.tvl; *.trd), CLIP Road (*.PLT; *.ALZ; *.TRV), ISPOL Road (*.ALI; *.RAS; *.SC1), Tekla Roads (*.vgp), MX GENIO Road (*.txt), or SBG Road (*.LIN).*

In TopSURV or TDS Road format, select the desired distance units (Figure 5-26 on page 5-24).

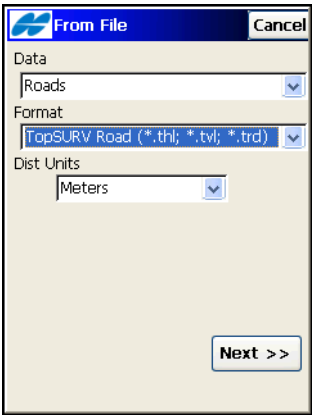


Figure 5-26. Roads from TopSURV Road

The header of the TopSURV Road format contains the starting azimuth if the Road is not a straight line.

X-Section Templates

For *X-Section Templates* data (Figure 5-27 on page 5-25), you can import the following formats: *SSS X-Section Templates (*.xtl), TDS X-Section Templates (*.tp5),* or *TopSURV X-Section Templates (*.xst)*.

When importing from TopSURV or TDS Road format, select the desired distance units.

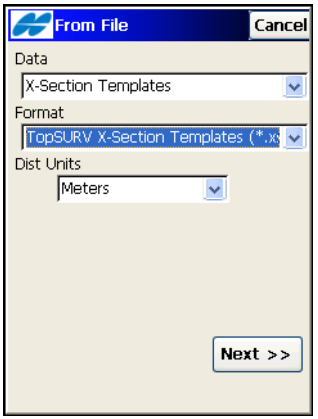


Figure 5-27. X-Section Templates from TopSURV Templates

Localization

For *Localization* data, you can import the following formats: *Topcon 3D (*.gc3), TDS (*.RAW)* and *Trimble DC (*.dc),* which contain coordinates of control points in two coordinate systems. Control Points are imported together with Localization data.

Scanning Data

For *Scanning* Data, all scanning data can be imported from *DI-3000 (*.cmr; *.imc *.csv).*

TINs

For TINs data, you can import the following formats: *AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg),* or *LandXML (*.xml).*

When importing from an AutoCAD DXF or Drawing file, tap the **Settings** button to select desired drawing styles to represent points and lines (for detail, see “On the Settings” on page 5-20).

The **OK** button on the ***From <Format>*** screen opens the ***Import Status*** screen and starts the import process to save results into TN3

files. The TN3 files will have the same name of the file imported, and will be saved in the DTM directory.

Layers

For *Layers* data, you can import the following formats: *Autodesk Layer States* (*.las)*, Topcon 3D Linework (*.ln3)*.

Multiple Data

For Multiple data, you can import the following formats: *Topcon Text Custom (*.txt), AutoCAD DXF (*.dxf), AutoCAD Drawing (*.dwg), ESRI Shape (*.shp), LandXML (*.xml), KOF (*.kof), Microstation 95/ISFF (*.dgn), MicroStation V8 (*.dgn), SBG Pxy (*.PXY),* or *SBG Geo (*.Geo)*.

TopSURV only imports AutoCAD 2000 format DWG files.

TopSURV imports layers to DWG/DXF files, along with the appropriate data types.

For Land XML file as an example, select the file from which you want to import data on the ***From <Format>*** screen and tap the **OK** button.

The ***Import Status*** screen first opens to retrieve information on the file contents (Figure 5-28 on page 5-27).

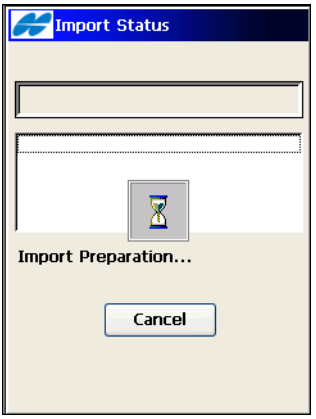


Figure 5-28. Import Preparation

The ***Data Selection*** screen displays to select desired data types (Figure 5-29).

On the Data selection screen (Figure 5-29), select the specific data group from the file to be imported. For *LandXML* as an example, you can select *Point Lists*, *Lines*, *Alignments*, *Codes*, *Surfaces*, *X-Sections* and *Parcels*.

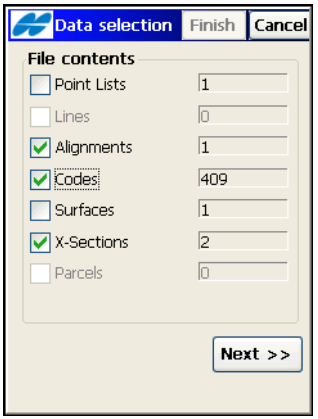


Figure 5-29. Data Selection

- **Next** – if available opens the ***Select Data For Import*** screen (Figure 5-30 on page 5-28).

The **Next** button becomes active after selection of a data group from the file contents which needs further selection from the list (Point Lists, Alignments, Surfaces and X-Sections).

- **Finish** – starts the import process. This button is not available (grayed out) until the data, not demanding further selection, is chosen and the **Next** button becomes inactive.
- **Cancel** – closes the screen without saving the settings.

On the Select Data For Import screen (Figure 5-30), select objects from the list to import. Follow the **Next** button until the **Finish** button appears on the screen.

- **Check** – check marks the highlighted entries.
- **Uncheck** – deselects the highlighted entries in the list.
- **Back** – returns to the previous screen.
- **Next** – tap until the **Finish** button displays on screen.
- **Finish** – opens the ***Import Status*** screen and starts the import process.
- **Cancel** – closes the screen without saving the settings.

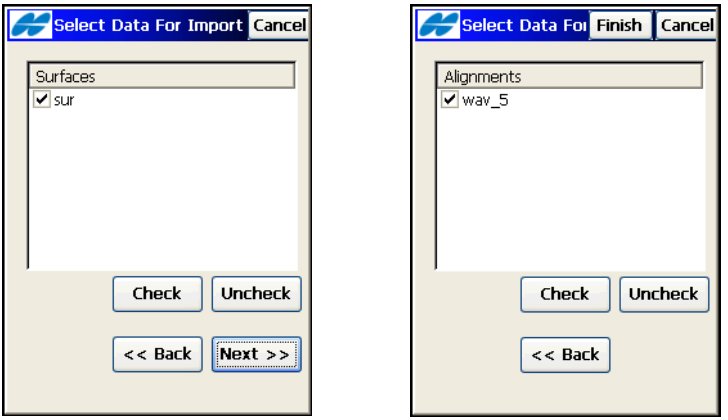


Figure 5-30. Select Data For Import

Editing Job Data

To edit data in a job, tap the **Edit Job** icon in the main menu.

The **Edit Job** menu (Figure 6-1) includes options to edit the following data in the current job: Points, Codes, Layers, Linework, Area, Point Lists, Raw Data, Sessions (for GPS+ post processing modes only), and Images. Also, you can Set Simulator in GPS mode.

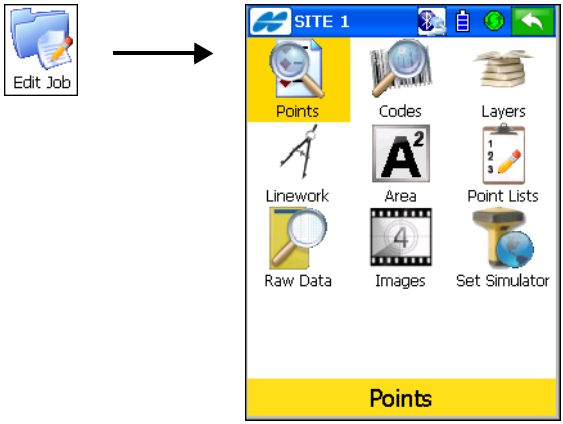


Figure 6-1. Edit Job

If the menu option you need is not visible, tap the **Configure/Menus** icons to enable these options in the ***Config Menus*** screen.

The Help Icon  opens a pop-up menu, giving access to the help files, module activation codes, port data logging, changing menu

interface, and information about TopSURV (for details see “Help Icon’s Pop-up Menu” on page 1-8).

To edit any object properties, double-click on the object or select the object and tap the Edit button.

Points

To edit points, tap the **Points** icon. The ***Points*** screen contains the list of stored points with coordinates and codes, and a set of tools for database operation (Figure 6-2).

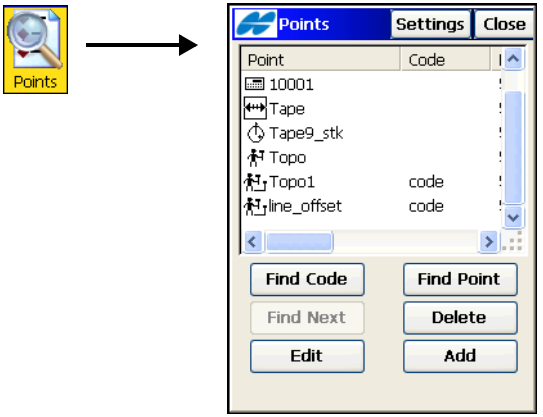


Figure 6-2. Points

In the Point column, an icon displays the point type (Table 6-1):

Table 6-1. Points Icons

Point Icon	Point Type
	GPS stationary (topo)
	offset point
	GPS kinematic (auto topo)
	RTK base

Table 6-1. Points Icons (Continued)

Point Icon	Point Type
	TS observed
	control
	design or imported
	staked out
	TS scanned point
	cogo
	manually entered

- **Find Code** – opens the ***Find by Code*** screen to enter a code for searching for a point.
- **Find Point –** opens the ***Find by Point*** screen to enter a point name (or a part of the name) to perform a search.
- **Find Next** – finds next point that satisfies the same conditions as the previously found point.
- **Delete** – deletes the point from the list.
- **Edit** – opens the ***Edit Point*** screen to edit the point parameters: *name*, *code*, *coordinates* and/or other parameters stored with the point.
- **Add** – opens the ***Add Point*** screen to create a new point.

The *Help* Icon in the upper-left corner of the screen displays the pop-up menu containing five items:

- *PTL Mode* – switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance on **PTL Points**). For details, see “PTL Point” on page 6-12.
- *String* – switches on the strings displaying function, along with the codes.
- *Show Scan Points* – switches on the scan points displaying function.

- *Show AutoTopo Points* – switches on the AutoTopo points displaying function.
- *Recompute* – recomputes the point coordinates after editing the point's raw data (if the recomputation was not performed in Raw Data).
- *Help* – accesses the Help files.
- **Settings** – opens the ***Display*** screen (Figure 6-3 on page 6-4).

Display Settings

On the ***Display*** screen (Figure 6-3) select the display parameters to customize the software interface, then press **OK** to save the settings and return to the ***Points*** screen.

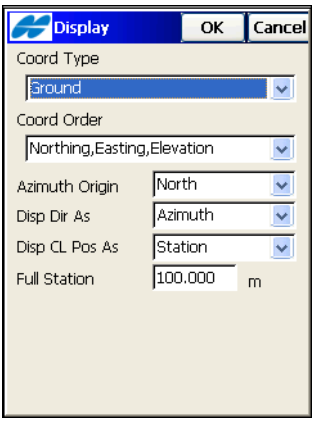


Figure 6-3. Display

For details on the display settings, see "Display" on page 2-8.

Finding Point by Name

The ***Find by Point*** screen (Figure 6-4 on page 6-5) contains settings for searching for a point by its name.

- *Point* – the name of a point or a part of the name.
- *Match entire name* – set if the whole name was entered in the *Point Name* field.

- *Match partial name* – set if a part of the searched name was entered in the *Point* field.

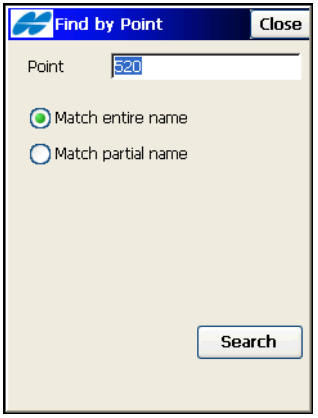


Figure 6-4. Find by Point Name

- **Search** – starts the search process and returns to the ***Points*** screen, highlighting the point found.

Finding Point by Code

The ***Find by Code*** screen (Figure 6-5) searches for point information by its code.

Figure 6-5. Find by Code

- *Code* – select a code from the drop-down list.

- **Search** – starts the search process and returns to the ***Points*** screen, highlighting the first point with the code selected.

Editing a Point

The ***Edit Point*** screen (Figure 6-6) shows the properties of a point to edit.

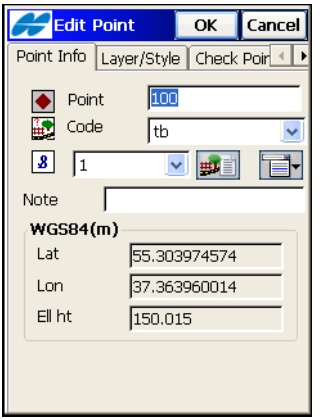


Figure 6-6. Add/Edit Point

Edit Point Information

On the ***Edit Point*** screen (Figure 6-6), tap the *Point Information* tab and edit the following fields:

- *Point* – enter the name of the point.
- *Code* – enter a code for the point, either manually or from the drop-down list.

  The lower field, marked by the sign, is intended for entering a string for a Code Type of Line or Area.

- – the *Attributes List* icon, opens the ***Point-Attribute*** screen to set the code and attributes available for the code chosen (Figure 6-7 on page 6-7).

- The icon next to the *Attributes List* icon displays the pop-up menu containing two items:

– *Layer*: opens the ***Select Layer*** screen (see “On the Select Layer” on page 6-10).

– *Note*: opens the ***Note*** screen. For details, see “The Topo Menu” on page 9-3.

- *WGS84* – the field for the coordinates of the point in the current coordinate system (the field name changes with the coordinate type selection).
- *Note* – enter any additional information about the point (if preferred).
- **OK** – saves the changes and returns to the ***Points*** screen.

  Points that have no codes, or have codes, but no strings associated with the codes, are simply stored as points.

On the Point Attributes screen (Figure 6-7), you can set a code, control code, string and attributes’ values for the point on the *Code Attributes* tab.

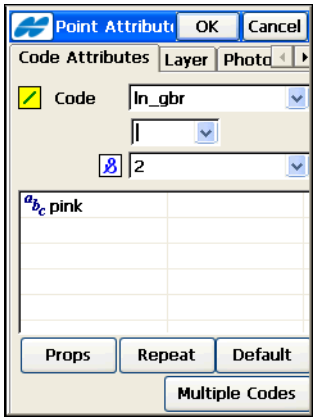


Figure 6-7. Point Attributes

- *Code* – select a code. By default, the lower panel shows the control code list available for a Code Type of Line or Area. The Control Code is a special type of code that is used by the graphic tool for the interpretation of survey results.

The supported control codes (*AS, AE, C, R*) control line behavior when creating arcs, closure of lines, and rectangles respectively. The *AS* control code indicates the start of an arc, and the *AE* control code indicates the end of the arc. *Arc* parameters are determined using additional points in the line.

TopSURV will not use this linework package if the *Allow Custom Control Code* box on the ***Global*** screen is check marked. In this case, the user can enter any string to mark it as a control code. TopSURV will not interpret these control codes.

- The field, marked by the  sign is intended for entering a string to generate a line for a Code Type of Line or Area. Code Type is set when editing the code.
- The lower panel shows the available attributes. Tap on the attribute to display a field to enter its value.
- **Properties** – opens the ***Attrib Ranges*** screen (Figure 6-8 on page 6-9) to view the ranges for the attributes.
- **Repeat** – erases the entered values.
- **Default** – sets default values.
- **Multiple Codes** – opens the ***Point Attributes*** screen with multiple codes to edit (Figure 6-9 on page 6-9).
- **OK** – saves the changes and returns to the ***Edit (Add) Point*** screen. The program displays a message prompt if the attribute value is not within the range specified.

The *Help* icon in the upper-left corner of the screen displays the pop-up menu containing three items:

– *Show Second Control Code*: switches on the field to enter another control code.

– *Help*: accesses the Help files

On the Attribute Ranges screen (Figure 6-8 on page 6-9), you can view the ranges for the attributes.

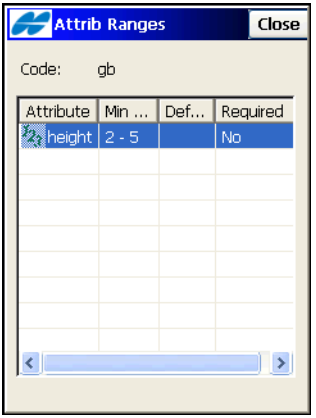


Figure 6-8. Attribute Range

Attributes can only be added on the ***Code-Attributes*** screen (Figure 6-18 on page 6-16).

On the Point Attributes, screen (Figure 6-9), tap the Multi-Code Attrs tab. You can edit multiple codes and strings. Multiple codes and strings associated with a point make the point a part of numerous lines.

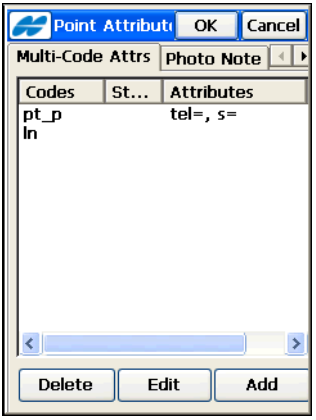


Figure 6-9. Multiple Code-Attributes

- **Delete** – deletes the code from the list.

- **Edit** – opens the ***Codes-Attributes*** screen to edit the selected code.
- **Add** – creates a new code through the ***Code-Attributes*** screen.
- **OK –** saves the settings and returns to the ***Edit Point*** screen.
- **Cancel** – closes the screen without saving the settings.

On the Select Layer screen (Figure 6-10), select the layer in which to locate the point.

Figure 6-10. Select Layer

- The **List** ... button opens the ***Layers*** screen to edit layers. (For details on editing layers, see "Edit Layers" on page 6-23.)
- **OK –** saves the settings and returns to the ***Edit Point*** screen.
- **Cancel** – closes the screen without saving the settings.

Layer and Style

On the ***Edit Point*** screen, you can change the layer and graphic properties of the point (Figure 6-11 on page 6-11):

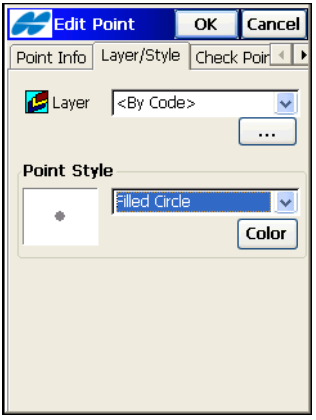


Figure 6-11. Add/Edit Point – Layer/Style Tab

Tap the *Layer/Style* tab to change the layer and graphic properties of the point:

- *Layer* – selects the layer to locate the point.
- The List ... button opens the ***Layers*** screen to edit layers. (For details on editing layers, see "Edit Layers" on page 6-23.)
- *Point Style* – select a point style from the drop-down list. The box to the left shows the style to designate the point on the map.
- **Color** – opens the ***Select Color*** screen (see "On the Select Color" on page 6-11) to edit the color you desire.

On the Select Color screen (Figure 6-12), set the color of the point mark to show on the map.

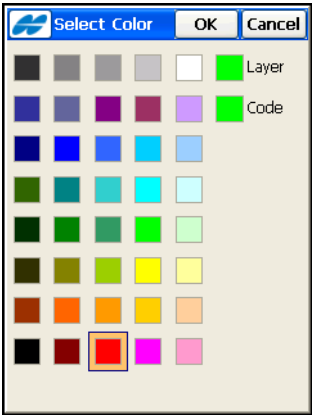


Figure 6-12. Select Color

Tap in the area of the color you want. You can select the color of the point for either the *Layer* or the *Code* by highlighting the *Layer* or *Code* node on the screen (Figure 6-12).

PTL Point

In PTL Mode, the *PTL* tab displays on the ***Edit Point*** screen with the following parameters (Figure 6-13 on page 6-13).

- *Start Ref Pt, End Ref Pt* – selects reference points, either from the map, from the list, or when entered manually.
- *PTL Offsets* – the offsets from the reference line formed by the reference points:
  - *Line*: the distance from the start of the reference point along the reference line, where the perpendicular to this line passes though the target.
  - *Offset*: the horizontal distance from the target.
- *Ell ht* – the height of the target.

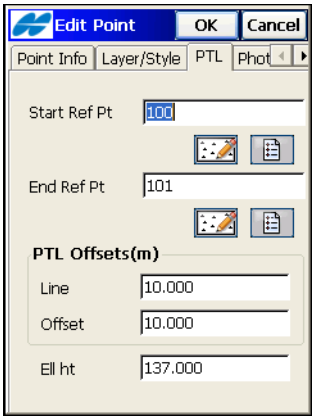


Figure 6-13. Edit Point (PTL)

Photo Note

The *Photo Note* tab on the ***Add Point*** screen displays a photo note—a picture of the situation at the point—if a picture has been taken and added (using the **Add** button) (Figure 6-14).

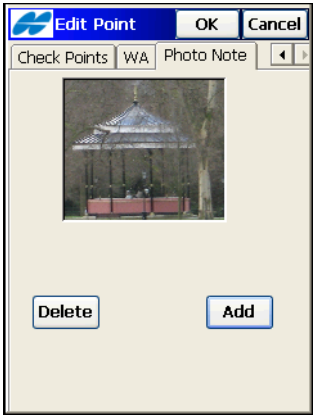


Figure 6-14. Add/Edit Point – Photo Note Tab

- **Delete** – erases the picture for the point.
- **Add** – opens the ***Select Image File*** screen to browse for the picture to attach.

Check Points

The *Check Points* tab appears on the ***Edit Point*** screen if the point has duplicate points and these points are saved as check points (Figure 6-15).

The *Check Points* tab displays the check points coordinates and the deviations from the original coordinate points.

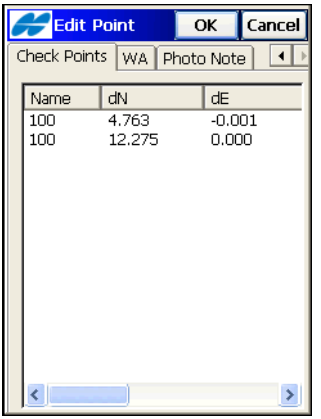


Figure 6-15. Edit Point – Check Points

Weighted Average

The *WA (Weighted Average)* tab appears on the ***Edit Point*** screen if the point has check points which are used in a weighted average (Figure 6-16 on page 6-15). The *Weighted Average* tab displays coordinate residuals of the check points used in a weighted average.

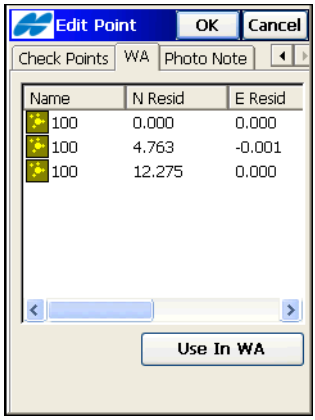


Figure 6-16. Edit Point – Weighted Average

To exclude a station from a weighted average, highlight the station. Tap the **Exclude from WA / Use in WA** button to delete/include the highlighted station in averaging (Figure 6-17).

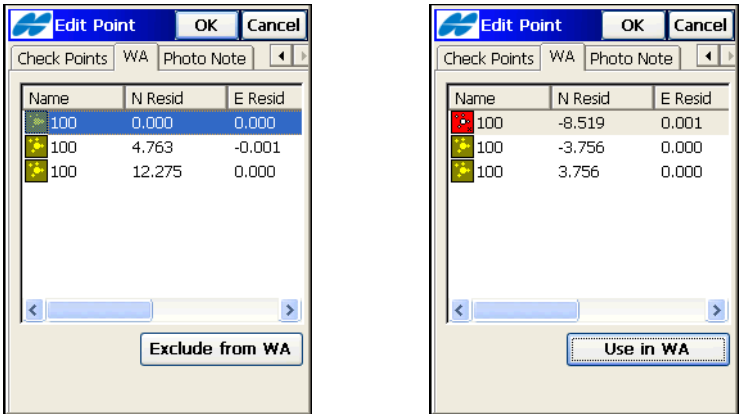


Figure 6-17. Exclude Station from Weighted Average

Codes

To edit codes and attributes, tap the **Codes** icon. The ***Code-Attributes*** screen displays (Figure 6-18).

The ***Code-Attributes*** screen (Figure 6-18) contains a list of codes used for a survey, the list of attributes for each code, and a set of tools for editing the codes and attributes. Codes already in use cannot be edited or deleted.

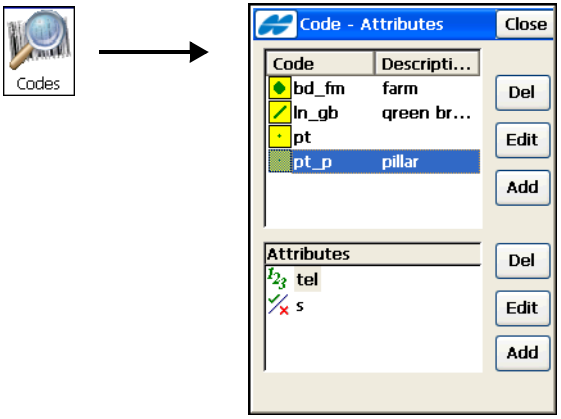


Figure 6-18. Code – Attributes

- *Codes* – contain a list of codes with their associated icons:

  Point, Line, or Area.

- *Attributes* – contains a list of attributes for the selected code.
- **Delete** – deletes the highlighted entry.
- **Edit** – opens the applicable ***Code*** (Figure 6-20 on page 6-18) or ***Attribute*** (Figure 6-23 on page 6-20) screen with the properties of the highlighted entry.
- **Add** – opens the applicable blank ***Code*** or the ***Attribute*** screen. A new attribute can be added if at least one code exists and is highlighted.
- The *Help* Icon in the upper-left corner of the screen opens the pop-up menu containing the *Export To File* option. The ***To File***

screen (Figure 6-19) displays to export the code library to the selected file format.

On the To File screen (Figure 6-19) select the file format from which to export codes of the current job. The **Next** button runs the export process.

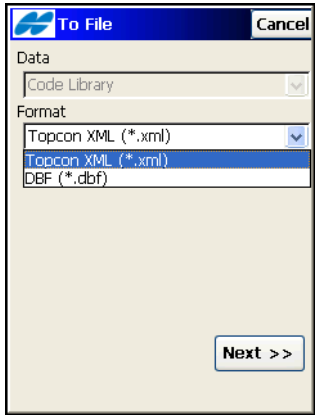


Figure 6-19. Export to Code Library

Edit Code

On the ***Code*** screen (Figure 6-20 on page 6-18), set the following code parameters:

- *Name* – the name of the code.
- *Desc* – the description for the code.
- *Type* – the type of objects the code describes: *Point, Line or Area*. A Code Style of Point, Line, or Area can be edited. Each style has an associated plotting attributes and colors.
  - *Point*: when *Point* is selected in the *Type* field, color and symbol attributes for the point displays (Figure 6-20 on page 6-18). The **Color** button opens the ***Color*** screen (see "On the Select Color" on page 6-11).
  - *Line*: when *Line* is selected in the *Type* field, color, symbol for node, style, and thickness for line attributes display (Figure 6-21 on page 6-18).

– *Area*: when *Area* is selected in the *Type* field, color, symbol for node, style and thickness for boundary, fill color, fill style and transparency attributes display on the *Area* tab (Figure 6-22 on page 6-19).

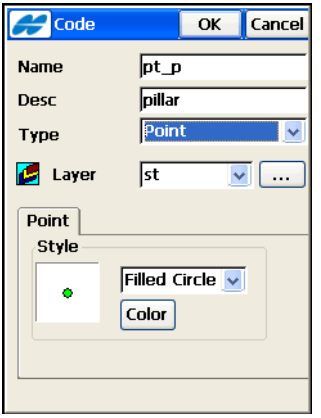


Figure 6-20. Edit Code - Point Type

- *Layer* – the name of the layer in which the code resides.
- The **List** ... button opens the ***Layers*** screen to edit layers. (For details on editing layers, see "Edit Layers" on page 6-23.)

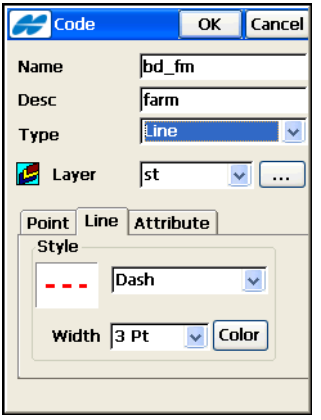


Figure 6-21. Edit Code - Line Type

- *Attribute* – the radio buttons selected on this tab determine whether the prompt for code should be at the beginning of a line/area (*Start*) or at every point along the line/area (*Each Node*).
- **OK** – saves the changes, closes the screen, and returns to the ***Code-Attributes*** screen.

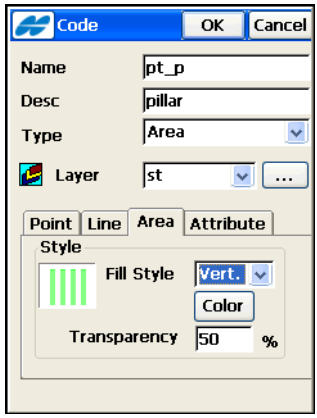


Figure 6-22. Edit Code - Area Type

Edit Attributes

On the ***Attributes*** screen, you can set attributes for the code selected on the C***ode-Attributes*** screen (Figure 6-18 on page 6-16). This screen sets different parameters depending on the attribute type chosen from the *Type* drop-down menu: *Bool (boolean* with default *True or Faulse), Date-Time, Integer, Menu*, *Real Number* or *Text*.

For Date-Time type, use the default (current date) and time for the code attribute or set the date and time from the drop-down list (Figure 6-23).

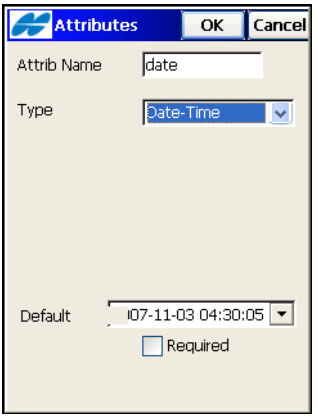


Figure 6-23. Date-Time Attribute

- *Attribute Name* – the name of the code attribute.
- *Required* – enable to always use the default value with the code attribute.
- **OK** – saves the changes, closes the screen and returns to the ***Code-Attributes*** screen.

For Integer type, the attribute value is an integer. Enter the minimum and maximum values of the attribute (Figure 6-24).

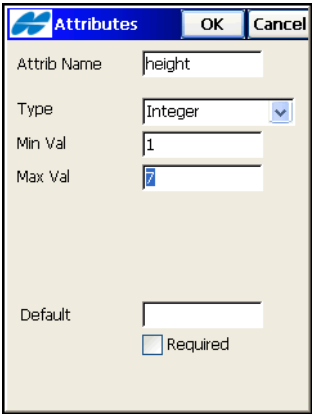


Figure 6-24. Integer Attribute

For Menu type, the attribute value is selected only from a list of available values (Figure 6-25).

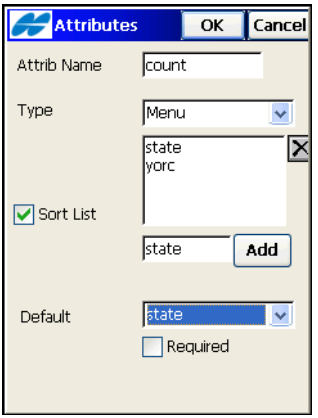


Figure 6-25. Menu Attribute

- **Add** – adds admissible values entered in the *Add* entry field.
- *Sort List* – enable to arrange the list in alphabetical order.
- **Delete** ☒ – deletes the selected entry from the menu.

For Real Number type, the attribute value is a real number. Enter the minimum and maximum values of the attribute (Figure 6-26).

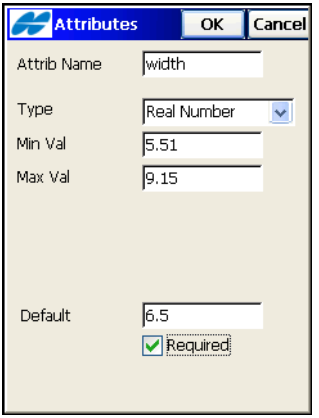


Figure 6-26. Real Number Attribute

For Text type, the attribute value is an alpha-numeric string. Enter the number of characters available for the text value (Figure 6-27).

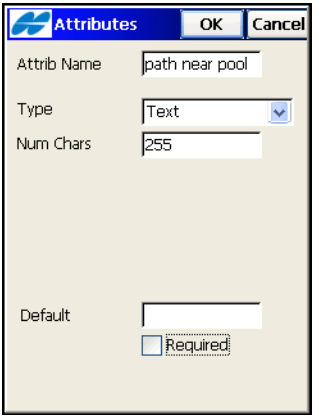


Figure 6-27. Text Attribute

Edit Layers

To edit layers, tap the **Layers** icon.

The ***Layers*** screen (Figure 6-28) displays the list of all existing layers in the current job and the layer status of each.

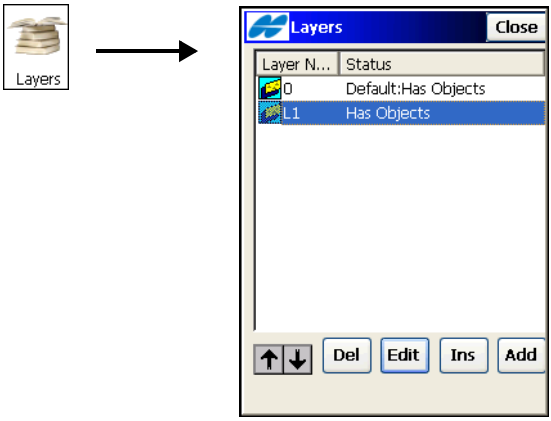


Figure 6-28. Select Layer

- *Layer Name* – a list of Layers. Each layer has an icon to show whether the layer is unhidden ( ) or hidden ( ). To turn on/off the visibility of the selected Layer, tap on the Layer Name column header.
- *Status* – shows whether the layer is empty or contains objects.
- – moves the highlighted layer up or down.
- **Delete** – deletes the highlighted layer.
- **Edit** – opens the applicable ***Edit Layer*** screen to display the properties of the highlighted layer (Figure 6-29 on page 6-24).
- **Insert** – opens the ***Add Layer*** screen to insert a new layer below the selected layer.
- **Add** – opens the ***Add Layer*** screen to add a new layer.
- **Close** – closes the screen without saving the changes.

The Help Icon in the upper-left corner of the screen displays a pop-up menu of the *Help* item.

View Objects on the Layer

The ***Edit Layer*** screen (Figure 6-29) is similar to the ***Add Layer*** screen but has the additional *Objects* tab to view objects on the layer.

Layer Name

The *Layer* tab contains general settings. You can edit the following to set new parameters for the layer:

- *Layer Name* – shows the name of the layer.
- *Visible* – hides/shows the layer objects on the map.
- *Note* – enter any additional information on the layer (if preferred).
- **OK –** saves the settings and returns to the ***Layers*** screen.
- **Cancel** – closes the screen without saving the changes.

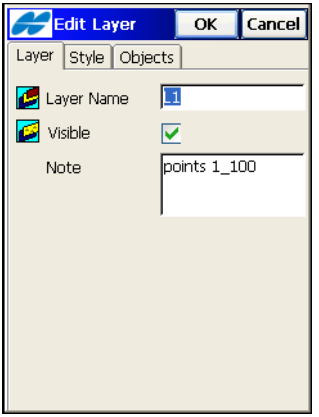


Figure 6-29. Edit Layer Name

Style Tab

The *Style* tab plots parameters for lines and points on the layer. Do the following to set parameters for the lines and points on the layer (Figure 6-30 on page 6-25).

- *Point Style* – selects a color and a symbol for the Point.
- *Line Style* – selects a color, a style, and thickness for Line.
- *Area Style* – selects a fill color, a fill style and transparency for the Area.
- **Color** – opens the ***Select Color*** screen to set the color for the layer (see Figure 6-12 on page 6-12).

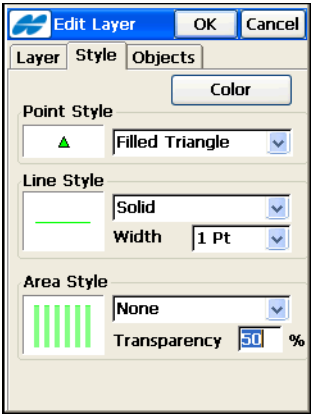


Figure 6-30. Edit Layer Style

Objects Tab

If the layer has objects, the *Objects* tab (Figure 6-31 on page 6-26) on the ***Edit Layer*** screen appears that displays points and other objects of the current layer.

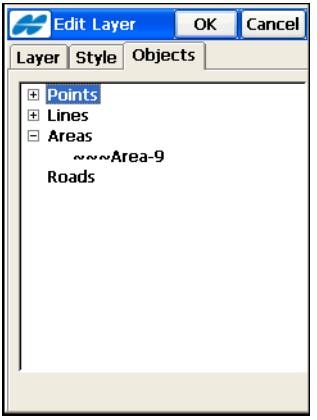


Figure 6-31. Edit Layer Objects

Edit Multiple Layers

To turn on/off the visibility of multiple layers at a time, select the layers you want using the **Ctrl** or **Shift** buttons on the controller's keyboard and tap on the *Layer Name* column (Figure 6-32).

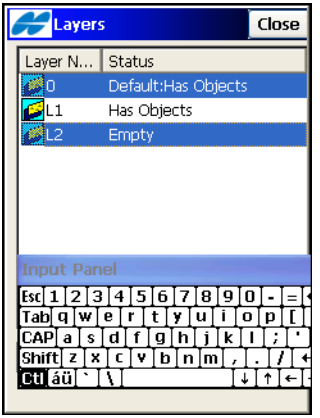


Figure 6-32. Edit Multiple Layers

The *Status* column shows the status of the layer.

Linework

Linework is a group of points connected with a line. Points defined by the same code-string combination automatically form a linework.

To edit a linework, tap the **Linework** icon.
The ***Linework*** screen (Figure 6-33) contains a list of existing Lineworks on the left side of the screen, and the two windows on the right side that represent the view of the selected linework in the horizontal and vertical planes (Figure 6-33).

- **Delete** – press to delete the Linework from the list.
- **Edit** – opens the applicable ***Edit Line*** screen (Figure 6-34 on page 6-28).
- **Add** – opens a blank ***Add Line*** screen to create a new linework. The Linework can be created in four ways: by either selecting the points with the desired codes and strings, by tapping the points on the map, or by selecting the points from the list.

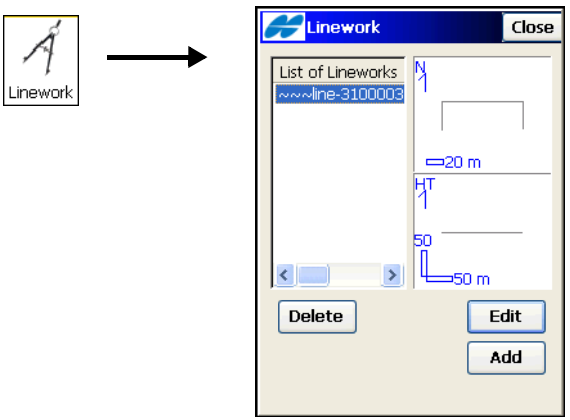


Figure 6-33. Linework

- **Close** – closes the screen without saving the settings.

To view the current selected linework in a larger map, double-tap one of the map plots.

The *Help* Icon in the upper-left corner displays the pop-up menu containing two items:

- *Edit Points* – displays the ***Points*** screen. For details, see "Points" on page 6-2.
- *Help* – accesses the Help files.

Edit Line

On the ***Edit Line*** screen (Figure 6-34), you can edit the points and the layer of the selected linework.

Points in Line

The *Point in Line* tab displays a list of existing points in the selected Linework on the left side of the screen, and the general view of the linework on the right side (Figure 6-34).
The hand symbol on the plot indicates the point highlighted in the list of points. To view the current selected linework on a large map, tap on the map plot.

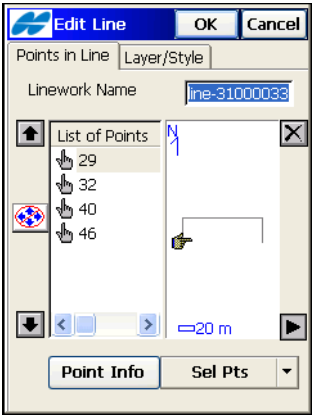


Figure 6-34. Edit Points in Line

- *Linework Name* – the name of the Linework.
- *List of Points* – points and their codes (if any) in the selected linework.
- The up and down arrows to the left of List of Points move the highlighted point up or down in the order of the points in the linework.

-  – toggles on/off the keyboard arrow keys that duplicate the arrows on the screen.
-  – deletes the highlighted point from the linework.
-  – closes the plot of the point list. Only the list of points table will be available.
- **Point Info –** displays information on the selected point.
- **Select Points** – displays a floating menu of four items. Select one of the following methods of adding points to the beginning of the line:
  - *By Code:* select the codes with which the points are added to the line.
  - *By Code String:* select the codes and strings with which the points are added to the line.
  - *From Map:* select the points by tapping them on the map; points that are sequentially tapped are connected with a line.
  - *From List:* select the points from the drop-down list.

The *Help* Icon in the upper-left corner displays the pop-up menu containing two items:

- *Edit Points* – displays the ***Points*** screen. For details see “Points” on page 6-2.
- *Help* – accesses the Help files.

Layer/Style

On the ***Edit Line*** screen (Figure 6-35), tap the *Layer/Style* tab to set a type and a color to display the line in the selected Linework on the map.

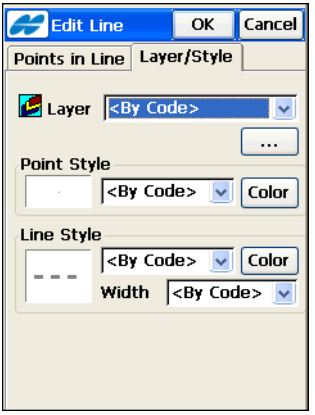


Figure 6-35. Edit Line Layer

- *Layer* – selects the layer for the line from the drop-down list.
- *Line Style* – selects the form and width of the line from the drop-down lists and shows the result.
- **Color** – opens the ***Select Color*** screen (see "On the Select Color" on page 6-11) to choose the color for the line.
- The **List** ... icon opens the ***Layers*** screen to edit layers. (For details on editing layers, see "Edit Layers" on page 6-23.)

Area

Area is bound with a closed line. Line nodes (points) have the same code of area type to form an area boundary.

To edit an area, tap the **Area** icon.
The ***Area*** screen (Figure 6-36 on page 6-31) contains a list of existing areas on the left side of the screen, and the two windows on the right side that represent the view of the selected area in the horizontal and vertical planes.

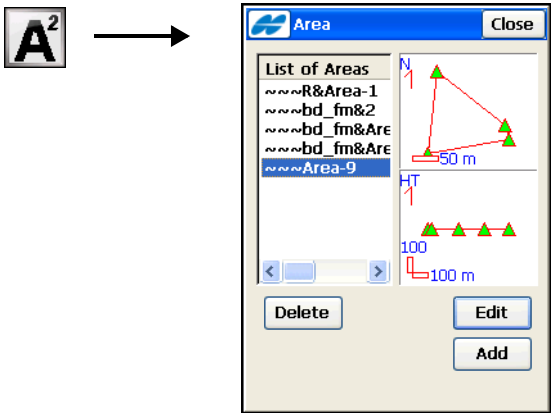


Figure 6-36. Area Screen

- **Delete** – press to delete the highlighted Area from the list.
- **Edit** – opens the applicable ***Edit Area*** screen (Figure 6-37 on page 6-32).
- **Add** – opens a blank ***Add Area*** screen to create a new area. The Area can be created in five ways: by selecting the points with the desired codes or code strings, by selecting the points from the list or from a line, by tapping the points on the map .

To view the current selected area in a larger map, tap one of the map plots.

The *Help* Icon in the upper-left corner displays the pop-up menu containing two items:

- *Edit Points* – displays the ***Points*** screen. For details, see "Points" on page 6-2.
- *Help* – accesses the Help files.

Edit Area

On the ***Edit Area*** screen (Figure 6-37 on page 6-32), you can edit the name, the points, and the layer of the selected area.

Points in Area

The *Points in Area* tab displays a list of existing points (*Area Name*) in the selected Area on the left side of the screen (Figure 6-37), and the general view of the area lines on the right side.

The point highlighted in the list of points will be marked with a yellow circle. The **Point Info** button displays information on the selected point.

To view the current selected area on a large map, tap on the map plot.

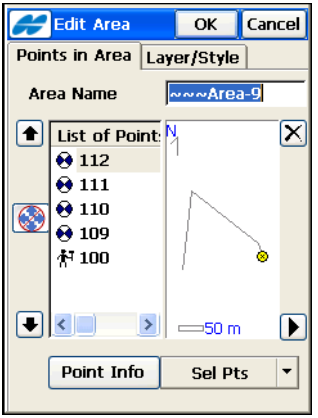


Figure 6-37. Edit Points in Area

Edit a Layer/Style

On the ***Edit Area*** screen, tap the *Layer/Style* tab to edit a style and color to display the points, lines and area in the selected Area on the map (Figure 6-38 on page 6-33).

- *Layer* – selects the layer for the line from the drop-down list.
- The **List** ... icon opens the ***Layers*** screen to edit layers. (For details on editing layers, see "Edit Layers" on page 6-23.)
- *Point Style* – selects the color and the symbol for the Point. **Color** opens the ***Select Color*** screen (see "On the Select Color" on page 6-11) to choose the fill color for the point.
- *Line Style* – selects color, style and thickness for Line.
- *Area Style* – selects fill color, fill style and transparency for Area.

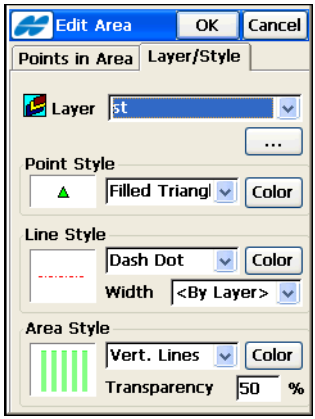


Figure 6-38. Edit Area Layer/Style

Point Lists

The Point List is a group of points that can be simultaneously processed and is tightly intergrated throughout TopSURV. Depending on the context, the points may or may not be connected with a line. A Point List with its points connected forms a polyline.

To use the Point Lists, tap the **Point Lists** icon. The ***List of Point Lists*** screen displays (Figure 6-39).

List of Point Lists

The ***List of Pt Lists*** screen (Figure 6-39 on page 6-34) contains a list of existing Point Lists on the left side of the screen, and the two windows on the right side, that displays a general view of the selected list in the horizontal and vertical planes. To view the current selected point list on a larger map, double-click one of the map plots.

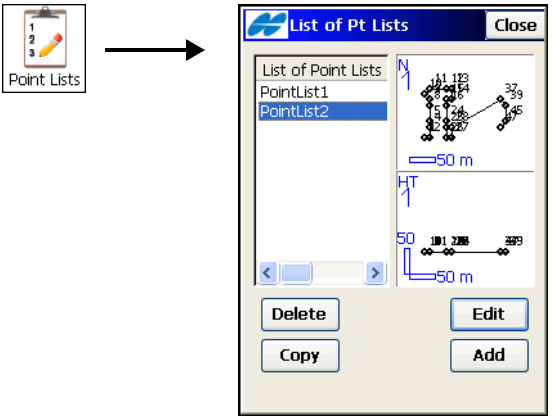


Figure 6-39. List of Point Lists

- **Delete** – deletes the Point List from the list.
- **Copy** – creates a copy of the selected List.
- **Edit** – edits the properties of the selected List. The ***Edit Point List*** screen displays (Figure 6-40 on page 6-35).
- **Add** – creates a new point List. The ***Add Point List*** screen displays.
- The Help Icon in the upper-left corner of the screen displays the pop-up menu containing two items:
  - *Edit Points*: displays the ***Points*** screen. For details, see "Points" on page 6-2.
  - *Help*: accesses the Help files.

Edit Point List

The ***Edit Point List*** screen (Figure 6-40 on page 6-35) is similar to the ***Add Point List*** screen and consists of two tabs: *Point List* and *Properties*.

The Point List tab displays the points included in the list to edit.

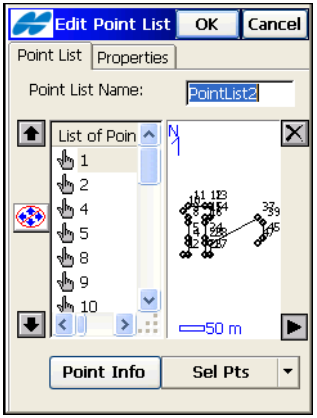


Figure 6-40. Edit Point List

- *Point List Name* – the name of the Point List.
- *List of Points* – the list of currently selected points. Use the up and down arrows to the left to select a point. Adding a point to the list can be performed in two ways.
  - Tap the map plot on the right: The large ***Map*** screen opens (for details on the screen icons, see "Points" on page 6-2). Select the points by tapping them on the map; the two sequentially tapped points are connected with a line. Press **Close** to return to the ***Edit Point List*** screen.
  - **Select Points**: displays the five methods of adding points: select either *By Range*, *By Code*, *By CodeString*, *By Radius*, *From Map*, or *From List*. Enter in this sequence: set the range, check the codes, set the center point and the radius of the area, then select the points from the map or use the list.
- **Point Info** – shows the point information of the currently selected single point.
- – toggles on/off the keyboard arrow keys that duplicate the arrows on the screen.
- – deletes the highlighted point from the list.

- – closes the plot of the point list. Only the list of points table is available.
- The *Help* Icon in the upper-left corner of the screen displays the pop-up menu containing two items:
  – *Edit Points*: displays the ***Points*** screen. For details see "Points" on page 6-2.
  – *Help*: accesses the Help files.

The Properties tab shows the name of the point list selected on the *Point List* screen (Figure 6-41).

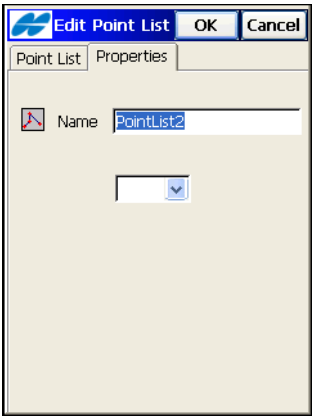


Figure 6-41. Edit Point List Properties

Raw Data

To edit raw data, tap the **Raw Data** icon.

The ***Raw Data*** screen has the following columns and buttons.

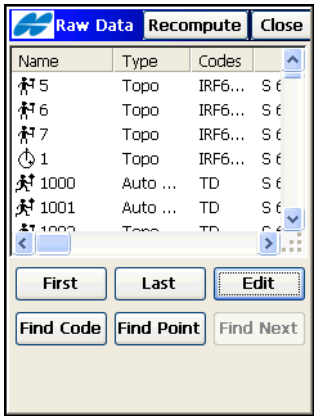


Figure 6-42. Raw Data - GPS

- *Name* – point name and the icon displaying the type of point
- *Type* – the type of measurement
- *Codes* – codes for the point
- *HI* – for TS mode, the height of the instrument; for a Level survey, the elevation of the line of sight of the levelled instrument above the datum.
- *Ant Ht* – for GPS+ mode, the antenna height (S-stands for the slope measurement of the antenna height).
- *Coordinates* – the coordinates of the point (TS and GPS+ modes).
- *Mid Wire* – the reading on the middle wire for Level survey.
- *Distance* – the horizontal distance between the Level and the rod for Level survey.
- *Ctrl Code* – control code for the point.
- *Notes* – additional information on the point.
- *Local Time* – the local time when the point is collected.
- **First** and **Last** – moves the cursor to the first or last point.
- **Edit** – opens the ***Edit Raw Data*** screen to edit user-entered raw data.

- **Recompute** – recomputes the point coordinates after editing the point's raw data.
- **Find by Point –** finds a point by its name or a part of its name.
- **Find by Code** – finds a point by its code or by a part of the code.
- **Find Next** – finds the next point that satisfies the same conditions as the previous found point.
- **Close** – closes the screen.
- The *Help* Icon in the upper-left corner of the screen enables the menu of four items:
  - *Job Info*: displays the ***Job Info*** screen (For details, see "Viewing Job Information" on page 2-12).
  - *Show Raw GPS+/TS*: toggles between displaying GPS+ raw data and TS raw data.
  - *String*: displays strings for points among raw data.
  - *Help*: accesses the Help files.

Edit Raw Data

The ***Edit Raw Data*** screen (Figure 6-43 on page 6-39) is used to edit the name and code of the surveyed point, and the antenna/instrument height at this point. Also, you can edit the antenna type for GPS measurements.

The title of the first tab is the survey type for the point being edited, for example:

- *Topo* or *Auto Topo* for GPS data (Figure 6-43 on page 6-39).
- *BS* and *Side Shot* for Total Station data.
- *Side Shot* for Digital Level data.

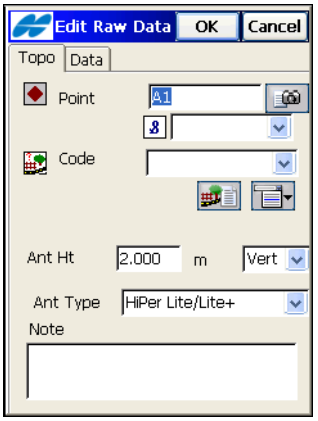


Figure 6-43. Edit Raw Data

The *Data* tab (Figure 6-44) displays information on measurements:

- Vector components for GPS data (Figure 6-44).
- Angle and distance measurements for Total Station data.
- Horizontal distance, rod height and vertical offset for Digital Level data.

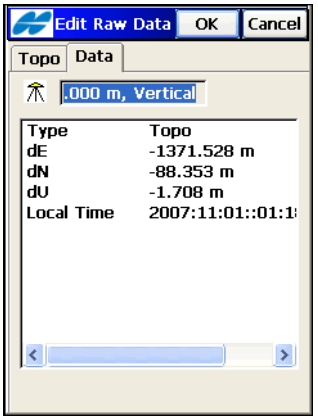


Figure 6-44. Edit Raw Data – Data Tab

For the Base Station, the **Edit** button displays the Base coordinates on the ***PC Coords*** screen (Figure 6-45).

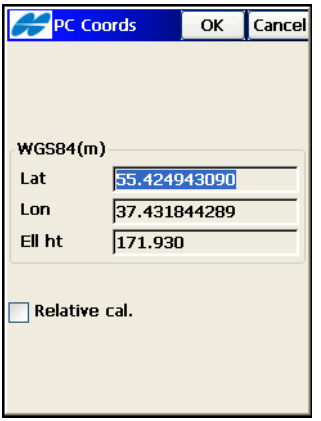


Figure 6-45. Base Station Coordinates

- *Relative cal* – enable to use relative parameters at the base with CMR+ data transmission if necessary.

The Latitudes are considered to be positive in the Northern Hemisphere and negative in the Southern one. The Longitudes are positive for the Eastern direction and negative for the Western direction, relative to the GMT line.

In addition, the ***Edit Raw Data*** screen (Figure 6-46 on page 6-41) for DL measurements contains a *Measurements* tab to adjust vertical offsets.

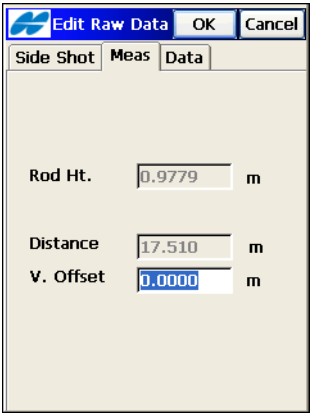


Figure 6-46. Edit DL Raw Data – Measurements Tab

Background Images

To edit background images in the current job, tap the **Images** icon.

Any raster image with a TIF, JPG, or BMP extension is supported. To be positioned correctly under all observed data on the map screen, the images must have geo-referenced data. GeoTIFF images already include geo-referenced data, while the others use a separate file that references the geographic location of the image. This file is called a **World File**. The World File contains information about the size of the corresponding image and the coordinates of the geo-reference point (the upper left corner of the image) in the coordinate system of the job. The World File must have the same filename extension associated with the image format (TFW, JGW or BPW) and should be located in the same directory as the image file.

The ***Background Images*** screen (Figure 6-47) displays a list of available image files. Initially, the list is empty.

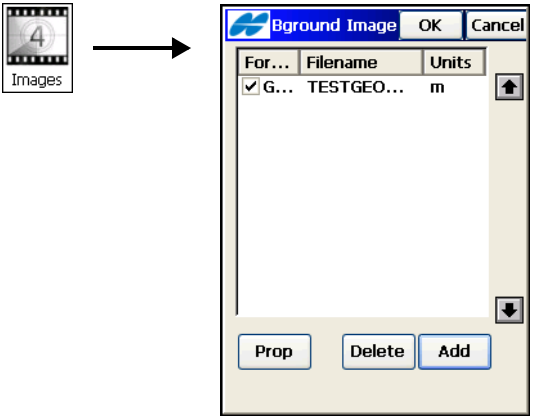


Figure 6-47. Select Image to Open

- **Properties** – opens the ***Properties*** screen for the highlighted file.
- **Delete** – deletes the currently selected file from the list.
- **Add** – opens the ***Add Image*** screen (Figure 6-48 on page 6-43) to browse the controller's directories for the desired file.
- **Up/Down** arrows – moves the selected images up or down in the list.
- **OK** – opens the selected file. If no World File exists for the background image file selected, a warning displays, and the ***Background Images*** screen appears again to select another file. Multiple background images can be selected, but is limited by the amount of free space in the controller memory.

Add Image

The ***Add Image*** screen (Figure 6-48) selects an image file to add to the *Background Images* list.

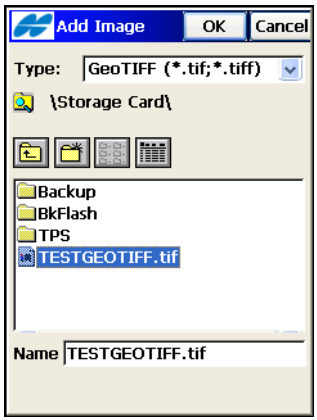


Figure 6-48. Add Image

- *Type* – selects the type of the image to be added, either GeoTIFF, TIFF, JPEG, or BITMAP.
- *Name* – displays the name of the selected file.
- **OK –** opens the ***Properties*** screen (Figure 6-49 on page 6-44) for the selected file.

Properties

If the selected image uses a **World File**, select the projection in which the coordinates in the World File are given: either *Current* job projection or *UTM*.

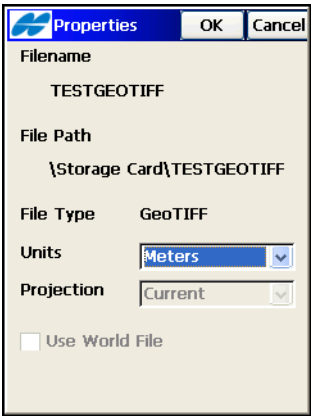


Figure 6-49. Properties of Background Image

- **OK** – returns to the ***Background Images*** screen (Figure 6-47 on page 6-42) with the file added to the list. To use a file once it is added, make sure the file is selected in the list.

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 (for example, in a corresponding UTM zone).

Sessions

To create or edit GPS sessions of the automatic survey for post-processing, tap the **Sessions** icon. The ***Sessions*** (Figure 6-50) screen displays.

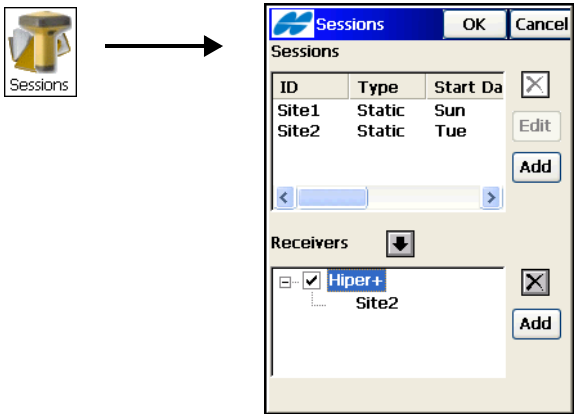


Figure 6-50. Sessions

- *Sessions* – on this panel, enter an ID name, survey type, the day and time the survey began, and the day, time, and date the survey ended.
- **Edit** – press to edit the existing session. The ***Session Setup*** screen opens (Figure 6-51 on page 6-46).
- **Add** – press to create a new session. The ***Session Setup*** screen opens (Figure 6-51 on page 6-46).
- *Receivers* – on this panel, is the list of the available receivers and their session plans. To hide/display the session plans of the receiver, tap on the "-/+" sign located near the receiver name.
- **Add** – press to add a receiver. The ***Receiver Name*** screen displays.
- – press to put a session to the session plan of the receiver. On the ***Sessions*** screen, highlight the preferred session in the *Sessions* panel and highlight the necessary receiver in the *Receivers* panel. Press this button.

- ☒ – press to delete the session from the sessions list or receiver.
- **OK** – saves the changes and closes the screen.

Session Setup

The ***Session Setup*** (Figure 6-51) screen contains the parameters of the session.

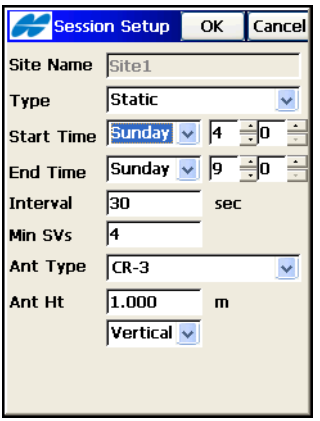


Figure 6-51. Session Setup

- *Site Name* – the name of the occupation point.
- *Type* – sets the type of session survey, either *static* or *kinematic*.
- *Start Time, End Time* – sets the start and end time of the survey
- *Interval* – sets the interval between measurements,
- *Min SVs* – sets the minimum satellites available for the survey
- *Ant Type* – sets the type of antenna.
- *Ant Ht* – sets the value and type of the antenna height.
- **OK** – saves the changes and returns to the ***Sessions*** screen (Figure 6-50 on page 6-45).

NOTICE

The antenna type specified in this screen does not display in the receiver file. But the antenna height recorded in the file includes offsets for the specified antenna type.

Simulation Setup

Simulation Setup becomes available in the **Edit Job** menu when GPS Simulation mode is enabled (see Figure 3-6 on page 3-7).

To setup the simulation mode, tap the **Set Simulator** icon. The ***Simulation Setup*** screen (Figure 6-52) sets a reference position for GPS simulation. Set the reference position by selecting the point, either from the map or from the list, or enter manually.

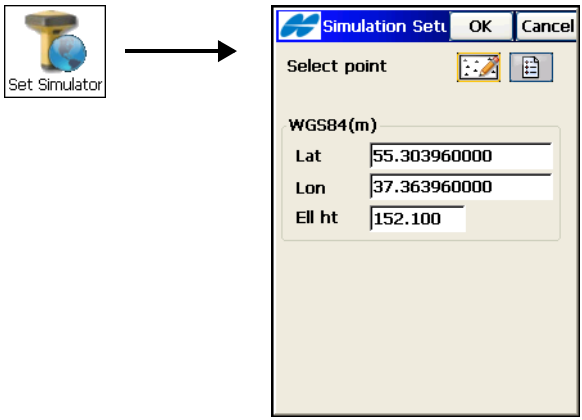


Figure 6-52. Simulation Setup

Notes:

Editing Roads

To edit road data in a job, tap the **Edit Roads** icon in the main menu.

The **Edit Roads** menu opens (Figure 7-1), which includes options to edit road data in the current job: Roads, Horizontal Alignments, Vertical Alignments, Templates, X-Sections

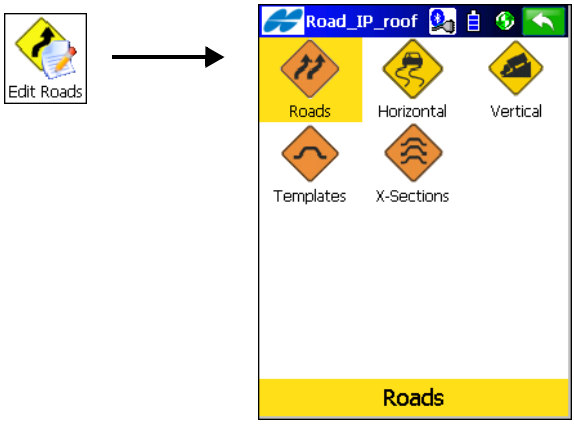


Figure 7-1. Edit Roads Menu

The *Help* Icon opens a pop-up menu, giving access to the help files, module activation codes, port data logging, changing menu interface, and information about TopSURV (for details see "Help Icon's Pop-up Menu" on page 1-8).

To edit object properties, double-click on the object or select the object and tap the Edit button.

Roads

The road as an object can be described through the horizontal and vertical projections of the center line, called *alignments*, and the line describing the surface of the road and lying in the plane perpendicular to the center line, called a *cross section*.

The alignment can be divided into sections, each described with the help of algebraic functions. The horizontal alignment can be 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 (see “The next X-Sect Temp screen (Figure 7-26) displays the parameters of the highlighted template to edit.” on page 7-27 for details).

To edit a road as a whole, tap the **Roads** icon.
The ***Roads*** screen (Figure 7-2) displays a list of the created roads, and plots of the horizontal and vertical alignments for each road.

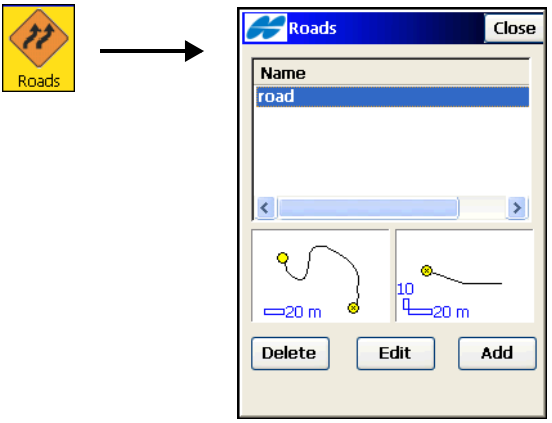


Figure 7-2. Select Road

The left side of the screen displays the list of created roads. The right side displays the corresponding alignment plots.

- **Delete** – deletes the road from the job.
- **Edit** – opens the ***Edit Road*** screen (Figure 7-3 on page 7-4), displaying the parameters of the selected road.
- **Add** – opens the ***Add Road*** screen blank parameter fields to set a new road.

The *Help* Icon in the upper-left corner of the screen displays a pop-up menu containing five items:

- *Import Road(s) From Job* – starts the import of roads from the job selected (“Importing From Job” on page 5-2).
- *Import Road(s) From File* – starts the import of roads from the file of the selected format (“Importing From a File” on page 5-13).
- *Export Road(s) To Job* – starts the export of roads to the job selected (“Exporting To a Job” on page 4-2).
- *Export Road(s) To File* – starts the export of roads to the file of the selected format (“Exporting to File” on page 4-12).
- *Help* – accesses the Help files.

Edit Road

The ***Edit Road*** screen (Figure 7-3) displays the general properties of the road.

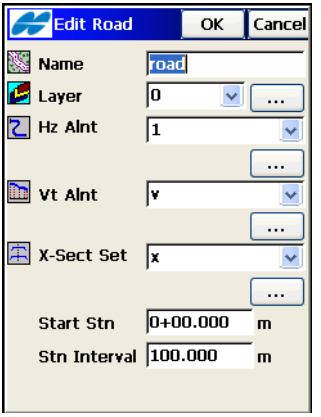


Figure 7-3. Edit Road

- *Name* – enter a name for the road.
- *Layer* – selects the layer on which the road is located.

  The **List** ... button opens the ***Layers*** screen to edit layers (for details see "Edit Layers" on page 6-23).
- *Hz Alnt* – selects a pre-defined horizontal alignment to use in designing the road.

  The **List** ... button opens the ***Horizontal Alignment*** screen to edit horizontal alignments (for details see "Horizontal Alignment" on page 7-5).
- *Vt Alnt* – selects a pre-defined vertical alignment from to use in designing the road.

  The **List** ... button opens the ***Vertical Alignment*** screen to edit vertical alignments (for details see "Vertical Alignments" on page 7-16).
- *X-Sect Set* – selects a set of cross section templates to use in designing the road.

The List ... button opens the ***X-Section Set*** screen to edit cross section sets (for details see "Cross Section Sets" on page 7-29).

- *Start Stn/Start Chn* – the starting station number with distance to the station, or the starting chain distance, depending on a selection made in the ***Display*** screen (for details see "Display" on page 2-8).
- *Stn Interval/Chain Interval* – the interval between the points where road related computations are made.

After the Road is created, calculate the road points. The *Help* Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Calculate Road Points* – opens the ***Calculate Road Points*** screen (see "Calculate Road Points" on page 7-33).
- *Help* – accesses the Help files.

Horizontal Alignment

To edit a horizontal alignment, tap the **Horizontal** icon. The ***Hz Alnt*** screen (Figure 7-4) displays a list of the horizontal alignments, and the map area displaying the plot of the highlighted horizontal alignment.

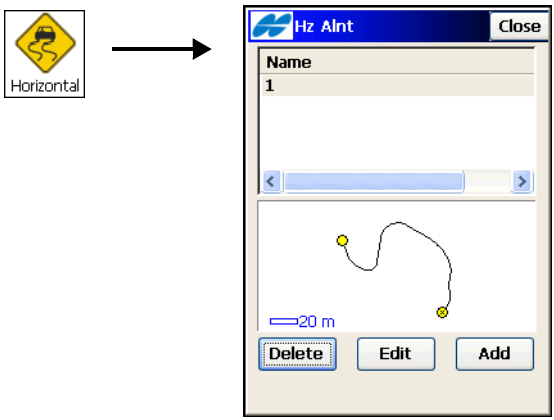


Figure 7-4. Horizontal Alignment

- **Delete** – deletes the horizontal alignment from the job.
- **Edit** – opens the ***Edit Hz Alnt*** screen, displaying the parameters of the selected horizontal alignment.
- **Add** – opens the ***Add Hz Alnt*** screen with empty parameter fields to set a new horizontal alignment (see Figure 7-5 on page 7-6).
- **Close** – closes without saving settings.

The *Help* Icon in the upper-left corner of the screen displays a pop-up of the *Help* menu.

Edit the Horizontal Alignment

The ***Edit Hz Alnt*** screen (Figure 7-5) contains the features of the horizontal alignment.

The Start Point tab (Figure 7-5) displays the starting point of the horizontal alignment parameters.

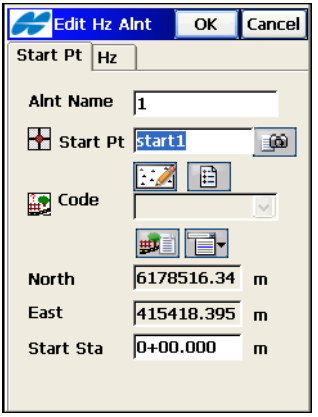


Figure 7-5. Edit Horizontal Alignment

- *Alnt Name* – the horizontal alignment name.
- *Start Pt* – the start point name. Do the following to enter the start point name, either manually, from the map icon, or from the list icon. The photo icon opens the ***Add Photo Notes*** screen to enter additional information for the point (if preferred).

- *Code* – the point code. Can be entered manually or selected from the drop-down list. The code of an existing point cannot be edited. The *Attributes List* icon opens the ***Code-Attributes*** screen to set the values for the attributes available for the selected code.
- The icon next to the *Attributes List* icon displays the following list:
  - *String*: toggles the *String* field. Also, the sign appears.
  - *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.
- *North, East* – the local coordinates of the point.
- *Start Sta/Start Chn* – the starting station number with distance to the station, or the starting chain distance, depending on a selection made in the Display screen (for details see "Display" on page 2-8).

The *Help* Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit points (see "Edit X-Section Template" on page 7-27).
- *Help* – accesses the Help files.

The Horizontal tab displays a list of horizontal alignment elements, the horizontal alignment plot, and the ending station (or chainage) of each element. The selected horizontal alignment element is highlighted in the plot displayed to the right of the screen (Figure 7-6 on page 7-8)

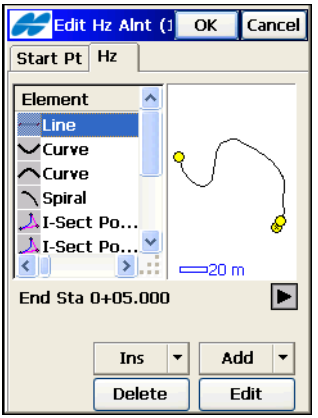


Figure 7-6. Edit Horizontal Alignment Elements

On the *Hz* tab, the element list has the following columns:

- *Element* – the icon and the name of the element; either *line*, *spiral*, *curve*, or *intersection point*.
- *Length* – the length of the element.
- *Azimuth* – the azimuth at the beginning of the element.
- *Radius* – the radius of the curve, spiral, or intersection point (the radius of the spiral is the radius at the end of the 'incoming' spiral or at the beginning of the 'exiting' spiral; the radius of the intersection point is the radius of the corresponding curve).
- **Delete** – deletes the element from the road.
- **Edit** – opens a screen with properties of the selected element.
- **Insert** – inserts elements selected from a floating menu (*Line*, *Curve*, *Spiral,* or *Intersection Point*) at the selected location in the list.
- **Add** – adds elements selected from the floating menu to the end of the list:
  - *Line*: for more information, see "Add a Line" on page 7-11.
  - *Curve*: for more information, see "Add a Curve" on page 7-12.

– *Spiral*: for more information, see “Add a Spiral” on page 7-13.

– *Intersection Point*: for more information, see “Intersection Point” on page 7-14.

Select a horizontal alignment element, then tap the *Station* information under the element list to display the start and end stations (or chainages) information for the selected alignment element (Figure 7-7).

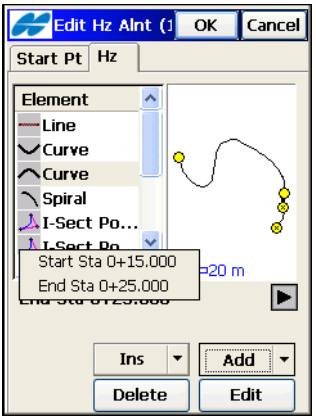


Figure 7-7. Alignment Element Information

Also, the graphics interface can display information on the start and final positions of the selected element. Double-click in the plot area to open the greater ***Map*** screen for horizontal alignments (Figure 7-8 on page 7-10).

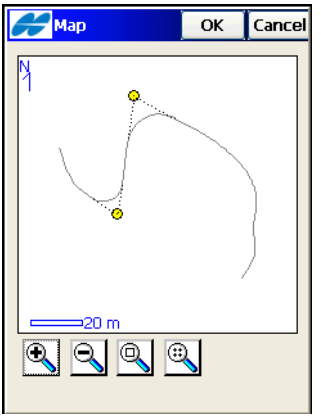


Figure 7-8. Alignment Map

Select the alignment element you want to display on the ***Alignment Element Info*** screen (Figure 7-9), then double-click to display information for the selected horizontal alignment element from the map: either *Start/End Station, Start NOrth, Start East, End North,* or *End East*.

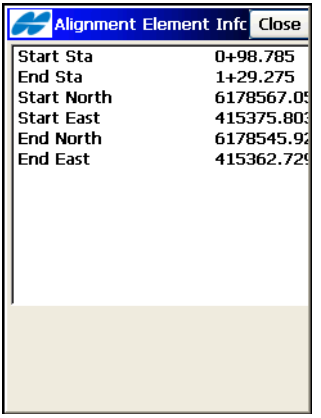


Figure 7-9. Alignment Element Information

Add a Line

To add a line, select the *Line* option from the **Insert** or **Add** floating menu on the *Horizontal* tab of the ***Edit Horizontal Alignment*** screen. The ***Line*** screen displays (Figure 7-10).

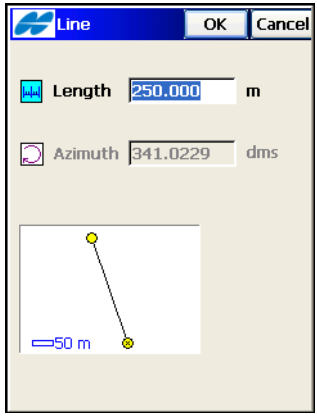


Figure 7-10. Line

The plot illustration at the bottom-left corner of the ***Line*** screen shows the element's appearance (Figure 7-10).

- *Length* – the length of the line element.
- *Azimuth* – by default, the azimuth is set tangent to the previous element. This field is editable only for the starting element of the road. To change the azimuth of all other elements, remove the check mark from the *Tangent to Previous Item* box on the Help Icon in the upper-left corner of the screen.

NOTICE

Caution should be exercised when setting the azimuth, since road elements are usually tangential to each other.

- **OK** – saves the element to the road and returns to the ***Add Horizontal Alignment*** screen.
- **Cancel** – closes the screen without saving the settings.

Add a Curve

To add a curve, select the *Curve* option from the **Insert** or **Add** floating menu on the *Horizontal* tab of the ***Edit Horizontal Alignment*** screen. The ***Curve*** screen displays (Figure 7-11).

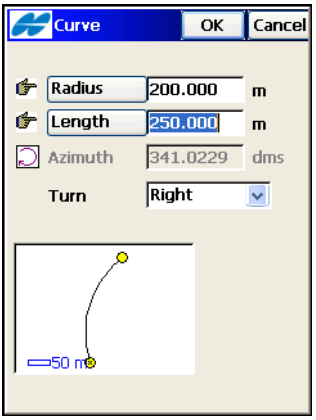


Figure 7-11. Curve

The plot illustration at the bottom of the ***Curve*** screen shows the element's appearance.

- *Radius/ Deg Chord/ Deg Curve* – the radius of the curve, or one of the two parameters unambiguously defining the radius: *degree of chord,* or *degree of curve*.

  Using the degree of chord (DCH) or degree of curve (DCV) parameters, the radius can be calculated as follows:

$$R = \frac{50}{\sin\left(\frac{DCH}{2} \times \frac{\Pi}{180}\right)}, R = \frac{100 \times 180}{\Pi} \times \frac{1}{DCV}$$

- *Length/Chord/Tangent/Mid Ord/External/Delta* – the *length* of the curve element, or one of five parameters unambiguously defining the curve length: *chord, tangent, middle ordinate* (the distance from the midpoint of a chord to the midpoint of the corresponding curve), *external* (the distance from the midpoint of the curve to the tangent), or *delta* (the angle between the radii corresponding to the curve).

- *Azimuth* – by default, the azimuth is set tangent to the previous element. This field is editable only for the starting element of the road. To change the azimuth of all other elements, remove the check mark from the *Tangent to Previous Item* menu on the bitmap icon in the upper-left corner of the screen.

NOTICE

Caution should be exercised when setting the azimuth, since road elements are usually tangential to each other.

- *Turn* – the direction of turn. Select either the *Right* value (clockwise direction) or the *Left* value (counter-clockwise direction).
- **OK** – saves the element to the road and returns to the ***Add Horizontal Alignment*** screen.

Add a Spiral

To add a spiral, select the *Spiral* option from the **Insert** or **Add** floating menu on the *Horizontal* tab of the ***Edit Horizontal Alignment*** screen. The ***Spiral*** screen displays (Figure 7-12).

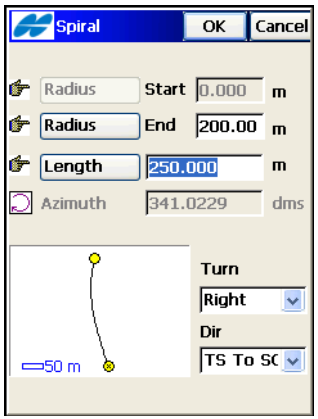


Figure 7-12. Spiral

The plot at the bottom of the screen displays the element's appearance.

- *Radius/ Deg Chord/ Deg Curve* – the *radius* of the curve, or one of two parameters unambiguously defining the radius: the *degree*

of chord, or the *degree of curve* (see "Add a Curve" on page 7-12).

- *Length/Sp Const* – the parameter is the square root of the product of the length and the radius of the spiral, as defined above. Consequently, the spiral constant has the units of length.
- *Azimuth* – by default, the azimuth is set tangent to the previous element. This field is editable only for the starting element of the road. To change the azimuth of all other elements, remove the check mark from the *Tangent to Previous Item* box on the bitmap in the upper-left corner of the screen.

Caution should be exercised when setting the azimuth, since road elements are usually tangential to each other.

- *Turn* – the direction of turn. Select either the *Right* value (clockwise direction) or the *Left* value (counter-clockwise direction).
- *Dir* – the direction of movement along the spiral, *TS* to *SC* (entering the turn), or *CS* to *ST* (exiting the turn)[1].
- **OK** – saves the element to the road and returns to the ***Add Horizontal Alignment*** screen.

Intersection Point

To add an intersection point, select the *Intersection Point* option from the **Insert** or **Add** floating menu on the *Horizontal* tab of the ***Edit Horizontal Alignment*** screen. The ***Intersection Pt*** screen (Figure 7-13 on page 7-15) displays.

1. The traverse points on the turn have the following markers: TS-traverse-spiral; SC-spiral-circle; CS-circle-spiral; and ST-spiral traverse.

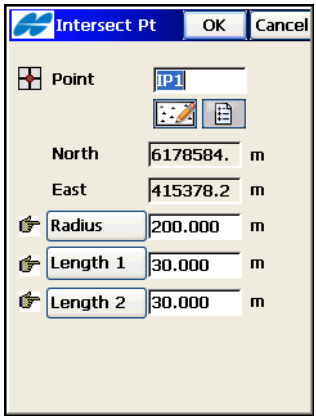


Figure 7-13. Intersection Point

- *Point* – the name of the intersection point. Either enter the name manually (with the coordinates specified in the *North* and *East* fields and a height of zero) or select it from the map or the list.
- *North, East* – the local coordinates of the intersection point; cannot be changed for an existing point.
- *Radius/ Deg Chord/ Deg Curve* – the radius of the corresponding curve, or the parameter, unambiguously defining the radius, degree of chord, or degree of curve. See “Add a Curve” on page 7-12.
- *Length1/Sp Const 1, Length2/Sp Const 2* – the length of the corresponding spiral elements, or the spirals constants. The spiral constants are defined. See“Add a Spiral” on page 7-13.
- **OK** – saves the element to the road and returns to the ***Add Horizontal Alignment*** screen.

Vertical Alignments

To edit a vertical alignment, tap the **Vertical** icon.The ***Vt Alnt*** screen (Figure 7-14) displays a list of the created vertical alignments and the map area to show the plot of the highlighted vertical alignment.

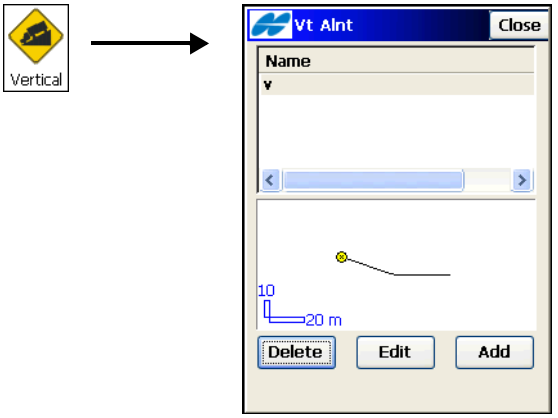


Figure 7-14. Vertical Alignment

- **Delete** – deletes the vertical alignment from the job.
- **Edit** – opens the ***Edit Vt Alnt*** screen (Figure 7-16 on page 7-18), to edit a vertical alignment highlighted in the list.
- **Add** – opens the ***Add Vt Alnt*** screen (Figure 7-15 on page 7-17) to add a new vertical alignment.

The *Help* Icon in the upper-left corner of the screen displays a pop-up menu of the *Help* item.

Add Vertical Alignments

Tap the **Add** button on the ***Vertical Alignment*** screen (Figure 7-15). The ***Add Vt Alnt*** screen selects a method of creating this alignment and sets the name of the new vertical alignment.

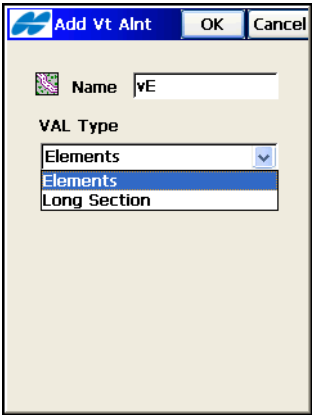


Figure 7-15. Add Vertical Alignment

- Name – enter a name for the new vertical alignment.
- VAL Type – the method of creating the vertical alignment, which include:
  - *Long Section*: select to create the vertical alignment by sections. The vertical alignment is presented as a set of sections between the stations where the heights are known (usually these are the extremes of the vertical alignment line), and the interval around the station where the vertical alignment line has a parabolic shape.
  - *Elements:* select to create the vertical alignment by element, starting and finishing where you want and starting again.
- **OK** – opens the next ***Add Vt Alnt*** screens similar to those for editing vertical alignments.

Edit Vertical Alignments

Select the alignment and tap the **Edit** button on the ***Vertical Alignment*** screen.

Elements

For Element vertical alignment types, the *Start Pt* tab on the ***Edit Vt Alnt*** screen (Figure 7-16) sets the parameters of the point starting the vertical alignment.

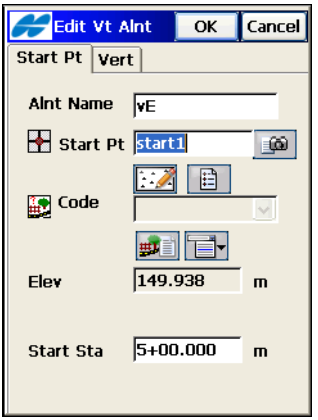


Figure 7-16. Edit Vertical Alignment

- *Alnt Name* – the vertical alignment name.
- *Start Pt* – the start point name. Enter manually (if a new point name is entered, the point is created with the height entered in the *Ell ht* field or in one of two other ways:
  - : select from the map
  - : select from the point name list
- The *Photo Notes* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point (if preferred).
- *Code* – the point code; enter either manually or select a point code from the drop-down list. The code of an existing point cannot be edited. The *Attributes List* icon opens the ***Code-***

Attributes screen to set the values for the attributes available for the code selected.

- *Ell ht* – the point height.
- The  icon next to the *Attributes List* icon displays the pop-up menu containing three items:
  - *String*: toggles the *String* field. The  sign icon also appears.
  - *Layer* – opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note* – opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.
- *Start Sta/Start Chn* – the starting station number with distance to the station, or the starting chain distance, depending on a selection made in the Display screen (for details see "Display" on page 2-8).

The *Vert* tab on the ***Edit Vt Alnt*** screen (Figure 7-17) displays a list of vertical alignment elements, the vertical alignment plot, and the ending station (or chainage) of each element.

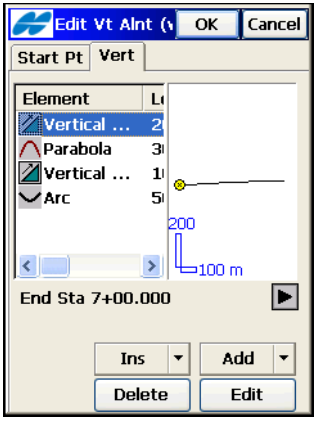


Figure 7-17. Edit Vertical Alignment Elements

The element list has the following columns for the vertical alignment elements:

- *Element* – the icon and name of the element: either *vertical grade*, *parabola*, or *arc*.
- *Length/Arc Radius* – depending upon the selection: either the length of the element or the radius of the circular arc.
- *Start Grade, End Grade* – the grades of the element, in percentage, at the starting and ending points. For a *Vertical grade* element, values are the same.
- **Insert** – inserts elements selected from a floating menu (*Vertical Grade* and *Curve*) at the selected location in the list.
- **Add** – displays a menu of two elements: select to add either *Vertical Grade* or *Curve*.

The *Help* Icon in the upper-left corner of the screen displays the pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit points (see "Edit X-Section Template" on page 7-27).
- *Help* – accesses the Help files.

Select a vertical alignment element, then tap the *Station* information under the element list to briefly display information (Figure 7-18) on the start and end stations (or chainages) for the selected alignment element.

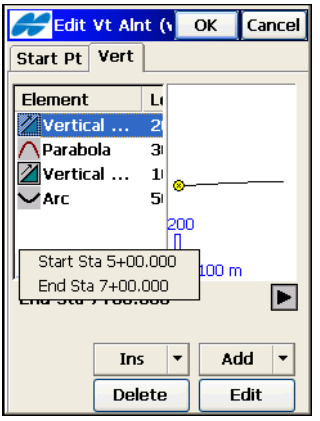


Figure 7-18. Alignment Element Information

The graphical interface also displays the start and final positions of the selected element. Double-tap in the plot area to open the greater ***Map*** screen (Figure 7-19) for vertical alignments.

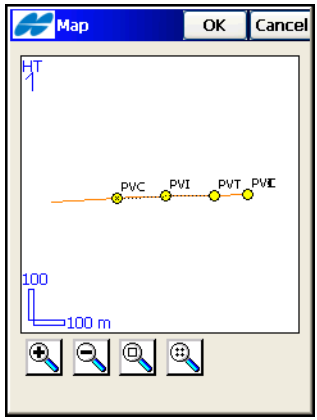


Figure 7-19. Alignment Map

For vertical curves, the ***Map*** screen displays the *PVC* point where the curve begins, the *PVI* point of intersection of two tangents, and the *PVT* point where the curve ends.

Vertical Grade

To add a vertical grade, select the *Vertical Grade* option from the **Insert** or **Add** floating menu on the *Vertical* tab of the ***Edit Vertical Alignment*** screen. The ***Vertical Grade*** screen (Figure 7-20) displays.

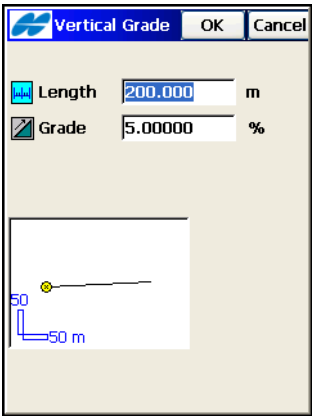


Figure 7-20. Edit Vertical Grade

The plot at the bottom of the screen shows the element's appearance.

- *Length* – the length of the vertical grade element.
- *Grade* – the grade percentage of the element. If the grade is falling, the value should be set to negative.
- **OK** – saves the element to the road and returns to the ***Add Vertical Alignment*** screen.
- **Cancel** – closes the screen without saving the settings.

Edit a Curve

To edit a curve, select the *Curve* option from the **Insert** or **Add** floating menu on the *Vertical* tab of the ***Edit Vertical Alignment*** screen. The ***Curve*** screen (Figure 7-21) displays.

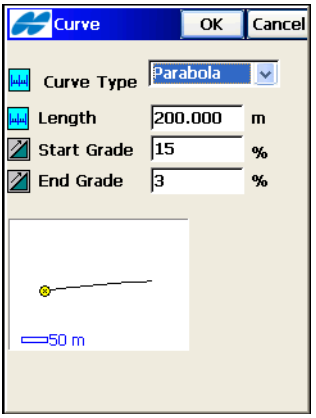


Figure 7-21. Edit Vertical Curve

- *Curve Type* – selects the type of curve to add, either *Circular Arc* or *Parabola*. The plot in the bottom of the screen shows the element appearance.
- *Length/Arc Radius* – the radius of the arc or the length of the parabola element, depending on the type of curve selected.
- *End Grade/Start Grade* – the percentage of the starting and ending grades of the element. If the grade is falling, use a negative value.
- **OK** – saves the element to the road and returns to the ***Add Vertical Alignment*** screen.

Long Sections

For Long Sections vertical alignment types (Figure 7-22), the *Start Pt* tab displays only the vertical alignment name.

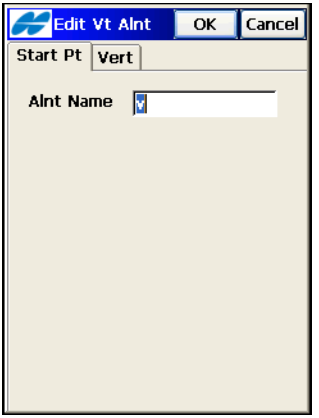


Figure 7-22. Edit Vertical Alignment Name

The *Vert* tab on the ***Edit Vt Alnt*** screen (Figure 7-23) displays the list of vertical long sections, the vertical alignment plot, and the ending station (or chainage) at each element.

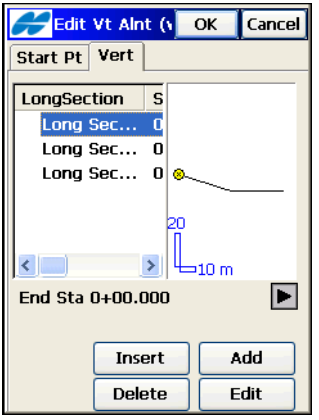


Figure 7-23. Edit Vertical Alignment Long Sections

The long section list has the following columns (Figure 7-23 on page 7-24) for vertical long sections:

- *Long Section* – the name of the element.
- *Station* – the station distance.
- *Elevation* – the elevation value on the station.
- *VC Length* – the vertical curve length is the length of the interval near the station, where the alignment has a parabolic shape.
- **Insert** – opens a blank ***Long Section*** screen in which to insert an element at the selected location in the list (Figure 7-24).
- **Add** – opens a blank ***Long Section*** screen for adding an element to the end of the list (Figure 7-24).
- **Delete** – deletes the element from the road.
- **Edit –** opens a screen with properties of the selected long section.

The Long Sections screen (Figure 7-24) adds a new long section to the vertical alignment.

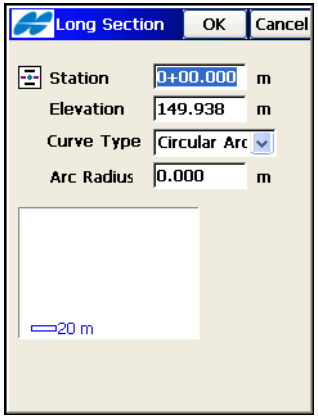


Figure 7-24. Long Section

- *Station* – the station distance from the beginning of the road.
- *Elevation* – the height at the station.

- *Curve Type* – selects the type of curve to add, either *Parabola* or *Circular Arc*. The plot at the bottom of the screen shows the element appearance.
- *VC Length* or *Arc Radius* – the length of the parabola at the station (assuming that the station is located in the middle of the interval), or the radius of the arc, depending on the type of curve selected.
- **OK** – saves the element to the road and returns to the ***Add Vertical Alignment*** screen.

Cross Section Templates

A cross-section template is a template for the creation of a complex cross-section view of the road. The cross-section template consists of several sets of *segments*, *cut slopes*, and *fill slopes*.

To create a template for a cross-section view of the road, tap the **Templates** icon.

The ***X-Sect Templates*** screen (Figure 7-25) displays a list of the existing templates in the upper part of the screen and a plot of the highlighted template in the lower part.

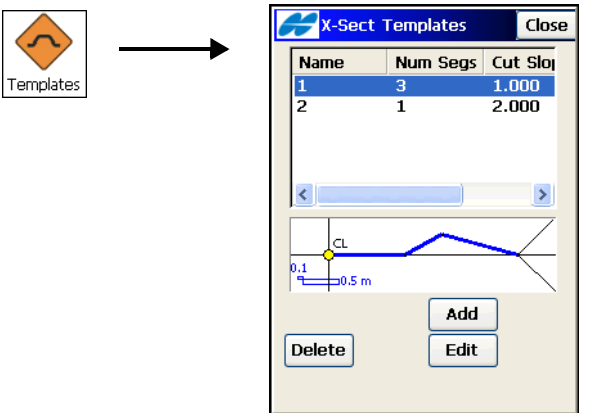


Figure 7-25. X-Sect Templates

- The list contains four columns – *Name* (the name of the template), *Num Segs* (the number of segments), *Cut Slope*, and *Fill Slope* values.
- **Delete** – deletes the template from the list.
- **Edit** – opens the properties of the selected template in the next ***X-Sect Templates*** screen (Figure 7-26).
- **Add** – opens the blank ***X-Sect Templates*** screen to enter the properties for a new template.
- **Close** – returns to the main screen.

Edit X-Section Template

To edit an existing template, highlight it and tap the **Edit** button in the ***X-Sect Templates*** screen (Figure 7-25 on page 7-26).

The next ***X-Sect Temp*** screen (Figure 7-26) displays the parameters of the highlighted template to edit.

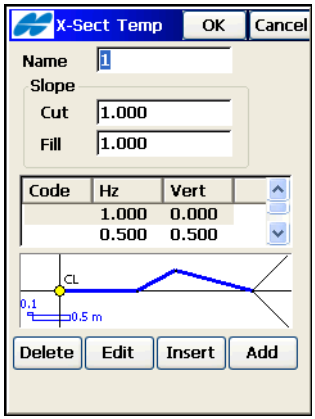


Figure 7-26. Edit X-Sect Template

- *Name* – the name of the template.
- *Slope* – the cut and fill parameter values (ratio of run values for cut and fill for a unit rise). These values represent the horizontal increment of the slope for a unit vertical increment.

– *Cut*: the cut slope is used when the road surface is below the terrain.

– *Fill*: the fill slope is used when the road surface is above the terrain.

The ***X-Sect Temp*** screen (Figure 7-26 on page 7-27) also contains a list of segments comprising the template and a plot of the template. A list of segments consists of three columns: *Code* (the code of the segment), *Hz* (the horizontal offset),*Vert* (the vertical offset).

- **Edit** – opens the ***Segment*** screen (Figure 7-27 on page 7-29) with the parameters of the highlighted segment.
- **Insert** – opens a blank ***Segment*** screen. The inserted segment is inserted in the list above the currently highlighted segment.
- **Add** – opens a blank ***Segment*** screen. The added segment is attached after the last segment in the list.
- **Delete** – deletes the segment from the template.
- **OK** – saves the changes and returns to the ***X-Sect Templates*** screen (Figure 7-25 on page 7-26).
- **Cancel** – closes the screen without saving the settings.

Cross Section Segments

The ***Segment*** screen (Figure 7-27 on page 7-29) contains the parameters of the highlighted segment

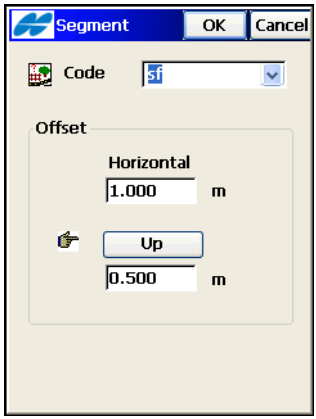


Figure 7-27. Segment Screen

- *Code* – the code of the segment. Select the code from the drop-down list or enter a new code.
- *Offset* – horizontal and vertical offsets. Press the **Down/Up/ Grade** button to select the type and value of the vertical offset. The "hand" symbol means the function is selectable. Although the value is input as **Grade** (in percents), the vertical offset is recalculated to meters (or another selected unit) after pressing the **OK** button.
- **OK** – saves the changes and closes the screen.

Cross Section Sets

To edit cross-section sets in the current job, tap the **X-Sections** icon.

The ***X-Sect Set*** screen (Figure 7-28 on page 7-30) contains a list of cross -section sets and a general scaled view of the highlighted cross section set.

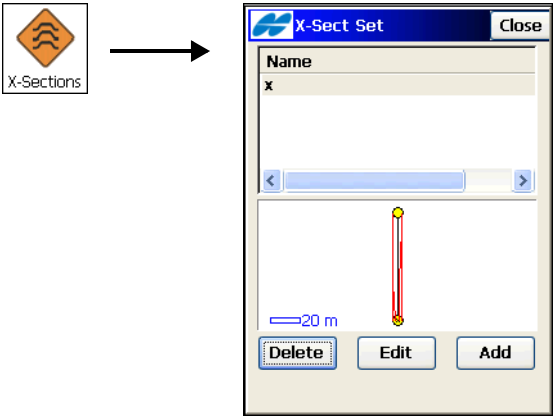


Figure 7-28. Cross Section Set

- **Delete** – deletes the cross section set from the list.
- **Edit** – opens the ***Edit X-Sect Set*** screen, displaying properties of the selected cross section set (Figure 7-28).
- **Add** – opens a blank ***Add X-Sect Set*** screen to create a new set of cross sections.

Edit Cross Section Set

The ***Edit X-Sect Set*** screen (Figure 7-29 on page 7-31) contains a list of stations where cross sections are applied, and a scaled plot of a cross section at the highlighted station.

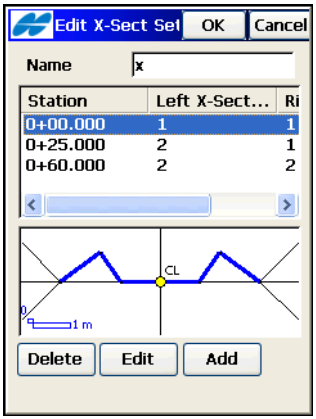


Figure 7-29. Edit X-Section Set Parameters

- *Name* – the name of the cross-section set.
- The list of stations contains the following columns:
  - *Station*: the station where the cross-section is applied.
  - *Left X-Section/Right X-Section:* the names of the cross-section templates for the left and right side of the road cross section relative to the center line. The left and right side cross sections can be different.

NOTICE

If two or more cross sections are defined, the intermediate cross sections are calculated using interpolation.

- **Delete** – deletes the station with the road cross-section from the list.
- **Edit** – opens the ***X-Section*** screen (Figure 7-30 on page 7-32) to edit the selected cross section.
- **Add** – opens a blank ***X-Section*** screen.

Cross-Section

The ***X-Section*** screen (Figure 7-30) contains parameters of the road cross-section at a given distance and a plot of the cross-section.

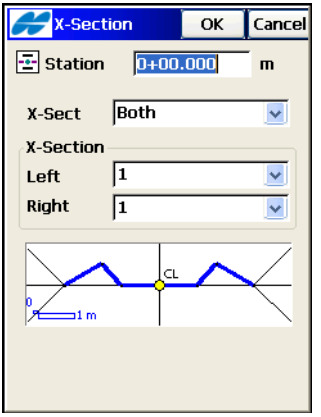


Figure 7-30. Cross Section Parameters

- *Station/Chainage* – the station where the cross-section is applied, or the distance to this station.
- *X-Sections* – selects whether the cross-section is created for both parts of the road or only for the left or right side of the road. The screen display changes, depending on the selection.
- *Left X-Section/Right X-Section* – the cross-section templates for the left and right side of the road cross-section. These can be selected only from the existing cross-section templates.
- **OK** – saves the cross-section in the list and returns to the ***Add Road*** screen.

The *Help* Icon in the upper-left corner of the screen displays the pop-up menu containing two items:

- *Edit X-Sect Templates* – opens the ***X-Sect Templates*** screen to edit cross section templates (see “Edit X-Section Template” on page 7-27).
- *Help* – accesses the Help files.

Calculate Road Points

To calculate road points, select the *Calculate Road Points* option from the Help pop-up menu on the ***Edit Road*** screen (Figure 7-3 on page 7-4).
The ***Calculate Road Points*** screen (Figure 7-31) generates points along to the right and to the left of the center line of the road, along the entire length.

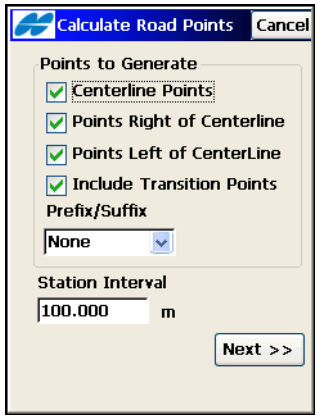


Figure 7-31. Calculate Road Points

- *Points to Generate* – defines the points to generate, either *center line* points, the points to the *right of the center line*, and/or the points to the *left of the center line*. Also, if you want to include transition points, place a check mark in the corresponding fields, and select a prefix/suffix for them, if necessary, in the *Prefix/ Suffix field* drop-down list below the *Points to Generate* section.
- *Station Interval/Chainage Interv* – sets the interval between the generated points. By default, it is the Station (or Chain) Interval set in the *Start Pt* tab on the ***Roads*** screen.
- **Next** – opens the appropriate screen, depending on the selection made in the *Points to Generate* panel. The last screen contains the **Calc** button to calculate the road points along the line.

Centerline Points Parameters

The ***Centerline Points Params*** screen (Figure 7-32) displays the parameters of points to be computed along the center line.

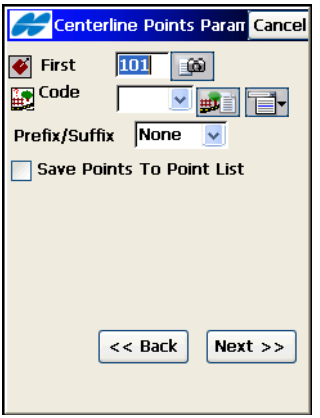


Figure 7-32. Centerline Points Parameters

- *First Point* – the name of the first point. The *photo notes* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code of the points being generated; either enter manually or select from the drop-down list. The *Attributes List* icon accesses the attributes of the chosen code and opens the ***Code-Attributes*** screen to set the values for the attributes available for the selected code.
- The icon next to the *Attributes List* bitmap displays the pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the sign appears.
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.

- *Prefix/Suffix* – when selected, sets the prefix or suffix to be added to the generated point name.
- *Save points to Point List* – enable if you want to save the generated points to a separate points list. If it is selected, a field appears where the name for the list can be set.
- Back – returns to the previous screen.
- **Next** – opens the ***Right Offset Points Params*** screen.

Right Offset Points Parameters

The ***Right Offset Points Params*** screen (Figure 7-33) displays the parameters of points to be computed to the right of the center line.

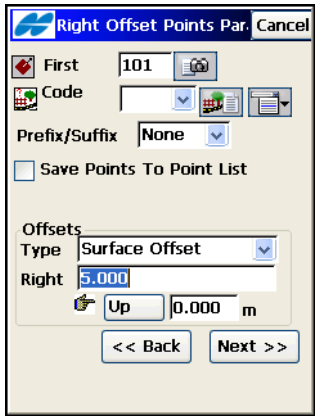


Figure 7-33. Right Offset Points Parameters

- *First Point* – the name of the first point. The  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code of the points being generated; either enter manually or select from the drop-down list. The *Attributes List* icon  accesses the attributes of the chosen code and opens the ***Code-Attributes*** screen to set the values for the attributes available for the selected code.
- The  icon next to the *Attributes List* icon displays the pop-up menu containing three items:

  - *String*: toggles on the *String* field. The  sign also appears.
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.

- *Prefix/Suffix* – when selected, sets the prefix or suffix to be added to the generated point name.
- *Save points to Point List* – enable (if necessary) to save the generated points to a separate points list. When check marked, a field appears where the name for the list can be set.
- *Offsets* – set the offset of the point from the center line along two dimensions: horizontal (the *Right* field) and vertical (the *Up/Down* field) relative to the surface (*Surface Offset* type) or to the horizontal line (*Flat Offset* type).
- **Back** – returns to the previous screen.
- **Next –** opens the ***Left Offset Points Params*** screen (Figure 7-34 on page 7-37).

Left Offset Point Parameters

The ***Left Offset Points Params*** screen (Figure 7-34) is similar to the ***Right Offset Points Params*** screen, except for the direction of the offset.

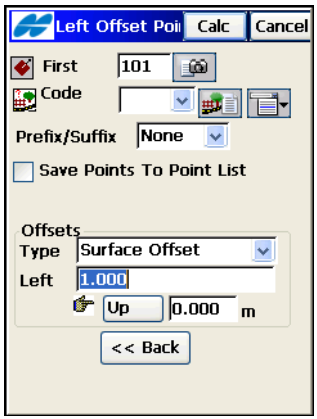


Figure 7-34. Left Offset Points Parameters

The **Calc** button calculates the points and stores them to the data set.

Notes:

Setting Up GPS

To set up a GPS survey, tap the **Setup GPS** icon in the main menu. The **Setup GPS** menu (Figure 8-1) includes options to:

1. Start a base station or static occupation
2. Perform a localization of the current job
3. View current status information on positioning
4. Perform an initialization at a known point
5. Perform an initialization of mmGPS (only for mmGPS+ aided RTK)

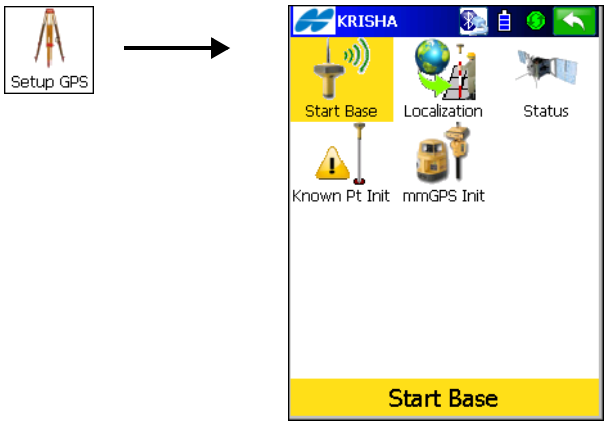


Figure 8-1. Setup GPS Menu

The *Help* icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for details see “Help Icon’s Pop-up Menu” on page 1-8).

Starting the Base

To start a Base, tap the **Start Base** icon.
The ***Start Base*** screen contains information about the Base receiver and can be used for the Base Receiver setting in an RTK survey.

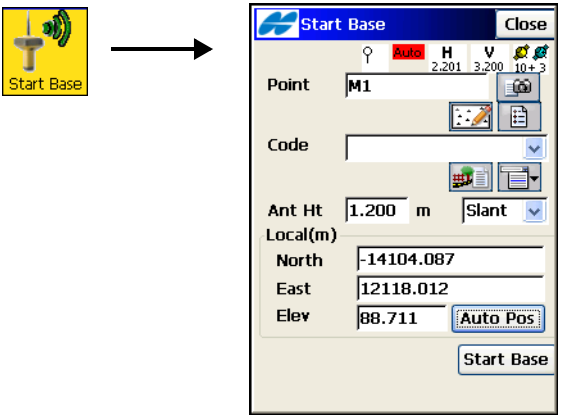


Figure 8-2. Start Base

- *Point* – select the name of the point of the Base receiver location from a *map* or *list* icon, or enter manually. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code of the point; select from the list or enter manually. Also, the attributes can be selected with the help of the *Attributes List* icon. The icon next to the *Attributes List* icon displays the list of additional features: *String, Layer* and *Note*. For details, see "The Topo Menu" on page 9-3.
- *Ant Ht* – enter the antenna height and type of measurement; select either *vertical* or *slant*).
- *Local (m)* – for RTK mode, the field for the coordinates of the antenna in the selected coordinate system. Changes its name based on the chosen value on the ***Coord System*** screen; that is, *WGS84* or *Local* (see "Coordinate System" on page 2-5), the Display screen (see "Display" on page 2-8), and the selected distance units (see "Units" on page 2-6).

- **Auto Pos** (for RTK mode) – measures the position of the current point. Once pressed, the button becomes a **Stop** button; press to stop position averaging. The average of the coordinates displays and the *Pos* field appears with the number of measurements used for averaging.
- *Duration* and *Remaining Time* (for PP Kinematic mode) – displays the time passed and the time that remains since the beginning of the survey.
- **Start Base** – sets the receiver as a Base transmitting data.

The *Help* icon at the upper-left corner displays the pop-up menu containing the following items, depending on the survey type and configuration chosen:

- *Status* – opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).
- *String* – toggles on the *String* field to enter a string for the code. Also, the  sign appears.
- *Base Antenna Setup* – opens the ***Antenna Setup*** screen to set the antenna for the current survey.
- *Config Radio* (for RTK mode) – opens the ***Configure Radio*** screen. For details, see "Configure Radio" on page 8-26.
- *Config RE-S1 Repeater* – opens the ***Configure Radio*** screen to setup the RE-S1 radio as a repeater (see "Configure RE-S1 Repeater" on page 8-31).
- *Multi Base* (for RTK survey type) – opens the ***Multi Base*** screen (Figure 8-4 on page 8-5) to set the multi base mode. This mode allows the base station to use a single frequency for transmitting data. Setting a transmission delay for each station prevents signals from colliding.
- *Grid to Ground* – opens the ***Grid to Ground Params*** screen (see "Grid to Ground" on page 8-5).

Correct the Base

If the Base starts in autonomous mode, and an observed Topo point has known coordinates stored in the job, you can correct the base position. Use the ***Duplicate Points*** screen in this case (Figure 8-3).

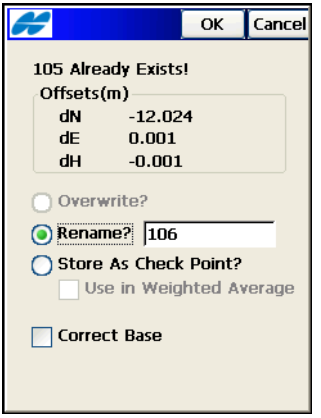


Figure 8-3. Duplicate Point

- *Overwrite* – overwrites the existing point.
- *Rename* – if enabled, the point is renamed. The new name is noted in the field and is the point with observed coordinates.
- *Store As Check Point?* – if enabled, the observed point is stored as a check point of the existing point.
- *Use in Weighted Average* – available if the *Store As Check Point* radio button is selected. The **OK** button opens the ***Weighted Average*** screen (see "Weighted Average" on page 6-14).
- *Correct Base* – if enabled, the existing coordinates of the observed point are not replaced by the coordinates of the observed point. Instead, the known coordinates of this point are used to correct the Base coordinates. After either closing the ***Topo*** screen or moving to another tab, recomputations are performed and the coordinates of all points are updated using the new Base coordinates. For the *Correct Base* option to work properly, the coordinate type selected in *Display* (see "Customizing Data Display" on page 3-89) must be the same as for the known coordinates of the observed Topo point.

Multi Base

The Multi Base function in TopSURV is implemented using 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.

All transmitters (Base receivers) must be configured to transmit at the same frequency and must transmit CMR+ format corrections. The Rover receiver must be configured to receive only CMR+ messages.

The ***Multi Base*** screen (Figure 8-4) sets parameters for Base Stations.

- *Base Station ID* – the ID of the current Base Station.
- *Transmit Delay* – a signal transmission delay for the current Base.
- *Use Multi Base* – when check marked, enables multi base mode for surveying. On the ***Status*** screen on the Rover side, the Multi-Base tab appears to select the Base.

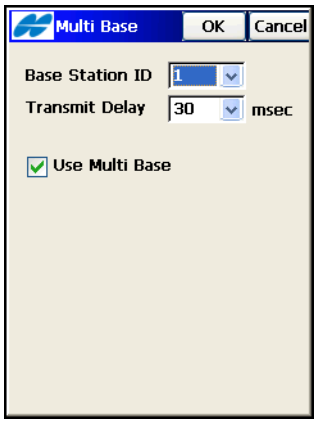


Figure 8-4. Multi Base

Grid to Ground

The ***Grid to Ground Params*** screen (Figure 8-5) displays the Grid to Ground (GG) system (in the defined coordinate system) for the

Origin Point option. This screen, available on the ***Start Base*** screen, provides a faster method for setting the calculated value of the *Scale Factor* that will be applied to the job.

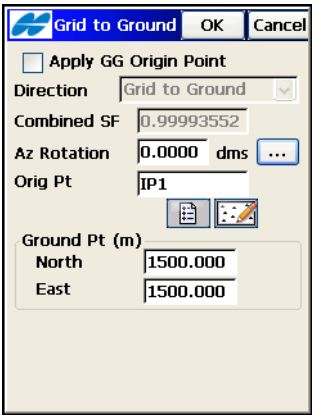


Figure 8-5. Grid to Ground from Start Base

For details, see “From Grid-to-Ground/Ground-to-Grid Transformation” on page 3-78.

Starting Static Occupation

To start a Static Occupation, tap the **Static Occupation** icon.

The ***Static Occupation*** screen contains information about the point occupied for static observations and starts logging data in PP Static survey (Figure 8-6 on page 8-7).

- *Point* – selects the name of the point of the Base receiver location from a *map* or *list* icon, or entered manually. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code of the point; select from the list or enter manually. Also, the attributes can be selected with the help of the *Attributes List* icon.

- The icon next to the *Attributes List* icon displays the list of additional features: *String, Layer,* and *Note*. For details, see "The Topo Menu" on page 9-3.
- *Ant Ht* – the antenna height and type of measurement (vertical or slant).

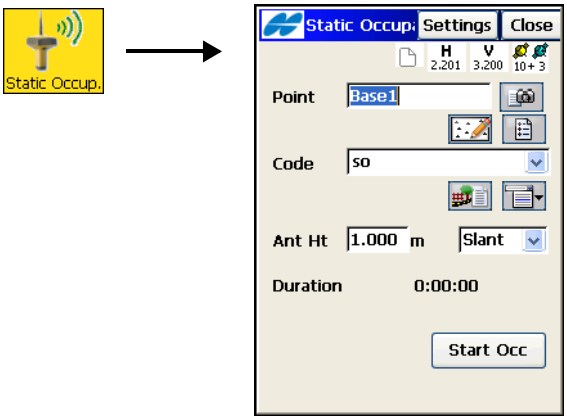


Figure 8-6. Static Occupation

- *Duration* – displays the time passed since the starting of the occupation.
- **Start Occ/Stop Occ** – starts the survey in static occupation mode. When pressed, it changes to **Stop Occ**. The icon displays the status of the log file. If the file is opened, the icon changes to .
- **Settings** – opens the ***Base Receiver*** screen to set logging parameters. (For details, see "Base Receiver" on page 3-7.)

The *Help* icon at the upper-left corner displays the pop-up menu containing the following items, depending on the survey type and configuration chosen:

- *Status* – opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).
- *Base Antenna Setup* – opens the ***Antenna Setup*** screen to set the antenna for the current survey.
- *Help* – accesses the Help files.

Localization

To set up a survey with localization, tap the **Localization** button.

Localization is used for transforming coordinates between a local system and a WGS84 system. The basic approach of calculating the mathematical conversion is to provide pairs of coordinates for each point used for localization in the job.

The ***Localization*** screen (Figure 8-7) contains a list of points used for localization, called control points. Their coordinates are known in both systems: Local and WGS84. Each point has a level of reliability specified with the values of the residuals along the horizontal and the vertical axes and the Control parameters, that shows the status of the point. The horizontal and vertical use of any of the control points can be changed by selecting the line and then tapping on the header of the H Control or V Control. This toggles the display between "used" and "not used".

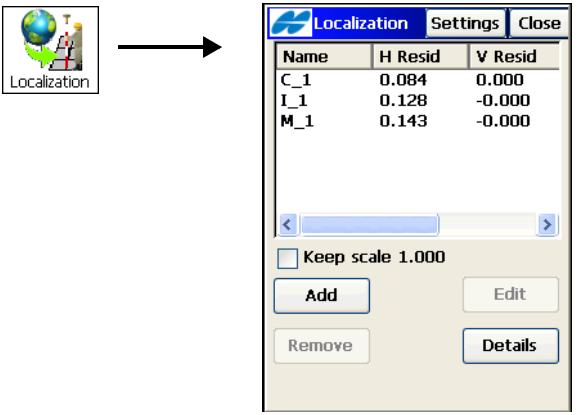


Figure 8-7. Localization

- The *Help* icon at the upper-left corner displays a pop-up menu containing two items:
  - *Config Radio*: opens the ***Configure Radio*** screen.
  - *Help*: accesses the Help files.
- *Keep scale 1.000* – preserves localization from a scale transformation (if enabled).

- **Details** – opens the ***Localization Results*** screen.
- **Remove** – removes the highlighted points.
- **Edit** – creates localization parameters, using the localization points.
- **Add** – opens the ***Add Point*** screen (Figure 8-8 on page 8-9) to add a point to use in localization.
- **Settings** – opens the Survey parameters screen. For details, see "Survey Parameters" on page 3-62.

NOTICE

The more localization points used, the more precise the localization is. The localization is updated (recomputed) every time a new point (local and WGS84 coordinates) is added to the localization list of points. The new parameters of the localization are available through the Details button.

Add Localization Point

The ***Add Point*** screen (Figure 8-8) contains the coordinates of the control points.

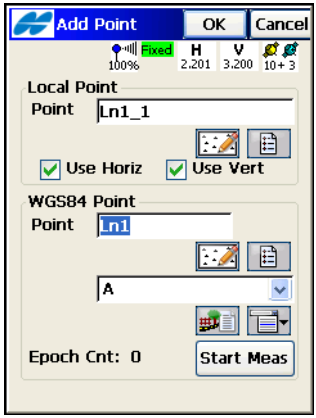


Figure 8-8. Add Localization Point

- The *Local Point* panel contains the name and coordinates of the point in the local coordinate system.

  - *Point*: sets the name of the control point; either enter a point name manually, select a point from the *map*  icon, or from the *list*  icon.
  - *Use Horizontal*: check and enable if the point should be used for horizontal localization.
  - *Use Vertical*: check and enable if the point should be used for vertical localization.

- The *WGS84 Point* panel contains the name and global coordinates of the control points.
  - *Point*: sets the name of the control point; either enter a point name manually, select a point from the map, or from the list.
  - *Code*: sets the code of the control point. Can be entered manually or chosen from the drop-down list.

-  – the *Attributes List* icon, opens the ***Code-Attributes*** screen to set the values for the attributes available for the code selected.

- The icon  next to the *Attributes List* icon displays the pop-up menu containing three items:
  - *Layer* – opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note* – opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.

- **Start Meas** – sets the control point to the current location. The *Epoch Count* field shows the number of the accepted epochs. The parameters of the logging are set through the ***Survey Parameters*** screen. If the point name already exists, the ***Point Check*** notification screen displays, which prompts you to overwrite, rename, or store the point as a check point.

- **OK** – saves the point and opens the ***Localization*** screen to display a new point.

Localization Details

The ***Localization Details*** screen (Figure 8-9 on page 8-11) contains the *Results* and *Map* tabs.

- The *Results* tab (Figure 8-9 on page 8-11) displays calculated parameters of the localization: global coordinates, corresponding local coordinates, scale parameter, the azimuth, and plane slope angles (deflections) corresponding to north and east directions.

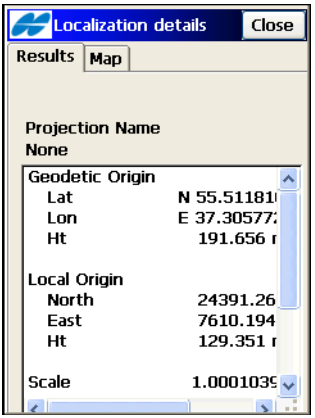


Figure 8-9. Localization Results

- The *Map* tab (Figure 8-10) displays the job graphically with the localization points marked by blue triangles.

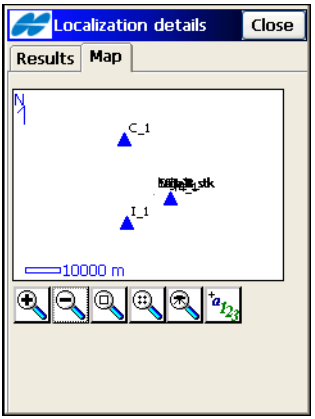


Figure 8-10. Localization Map

After editing coordinates of a localization point, a confirmation message displays (Figure 8-11 on page 8-12) to select whether to recompute the localization or not.

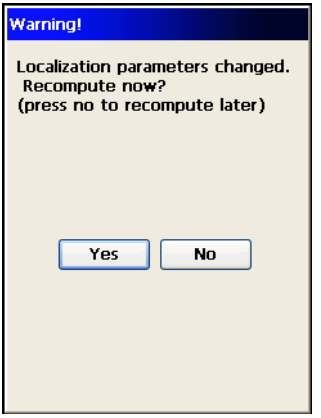


Figure 8-11. Recompute Localization

GPS+ Survey Status

To check the status of a GPS+ survey, tap the **Status** icon. The ***Status*** screen displays (Figure 8-12 on page 8-13). The ***Status*** screen contains information about the current position of the receiver, RTK status, and the satellite constellation.

Position

The *Position* tab displays the following information:

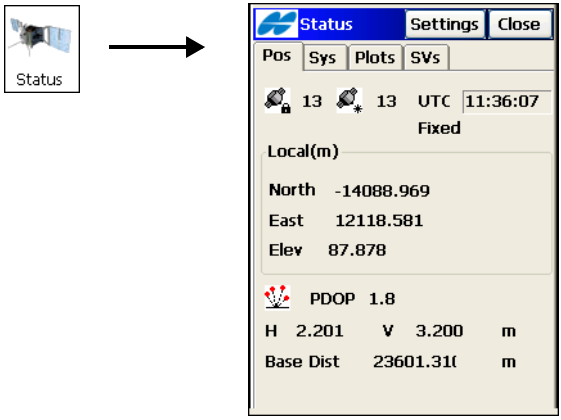


Figure 8-12. Status – Position Tab

- Total number of available satellites. The *lock* icon signifies the number of the satellites tracked, the *star* icon shows the number of satellites used in position determination.
- For mmGPS, the *Position* tab displays a mmGPS icon . This icon displays when the receiver calculates mmGPS heights.
- *UTC* – the current UTC time.
- The type of the position calculation method – Autonomous, Fixed, Float, Code Differential.
- *WGS84* – the coordinates of the antenna (*Local(m)*) in the selected coordinate system; this field changes its name based on the chosen value in the Coordinate System screen (see "Coordinate System" on page 2-5), Display screen (see "Display" on page 2-8), and the selected distance units (see "Units" on page 2-6
- *PDOP* – the PDOP value. A factor depending solely on satellite geometry describing how the uncertainty in the coordinates depends on the measurement errors. PDOP is proportional to the estimated position uncertainty.

- *(H) HRMS* and (V) *VRMS* –the RMS[1] values of the horizontal and vertical coordinates for the last epoch of observation, respectively.
- *Base Dist* – slope distance to base antenna. The field is empty if no differential corrections are received.
- **Settings** – opens the ***Elevation Mask*** screen (Figure 8-13).
- **Close** – closes the screen

Elevation Mask

The ***Elevation Mask*** screen (Figure 8-13) sets the value for the minimum threshold; data from satellites below this elevation angle are not used.

Figure 8-13. Elevation Mask

- *Elevation Mask for* – sets the device of elevation mask application.
- *Elevation Mask* – the value of the elevation mask.
- **Set** – sends the current elevation mask to the base or rover receiver as selected above.

1. RMS (Root Mean Square) – a factor that characterizes the precision of the collected coordinates.

System

The *System* tab (Figure 8-14) displays the information about the current state of RTK measurements.

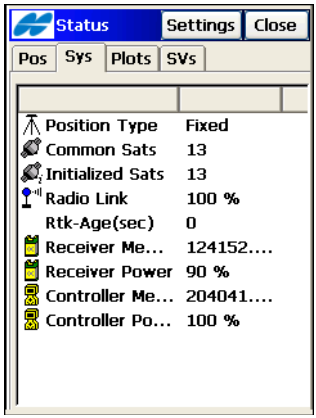


Figure 8-14. Status – System

- *Position Type* – the type of the position calculation method: *Autonomous*, *Fixed*, *Float*, or *Code Differential*.
- *Common Sats* – the number of satellites common to the Base and Rover used in RTK solution.
- *Initialized Sats* – the number of satellites contributing to the solution.
- *Radio Link* – a check sum reading from the radio as the Base generates packets. 100% means all packets have been received.
- *RTK-Age(sec)* – how much delay is seen between the marker of the last RTK message received from the Base and the epoch being solved at the Rover.
- *Receiver Memory* – the remaining memory of the receiver.
- *Receiver Power* – the current receiver power value.
- *Controller Memory* – the available memory in the controller.
- *Controller Power* – the current controller power value.

Log History

For PP enabled RTK, PP Kinematic and PP DGPS, when file logging starts, the ***Status*** screen (Figure 8-15) also displays the *Log History* tab.

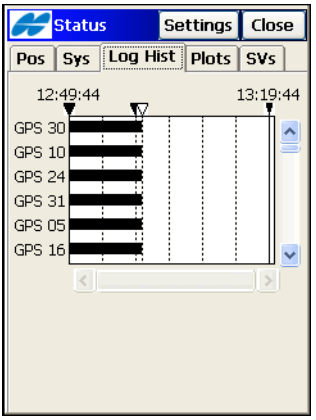


Figure 8-15. Status – Log History

The *Log History* tab graphically displays the usage of satellites over time. The field is divided into 5-minute portions along dotted lines with the starting time and each new hour marked.

Multi Base

If the Rover receives CMR+ corrections from more than one Base, an additional tab called *Multi Base* appears in the ***Status*** screen on the Rover side. Muti Base mode is set in the ***Start Base*** screen (Figure 8-4 on page 8-5).

The *Multi Base* tab (Figure 8-16 on page 8-17) displays a list of the Base Stations with their parameters (age, link quality, type, and so forth). Check mark the desired Base to use its corrections.

Currently, TopSURV supports processing RTK baselines from one base at a time. If the receiver switches base stations when recording data, TopSURV warns the user.

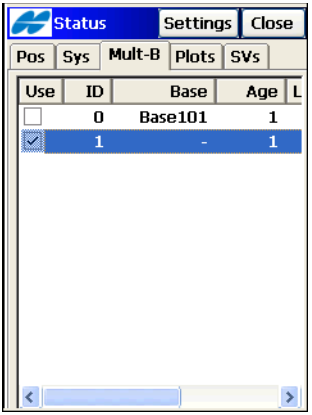


Figure 8-16. Status – Multi Base Tab

Position Plots

The *Plots* tab (Figure 8-17) displays the current receiver position.

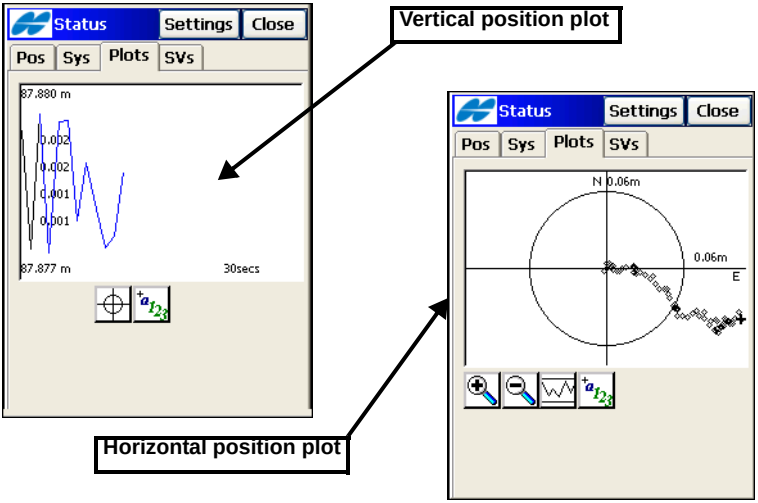


Figure 8-17. Status – Scatter Plots

Table 8-1 lists and describes the plot icons for the current position receiver.

Table 8-1. Plot Icons/Current Receiver Position

Plot Icons	Receiver Position Description
	Zooms the plot inward.
	Zooms the plot outward.
	Switches the vertical position plot to the horizontal one.
	Switches the horizontal position plot to the vertical one.
	Opens the ***Properties*** screen (Figure 8-18) from which to set graphical features for the scatter plots.

Properties

On the ***Properties*** screen, you can set graphical features for scatter plots (Figure 8-18).

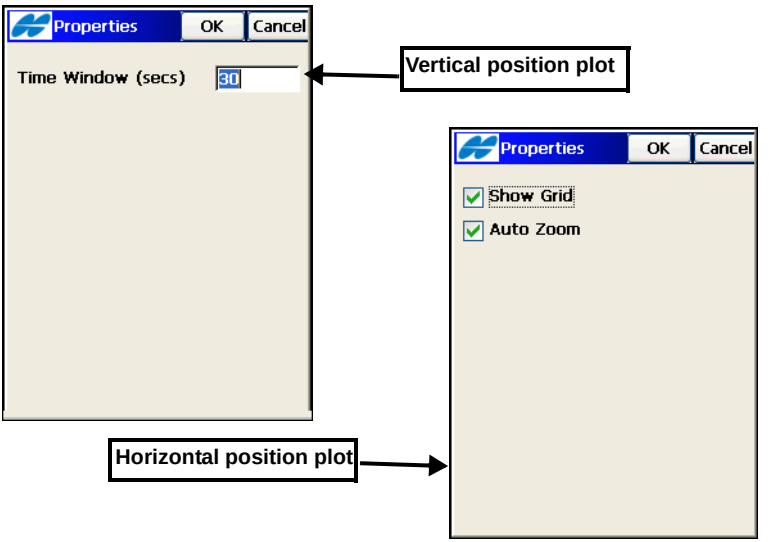


Figure 8-18. Scatter Plot Properties

On the ***Properties*** screen (Figure 8-18 on page 8-18) for the vertical position plot, enter the duration in seconds for the time axis. (*Time Window (secs)*).

On the ***Properties*** screen (Figure 8-18 on page 8-18) for the horizontal position plot, enter the following parameters:

- *Show Grid* – if enabled, displays the local coordinate axes.
- *Auto Zoom* – if enabled, automatically scales the horizontal position plot to fit into the screen.

Satellites

The *SVs* tab of the ***Status*** screen (Figure 8-19) displays the graphical position of the satellites on the sky.

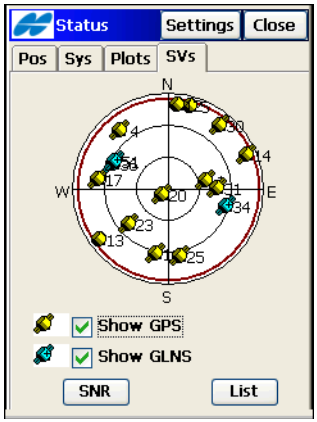


Figure 8-19. Status – SVs Plot

- *Show GPS* – shows/hides the GPS satellites images.
- *Show GLNS* – shows/hides the GLONASS satellite images. GLONASS satellites are marked with a "+" sign.

NOTICE

The absence of "wings" on the satellite image means that for some reason, the signal from this satellite is not used in the positioning (for example, below elevation cutoff).

- **SNR** – toggles the appearance of the screen to a table displaying the signal-to-noise ratio of each of the satellites (Figure 8-20).

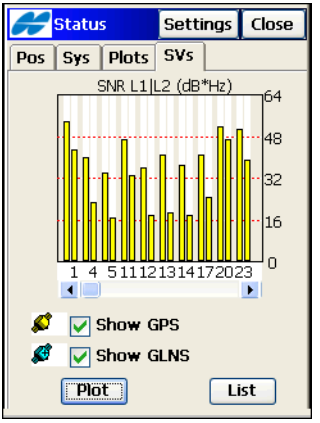


Figure 8-20. Status – SVs SNR

- **List** – toggles to the table (Figure 8-21) that displays the satellite parameters.

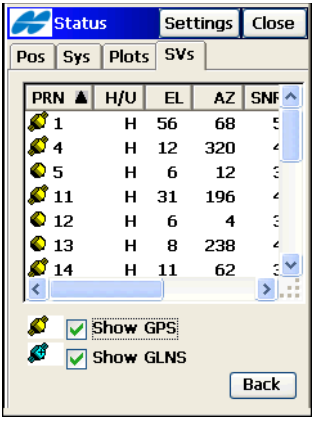


Figure 8-21. Status – SVs List

– *PRN*: shows the number of the satellite.

– *H/U*: shows whether signal is healthy or unhealthy.

– *EL*: shows the elevation angle of the satellite.

– *AZ*: shows the azimuth of the satellite.

  - *SNR1*: shows the L1 signal to noise ratio.
  - *SNR2*: shows the L2 signal to noise ratio.
  - *L2C*: shows the L2C signal to noise ratio.
  - *USED*: shows whether a satellite is used in position computation. The user can select whether a satellite should be used or not by selecting the corresponding row for the satellite in the list and clicking on the USED column header. This will toggle the use of the satellite.

- **Back** – return to the sky plot view (Figure 8-20 on page 8-20).
- **Close** – closes the screen.

Help Icon Options

The *Help* icon  in the upper-left corner of the ***Status*** screen displays a pop-up menu which varies depending on the configuration type used:

- *Rover Antenna Setup* – opens the ***Antenna Setup*** Screen to set the antenna for the survey.
- *Config OmniSTAR* – available if OmniStar is configured; opens the ***OmniSTAR*** screen to setup the OmniSTAR service (see "Configure OmniSTAR" on page 8-22).
- *Config Beacon* – available if Beacon is configured; opens the ***Beacon*** screen to setup the Beacon service (see "Configure Beacon" on page 8-24).
- *Config Radio* – opens the ***Configure Radio*** screen to setup the radio (see "Configure Radio" on page 8-26). The option varies depending on the radio selected for the rover (see "Configure Radio" on page 8-26). It can be: *Config Radio, Config CDMA, Config CDPD, Config GSM* or *Config UHF*.
- *Config RE-S1 Repeater* – available if RE-S1 is configured as a repeater; opens the ***Configure Radio*** screen to setup the RE-S1 repeater (see "Configure RE-S1 Repeater" on page 8-31).
- *Reset RTK* or *Reset DGPS* – reinitializes the receiver.

- *mmGPS+ Options* – opens the ***mmGPS+ Options*** screen (see "mmGPS+ Options" on page 8-32).
- *Help* – accesses the Help files

Configure OmniSTAR

TopSURV references two OmniSTAR services: either *Virtual Base Station* (VBS) or *High Performance* (HP). To set up a DGPS survey with OmniSTAR, select the *Config OmniSTAR* option from the *Help* Icon menu in the upper-left corner of the ***Status*** screen.

The same option is accessible from the ***Topo*** and ***Auto Topo*** screens.

If the job is configured to use the OmniSTAR VBS service with GPS receivers that allow using only VBS, the ***OmniSTAR*** screen (Figure 8-22), opens to select the satellite.

Figure 8-22. OmniSTAR information

- *Satellite* – selects the satellite that the receiver subscribes to.
- OmniSTAR SN – shows the OmniSTAR serial number.
- Subscription – shows the OmniSTAR subscription number.
- **Status –** opens the OmniSTAR screen to view information on the OmniSTAR link and the receiver OmniSTAR board (Figure 8-23 on page 8-23).

If the job is configured to use the OmniSTAR service with MAP-HP receivers, the ***OmniSTAR*** screen begins to display the status of OmniSTAR service directly after selecting the Config OmniSTAR option. Wait for some time to get the information shown.

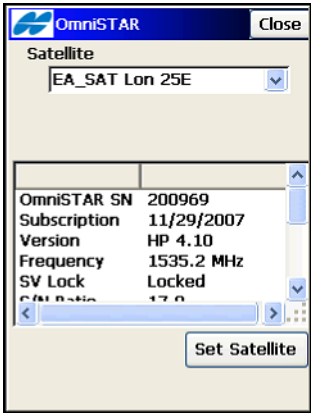


Figure 8-23. OmniSTAR HP Status

- Satellite – select an OmniSTAR satellite.
- **Set Satellite** connects to the selected satellite and begins logging data from this satellite.

The *System* tab will display (Figure 8-24) first DGPS VBS position type and then, HP DGPS solution.

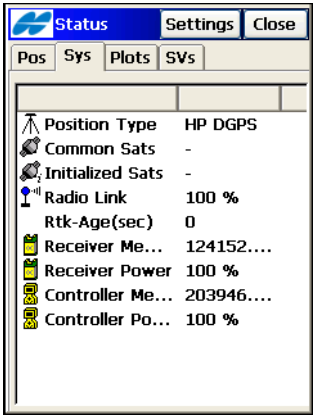


Figure 8-24. HP DGPS

Configure Beacon

To set up a DGPS survey with the Beacon service select the *Config Beacon* option from the *Help Icon* menu in the upper-left corner of the ***Status*** screen. The ***Beacon*** screen (Figure 8-25) displays.

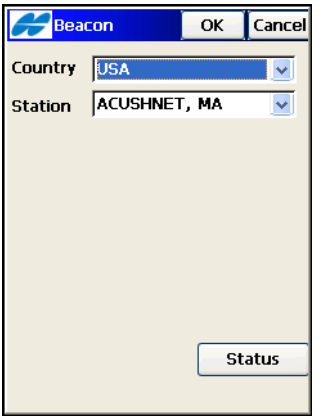


Figure 8-25. Beacon

- *Country* – the country where the radio-beacon is located.
- *Station* – the station that provides broadcasting differential corrections for the Rover.
- **Status** – opens the ***Beacon Status*** screen (Figure 8-26) to view information on the beacon link and the receiver beacon board.

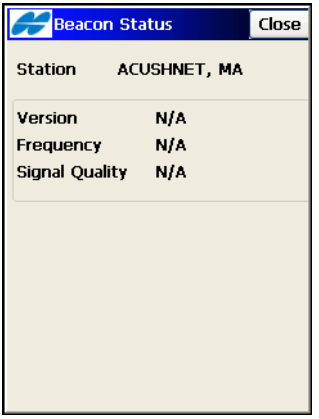


Figure 8-26. Beacon Status

BR-1 Configuration

When a survey is configured to use the differential corrections receiver BR-1 (see “Config: Beacon” on page 3-34), the ***Beacon*** screen (Figure 8-27) displays to set up the BR-1 radio.

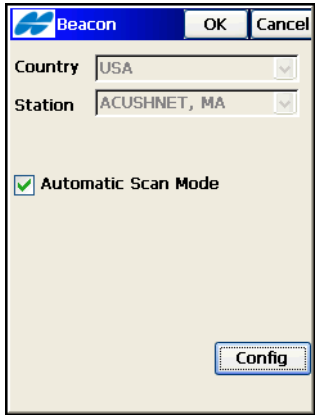


Figure 8-27. Beacon BR-1 Setup

- **Config** – sends the appropriate configuration command for BR-1 radio channels (Figure 8-28):
  - When Automatic Scan mode is on, all four channels of the BR-1 automatically scans frequencies until one of the channels find the available Beacon Signal. After the signal is found, the channel maintains this frequency.

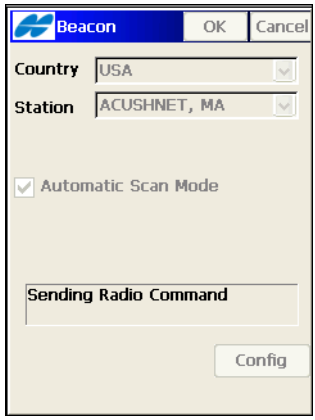


Figure 8-28. BR-1 Configuration

– When Automatic Scan mode is off, the frequency and data transfer rate of the known Station selected is set only to channel ‘a’ of the BR-1 receiver. The other channels do not work.

Configure Radio

The ***Config Radio*** screen sets up the parameters for the rover/base/repeater radio modem. This screen displays the parameters which were set in the job configuration (see “Base Radio” on page 3-11 and “Rover Radio” on page 3-29).

The set of the parameters depends upon the type of the radio selected. For detailed description of the radio parameters see “Base Radio Parameters” on page 3-14.

For a Digital UHF Modem: Internal GR-3 Digital UHF, Internal HiPer Digital UHF, TRL-2 and TRL-35 External Digital UHF the *Config Radio* screen (Figure 8-29 on page 8-27), after querying the radio for the frequency, sets the radio channel to the frequency on which to receive or transmit correctional data.

Script file with Frequency list (Pac Crest Channels.ccx) must be loaded (using the Modem TPS software) before any frequencies will be displayed in TopSURV. Please do this BEFORE configuring the radio.

- *Radio Connected to* – selects the modem from the configured ones to setup.
  - – Rover: selects the modem connected with the Rover receiver.
  - – Base: selects the modem connected with the Base receiver.
- *Channel* – selects the frequency that the radio broadcasts and/or listens to.

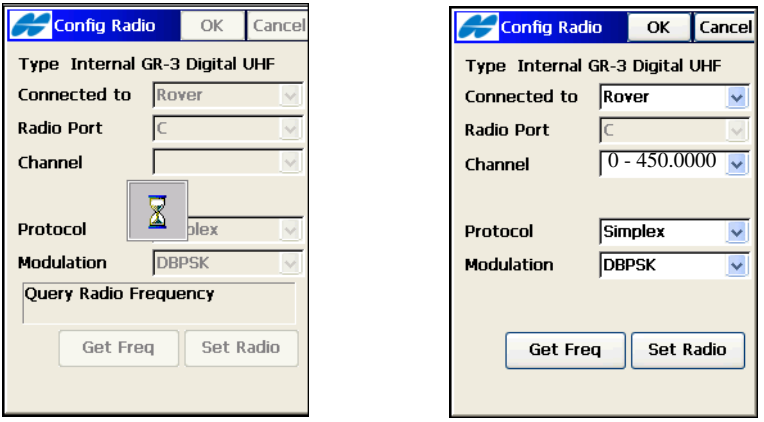


Figure 8-29. Config Internal GR-3 Digital UHF

When using the GR-3 Digital UHF as the Base radio or when using a repeater, set the signal strength that the Base transmits (Figure 8-30). Select either *100 mW, 250 mW, 500 mW,* or *1W* power.

Figure 8-30. Config Base GR-3 Digital UHF Radio

For UHF Modems: the Internal HiPerXT (UHF) and Internal MapHP (UHF) the ***Config Radio*** screen (Figure 8-31) sets the following parameters:

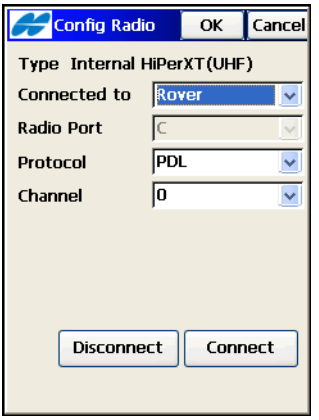


Figure 8-31. Config Internal HiPerXT (UHF)

- **Connect** – opens a daisy chain and sends commands to setup the UHF radio and get correctional data for the rover. For the base radio this button changes into **Set Radio**. A confirmation message displays if the modem was setup successfully.
- **Disconnect** – turns off the UHF modem.
- **OK** – returns to the ***Status*** screen.

For the FH915 Modem: Internal HiPer Lite set the operating channel for the modem on the ***Config Radio*** screen (Figure 8-32 on page 8-29).

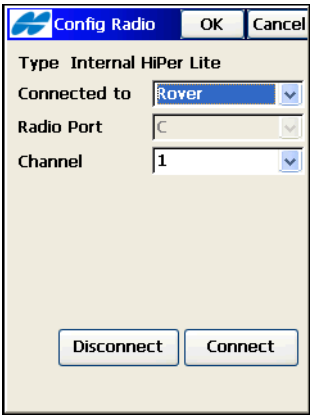


Figure 8-32. Config Internal HiPer Lite

For FH 915Plus Modems: the Internal GR-3 FH915Plus, the Internal Hiper Lite+ FH915Plus and RE-S1 radios the ***Config Radio*** screen (Figure 8-33) contains the following parameters.

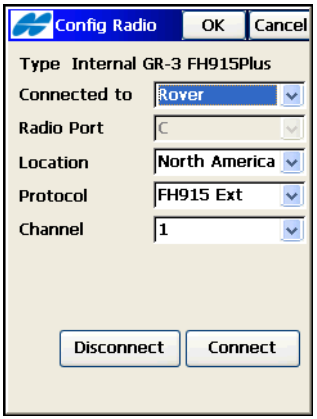


Figure 8-33. Config Internal GR3 FH915Plus

The RE-S1 is a 1W radio extension system using FH915 Plus spread spectrum radio. It can be used as a repeater with the GR-3 or HiPer Lite+ GPS receivers, or as a transmit/receive external FH915 Plus radio for the GB or Legacy GPS receivers. For the RE-S1 radio used as a repeater, see “Configure RE-S1 Repeater” on page 8-31.

For Satel modems the ***Config Radio*** screen (Figure 8-34) displays the model, channel and frequency to set for the radio.

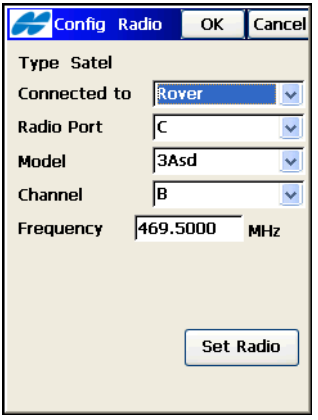


Figure 8-34. Config Satel

For the Internal GR3 Satel radios the ***Config Radio*** screen (Figure 8-35) allows to get the frequency from the radio or to turn Free Channel Scan mode.

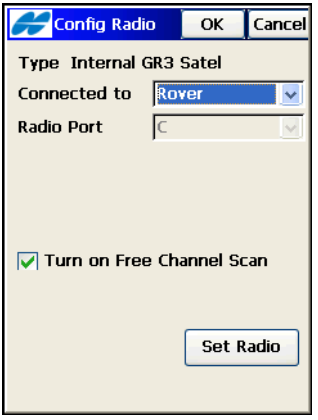


Figure 8-35. Config Internal GR3 Satel

When using the Internal GR-3 Satel as the Base radio, set the signal strength that the Base transmits. Select either *100 mW*, *250 mW*, *500 mW*, or *1W* power.

Configure RE-S1 Repeater

To setup the RE-S1 as a stand-alone repeater, during the survey configuration, first enable the usage of the RE-S1 radio modem as a repeater (see “RE-S1 FH915 Repeater” on page 3-31). Then the *Config RE-S1 Repeater* option appears in the pop-up menu of the ***Status***, ***Start Base*** and ***Topo*** screens. This option opens the ***Config Radio*** screen to set RE-S1 as a repeater (Figure 8-36 on page 8-31).

- *Radio Port* – selects the radio port that connects with the receiver or controller.
- *Location* – selects the territory (North America, Australia or New Zealand) where the RE-S1 is used.
- *Protocol* – shows the compatibility protocol.
- *Channel* – sets the operating frequency channel.
- **Disconnect** – turns off the RE-S1 modem.
- **Connect** – opens a daisy chain and sends commands to setup the RE-S1 radio as a repeater. A confirmation message displays if the modem was setup successfully.
- **OK** – saves and returns to previous screen.
- **Cancel** – closes the screen without making changes.

Figure 8-36. RE-S1 Repeater Configuration

mmGPS+ Options

The ***mmGPS+ Options*** screen (Figure 8-37) displays the status of mmGPS+ in RTK survey mode. To open this screen, select the *mmGPS+ Options* item from the Help Icon menu in the upper-left corner of the ***Status*** screen.

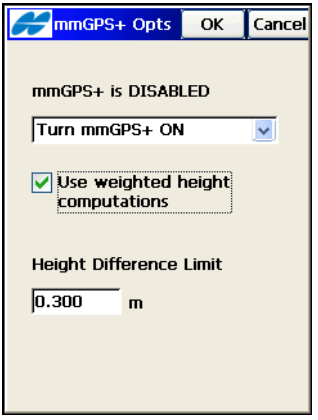


Figure 8-37. mmGPS+ Options

- Select "Turn mmGPS+ ON" to enable mmGPS+ height computation.
- *Use weighted height computations* – check and enable to combine mmGPS elevations and GPS elevations. When selected, this option forces the receiver/sensor to always consider the angle and distance when determining the elevation, then combines the two elevations accordingly. This option works well at large (300m) distances and steep angles.
- *Height Difference Limit* – sets the threshold for the difference between GPS and mmGPS+ height measurements.

Known Point Initialization

To set up a survey with known points, tap the **Known Point Init** icon.

The ***Known Point Init*** screen (Figure 8-38) initializes the receiver using known coordinates for the Rover station. This screen is used with single frequency receivers and for quality control on dual frequency receivers.

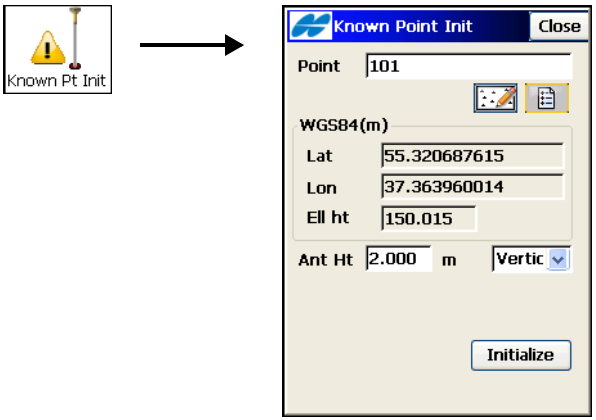


Figure 8-38. Known Point Rover

- *Point* – sets the name of the point; select from either the list icon or from the map icon.
- *WGS84* – the coordinates of the point in the current coordinate system. (Use the **Configure** ▸ **Coord System** and **Display** icons selection to change the system and the name of the field. Its contents also change.)
- *Ant Ht* – the height of the antenna reference point (ARP) above the mark, and the type of height measurement (vertical or slant).
- **Initialize** – sends the information to the Rover receiver.
- The Help Icon in the upper-left corner of the ***Known Point Init*** screen displays the pop-up menu containing four items:
  - *Status*: opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).

– *Rover Antenna Setup*: opens the ***Antenna Setup*** Screen to set the antenna for the current survey.

– *Config Radio* – opens the ***Configure Radio*** screen (see "Configure Radio" on page 8-26). The option varies depending on the radio selected for the rover (see "Configure Radio" on page 8-26). It can be: *Config Radio, Config CDMA, Config CDPD, Config GSM* or *Config UHF.*

– *Help*: accesses the Help files.

Initialize mmGPS+

To setup mmGPS+ system for RTK surveying, tap the **Init mmGPS** icon. The ***Init mmGPS+*** screen contains information about the calibration of the laser transmitter and initialization of the sensor (Figure 8-39 on page 8-35).

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing three items:

- *Field Calibration* – opens the ***Calibration*** screen to set the transmitter to calibrate (that is, to fix errors in incline in the self-leveling mechanism of the transmitter).
- *Known Point Offset* – opens the ***Known Point*** screen (Figure 8-42 on page 8-37).
- *Help* – accesses the Help files.

Transmitter Data

The *Data* tab (Figure 8-39 on page 8-35) calibrates the transmitter with the correct channel and communication port:

- *Name* – the name of the transmitter.
- *ID* – the ID that corresponds to the channel of the transmitter.
- *Data* – the status of calibration data.
- **Add** – opens the ***Transmitter*** screen (Figure 8-40 on page 8-36) to get the transmitter data.

- **Edit** – opens the ***Transmitter*** screen (Figure 8-40 on page 8-36) to change the information on the transmitter.
- **Delete** – removes the transmitter from the list.
- **OK** – saves settings and returns to the previous screen.
- **Cancel** – closes the screen without saving the settings.

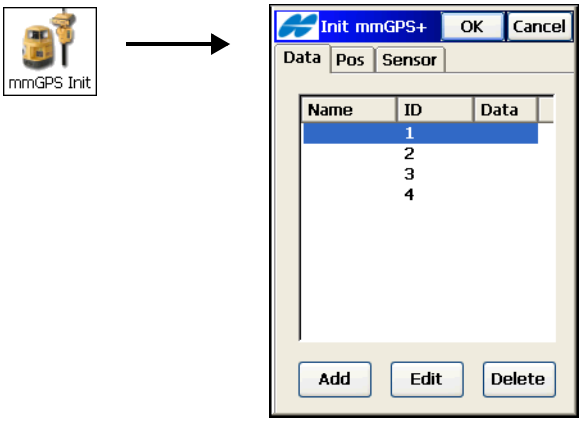


Figure 8-39. Initialize mmGPS – Data Tab

Transmitter

On the ***Transmitter*** screen (Figure 8-40 on page 8-36), set the following parameters:

- *Name* – the name of the transmitter.
- *Com Port* – the communication port of the transmitter.
- *ID* – the channel of the transmitter.
- *Calibration Data* – the status of calibration data.
- **Clear Data** – clears the ID and Calibration Data fields.
- **Get Data** – retrieves the transmitter's data.
- **OK** – returns to the ***Init mmGPS+*** screen (Figure 8-41 on page 8-36) showing the calibration data.

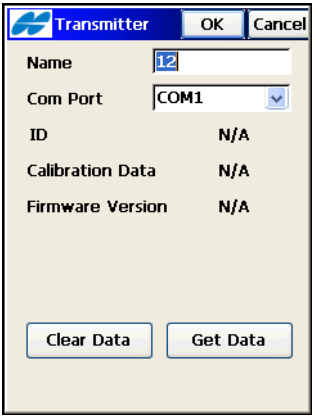


Figure 8-40. Transmitter

Transmitter Position

The *Position* tab (Figure 8-41) sets up the transmitter's height and location at the jobsite.

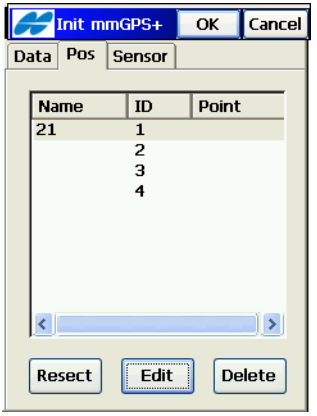


Figure 8-41. Initialize mmGPS – Position Tab

- *Name* – the name of the transmitter.
- *ID* – the channel of the transmitter.
- *Point* – the point over which the transmitter is setup.

- **Resect** – opens the ***Resect mmGPS+*** screen to perform a resection for an unknown transmitter location.
- **Edit** – opens the ***Known Point*** screen to select the point over which the transmitter is setup.
- **Delete** – removes the transmitter from the list.

Known Point

On the ***Known Point*** screen (Figure 8-42) select the known point over which the transmitter is setup and enter the transmitter height.

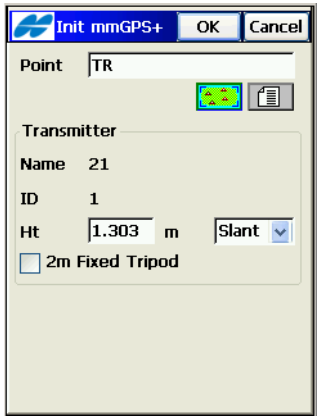


Figure 8-42. Known Point

- *Point* – the point over which to set up the transmitter; select using either the map or list icons next to the Point entry box.
- *Transmitter* – enter transmitter parameters:
  - *Name*: displays the name of the transmitter.
  - *ID*: displays the transmitter channel.
  - *Ht* and *m*: sets the height of the transmitter from the ground to the mark on the transmitter's side and the method of height measurement.
  - *2m Fixed Tripod*: check mark this box if using a 2 meter fixed tripod.
- **OK** – uploads the transmitter calibration information to the sensor.

Resection

On the ***Resect mmGPS+*** screen (Figure 8-43), measure an unknown transmitter location using the Rover and three or more points.

The Sensor tab (Figure 8-43) is identical to the title tab on the ***Init mmGPS+*** screen and is used to set up the sensor.

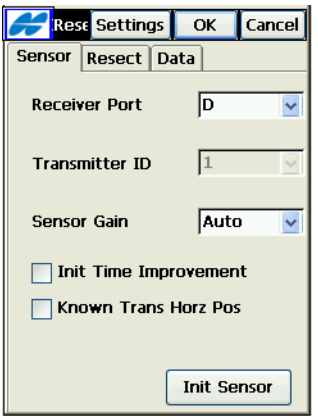


Figure 8-43. Resection – Sensor Tab

- *Receiver Port* – sets the receiver port that connects the receiver to the sensor.
- *Transmitter ID* – displays the channel of the transmitter.
- *Sensor Gain* – select Auto to automatically control the mmGPS receiver's detection level of the transmitter's signal.
- **Init Sensor** – starts the initialization of the sensor.
- *Init Time Improvement* – enable 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).
- *Known Trans Horz Pos* – if enabled, then after pressing the **Init Sensor** button, the ***Known Point*** screen (Figure 8-42 on page 8-37) displays. Select the point over which the transmitter is setup.

The Resect tab (Figure 8-44) is used to calculate the resection calculation from the Rover point to the point over which the transmitter is set up.

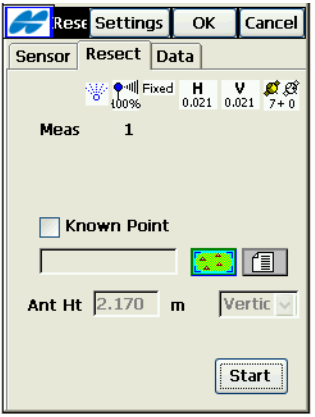


Figure 8-44. Resection – Resect Tab

The icons on the status bar of the screen displays information about the current state of measurement:

- – the mmGPS icon displays the sensor receives the transmitter's beam.
- – the quality of the radio link.
- – the type of the position calculation method.
- – the RMS errors for horizontal and vertical coordinates, respectively.
- – the number of satellites tracked and used in position calculation, respectively.
- *Meas* – the number of the measurement.
- *Known Point* – check mark this box when occupying a known point, and select a point to occupy using the map and list icons.
- *Ht* and *m* – the antenna's height and method of height measurement.

- **Start** – starts the measurement process. After pressing, the button toggles to **Stop**, and the counter of the epochs collected appears.
- *Logging* – displays the number of GPS epochs used in the resection calculation during the measurement.

Data tab (Figure 8-45) is used to view the results of resection measurements. Data displays only after three or more points have been measured.

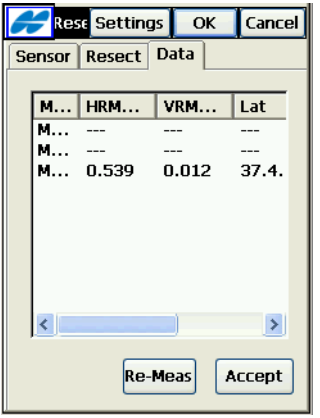


Figure 8-45. Resection – Data Tab

- **Re-Meas** – clears all data measurements and restarts the resection process.
- **Accept** – opens the ***Add Point*** screen (Figure 8-46 on page 8-41) to view the point information for the transmitter.

The Add Point screen (Figure 8-46 on page 8-41) is used to view and save the transmitter location.

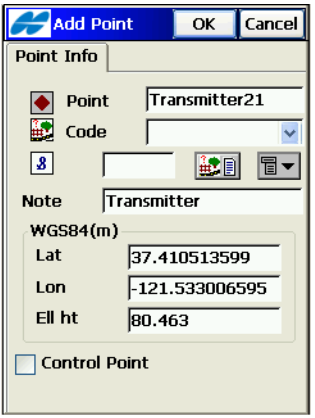


Figure 8-46. Add Point

Sensor

The *Sensor* tab of the ***Init mmGPS+*** screen (Figure 8-47) uploads transmitter calibration information to the sensor and sets up the sensor for receiving the transmitter's laser beam.

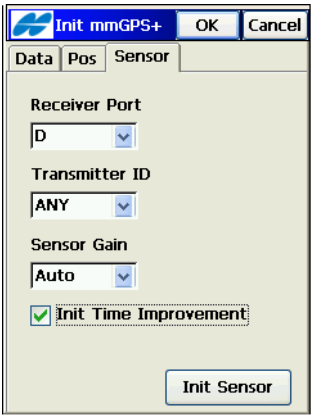


Figure 8-47. Initialize mmGPS – Sensor Tab

- *Receiver Port* – connects the receiver and sensor.
- *Transmitter ID* – the transmitter's channel. The ANY selection allows the sensor to independently select the transmitter with the smallest error rate.

- *Sensor Gain* – sets the sensitivity of the sensor to the transmitter's laser beam.
- *Init Time Improvement* – check mark this box to improve the RTK fix time for the receiver.
- **Init Sensor** – starts the initialization process.

Field Calibration

The ***Calibration*** screen (Figure 8-48) selects the transmitter for field calibration.

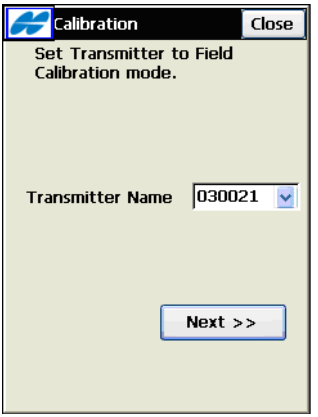


Figure 8-48. Calibration

- *Transmitter Name* – the name of the transmitter to calibrate
- **Next** – starts the process of auto-leveling (Figure 8-49 on page 8-43).

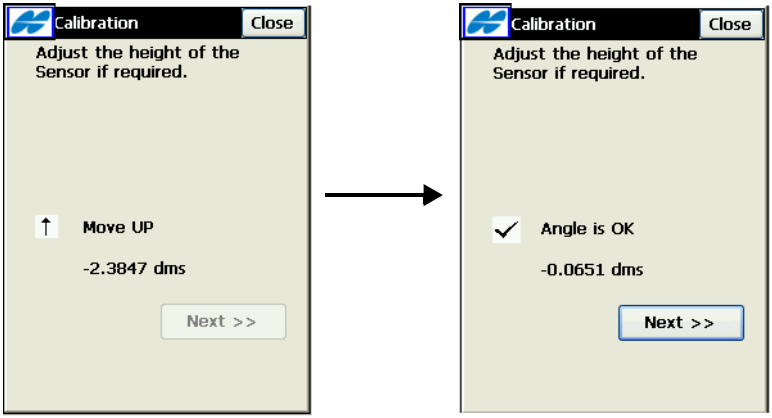


Figure 8-49. Check Angle of Sensor

- **Next** – opens the ***Calibrate*** screen with instructions to follow.

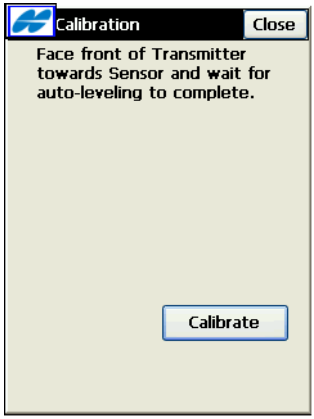


Figure 8-50. Calibrate

- **Calibrate** – press to collect calibration data after the auto-leveling process completes (Figure 8-50).

Notes:

GPS Survey

To perform a survey with GPS receivers, tap the **Survey** icon in the main menu. The **GPS Survey** menu (Figure 9-1) includes options to set up the following surveys:

1. Topo
2. Auto Topo
3. X-Section
4. Find Station
5. Tape Dimension

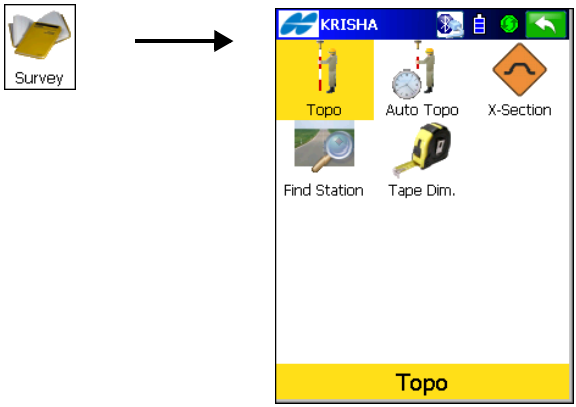


Figure 9-1. GPS Survey Menu

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for details see "Help Icon's Pop-up Menu" on page 1-8).

If there is no choice for some needed menu options, tap **Configure/Menus** icons and enable these options in the ***Config Menus*** screen.

Topo Survey

To set up a survey with topo points, tap the **Topo** icon.

The ***Topo*** screen (Figure 9-2) records stop and go survey.

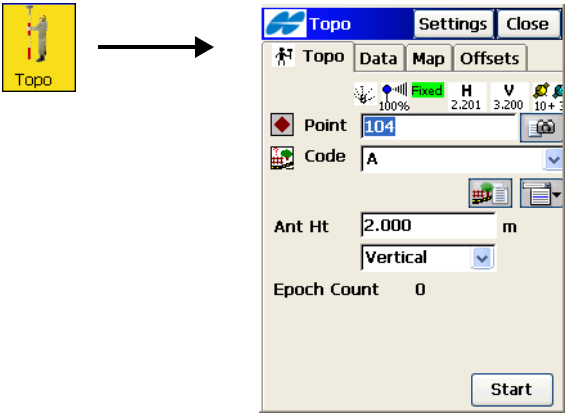


Figure 9-2. Topo Points Survey

The Help Icon in the upper-left corner of the screen displays the pop-up menu that varies, depending on survey mode used:

- *Status* – opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).
- *Rover Antenna Setup* – opens the ***Antenna Setup*** screen to set the antenna for the current survey.
- *Config Radio* – opens the ***Configure Radio*** screen. For details, see "Configure Radio" on page 8-26.
- *Config RE-S1 Repeater* – opens the ***Configure Radio*** screen to setup the RE-S1 radio as a repeater (see "Configure RE-S1 Repeater" on page 8-31).
- *Config OmniSTAR* – opens the ***OmniSTAR*** screen to start the OmniSTAR service. For details, see "Configure OmniSTAR" on page 8-22.
- *Reset RTK* – resets the ambiguities and sets the receiver in the Rover RTK mode. The settings being used are based on the selections in the survey configuration.

- *Reset DGPS* – sets the receiver in the Rover DGPS mode. The settings being used are based on the selections in the survey configuration.
- *mm GPS+ Options* – opens the mmGPS+ Options screen in RTK survey (see "mmGPS+ Options" on page 8-32).
- *Notes* – opens the ***Notes*** screen (Figure 9-4 on page 9-5).
- *Edit Points* – opens the **Points** screen.
- *Inverse* – opens the *Two-Point Inverse* COGO task screen. For details see "Inverse" on page 14-3.
- *PTL Mode* – switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to ***Topo (PTL)***.) For details see "PTL Point" on page 6-12.
- *Grid Setup* – opens the ***Grid Setup*** screen to set a grid to be displayed with the Map (see "Grid Setup" on page 9-16).
- *Help* – accesses the Help files.

The Topo Menu

The *Topo* tab on the Topo screen (Figure 9-4 on page 9-5) contains the initial data for the survey and displays the progress of the survey (Figure 9-2 on page 9-2). The upper-right corner of the screen displays the status of information on the **Status** screen. For details, see "GPS+ Survey Status" on page 8-12.

- *Point* – displays the current point name. The  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – displays the current point code: enter manually or select from the drop-down list.
-  – tap on this icon to open the ***Code-Attributes*** screen to set the attributes for the selected code (for details, see "On the Point Attributes" on page 6-7).
- The  icon next to the *Attributes List* bitmap displays the pop-up menu containing three items:

– *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point. See “On the Select Layer” on page 6-10.

– *Note*: opens the ***Note*** screen (Figure 9-3). The ***Note*** screen is used for additional information. When exporting raw data (for example, to a TDS Raw Data file), this information is in the *Point Description* field. The note should be entered in the *Note* field. Press **OK** to store the Note.

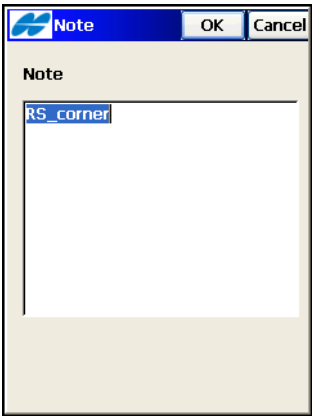


Figure 9-3. Note

- *Ant Ht* – sets the antenna height and its type (slant or vertical).

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

- *Epoch count* – shows the number of accepted epochs.
- *Rem Time* – shows remaining time to stop logging when in *PP Kinematic* or *PP DGPS* mode.

- **Start** – starts the survey process. After pressing, the button changes it name on **Accept** and a new button **Cancel** appears along with the counter of the epochs collected (Figure 9-4).

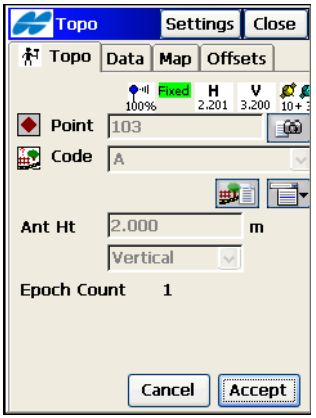


Figure 9-4. Topo – Accept

- A mmGPS icon displays on the ***Topo*** screen when the receiver calculates mmGPS heights.
- **Settings** – opens the ***Survey Parameters*** screen. See "Survey Parameters" on page 3-41. If you set precision constraints for a Topo survey, TopSURV accepts some averaged point coordinates which are the first to meet the precision requirements.
- **Start Log** (for PP enabled RTK, PP Kinematic, and PP DGPS) – starts logging file in the receiver. When pressed, the button toggles to **Stop Log**.

  Instead of an icon displaying the RTK solution, the symbol displays, showing the status of the log file. If the file is opened, it changes its appearance to .

  When file logging starts, the ***Status*** screen also displays the *Log History* tab (see "Log History" on page 8-16).

If an observed Topo point has a name existing in the job, the ***Duplicate Points*** screen (Figure 9-5) displays.

- *Overwrite* – overwrites the existing point.
- *Rename* – the point is renamed. The new name is noted in the field and is the point with observed coordinates.
- *Store As Check Point?* – if enabled, the observed point is stored as a check point of the existing point.
- *Use in Weighted Average* – available if the *Store As Check Point* radio button is selected. The **OK** button opens the ***Weighted Average*** screen (see "Weighted Average" on page 6-14 for details).
- *Correct Base* – if enabled, the existing coordinates of the observed point are not replaced by the coordinates of the observed point. Instead, the known coordinates of this point are used to correct the Base coordinates. After pressing the **OK** button, a warning message displays that recomputations are being performed. Then the coordinates of all points are updated using the new Base coordinates.

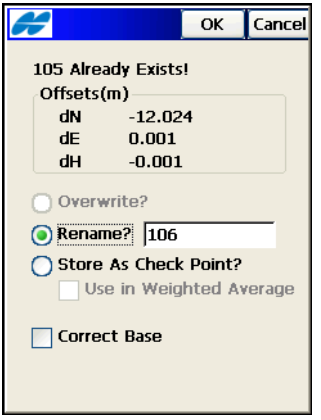


Figure 9-5. Duplicate Point

The ***Weighted Average*** screen (Figure 9-6 on page 9-7) displays coordinate residuals of the check point.

- The WA tab lists the names of the coordinate residuals

- **Use In WA** – uses the check points in weighted averaging positions.

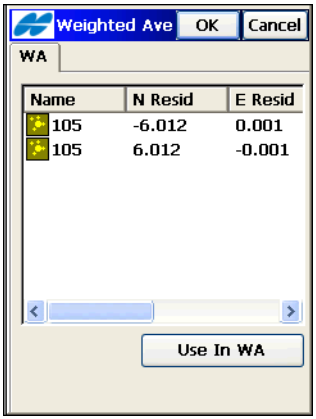


Figure 9-6. Weighted Average

Data

The *Data* tab on the ***Topo*** screen (Figure 9-7) shows the results of the survey.

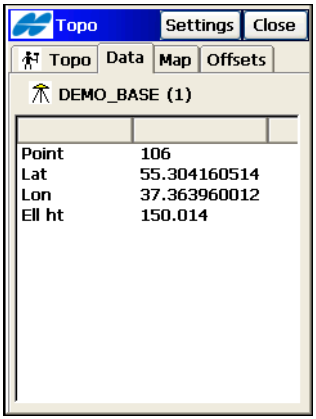


Figure 9-7. Topo – Data

The Map tab on the Topo screen (Figure 9-8) shows the stored point graphically.

On the *Map* tab (Figure 9-8), just like the *Topo* tab, you can collect topo points using the **Start** button. Use the **Sim/Sim Off** button to turn on/off Simulation mode.

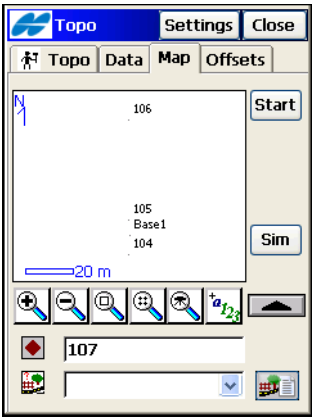


Figure 9-8. Topo – Map

Table 9-1 describes the stored point icons that display on the *Map* tab.

Table 9-1. Stored Point Descriptions

Icon	Description
	the name of a point
	the code of a point
	attributes for the code
	toggles between the Start button and the status icons.

For a detailed description of the Map view see “Viewing Map” on page 15-1.

Offsets

The *Offsets* tab (Figure 9-9) sets the offset point for the measurement.

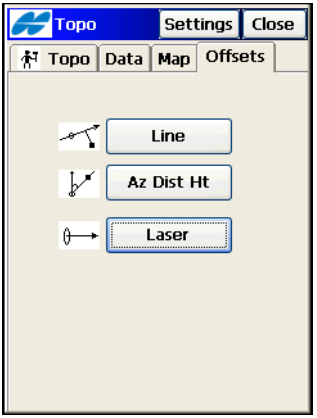


Figure 9-9. Topo – Offsets

- **Line** – opens the ***Line*** screen to define a point, set by the offset from a line. See Figure 9-10 on page 9-10.
- **Az Dis Ht** – opens the ***Azimuth-Distance-Height*** screen to define a point specified by the offset from a point. See Figure 9-11 on page 9-12.
- **Laser** – only available when a laser device has been added in the Config Survey; opens either the ***Config Laser*** screen (see "Laser Configuration" on page 9-13) or the ***Laser BS Meas*** screen to define a point specified through a backsight (see "For the Laser with an Encoder" on page 9-14).
- **Settings** – opens the ***Survey Parameters*** screen. See "Survey Parameters" on page 3-41.

Line

The ***Line*** screen (Figure 9-10) is used to enter the parameters defining a point that are not available physically, relative to some reference line.

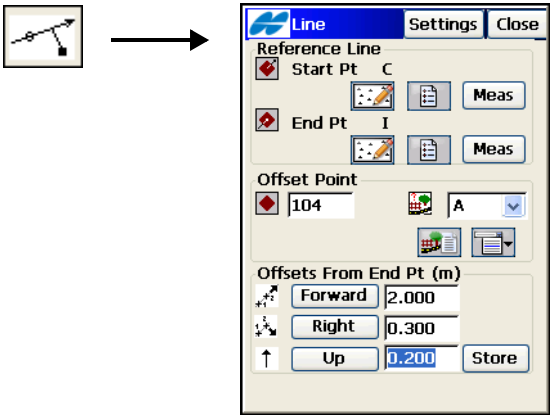


Figure 9-10. Line Screen

- *Reference Line* – a line specified by two known or measured points: select either from the map, from the list, or measure directly.
- **Meas** – starts measuring the current location point.
- *Offset point* – sets the parameters of the offset point:
  - – the name of a point
  - – the code of a point (can be typed manually or chosen from the drop-down list)
  - – the attributes of the code (can be entered through the *Attributes List* icon, see "On the Point Attributes" on page 6-9 for details)
- The icon next to the *Attributes List* icon displays the pop-up menu containing three items:
  - – *String*: toggles the *String* field. Also, the sign appears.

  - *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen (see "Topo Survey" on page 9-2).

- *Offsets From End Pt (m)* – the offset values include (Figure 9-10 on page 9-10):
  - **Forward/Backward**: the distance from Point 2 to the projection of the target point along the Line of Sight.
  - **Right/Left**: the distance from the target point to the line of sight, either to the Right or to the Left of the line.
  - **Up/Down**: the height difference from the target point, either Up or Down.
- **Store** – calculates the coordinates of the offset point and saves the point to the database.
- The Help Icon on the upper-left corner displays the pop-up menu containing two items:
  - *Antenna Setup*: opens the ***Antenna Setup*** screen to set the antenna for the current survey.
  - *Help:* accesses the Help files.
- **Settings** – opens the ***Survey Parameters*** screen. See "Survey Parameters" on page 3-62.

Azimuth-Distance-Height

The ***Azimuth-Distance-Height*** screen (Figure 9-11) defines an offset point using the current point as a reference.

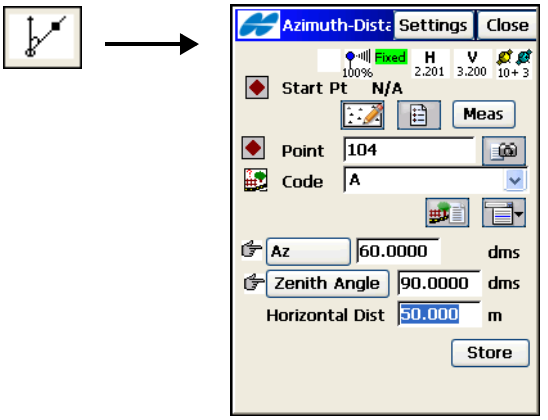


Figure 9-11. Azimuth-Distance-Height

- *Start Pt* – the starting point of the offset measurement.
- *Point* – the name of the new point.
- *Code* – the code of the new point, either enter manually or select from the drop-down list. The icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- – the *Attributes List* icon opens the ***Code-Attributes*** screen. See "On the Point Attributes" on page 6-7.
- The icon next to the *Attributes List* bitmap displays the pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the sign appears.
  - *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point ("On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen. For details, see "Topo Survey" on page 9-2.
- **Azimuth/Az to Pt** – sets the azimuth to the target point by value or by point.

- *Zenith Angle/Elev Ang/Vert Dist* – sets the zenith angle (zenith distance) to the target point or vertical distance.
- *Horizontal Dist* – sets the horizontal distance between the current and the target point.
- *Store* – calculates and stores the point. The next screen shows the parameters of the current point, the PDOP value, the Sigma values, and the epochs logged counter.
- The Help Icon on the upper-left corner displays the pop-up menu containing two items:
  - *Antenna Setup*: opens the ***Antenna Setup*** screen to set the antenna for the current survey.
  - *Help*: accesses the Help files.
- **Settings** – opens the ***Survey Parameters*** screen (see "Survey Parameters" on page 3-62).

Laser Configuration

Laser configuration depends on whether the laser selected in the job configuration has an Encoder or not.

For the Laser without an Encoder the ***Config Laser*** screen (Figure 9-12) defines an occupation point and backsight azimuth or point, and defines the laser height and point information.

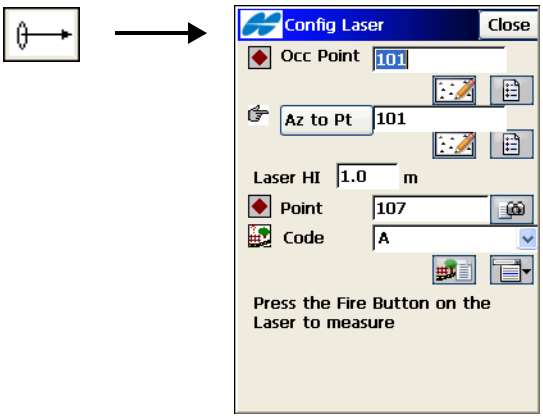


Figure 9-12. Config Laser

- *Occ Point* – enter an occupation or select an occupation using the map or list buttons.
- *(Az to Pt)* **BS Azimuth / BS Point** – enter either a BS azimuth value or select a BS point using the map or list buttons.
- *Laser HI* – enter the height of the device above the occupation point.
- *Point* – enter the name of the point being measured. The *photo note*  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – displays the current point code. Can be entered manually or chosen from the drop-down list.
-  – the *Attributes List* icon opens the ***Code-Attributes*** screen. See “On the Point Attributes” on page 6-7.
- The icon next to the *Attributes List* icon displays the pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the  sign appears.
  - *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point. See “On the Select Layer” on page 6-10.
  - *Note*: opens the ***Note*** screen. For details, see “Topo Survey” on page 9-2.
- **OK** – saves the settings and returns to the ***Topo*** screen.

For the Laser with an Encoder the ***Laser BS Meas*** screen (Figure 9-13 on page 9-15) first defines an occupation point and backsight azimuth or point.

- *Occ Point* – enter an occupation or select an occupation using the map or list buttons.
- **BS Azimuth / BS Point** – enter either a BS azimuth value or select a BS point using the map or list buttons.
- **OK** – saves the settings and opens the ***Config Laser*** screen (Figure 9-14 on page 9-15) for lasers with an Encoder.

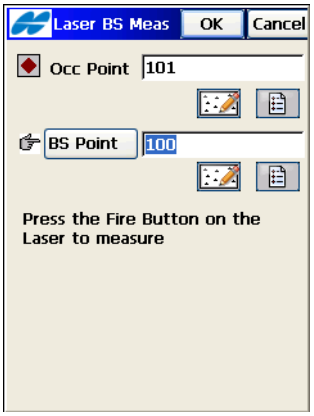


Figure 9-13. Laser BS Meas

The ***Config Laser*** screen (Figure 9-14) defines the laser height and point information.

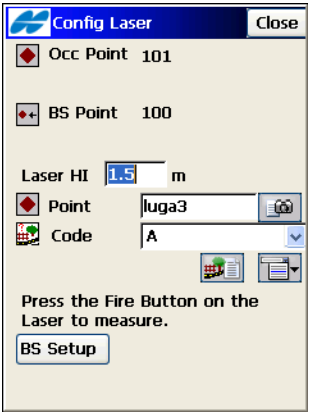


Figure 9-14. Config Laser

- *Occ Point* – enter an occupation or select an occupation using the map or list buttons.
- *BS Azimuth / BS Point* – enter either a BS azimuth value or select a BS point using the map or list buttons.
- *Laser HI* – enter the height of the device above the occupation point.

- *Point* – enter the name of the point being measured. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point. Also, the field appears to enter a string.
- *Code* – displays the current point code. Can be entered manually or chosen from the drop-down list.
- **BS Setup** – returns to the ***Laser BS Meas*** screen to set up a new BS.

Grid Setup

Tap the *Help Icon* in the upper-left corner of the ***Topo*** screen. Select the *Grid Setup* option from the pop-up menu. The ***Grid Setup*** screen (Figure 9-15) displays. The ***Grid Setup*** screen sets up a grid for the Map to help while collecting data.

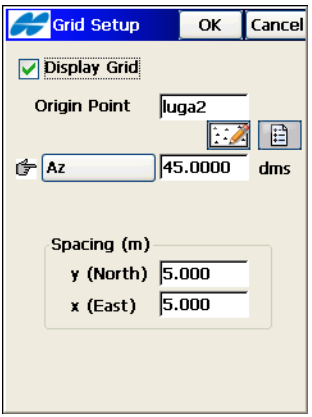


Figure 9-15. Grid Setup

- *Display Grid* – check mark this box to display a grid on the Map tab.
- *Origin Point* – specifies the origin point for the grid.
- *Azimuth(Bearing)/Azimuth(Bearing) To Point* – sets the corresponding value to the direction of the grid lines.
- *Spacing (m)* – specifies the intervals between the grid lines along the y(North) and x(East) axes.

- **OK** – displays the grid on the *Map* tab (Figure 9-16) with the specified settings.

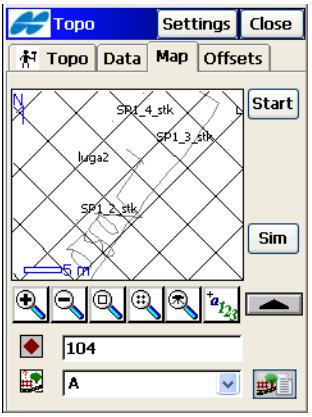


Figure 9-16. Grid in Map

If a grid is set up, the ***Topo*** screen (Figure 9-17) displays an offset of the current position from the grid origin point.

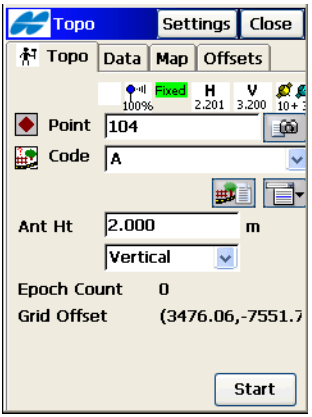


Figure 9-17. Grid Offset

Auto Topo Survey

To set up a survey with automatic topo points, tap the **Auto Topo** icon.

The ***Auto Topo*** screen (Figure 9-18) initiates a kinematic survey.

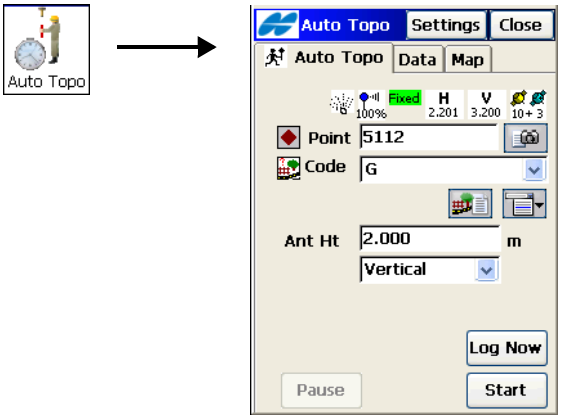


Figure 9-18. Auto Topo

The Help Icon in the upper-left corner of the ***Auto Topo*** screen displays the following pop-up menu items:

- *Status* – opens the ***Status*** screen. See "GPS+ Survey Status" on page 8-12.
- *Topo* – opens the Topo screen. See "Topo Survey" on page 9-2.
- *Rover Antenna Setup* – opens the ***Antenna Setup*** screen to set the antenna for the current survey.
- *Config Radio* – opens the ***Configure Radio*** screen. See "Configure Radio" on page 8-26.
- *Config OmniSTAR* – opens the ***OmniSTAR*** screen to start the OmniSTAR service. See "Configure OmniSTAR" on page 8-22.
- *Reset RTK* – resets the ambiguities and sets the receiver in the Rover RTK mode. The settings are based on selections made in the survey configuration.

- *Reset DGPS* – sets the receiver in the Rover DGPS mode. The settings are based on the selections made in the survey configuration.
- *mm GPS+ Options* – opens the ***mmGPS+ Options*** screen in RTK survey. See “mmGPS+ Options” on page 8-32.
- *Note* – opens the ***Notes*** screen (“Note” on page 9-4).
- *Edit Points* – opens the Points screen. See “Points” on page 6-2.

To display points in the list of points, ensure that the Show Auto Topo Point option is selected in the Help Icon menu in the upper-left corner of the Points screen.

- *PTL Mode* – switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to ***Auto Topo (PTL)***). For details see “PTL Point” on page 6-12.

Auto Topo

The *Auto Topo* tab contains the initial data for the survey and displays the progress of the survey (Figure 9-18). The upper-right corner of the screen displays the status of information on the **Status** screen. For details see “GPS+ Survey Status” on page 8-12.

- *Point* – displays the current point name. The  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – displays the current point code, enter either manually or select from the drop-down list.
-  – the *Attributes List* icon opens the ***Code-Attributes*** screen (for details see “On the Point Attributes” on page 6-7).
- The icon next to the *Attributes List* icon displays the pop-up menu containing three items:

  – *String*: toggles on the *String* field. Also, the  sign appears.

– *Layer*: opens the ***Select Layer*** screen to select the layer in which to locate the point. See "On the Select Layer" on page 6-10).

– *Note*: opens the ***Note*** screen. For details, see "Note" on page 9-4.

- *Ant Ht* – sets the antenna height and its type (slant or vertical).

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

- **Log Now** – immediately stores the current position of the receiver antenna.
- **Pause/Resume** – interrupts the survey. After pressing, **Pause**, the button changes to **Resume**. Press again to resume the survey.
- **Start/Stop** – starts the survey process. After pressing, **Start**, the button changes to **Stop**; the **Pause** button activates.

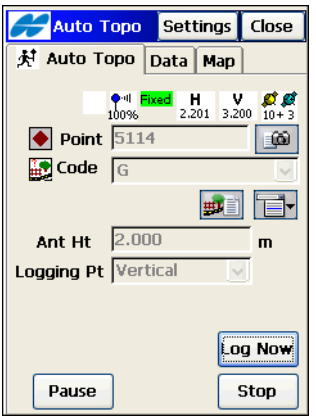


Figure 9-19. Auto Topo – Start

A mmGPS icon displays on the status bar of the ***Auto Topo*** screen to calculate mmGPS heights for the receiver.

- **Settings** – opens the ***Survey Parameters*** screen. See "Survey Parameters" on page 3-41.

Data

The *Data* tab (Figure 9-20) shows the properties of the last stored point: the Point name and its coordinates.

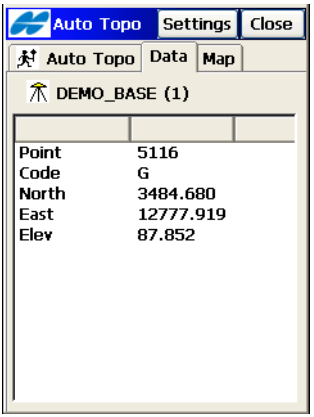


Figure 9-20. Auto Topo – Data

Map

The *Map* tab (Figure 9-21) shows the stored points graphically. All survey processes can be done through this page, and the *Auto Topo* tab, as all the controls are duplicated.

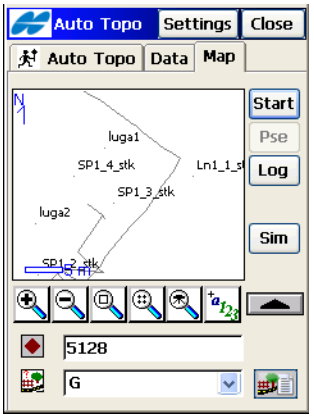
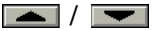


Figure 9-21. Auto Topo – Map

Table 9-2 lists and describes the fields for stored points:

Table 9-2. Stored Points

Icon	Description
	the name of a point
	the code of a point
	the *Attributes List* icon, opens the ***Code-Attributes*** screen (for details, see "On the Point Attributes" on page 6-7).
	toggles between the buttons and status icons on the right part of the screen. When pressed, changes its appearance to the second icon.

For a detailed description of the Map view, see "Viewing Map" on page 15-1.

X-Section

To perform X-Section function, tap the **X-Section** icon  .

The X-Section function is similar to that of the Total Station mode, except for the measurement screens, which are the corresponding GPS+ measurement screens. For details, see "Edit Cross Section Set" on page 7-30 and "Topo Survey" on page 9-2.

Find Station

To perform Find Station function, tap the **Find Station** icon  .

The Find Station function is similar to that of the Total Station mode, except for the measurement screens, which are the corresponding GPS+ measurement screens. For details, see "Find Station" on page 11-27 and "Topo Survey" on page 9-2.

Tape Dimension

To perform Tape Dimension function, tap the T**ape Dimension** icon

The Tape Dimension function is similar to that of the Total Station mode, except for the measurement screens, which are the corresponding GPS+ measurement screens. For details, see “Tape Dimension” on page 11-29 and “Topo Survey” on page 9-2.

Notes:

Setting Up TS Survey

To set up a TS survey, tap the **Setup** icon in the main menu when in TS mode. The **Setup** menu (Figure 10-1) includes options to:

1. Start a backsight survey (Backsight).
2. Calculate a resection task (Resection).
3. Calculate a point's elevation from remote benchmarks (Remote BM).
4. Remote Control (for Robotic mode).

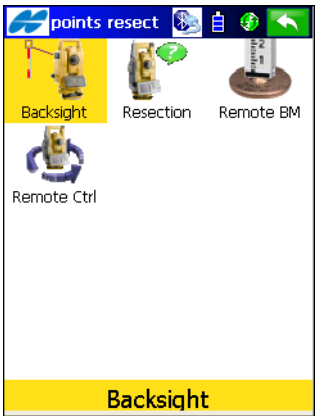


Figure 10-1. Setup GPS Menu

The Help Icon  opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for details see "Help Icon's Pop-up Menu" on page 1-8).

Backsight Survey

To set up a Total Station survey with localization, tap the **Backsight** icon. The ***BS Survey*** screen (Figure 10-2) displays.

On the ***BS Survey*** screen (Figure 10-2), the *BS Setup* tab contains the following *Backsight* parameters.

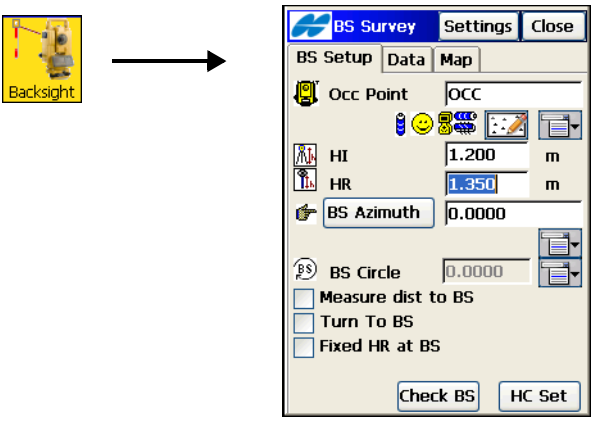


Figure 10-2. Backsight Survey

- *Occ. Point* – the name of the point where the total station is located.
- – opens the map for choosing the occupation point (*map* icon).
- The menu icon next to the *Occ Point* field opens a pop-up menu containing five items:
  - *From List*: opens the list to choose the occupation point.
  - *Station Offset*: opens the ***Station and Offset*** screen to add an arbitrary occupation point near a road.
  - *Properties*: opens the ***Add/Edit Point*** screen that displays the properties of the current point, or you can create a new point if no point is selected yet.
  - *Resection*: opens the ***Resection*** screen to determine the occupation point coordinates by solving the resection task,

using the known point's coordinates (for details, see "Resection" on page 10-11.)

– *Elevation*: opens the ***Remote BM*** screen (for details, see "Remote Benchmarks" on page 10-16).

- – shows battery status for the total station.
- – shows the status of communication between the controller and the total station.
- – shows battery and memory status for the controller.
- *(HI)* – sets the height of the instrument above or below the mark (the HR value can be negative, so points above the prism, such as those on a bridge, can be measured from below).
- *(HR)* – sets the height of the target above the mark.
- **BS Point (BS Azimuth)** – sets the backsight point location or the direction to it.
- The menu icon next to the *BS Point* field displays the pop-up menu to set the backsight point:
  - – *From List*: opens the list of points.
  - – *Station Offset*: opens the ***Station and Offset*** screen to add an arbitrary occupation point near a road.
  - – *Properties*: opens the ***Add/Edit Point*** screen that displays the properties of the current point, or creates a new point if no point is chosen yet.
  - – *Multiple BS*: opens the ***Multi-Point BS*** screen, to involve several Backsight points for performing a survey (see "Multi-Point Backsight" on page 10-6).
- *BS Circle* – displays the horizontal circle reading corresponding to the backsight point.
- The menu icon next to the *BS Circle* field displays the pop-up menu that sets the BS Circle value to zero, azimuth, input value, obtains the value from the instrument, or changes the value by +/- 90 or 180 degrees.

- *Measure dist to BS* – set if the distance to backsight point should be measured.
- *Turn To BS* (available only for the Robotic mode) – select to turn the total station to the Backsight Point.
- *Fixed HR at BS* – set if the height of the backsight point is fixed for the whole set of measurements. If the box is check marked, an additional HR box displays. This is useful when one target is mounted at the BS for the duration of an occupation and another is used for the sideshots.
- **Check BS** – opens the ***Backsight Survey*** screen to check the Backsight point (see "Check Backsight" on page 10-8).
- **HC Set** – sets the horizontal circle as defined in the *BS Circle* field and opens the *Data* tab.
- **Settings** – opens the ***Mode*** screen (see "Set Measurement Mode" on page 10-9).
- The Help Icon  in the upper-left corner displays the pop-up menu containing seven items:
  - *Edit Points*: opens the ***Points*** list screen (see "Points" on page 6-2).
  - *Edit Raw*: opens the ***Raw Data*** screen (see "Raw Data" on page 6-36).
  - *Remote Control* (for Robotic mode only): opens the ***Remote Control*** screen, which controls the total station through the radio (see Figure 10-19 on page 10-18).
  - *Config Link* (only for the Robotic mode): opens the ***Configure Link*** screen (see "Configure Link" on page 13-7).
  - *Inverse*: opens the ***Inverse*** COGO screen (see "Inverse" on page 14-3).
  - *Intersection*: opens the ***Intersection*** COGO screen (see "Compute the Intersection Point" on page 14-14).
  - *Help*: accesses the Help files.

The *Data* tab on the ***Backsight Survey*** screen (Figure 10-3 on page 10-5) displays the available values of the backsight point

parameters: *HR* (Height of Rod/target), *HA* (Horizontal Angle), *VA* (Vertical Angle), and *SD* (Slope Distance).

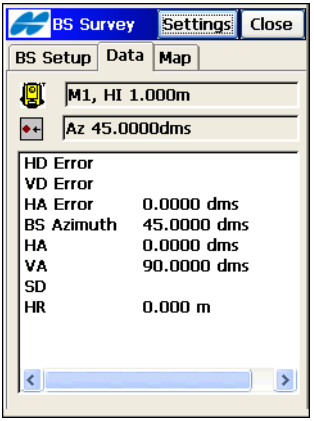


Figure 10-3. Backsight – Data

The two fields at the top of the page display the height of the instrument and the azimuth respectively.

The *Map* tab (Figure 10-4) shows all points in a graphic mode. For details on map properties and customizing, see “Viewing Map” on page 15-1.

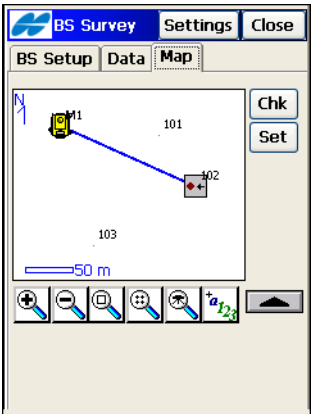


Figure 10-4. Backsight – Map

Multi-Point Backsight

To access the ***Multi-Pnt BS*** screen (Figure 10-5), press the menu icon next to the *Map* icon in the *BS Point* field and select the *Multiple BS* item. Multiple backsight points can generate more precise measurements.

On the *Meas* tab, edit the following parameters:

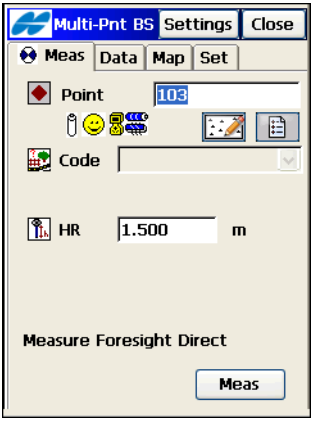


Figure 10-5. Multi-Point BS

- *Point* – the known point name. Can be selected from the map or from the list.
- *Code* – the known point code.
- *HR* – the height of the rod (target).
- **Measure Foresight Direct** – press the **Meas** button to take the sideshot of the point.
- **Settings** – opens the ***Mode*** screen (see "Survey Parameters" on page 3-41).
- The Help Icon on the upper-left corner of the ***Multi-Pnt BS*** screen displays a pop-up menu containing six items:
  - *Edit Points*: opens the ***Points*** list (see "Points" on page 6-2).
  - *Inverse*: opens the ***Inverse*** COGO screen (see "Inverse" on page 14-3).

– *Notes*: opens the ***Notes*** screen.

– *PTL Mode*: opens the **PTL Mode** screen (see “PTL Point” on page 6-12).

– *Display Coord*: if selected, the coordinates of the previous point measured displays below HR data.

– *Help*: accesses the Help files.

The *Data* tab (Figure 10-6) on the ***Multi-Pnt BS*** screen shows the results of the current measurement and the scale factor and standard deviations of the coordinates.

The *Map* tab shows all points in graphic mode. For details on map properties and customizing, see “Viewing Map” on page 15-1.

The *Set* tab on the ***Multi-Pnt BS*** screen (Figure 10-6) displays measurement results of the sideshots being done during one set: the *Res HA* (residuals of the horizontal angles) and the measured and initial parameters (*HR, HA*, and so forth)

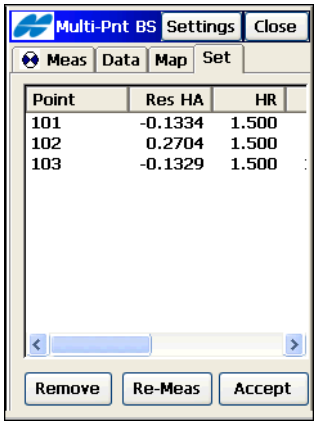


Figure 10-6. Multi Point BS – Meas Set Tab

- **Remove** – deletes the highlighted measurement from the set.
- **Re-Meas** – replaces the current measurement with a new measurement.
- **Accept** – stores the new coordinates in the database.

Check Backsight

The ***BS Survey*** screen (Figure 10-7) shows information about the backsight point errors.

HD and VD does not display if only an azimuth (direction) has been entered for the backsight.

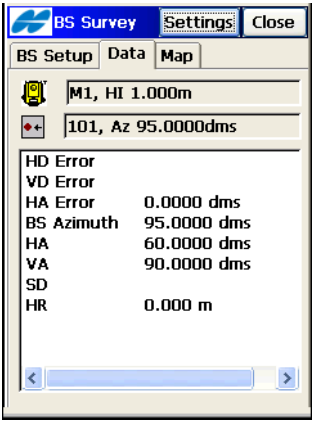


Figure 10-7. Check Backsight

There are two fields at the top of the page for the height of the instrument and the azimuth.

Station and Offset

The ***Station and Offset*** screen (Figure 10-8 on page 10-9) calculates a point defined by the number of stations on the road and an offset from this station.

Select the road from the list and enter the desired station, offset and elevation.

Press the **OK** button to open the ***Add Point*** screen on which to add the calculated point to the list of points. The ***Backsight Survey*** screen opens with this occupation point.

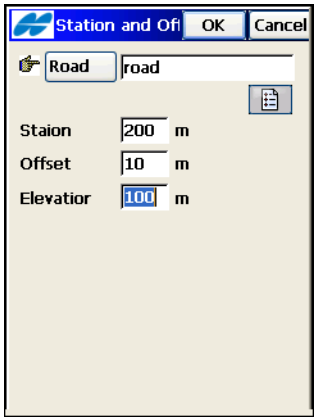


Figure 10-8. Station and Offset

Set Measurement Mode

To toggle between sideshot modes, press the **Settings** button on any ***Survey*** screen. The ***Mode*** screen (Figure 10-9 on page 10-10) displays. Select one of three measurement methods, *Sideshot Dir*, *Sideshot-Dir/Rev,* or *Ang/Dist Sets-Dir/Rev.*

- *Sideshot-Dir* – defines the measurement to a single point, taken using the Direct position of the Total Station.
- *Sideshot-Dir/Rev* – defines that the measurement to a single point is taken using the Direct Position and the Reverse Position of the Total Station (that is, Plunge – Flip and Rotate the Total station by 180 degrees to get the reverse measurement). This measurement method is known as *Multiple*, in which case the *Set* tab appears in the ***SS-Dir/Rev*** screen. One set consists of one direct and one reverse measurement. These measurements are used to eliminate the Vertical and Horizontal circle centering errors.
- *Ang/Dist Sets-Dir/Rev* – during the measurement, defines the instrument that uses the specified Angle sequence to perform repeated measurements. In this case the ***SS-Dir/Rev*** screen also has the *Set* tab. The sequence of four measurements constitutes one set. One measurement is the backsight in *Direct* face or the

Foresight in *Reverse* face in two positions of the Total Station. These measurements are used to eliminate the Vertical and Horizontal circle centering errors.

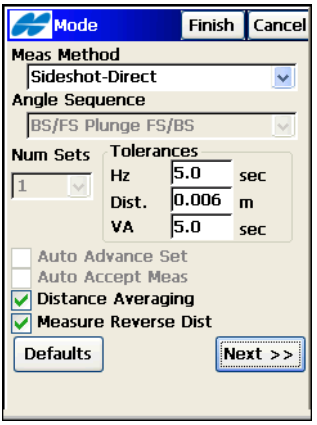


Figure 10-9. Mode - Measurement Method

- **Next** – opens the next ***Mode*** screen to set the order and the type of the measurements in one set (Figure 10-10).

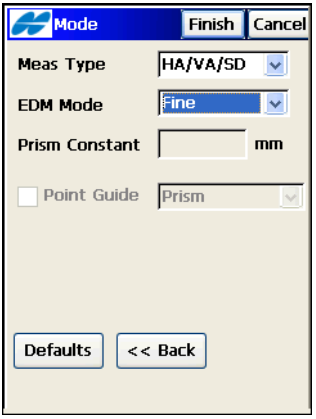


Figure 10-10. Mode - Type of Measurements

For a description of other parameters on these screens, see “Survey Parameters” on page 3-41).

Resection

The method of resection computes the coordinates of an occupation point, where the instrument is set up, using measurements to two (or more) points with known coordinates.

To access the ***Resection*** option, tap the **Resection** icon. The ***Occupation Pt*** screen displays first to set the occupation point (Figure 10-11).

To perform resection for the occupation point selected in the ***BS Survey*** screen, press the menu icon next to the *Map* icon in the *Occ. Point* field of this screen and select the *Resection* item (Figure 10-2 on page 10-2).

Occupation Point

The ***Occupation Pt*** screen sets the name of the point, the heights of the instrument, and the target (Figure 10-11).

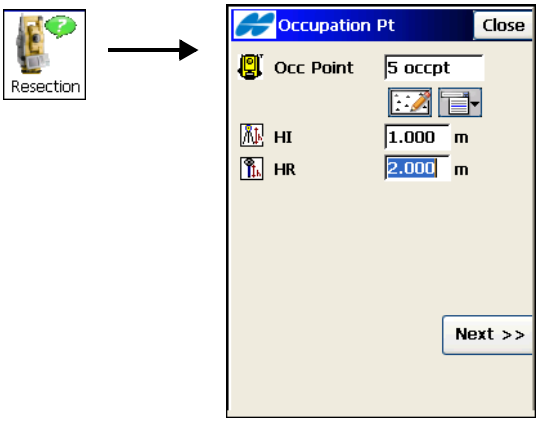


Figure 10-11. Occupation Point

- **Next** – opens the resection screen to take measurements to known points.

Resection 3D

The ***Resection 3D*** screen calculates a three dimensional resection of the occupied point (Figure 10-12). Use the *2D/3D* option to select performing either a two or three dimensional resection.

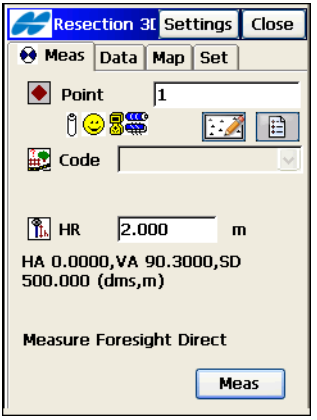


Figure 10-12. Resection 3D

The *Measurement* tab takes the measurements to known points.

- *Point* – the known point name; select from either the map or from the list.
- *Code* – the known point code.
- *HR* – the height of the rod (target). Saves settings from the ***Occupation Pt*** screen.
- **Meas** – takes the sideshot to the point and displays the measurements of the point below the HR data.
- **Settings** – opens the ***Mode*** screen (see “Survey Parameters” on page 3-41).
- The Help Icon in the upper-left corner displays the following pop-up menu items:
  - *Edit Points*: opens the ***Points*** list (see “Points” on page 6-2).
  - *Inverse*: opens the ***Inverse*** COGO screen (see “Inverse” on page 14-3).

– *Notes*: opens the **Note** screen for to add notes to the measurement session (if preferred).

– *PTL Mode*: switches on the PTL (Point-To-Line) Mode. (The screen changes to ***Points (PTL)***.) For details, see "PTL Mode" on page 11-6.

– *Remote Settings* (for Robotic mode only): opens the ***Search/ Track Parameters*** screen (see "Staked Point Icon" on page 3-47).

– *Config Link* (only for the Robotic mode): opens the ***Configure Link*** screen (see "Configure Link" on page 13-7).

– *Options*: opens the ***Resection Options*** screen (see "Resection Options" on page 10-15).

– *Help:* accesses the Help files.

The *Data* tab shows the current measurement data.

The *Map* tab shows all points in a graphic mode and allows selection of a point for measurement and performing measurements (Figure 10-13).

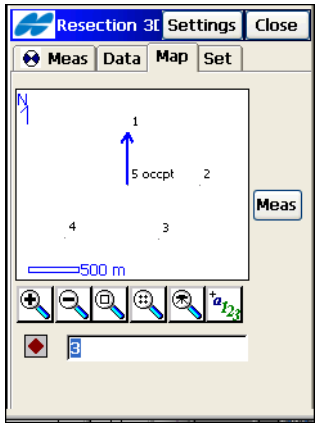


Figure 10-13. Resection 3D - Map Tab

For details on map properties and customizing, see "Viewing Map" on page 15-1.

The *Set* tab displays the result of the sideshots being done (Figure 10-14 on page 10-14).

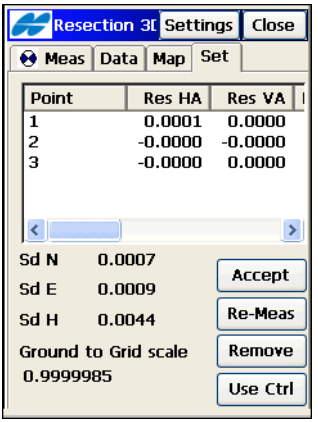


Figure 10-14. Resection – Meas Set Tab

- *Sd N*, *Sd E*, *Sd H* – displays Standard deviations for North, East and Height, respectively.
- *Ground to Grid scale* – displays the calculated scale factor.
- **Accept** – opens the ***Store Point*** screen (Figure 10-15 on page 10-15) to save the new point.
- **Re-Meas** – replaces the current measurement with a new measurement.
- **Remove** – deletes the selected measurement.
- **Use Ctrl** – toggles through specific measurements in the resection, for example the horizontal angle, but not the vertical, or vice versa. The used measurements are listed in the Use column. For example, *HVSD* indicates that the *Horizontal* angle, *Vertical* angle and the *Slope Distance* were used.

Store Point

The ***Store Point*** screen (Figure 10-15 on page 10-15) saves the resection point in the job.

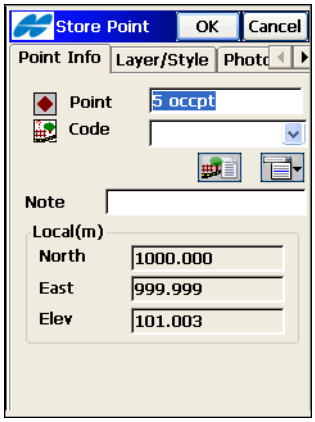


Figure 10-15. Store Point

This is a standard screen adding a new point. For details on this screen see “Editing a Point” on page 6-6.

Resection Options

The ***Resection Options*** screen (Figure 10-16) sets the resection type: whether to calculate the height (3-D) or just the horizontal coordinates (2-D).

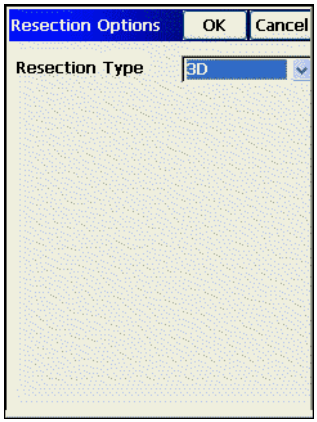


Figure 10-16. Resection Options

The *2D/3D* option is retained between sessions. When doing a resection the next time, the resection will start up with the previous used setting.

Remote Benchmarks

The method of Remote Benchmarks computes the elevation of an occupation point, where the instrument is set up, using measurements to two (or more) points with known elevations.

To access the ***Remote BM*** option, tap the **Remote BM** icon (Figure 10-2). The ***Occupation Pt*** screen displays first to set the occupation point (Figure 10-11 on page 10-11).

To perform Remote BM for the occupation point selected in the *BS Survey* screen, press the menu icon next to the *Map* icon in the *Occ. Point* field of this screen and select the *Elevation* option (Figure 10-2 on page 10-2).

Computation or estimation of elevation (vertical coordinate) typically uses measurements from two or more points with known coordinates.

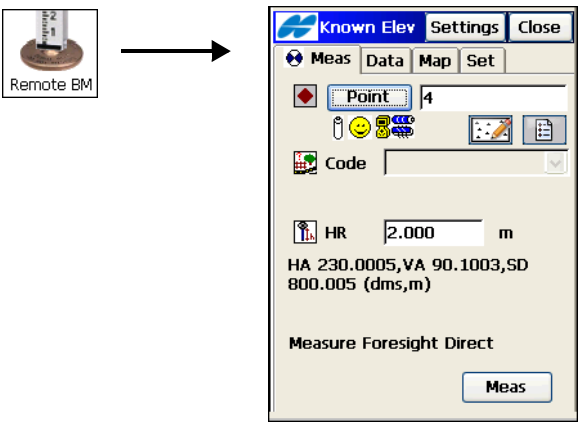


Figure 10-17. Elevation

- *Point / Elevation*: the known point name (select either from the map or from the list) / the known elevation.

- *Code* – the known point code.
- *HR* – the height of the rod (target).
- **Measure Foresight Direct –** press the **Meas** to take the sideshot to the point.
- **Settings** – opens the **Mode** screen (see “Set Measurement Mode” on page 10-9).
- The Help Icon on the upper-left corner displays the same pop-up menu as for the Resection task, except the *Options* item displays.

The *Data* tab shows the results of the current measurement and the scale factor and standard deviations of the coordinates.

The *Map* tab shows all points in a graphic mode. For details on map properties and customizing, see “Viewing Map” on page 15-1.

The *Meas Set* tab displays the results of the sideshots being done during one set, the same as for the *Resection* task.

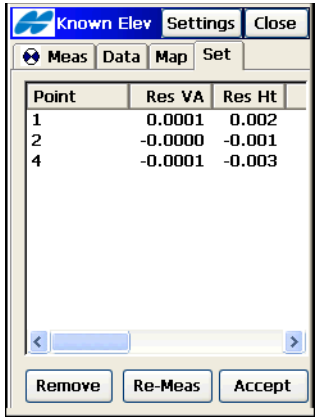


Figure 10-18. Elevation – Meas Set Tab

The table (Figure 10-18) represents the result list of the measurements being made: the residuals of the vertical and horizontal angles, the measured and initial parameters (*HR, HA, VA,* and so forth). The *Ht Diff* column represents the difference between the calculated height and the height of that measurement.

- **Remove** – deletes highlighted measurements in the elevation.

- **Re-Meas** – replaces the current measurement with a new measurement.
- **Accept** – stores the new coordinates in the database.
- **Settings** –
- **Close** –

Remote Control

To set up a survey with remote control, tap the **Remote Control** icon.

If one person performs the survey process with a motorized instrument, the remote control transmits commands from the controller to the total station. The radio modems need to be set and connected to the controller and the instrument.

The ***Remote Cntrl*** screen (Figure 10-19) controls the total station through the radio.

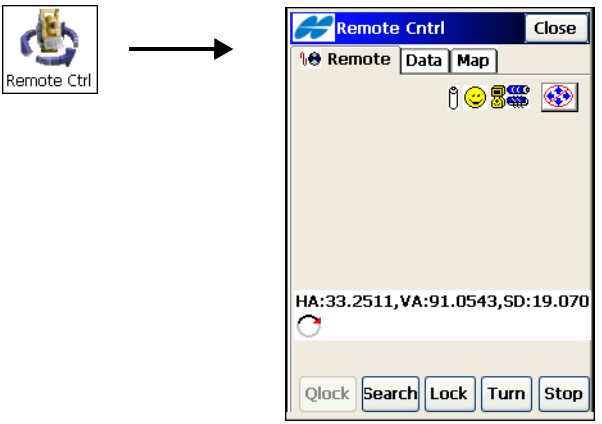


Figure 10-19. Remote Control o the Total Station

The *Remote* tab shows the current values of the total station measurements and provides a set of tools for control:

- – shows the battery status for the total station.
- – shows the status of communication between the controller and total station.

-  – switches the keyboard control on/off; shows the current status of the switch.
- **Qlock** – sends the "Quicklock" or "Turn Around" command which causes the total station to search for the RC-2[1].
- **Search** – makes the instrument search for the prism.
- **Lock** – locks onto the prism or "tracks" it.
- **Turn** – opens the ***Rotate*** screen (Figure 10-21 on page 10-21) which allows the total station to turn to various angles or points.
- **Stop** – makes the total station stop tracking the prism and go into "Standby" mode.
- The Data Indicator above the **Qlock** button shows the current status of the total station. There are four status types: no data, querying status, turning, and receiving data.
- All the observations can be done in remote mode as well if the instrument chosen is robotic.
- The Help Icon in the upper-left corner of the screen displays the pop-up menu containing seven items:
  - *Edit Points*: opens the **Points** list.
  - *Inverse*: opens the ***Inverse*** COGO screen.
  - *Notes*: opens the ***Notes*** screen (see "The Topo Menu" on page 9-3).
  - *PTL Mode*: opens the **PTL Mode** screen (see "PTL Mode" on page 11-6).
  - *Remote Settings*: opens the ***Search/Track*** screen.
  - *Config Link*: opens the ***Configure Link*** screen (for details, see "Configure Link" on page 13-7).
  - *Display Coord*: if selected, the coordinates of the previous point measured displays below the HR data.

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.

– *Help*: accesses the Help files.

The *Map* tab shows all points in a graphic mode. For details, on map properties and customizing, see “Viewing Map” on page 15-1.

When the Robotic total station operates in Remote Control Mode, some of the screens change their appearance. The remote control tools display on the *Measurement* tab (Figure 10-20) of the ***Resection*** screen.

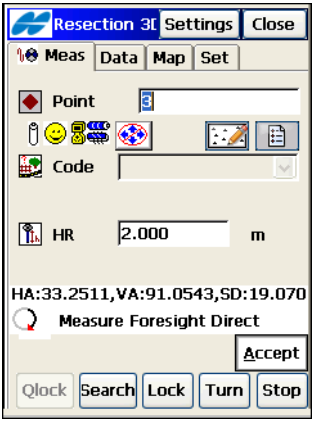


Figure 10-20. Sample Screen for Remote Control Mode

Rotate

The ***Rotate*** screen (Figure 10-21 on page 10-21) contains settings for rotation of the remote total station.

- *Rotation Angles* – sets the values of the horizontal and vertical rotation angles.
- **Turn** – sends the data to the total station. The corresponding icon shows the rotation process.
- *Rotate to Point* – selects a point by typing its name, selecting it from the map or a list, or inserting the HR value (height of rod or target). Press the **Turn** button.
- **Plunge TS** – press to plunge the instrument (rotate the telescope and the body by 180 degrees).

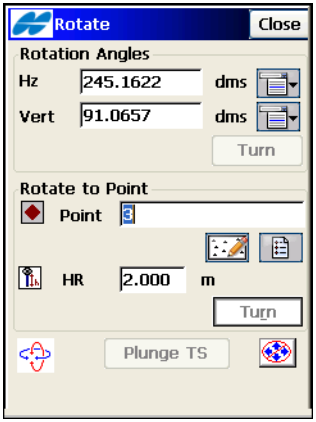


Figure 10-21. Rotate the Remote Total Station

Notes:

Total Station Survey

The Survey menu (Figure 11-1) for Total Station surveys opens by the **Survey** icon in the main menu and allows to perform the surveys:

- Topo
- Auto Topo (for Robotic mode)
- X-Section
- Find Station
- Tape Dimension
- Missing Line
- Scanning (for Robotic mode)
- Monitor (for Robotic mode)

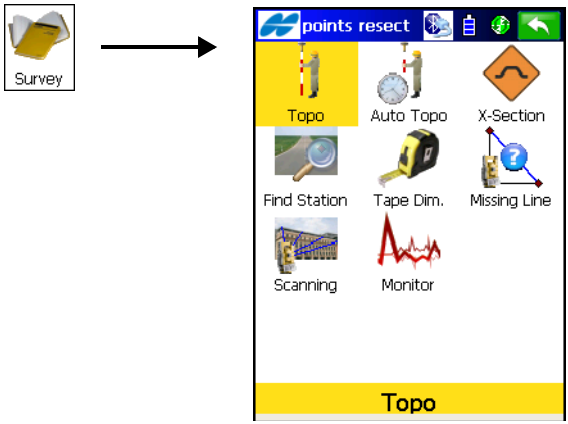


Figure 11-1. TS Survey

If needed menu options are not visible, tap **Configure/Menus** icons to enable these options in the ***Config Menus*** screen.

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see “Help Icon’s Pop-up Menu” on page 1-8).

Topo

To toggle between sideshot modes (Figure 11-2), press the **Settings** button on any Survey screen. Select one of three measurement methods from the *Meas Method* drop-down list, *Sideshot Dir*, *Sideshot-Dir/Rev,* or *Ang/Dist Sets-Dir/Rev.* For a description of other parameters on this screen, see “Survey Parameters” on page 3-41 for more information).

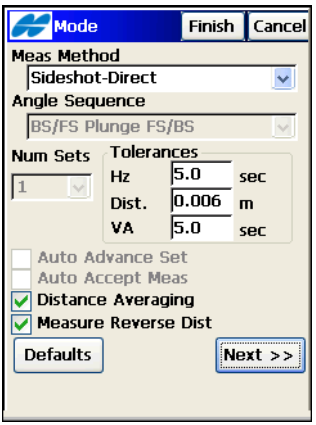


Figure 11-2. Mode

- *Sideshot-Dir* – defines that the measurement to a single point is taken using the Direct position of the Total Station.
- *Sideshot-Dir/Rev* – defines the measurement to a single point that is taken using the Direct Position and the Reverse Position of the Total Station (that is, Plunge – Flip and Rotate the Total station by 180 degrees to get the reverse measurement). This measurement method is known as *Multiple*, in which case the *Set* tab displays in the ***SS-Dir/Rev*** screen. One set consists of one direct and one

reverse measurement. These measurements are used to eliminate the *Vertical* and *Horizontal* circle centering errors.

- *Ang/Dist Sets-Dir/Rev* – defines that during the measurement, the instrument uses the specified Angle sequence to perform repeated measurements. In this case the ***SS-Dir/Rev*** screen also has the *Set* tab. The sequence of four measurements constitutes one set. One measurement is the backsight in Direct face or the Foresight in Reverse face in two positions of the Total Station. These measurements are used to eliminate the Vertical and Horizontal circle centering errors.
- **Next** – opens the next ***Mode*** screen to set the order and the type of the measurements in one set.

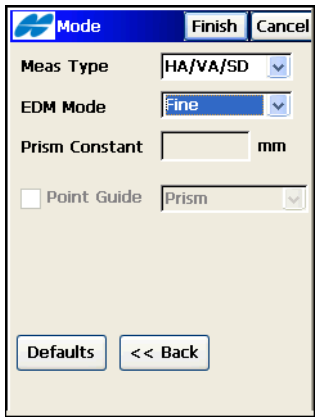


Figure 11-3. Mode - Type of Measurements

For a description of other parameters on the ***Mode*** screens, see “Survey Parameters” on page 3-41 for more information).

Sideshot-Direct

The *Meas* tab on the ***SS-Dir*** screen (Figure 11-4) contains the initial data for performing single sideshots and displays the following information during a survey.

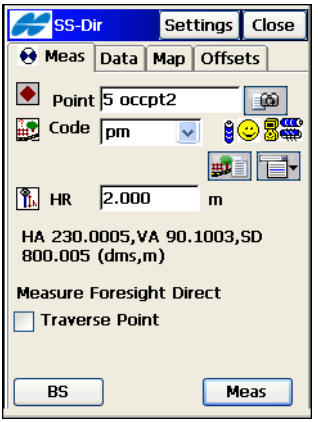


Figure 11-4. Sideshot-Direct – Measurement Tab

- *Point* – sets the current point name. During the survey, the numerical part of the name increments automatically by one. The icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – sets the Code for the current point: enter either manually or select a code from the drop-down list.
- – accesses the attributes of the selected code and opens the ***Code-Attributes*** screen (for details see “On the Point Attributes” on page 6-7).
- – shows battery status for the total station.
- – shows the status of communication between the controller and the total station.
- – shows battery and memory status for the controller.

- The menu icon next to the *Attributes List* icon displays a pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the  sign appears.
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.
- *HR* – sets the height of the target above the mark (rod height).
- The Help Icon in the upper-left corner of the screen displays a pop-up menu containing seven items:
  - *Adv*: opens the ***Backsight Survey*** screen for setting the next traverse point as the next occupation point. The current occupation point becomes the next backsight point.
  - *Edit Points*: opens the ***Points*** list.
  - *Inverse*: opens the ***Inverse*** COGO screen.
  - *Notes*: opens the ***Notes*** screen.
  - *PTL Mode*: opens the **PTL Mode** screen (see "PTL Mode" on page 11-6).
  - *Display Coord*: if chosen, the coordinates of the previous point measured displays below the HR data (Figure 11-4 on page 11-4).
  - *Help*: accesses the Help files.
- **Measure Foresight Direct** – Check and enable *Traverse Point* to open the screen to set the coordinates of the point manually.

If more than two points have been tagged as Traverse Points, the ADV button displays a list box with all tagged Traverse points from which to select the next occupation point. Select OK, to display the Backsight screen, which automatically updates, as is the case when one TP point is available.

- **BS** – opens the ***Backsight Survey*** screen to set the backsight point. The information displays on screen.
- **Meas** – takes the sideshot to the point. The results display in the information window.
- **Settings –** opens the ***Mode*** screen (for a description of parameters on this screen, see "Survey Parameters" on page 3-41).

PTL Mode

On the (Point-To-Line) ***PTL Mode*** screen, the coordinates are defined through two reference points (Figure 11-5). The line traced through these points is set as one axis and is as perpendicular as another.

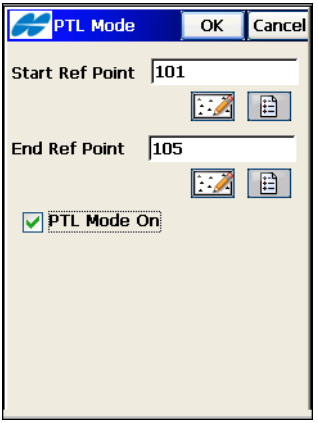


Figure 11-5. PTL Mode

- *Start Ref Point/End Ref Point* – the start number and the end number of the reference points: select from either the map or from the list of points.
- *PTL Mode On* – enables the PTL mode.
- **OK** – saves the changes and returns to the previous screen.

The *Data* tab on the ***SS-Dir*** screen (Figure 11-6) contains the results of the measurements, along with the initial data.

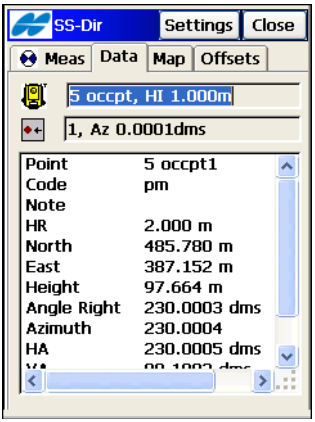


Figure 11-6. Sideshot-Direct – Data Tab

The *Map* tab (Figure 11-7) on the second ***SS-Dir*** screen performs sideshots in the graphic mode. The buttons on the right duplicate the controls on the first ***SS-Dir*** screen (Figure 11-4 on page 11-4).

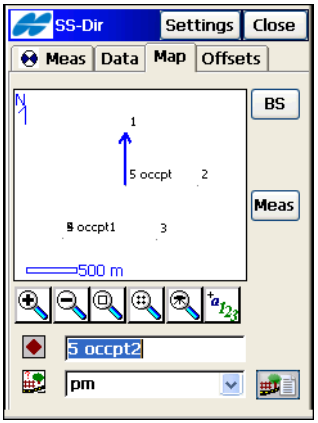


Figure 11-7. Sideshot-Direct – Map Tab

For details on map properties and customizing, see “Viewing Map” on page 15-1.

In the ***Sideshot Sets-Dir/Rev*** and ***Ang/dist Sets-Dir/Rev*** mode, the *Set* tab displays (Figure 11-8 on page 11-8).

The ***SS-Dir/Rev*** screen (Figure 11-8) contains the data collected during the measurements, grouped by sets: the set for Multiple mode contains two measurements; the set of the Repeat mode contains four measurements).

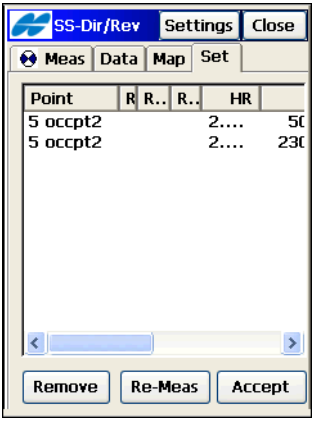


Figure 11-8. Ang/dist Sets-Dir/Rev – Meas Set Tab

- The columns on the *Set* tab displays the following parameters:
  - *Point*: the name of the point.
  - *Res HA*: Difference of each HA measurement within the set from the average of all the HAs in the set.
  - *Res VA*: Difference of each VA measurement within the set from the average of all the VAs in the set.
  - *Res SD*: Difference of each SD measurement within the set from the average of all the SDs in the set.
  - *HR*: the height of the rod (target).
  - *HA*: Horizontal Angle measurement in the corresponding set.
  - *VA*: Vertical Angle measurement in the corresponding set.
  - *SD*: Slope Distance measurement in the corresponding set.
- **Remove** – deletes all measurements from the set.
- **Re-Meas** – displays the sideshot page to measure a new angle set.
- **Accept** – saves the measured point.
- **Settings** – opens the ***Mode*** screen (see Figure 11-2 on page 11-2).

Offsets

The *Offsets* tab (Figure 11-9) on the ***SS-Dir*** screen contains a set of tools to define the offsets.

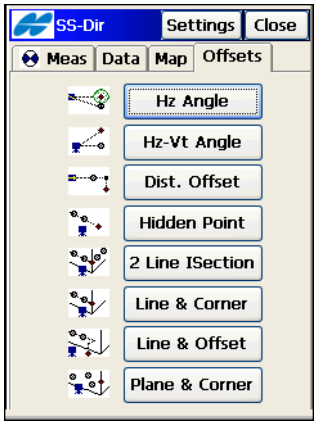


Figure 11-9. Offsets

- *Hz Angle* – defines a point using the horizontal angle from one point and the distance to another (see “Horizontal Angle Offset” on page 11-10).
- *Hz-Vt Angle* – defines a point using horizontal and vertical angles (see “Horizontal/Vertical Angle” on page 11-13).
- *Dist. Offset* – defines a point giving the ability to add or subtract distances, horizontally and vertically (see “Distance Offset” on page 11-14).
- *Hidden Point* – defines a point on the ground surface, with a slanted rod touching the ground point (see page 11-16).
- *2 Line ISection* – determines a point by the intersection of the two lines. Each line is defined by two points or two measurements (see “Two Line Intersection” on page 11-17).
- *Line & Corner* – determines a point on the corner using one line defined by two points and a horizontal angle measurement.
- *Line & Offset* – determines a point distant from a line defined by two points.

- *Plane & Corner* – determines a point (Corner) by a plane, which is defined by three points and horizontal/vertical angle measurements.

Horizontal Angle Offset

The *Measurement* tab of the ***HorAng Ofst*** screen (Figure 11-10) contains data for definition of a point using the horizontal angle from one point and the distance to another.

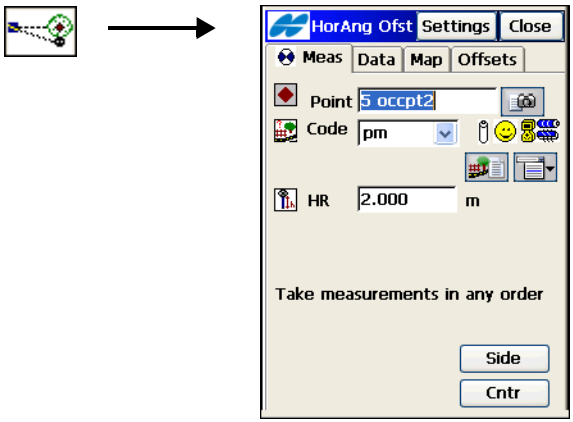


Figure 11-10. Horizontal Angle Offset – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored. Can be entered manually or chosen from the drop-down list.
- – the *Attributes List* icon opens the list of available attributes (for details see "On the Point Attributes" on page 6-7).
- The menu icon close to the *Attributes List* icon displays a pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the sign appears.
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).

  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.

- *HR* – sets the target height above the mark (rod height).
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.
- **Side and Center** – on the Take measurements in any order panel, press **Center**, then **Side**. Take measurements to *Center* and obtain vertical angle and horizontal angle measurements; a *Side* measurement then provides *VA, HA*, and distance measurements. With these two sets of measurements, the computation can be made for a point at the center of a tree; for example, when taking measurements, a comment displays on the screen.
- The Help Icon on the upper-left corner of the screen displays the pop-up menu containing nine items:
  - *Adv* (Advance): opens the ***Backsight Survey*** screen for setting the next traverse point as the next occupation point. The current occupation point becomes the next backsight point.
  - *Edit Points*: opens the ***Points*** list.
  - *Edit Raw*: opens the ***Raw TS*** screen (see "Edit Raw Data" on page 6-38).
  - *Inverse*: opens the ***Inverse*** **COGO** screen (see "Inverse" on page 14-3).
  - *Intersection*: opens the ***Intersection*** **COGO** screen (see "Compute the Intersection Point" on page 14-14).
  - *Note*: opens the ***Notes*** screen (see "The Topo Menu" on page 9-3)
  - *PTL Mode*: opens the ***PTL Mode*** screen (see "PTL Mode" on page 11-6).
  - *Display Coord*: if selected, the coordinates of the previous point measured displays below the HR data (see Figure 11-4 on page 11-4).
  - *Help*: accesses the Help files.

The following three tabs are similar to the *Offset* options:

- The *Data* tab (Figure 11-11) on the ***Horizontal Angle Offset*** screen contains the data collected during the offset measurement.

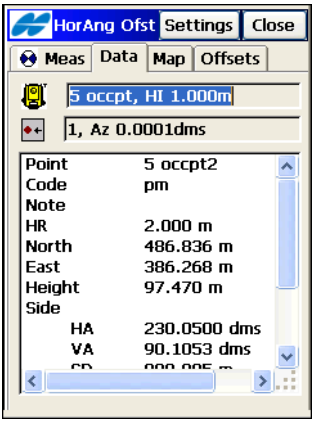


Figure 11-11. Horizontal Angle Offset – Data Tab

- The *Map* tab (Figure 11-12) on the ***Horizontal Angle Offset*** screen contains the graphic view and duplicated controls from the *Measurement* tab. For the details on viewing and customizing properties, see "Viewing Map" on page 15-1.

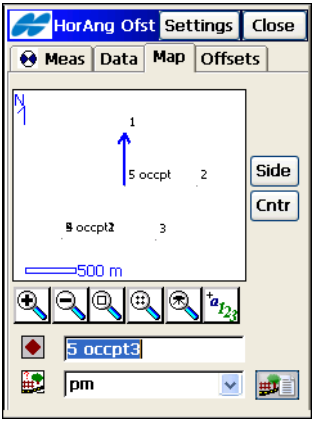


Figure 11-12. Horizontal Angle Offset – Map Tab

- The *Offsets* tab toggles to another offset option.

Horizontal/Vertical Angle

The *Measurement* tab (Figure 11-13) on the ***H/VAng*** screen contains data for definition of a point using horizontal and vertical angles.

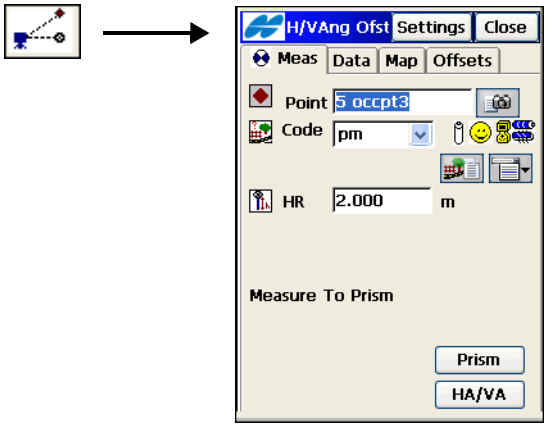


Figure 11-13. Horizontal/Vertical Angle – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored, which can be entered manually or selected from the drop-down list.
- – the *Attributes List* icon lists available attributes (see "On the Point Attributes" on page 6-7).
- The menu icon next to the *Attributes List* icon and in the upper-left corner of the screen displays the same lists as for the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target height (Rod Height).
- *Prism* – stores horizontal distance and horizontal angle measurements (to prism).
- *HA/VA* – combines horizontal angle and zenith angle measurements with horizontal distance logged in Prism step to determine point location.
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.

See the ***Horizontal Angle Offset*** measurement for other tabs.

Distance Offset

The *Measurement* tab (Figure 11-14) on the ***Dist Ofst*** screen contains the parameters for definition of a point. You can add or subtract distances, horizontally and vertically.

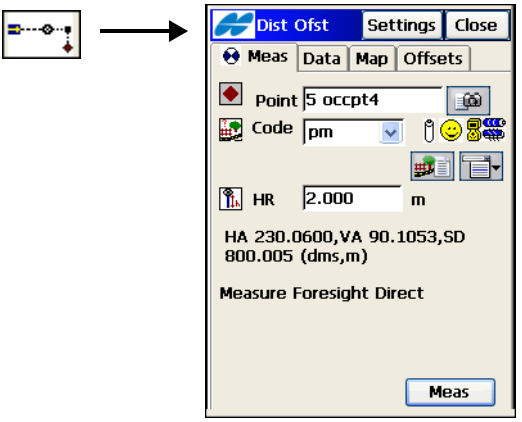


Figure 11-14. Distance Offset – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored: enter either manually or select from the drop-down list.
- – The *Attributes List* icon opens the list of available attributes.
- The menu icons next to the *Attributes List* icon, located in the upper-left corner of the screen, displays the same lists as those shown on the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target height above the mark (rod height).
- – shows the battery and memory status for the controller.

After the sideshot is taken, the ***Enter Distance Offsets*** screen (Figure 11-15) displays to enter 3 distance offsets:

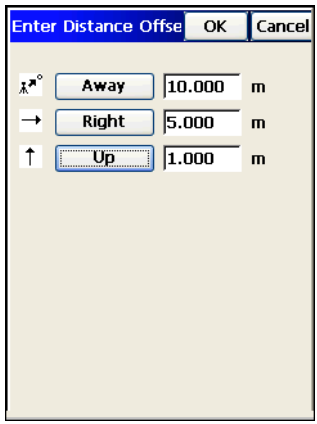


Figure 11-15. Distance Offset Screen

  - **Away/(Toward)**: sets the distance between the current point and the projection of the offset point on the line of sight.
  - **Right/(Left)**: sets the distance between the offset point and its projection, taking into consideration the location relative to the line of sight.
  - **Up/(Down)**: sets the height of the point, relative to the current position.

- **Meas** – performs the measurement (Figure 11-14 on page 11-14).
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode. (Figure 11-14 on page 11-14)

The *Data*, *Map* and *Offsets* tabs are similar to those in the ***Horizontal Angle Offset*** measurement.

Hidden Point

The *Measurement* tab (Figure 11-16) of the ***Hidden Pt*** screen defines a point on the ground surface, with a slanted rod touching the ground point. The rod has two targets.

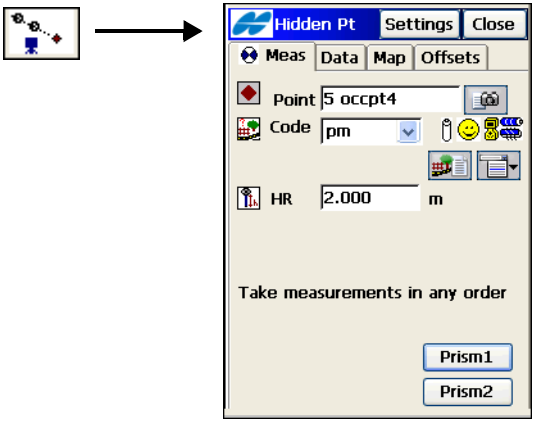


Figure 11-16. Hidden Point – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored. Can be entered manually or chosen from the drop-down list.
- – the *Attributes List* bitmap, opens a list of available attributes.
- The menu icons next to the *Attributes List* icon and the Help Icon in the upper-left corner of the screen display the same lists as for the ***Horizontal Angle Offset*** screen.
  - **Single**: toggles between the *Single* and *Repeat* sideshot modes.
  - **Fine**: toggles between the *Fine* and *Coarse* sideshot modes.
  - **Prism1**: measures the first target on the rod.
  - **Prism2**: measures the second target on the rod.
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.

Two Line Intersection

The *Measurement* tab (Figure 11-17) on the ***2Line Intersection*** screen contains data for determination of a point by the intersection of two lines. Each line is defined by two points or by two measurements.

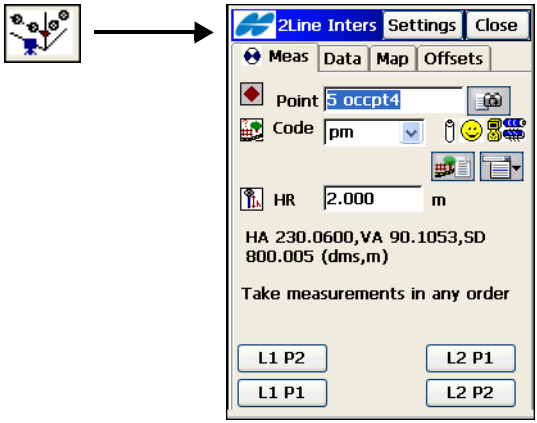


Figure 11-17. Two LIne Intersection – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored. Can be entered manually or chosen from the drop-down list.
- – the *Attributes List* icon, opens the list of available attributes.
- The menu icons next to the *Attributes List* icon and the Help Icon in the upper-left corner of the screen display the same lists as for the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target height above the mark (rod height).
- **Line 1 Pt1** and **Line 1 Pt2** – obtains measurements to determine the first and second points defining the first line.
- **Line 2 Pt 1** and **Line 2 Pt 2** – obtains measurements to determine the first and second points defining the second line.

- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.

See the ***Horizontal Angle Offset*** measurement for other tabs.

Line and Corner

The *Meas* tab (Figure 11-18) on the ***Line&Corner*** screen contains data for determination of a point on the corner using one line defined by two points.

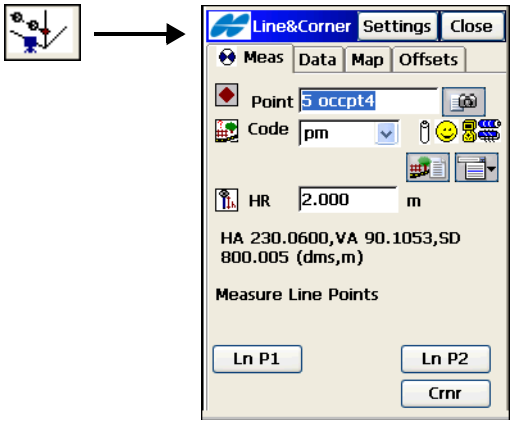


Figure 11-18. Line and Corner – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo icon* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored. Can be entered manually or chosen from the drop-down list.
- – the *Attributes List* icon, opens a list of available attributes.
- The menu icons next to the *Attributes List* icon and the Help Icon in the upper-left corner of the screen display the same lists as for the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target height above the mark (rod height).
- **Line Pt1** – obtain measurements to determine first point defining a line.

- **Line Pt2** – obtain measurements to determine first point defining a line.
- **Corner** – obtain the horizontal angle to locate a point on line at the corner.
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.

Line and Offset

The *Measurement* tab (Figure 11-19) on the ***Line&Ofst*** screen contains data for determination of a point distant from a line defined by two points.

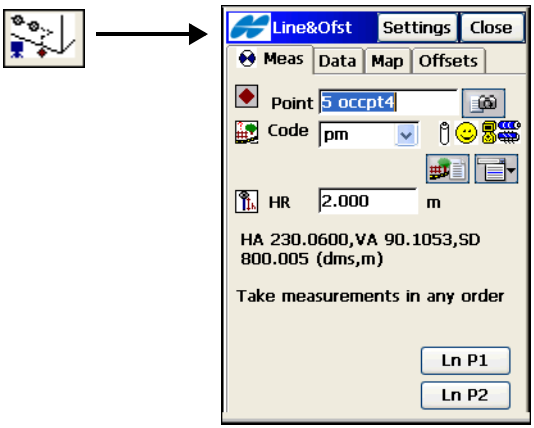


Figure 11-19. Line and Offset – Measurement Tab

- *Point* – name for the offset point to be stored. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored. Can be entered manually or chosen from the drop-down list.
- – the *Attributes List* icon, opens a list of available attributes.
- The menu icon next to the *Attributes List* icon and the Help Icon in the upper-left corner of the screen display the same lists as for the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target height above the mark (rod height).

- **Line Pt1** – obtains measurements to first point on a line.
- **Line Pt2** – obtains measurements to second point on a line.
- **Settings** – opens the ***Mode*** screen for setting the sideshot mode.

After the lines are measured, the ***Enter Distance Offsets*** screen displays to enter offsets (see Figure 11-15 on page 11-15):

- **Forward/Backward** – sets the distance between the current point and the projection of the offset point on the line of sight.
- **Up/Down –** sets the height of the point relatively to the current position.
- **Right/Left** – sets the distance between the offset point and its projection, taking into consideration its location relative to the line of sight.

The *Data*, *Map* and *Offsets* tabs are similar to that of the ***Horizontal Angle Offset*** measurement.

Plane and Corner

The *Measurement* tab (Figure 11-20) on the ***Pln&Corner*** screen helps determine a point (Corner), using a plane defined with three points and an angle measurement.

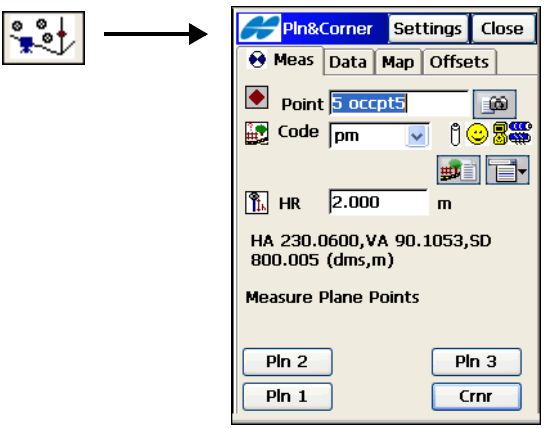


Figure 11-20. Plane (Point) and Corner – Measurement Tab

- *Point* – name for the offset point to be stored. The  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – code for the offset point to be stored: enter either manually or select from the drop-down list.
-  – the *Attributes List* icon opens a list of available attributes for the selected code.
- The menu icons next to the *Attributes List* icon and the Help Icon in the upper-left corner of the screen display the same lists as for the ***Horizontal Angle Offset*** screen.
- *HR* – sets the target (rod) height above the mark.
- **Plane 1** – obtains measurements to determine the first point in a plane.
- **Plane 2** – obtains measurements to determine the second point in a plane.
- **Plane 3** – obtains measurements to determine the third point in a plane.
- **Crnr** – obtains horizontal and vertical angle measurements to determine corner point in a plane.

The three points defining a plane must be not be colinear (all on the same line).

- **Settings** – opens the ***Mode*** screen to set the sideshot mode.

The *Data*, *Map,* and *Offsets* tabs are similar to that of the ***Horizontal Angle Offset*** measurement.

Auto Topo

This function is activated only with Robotic instruments, and collects points by Time and Distance. To open the ***Auto Topo*** screen (Figure 11-22), select the **Auto Topo** icon in the Robotic mode.

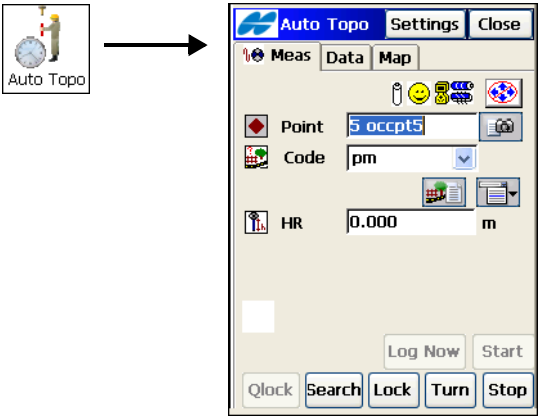


Figure 11-21. Auto Topo

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing nine items:

- *Edit Points* – opens the ***Points*** list.
- *Inverse* – opens the ***Inverse*** COGO screen.
- *Notes* – opens the ***Notes*** screen.
- *PTL Mode* – opens the ***PTL Mode*** screen (see “PTL Mode” on page 11-6).
- *Remote settings* – opens the ***Search/Track Parameters*** screen (see “Stake Parameters” on page 3-44).
- *Config Link* – opens the ***Configure Link*** screen (see “Configure Link” on page 13-7).
- *BS Setup* – opens the ***Backsight Survey*** screen (see “Backsight Survey” on page 10-2).

- *Display Coord* – if selected, the coordinates of the previous point measured displays below the HR data (see Figure 11-4 on page 11-4).
- *Help* – accesses the Help files.

The *Measurement* tab on the ***Auto Topo*** screen (Figure 11-21 on page 11-22) contains the initial data for the survey:

- *Point* – displays the current point name. The *photo note*  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – displays the current point code: either enter manually or select from the drop-down list.
-  – selects attributes for the selected code.
- The menu icon next to the *Attributes List* icon displays a pop-up menu containing three items:
  - *String*: switches on the *String* field. (The  sign also appears.)
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Notes*** screen (see "The Topo Menu" on page 9-3).
- *HR* – the height of the rod (target).
- **Log Now** – immediately stores the current position.
- **Start** – starts the survey process. After pressing, the button changes (toggles) to **Stop**. Press again to stop the survey process.
- **Qlock** – sends the "Quicklock" or "Turn Around" command which causes the total station to search for the RC-2[1].
- **Search** – make the instrument search for the prism.
- **Lock** – lock onto the prism or "track" it.

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.

- **Turn** – opens the ***Rotate*** screen, which allows the total station to turn to various angles or points.
- **Stop** – causes the total station to stop tracking the prism and go into "Standby" mode.
- **Settings** – opens the ***Mode*** screen (see Figure 11-2 on page 11-2). Press **Next** to access the Auto Topo settings (Figure 11-22 on page 11-24):
  - Method: sets the method of data collection; either *By Time*, *By Horizontal Distance*, or *By Slope Distance*.
  - Interval: the time interval for the data collection.
- Press **Finish** to save the changes and return to the ***Auto Topo*** screen.

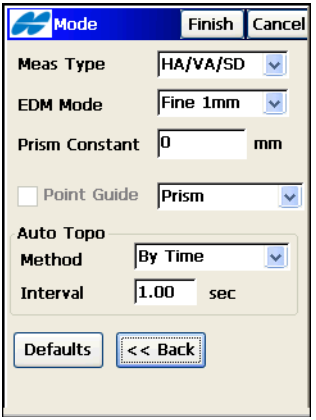


Figure 11-22. Mode Screen – Auto Topo Settings

The *Data* tab displays the data being surveyed.

The *Map* tab shows the surveyed data graphically and duplicates the controls from the *Meas* tab to perform the survey to work in map mode.

Cross-Section

To perform a cross-section survey of the selected road, select the **X-Section** icon. The ***Cross Section*** screen displays.

The ***Cross Section*** screen contains station settings for a selected road, where the cross section survey is to be performed.

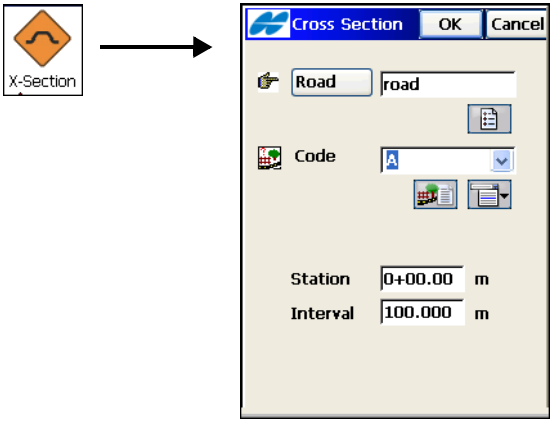


Figure 11-23. Cross Section

- *Road* – select the road from the ***Roads*** list.
- *Cl Code* – the code of the center line points: manually enter a road or either select one from the drop-down list.
- – the *Attributes List* icon opens the list of available attributes (for details see "On the Point Attributes" on page 6-7).
- The menu icon next to the *Attributes List* icon displays the *String* option to switch on the *String* field (see "Topo" on page 11-2).
- *Station/Chainage*: sets the station/distance where the cross section is surveyed.
- *Interval* – the increment of distance towards the next station.

NOTICE

The Station/Chainage and Interval fields display ONLY if the road is selected.

- The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:
  - *Edit Roads*: enables the ***Roads*** screen. See "Roads" on page 7-2.
  - *Help*: accesses the Help files.
- **OK** – saves the changes and opens a screen to perform sideshot measurements. Toggling between the sideshot modes is performed from the *Measurement Method* field in the two ***Mode*** screens opened by the **Settings** button in the ***XSect-Dir*** (***XSect-Dir/Rev)*** screen.

XSection - Direct

The ***XSect-Dir*** screen (Figure 11-24) performs the usual observation work, relative to the cross-section.

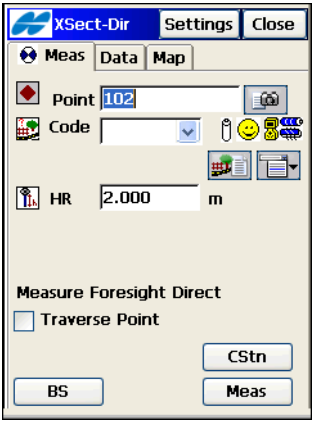


Figure 11-24. Cross Section - Direct

The survey is performed from one side of the road to another in a plane perpendicular to the center line. If the road has not been set, define the plane. On the first station, the survey is performed so that the next point has a different code, for example *A, B, C, cl, D, E, F.* Press the **Close** button to automatically change the station number. The application suggests that the survey on the next station uses the same codes in the opposite order: *F, E, D, cl, C, B, A*. The line is created along the points with the "cl" code.

For a detailed description of the survey process, see “Topo” on page 11-2. The only difference lies in the presence of the **Cur Stn/ Cur Chn** button. Similar to the **Meas** button, it makes the measurement, but does not store the point to the data set.

Find Station

To start working, select the **Find Station** icon.

The *Meas* tab (Figure 11-25) on the ***Find Station*** screen identifies 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.

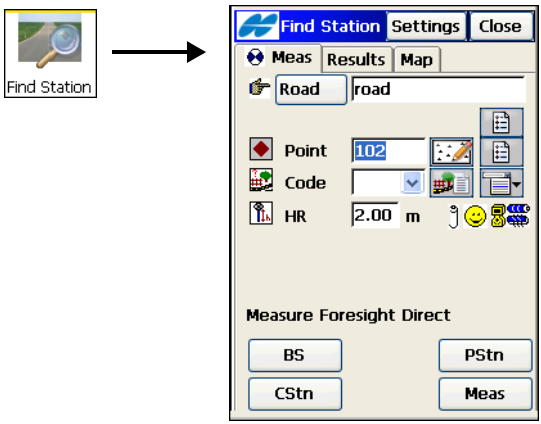


Figure 11-25. Find Station – Measurement Tab

- *Road* – enter the name of the road or select it from the list.
- *Point* – select the name of the point from the map or the list.
- *Code* – enter either manually or select from the drop-down list.
- – the *Attributes List* icon opens a list of available attributes (for details, see “On the Point Attributes” on page 6-7).
- – shows the battery and memory status for the controller.
- The menu icon next to the *Attributes List* icon displays the pop-up menu containing three items:

  - *String*: toggles on the *String* field. Also, the  sign appears.
  - *Layer*: opens the ***Select Layer*** screen (see "On the Select Layer" on page 6-10).
  - *Note*: opens the ***Note*** screen.
- *HR* – sets the target height above the mark (rod height).
- **BS (Setup)** – opens the ***Backsight Survey*** screen to set the backsight point. The information displayed is the same as has been entered.
- **PStn** – computes the result of the point station.
- **CStn** – computes the result of the current station, takes the sideshot to the point, and stores the point to the data set.
- **Meas** – computes the result and takes the sideshot to the point. The result is reflected on the *Results* tab (Figure 11-25 on page 11-27).
- **Settings** – opens the ***Mode*** screen to set the sideshot mode.
- The Help Icon in the upper-left corner of the screen displays a pop-up menu containing six items:
  - *Edit Points*: opens the *Points* list.
  - *Inverse*: opens the ***Inverse*** COGO screen.
  - *Notes*: opens the ***Notes*** screen.
  - *PTL Mode*: opens the **PTL Mode** screen (see "PTL Mode" on page 11-6).
  - *Display Coord*: if selected, the coordinates of the previous point measured displays below the HR data (see Figure 11-4 on page 11-4).
  - *Help*: accesses the Help files.

The *Result* tab shows the results of the computation.

The *Map* tab shows all points in a graphic mode and duplicates the button controls from the first tab.

The *Set* tab (if available) displays the result of the sideshots being done during one set.

Tape Dimension

To start working, select the **Tape Dimension** icon. The ***Tape Dimension*** screen displays.

The ***Tape Dimension*** screen calculates 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 a so called *reference line*.

Reference Line

The *Ref Line* tab contains information about the two points comprising the reference line.

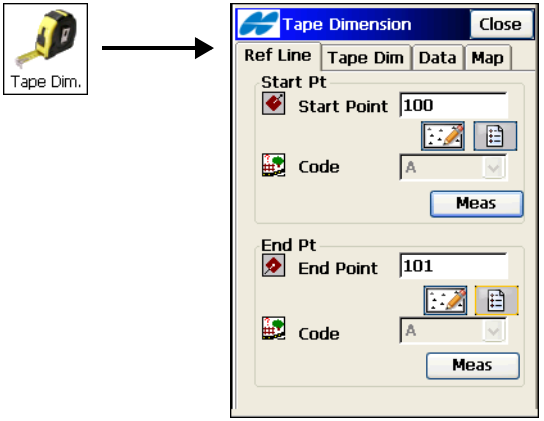


Figure 11-26. Tape Dimension - Ref Line Tab

- *Start Point/End Point* – contains properties of the starting and ending point: the name (can be entered manually or selected from the map or list) and code. Also, the point can be measured by pressing the **Meas** button.

Tape Dimension Points

The *Tape Dim* tab contains the following settings for performing the survey.

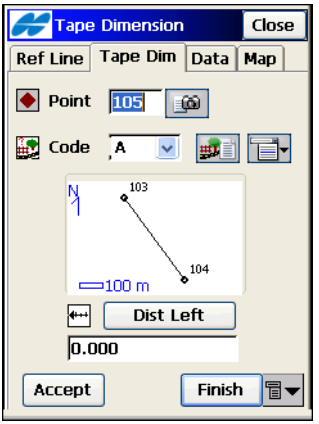


Figure 11-27. Tape Dimension – Tape Dim Tab

- *Point* – the name of the next point in the survey. The *photo note* icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code of the point: either enter manually or select from the drop-down list.
- – the *Attributes List* icon, opens the list of available attributes (see "On the Point Attributes" on page 6-7 for more details).
- The menu icon next to the *Attributes List* icon contains the *String, Layer,* and *Note* items.
- **Dist Left** – toggles between *Dist Left* and *Dist Right* values. These set the direction of the next movement, relative to the previous direction. The field below sets the distance to move.
- **Accept** – applies the taped distance to the perimeter line.
- **Finish** – opens the floating menu of two items:
  - *Close Polygon*: connects the first and the last two points with a line.

– *Calc Closure*: calculates the difference between the last and the first points.

- The icon in the lower-left corner of the screen shows the plot of the already taped perimeter.

The *Data* tab shows the initial data and current results of the measurements.

The *Map* tab displays the plot of the already made measurements.

Missing Line

To start working, select the **Missing Line** icon. The ***Missing Line*** screen displays (Figure 11-28).

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

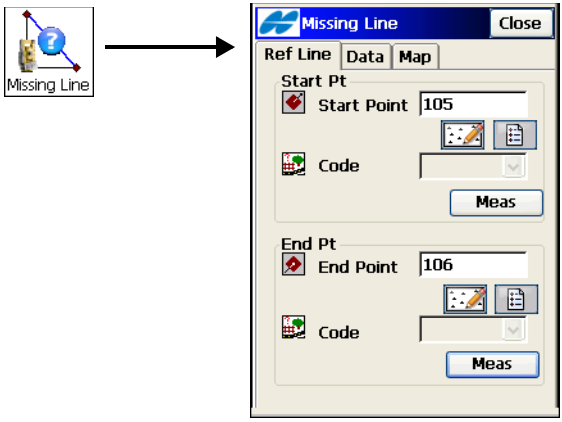


Figure 11-28. Missing Line – Ref Line Tab

- The *Start* and *End Points* can be entered manually, chosen from the map or from the list, or measured through the **Meas** button.

The *Data* tab displays the results of the measurements.

The same results are reflected in the ***Raw Data*** screen.

The *Map* tab shows the relative position of the points and the measured line.

Scanning

This function is activated only with robotic/reflectorless and motorized/reflectorless total stations. Make sure that the *Show Scan Point* option is selected in the Help Icon menu in the upper-left corner of the ***Points*** screen (see “Points” on page 6-2).

To open the ***Scanning*** screen, select the **Scanning** icon in the Robotic mode. On the ***Scanning*** screen (Figure 11-42) select either, *Scan w/o Image* or *Scan with Image* mode.

Scanning with an Image

To scanning with an image, tap **Next** to follow a scan wizard.

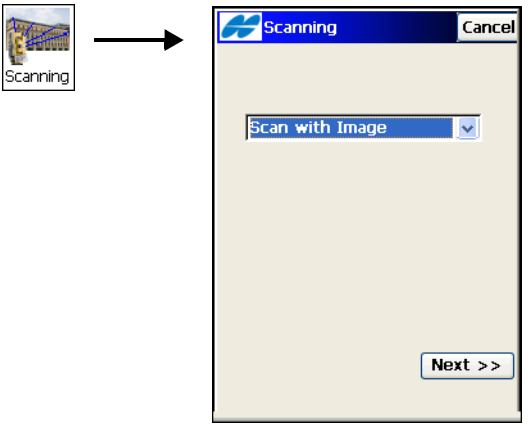


Figure 11-29. Scan with Image

Enter the following parameters on the ***Select Scan*** screen (Figure 11-30 on page 11-33).

- *Session* – sets a name for the session.
- *Image* – sets an Image file. Select a previous Image or browse for a new one (Images are stored as a JPEG file with the *.jpg file extension).
- *Camera* – sets the Camera parameters. If the Image exists in the Job, the Camera data is selected automatically. Otherwise, select

a previous Camera or browse for a new one (Cameras are stored as text files with the *.cmr extension).

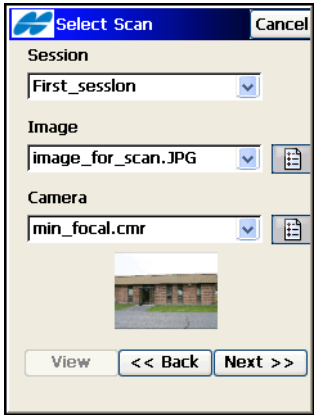


Figure 11-30. Enter Scan Session Information

- **View** – when available, opens the ***View Scan*** screen.
- **Back** – returns to the previous screen.
- **Next** – click to open the ***Orient*** screen (Figure 11-32 on page 11-34) to complete.

View Scan

The ***View Scan*** screen (when available) displays the image, along with orientation and scanned points for completed scan sessions.

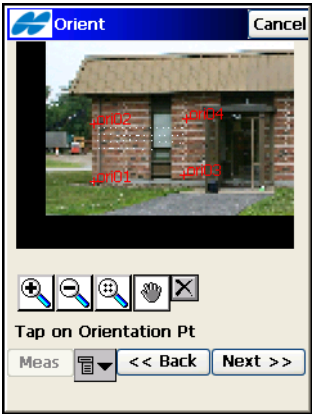


Figure 11-31. View Scan

Orientation

The ***Orient*** screen (Figure 11-32) associates a position on the image (*x*,*y*) with known NEZ coordinates.

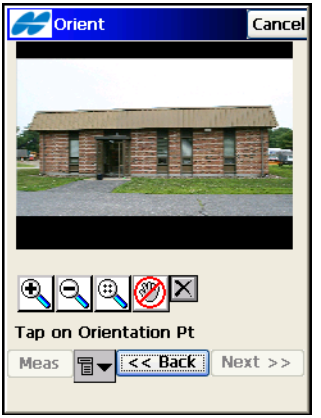


Figure 11-32. Orientation

- – zooms in the image
- – zooms out the image
- – displays the whole image

- / – enables/disables a pan drag control of the image. When the **Pan** button is disabled, tap on the image to choose the orientation point. The image zooms to this point and displays a crosshair. The position of the crosshair can be adjusted (Figure 11-33)

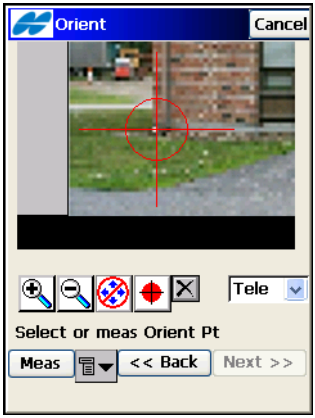


Figure 11-33. Select Orientation Point

- / – switches on/off the arrow keys on the keypad to adjust the crosshair position. When the **Arrow** button is enabled, the arrow keys on the keypad can move the crosshair up, down, left, or right.
- – attempts 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.
- The drop-down list in the bottom-left corner of the screen (next to the **Meas** button) contains two options to view the image (Figure 11-34 on page 11-36):
  - *Tele* (telescope): the default zoomed-in view of the crosshair.
  - *Wide View*: zooms out and shows the area of the image which contains the orientation point.

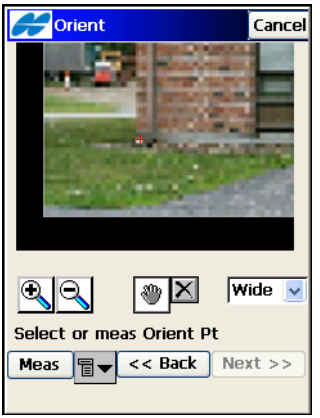


Figure 11-34. Select Orientation Point – Wide View

- **Meas** – measures the orientation point. The bitmap menu options (*Meas*, *From Map*, *From List*) are used to take a measurement or to select an existing point from a map or list (Figure 11-35).

- [X] – opens the ***Orientation Res*** screen(Figure 11-35 on page 11-36) to delete the selected orientation points.

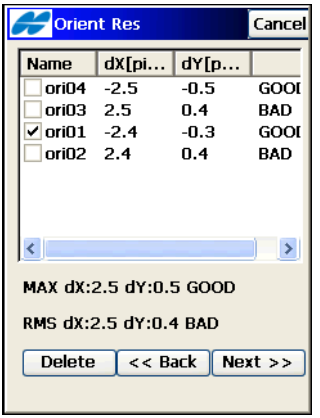


Figure 11-35. Delete Orientation Points

- **Next** – when four or more orientation points have been established, click to display the orientation results (Figure 11-37 on page 11-37).

Figure 11-36. Calculate Image Orientation

Orientation Results

The ***Orientation Results*** screen displays the results of the image orientation (Figure 11-37). The results for each orientation point is displayed as *dX* and *dY* in image pixels.

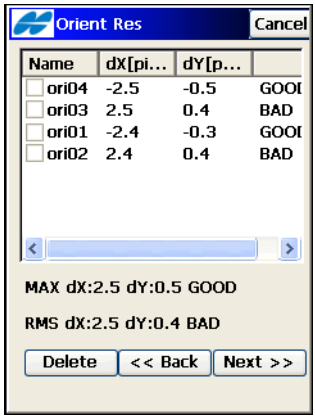


Figure 11-37. Orientation Results

- **Delete** – removes the selected point to adjust the orientation calculation. If four points still remain, the new results are displayed. If less than four orientation points display, the *Orientation Results* screen closes automatically to continue the orientation procedure.

- **Back** – continues to the ***Scan*** screen (Figure 11-38) to select areas for scanning.

Selecting Scan Area

Use one of the following methods to select one or more areas for scanning:

Select Area Method 1. Draw a rectangle by pressing 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 11-38).

Select Area Method 2. Draw a polygon by pressing the stylus down at each vertex. Lines will be drawn connecting each vertex to the previous one. Press the stylus near the first vertex to close the area.

Figure 11-38. Select Scan Area

- **Next** – press to begin the scan when the areas are set; the ***Interval*** screen (Figure 11-39 on page 11-39) opens first to set the scanning settings.
- **Clear** – erases all drawn areas.
- **Settings** – opens the ***Mode*** screen (for a description of parameters on this screen, see "Survey Parameters" on page 3-62). This is the same screen that opens if you press the **Settings** button in the ***Observation and Occ/BS Setup*** screens. The main objective is to set the instrument to "Non-Prism" mode, which is required for

scanning and also, to change the measurement mode (*Fine*, or *Coarse*).

Interval

The ***Interval*** screen (Figure 11-39) sets the starting point and the horizontal and vertical intervals for scanning.

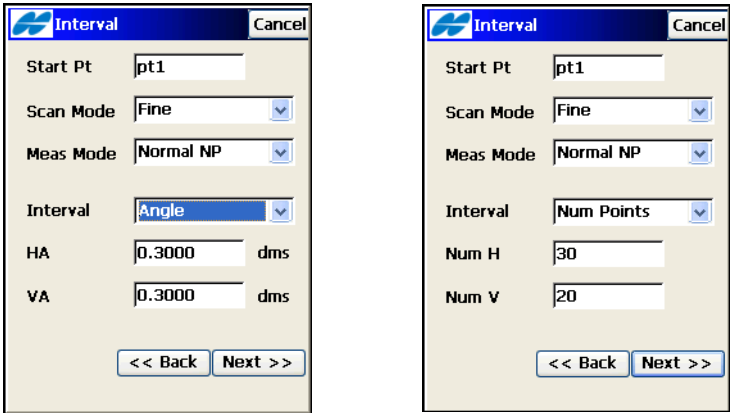


Figure 11-39. Scanning Interval

- *Start Pt* – enter a name for starting point the scanned points.
- *Scan Mode* – select the scanning mode: either *Fine* or *Coarse*.
- *Meas Mode* – select the measuring mode:
  - *Normal NP*: normal Non-Prism measurements.
  - *Long NP*: long distance Non-Prism measurements (200-300 meters away); only available for GPT-8200 and GPT-7000 Total Stations.
  - *Normal/Long NP*: attempts to take a normal NP measurement. If unsuccessful, the instrument automatically switches to long NP mode for the measurement; only available for GPT-8200 and GPT-7000 Total Stations.
- *Interval* – select the scanning intervals either as *Angle values* or *Numbers of points*.
- *HA/Num H* – enter the interval in the horizontal direction.

- *VA/Num V* – enter the interval in the vertical direction.
- **Next** – saves the settings and opens the ***Estimate Time*** screen (Figure 11-40).

Time Estimate

Before scanning begins, the ***Estimate Time*** screen (Figure 11-40) displays the scanning information, including the total number of points to be scanned and an estimate of the time it takes to complete the scan. If the estimated time is too long, click **Cancel** and enter larger intervals.

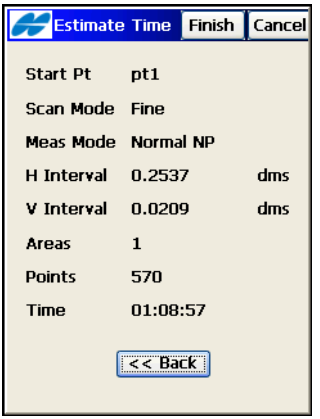


Figure 11-40. Estimate Time

- **Stop** – immediately stops the scan.
- **Finish** – begins scanning points.

As the total station measures points within a predefined area, each point displays on the image.

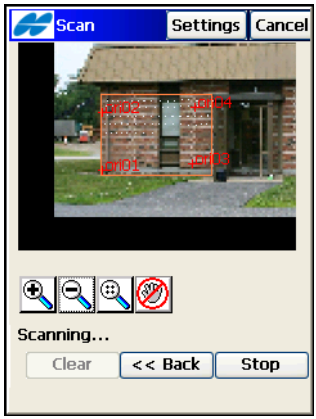


Figure 11-41. Scanning in Progress

Scanning without an Image

To start working, select the *Scanning* icon. The ***Scanning*** screen displays.

To scanning without an image, select the type of scan orientation; either *Vertical*, *Horizontal*, or *Incline* (Figure 11-42).

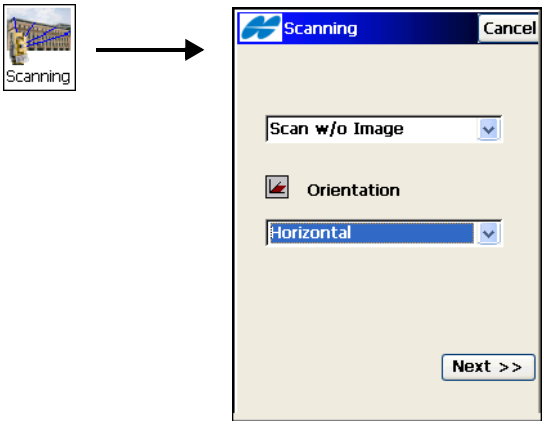


Figure 11-42. Scan without Image

- **Next** – opens the ***Area*** screen (Figure 11-43 on page 11-42).

Area

The ***Area*** screen (Figure 11-43) selects the starting and ending points for the scanning area.

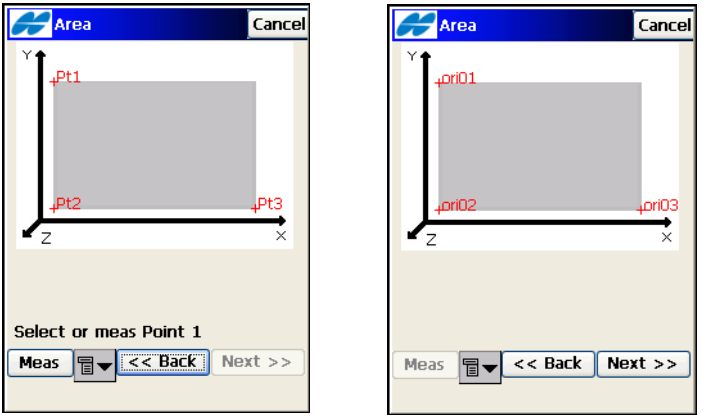


Figure 11-43. Select Area

- **Meas** – measures the orientation point. The menu icon opens the menu options (*Meas*, *From Map*, *From List*) used to take a measurement or to select an existing point from a map or list.
- **Next** – displays the same ***Interval*** and ***Estimate Time*** screens as for Scanning with Image mode (Figure 11-44).

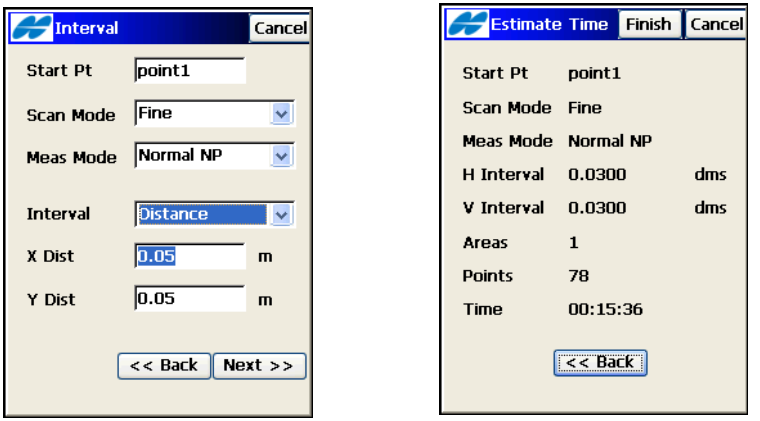


Figure 11-44. Interval and Estimate Time

Scan

Press the **Finish** button on the ***Estimate Time*** screen (Figure 11-44 on page 11-42) to start scanning (Figure 11-45).

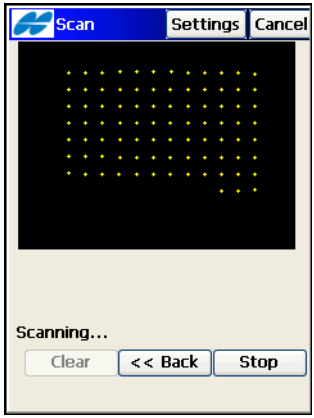


Figure 11-45. Scanning in Progress

As the total station measures points within the predefined area, each point displays on the screen.

- **Stop** – immediately stops the scan and returns to the ***Area*** screen.

After scanning is completed, the screen returns to the Area screen to set a new area for scanning. The *points* icon denotes the scanned points in the list of points (Figure 11-46 on page 11-44).

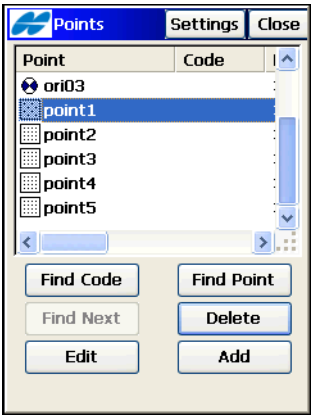


Figure 11-46. Scanned Points

Monitor

This function is activated only with robotic total stations. To enable the monitor survey, select the **Monitor** icon in the Robotic mode. The ***MonitorPoint List*** screen displays (Figure 11-47 on page 11-45).

Monitor PointList

The points to be measured are added to a point list which is then loaded using the ***Monitor Pointlist*** screen (Figure 11-47 on page 11-45) displays.

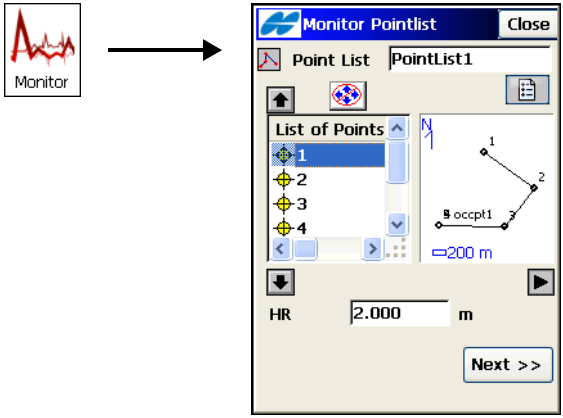


Figure 11-47. Monitor Point List

After the point list is selected, the **Next** button opens the ***Monitor*** 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.

Optionally, the raw measurements or the computed points can be output to a file or communication port in either an FC-6 or GTS-7 format. The output format and destination is accessed from the ***Monitor Options*** screen when configuring the total station (see “Monitor Options” on page 3-55).

The ***Monitor*** screen is used to control the monitor survey (Figure 11-48).

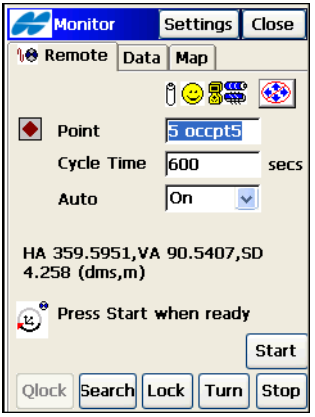


Figure 11-48. Monitor

- *Points* – the point name.
- *Interval* – interval listed as the Cycle Time. If a prism cannot be found after a period of 15 seconds, the total station rotates to the next point in the sequence.
- *Auto* – If the Auto combo box 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 always completes the entire sequence, even if the measurements take longer than cycle time.
- **Start** – initiates the sequence of measurements, which repeats at the interval you want.
- **Qlock** – sends the "Quicklock" or "Turn Around" command, which causes the total station to search for the RC-2[1].
- **Search** – causes the instrument to search for the prism.

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.

- **Lock** – lock onto the prism or “track” it.
- **Turn** – opens the ***Rotate*** screen, which allows the Total station to turn to various angles or points.
- **Start/Stop** – makes the total station start or stop tracking the prism and go into “Standby” mode.

The Data Indicator above the **Qlock** button shows the current state of the robotic total station with one of the following icons listed below:

 – no data

 – turning

 – querying status

 – receiving data

The *Data* tab lists the differences between the coordinates of the reference point and the measured point.

The *Map* tab shows all points in graphic mode. For details, on map properties and customizing. See “Viewing Map” on page 15-1.

Notes:

Digital Level Survey

The Survey menu (Figure 12-1) for Level survey opens by the **Survey** icon in the main menu and allows to perform:

- Level Run
- Two Peg Test

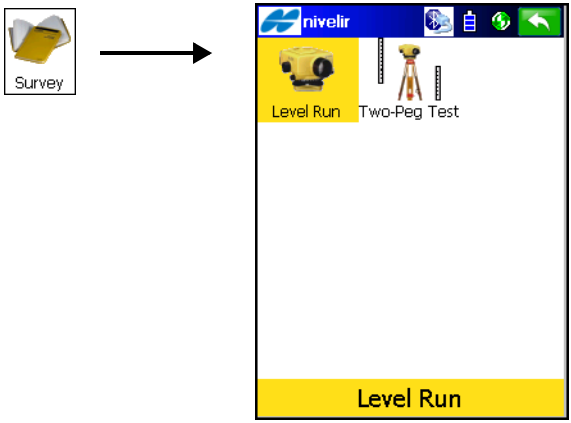


Figure 12-1. Level Survey Menu

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see “Help Icon’s Pop-up Menu” on page 1-8).

Level Run

To set up a Level survey in running mode, tap the **Level Run** icon.

The ***Level Run*** screen (Figure 12-2) creates a new level run.

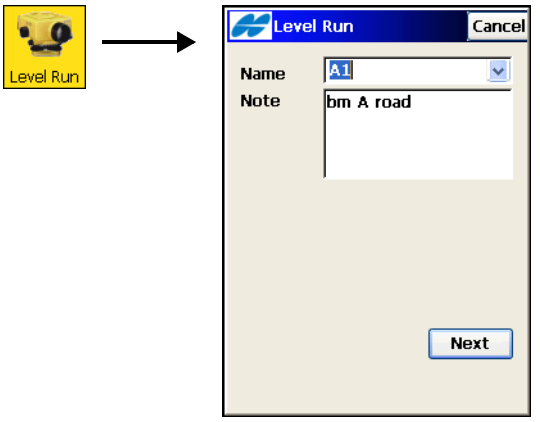


Figure 12-2. New Level Run

- *Name* – sets a name for the new level run.
- *Note* – adds optional information on the level run.
- **Next –** opens the screen to make leveling measurements (see Figure 12-3 on page 12-3).

DL Level Run

The *DL* tab on the ***Level Run <run name>*** screen (Figure 12-3) displays all leveling data in progress and contains tools to conduct leveling.

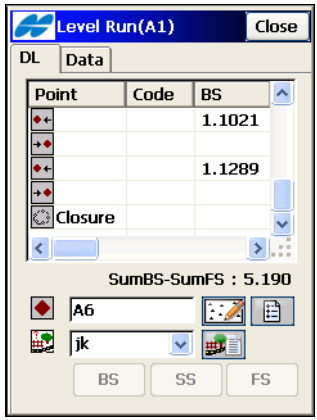


Figure 12-3. DL Level Run

- – sets the point for rod reading; select from either the map or the list of points.
- – sets the code for the measured point. The icon next to the field opens the ***Code-Attributes*** screen to set a new code. For details, see "On the Point Attributes" on page 6-7.
- **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.
- The fieldbook displays the following information:
  - *Pt Name*: point name and icon displaying point type. Icons can be:

    – backsight point

    – foresight point

    – sideshot point

    – closure

– *Code*: the code of the point.

– *BS*: a rod reading taken on the backsight point.

– *HI*: the height of the leveled instrument; the elevation of the line of sight of the telescope above the datum.

– *FS*: a rod reading taken on the foresight point.

– *Elev:* elevation of the point.

– *BS Dist*: the horizontal distance from the level to the rod on a backsight point.

– *FS Dist*: the horizontal distance from the level to the rod on a foresight point.

– *Sum BS Dist*: the sum of backsight distances.

– *Sum FS Dist*: the sum of foresight distances.

– *SumBS-SumFS*: the difference between the sums of BS and FS measurements.

– *Accumulated Ht*: the difference between the sum of the backsights and the sum of the foresights.

– *Notes*: any additional information on the point.

All columns except PT Name can be selected to display (see “Display Settings” on page 12-6).

- The Help Icon in the upper-left corner of the screen displays a pop-up menu containing eight items:

  – *Stake Point*: opens the ***Stake Point*** screen to stake out a point.

  – *Stake Point List*: opens the ***Stake Point List*** screen to stake out points from the list (see “DL Stakeout” on page 13-12).

  – *Stake Elev*: opens the ***Stake Elev*** screen to stake out at a rod point (see “DL Stakeout of Elevations” on page 13-42).

  – *Vertical Offset:* opens the ***Vertical Offset*** screen to set the vertical offset to apply at the point.

– *Display Settings:* opens the ***Settings*** screen to select the columns and the order of the columns to display.

– *Show SumBS-SumFS:* displays SumBS-SumFS measurement.

– *Inverse*: opens the ***Two-Point Inverse*** COGO screen (see "Inverse" on page 14-3).

– *Help*: accesses the Help files.

The *Data* tab on the ***Level Run <run name>*** screen (Figure 12-4) displays information related to the current measurement.

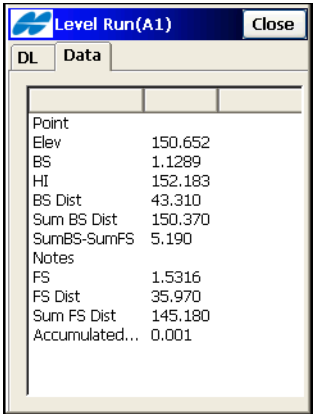


Figure 12-4. Level Run - Data

Display Settings

The ***Settings*** screen (Figure 12-5) selects the columns to display. The Up/Down arrows are used to change the order of the selected column.

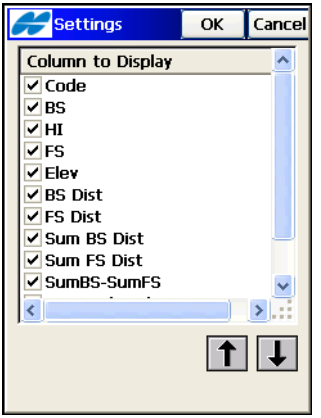


Figure 12-5. Display Settings

Two Peg Test

The Two Peg Test is performed to check if the line of sight of the level telescope is horizontal when the instrument is leveled.

To perform the Two Peg Test, tap the **Two Peg Test** icon .

The ***Two Peg Test*** screen (Figure 12-6 on page 12-7) guides you through a series of measurements to help determine any errors. First, it prompts you to take shots to the first point, assuming the level is fairly centered between the two points. Then the instrument should be moved to one of the pegs and the shots are taken again to Pegs 1 and 2.

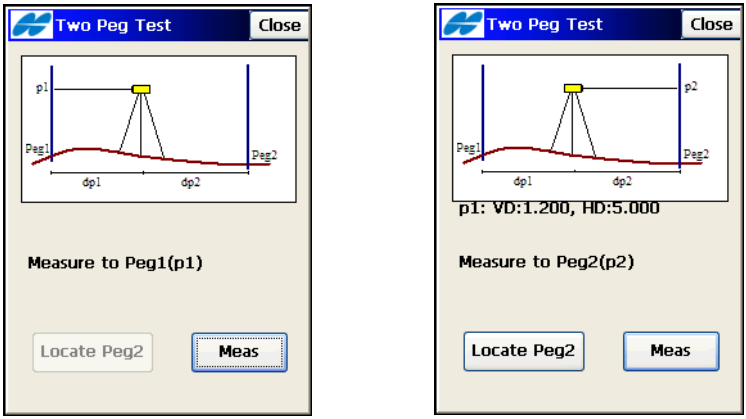


Figure 12-6. Two Peg Test

- **Locate Peg2 –** measures the horizontal distance to Peg2 and compares it with the Peg1 measurement previously taken. This measurement is not used in the error computations.
- **Meas** – takes measurements for the displayed prompted Peg. The results display on the ***Two Peg Test Results*** screen (Figure 12-7 on page 12-8).

Two Peg Test Results

The ***Two Peg Test Results*** screen (Figure 12-7) displays the results of the test after all measurements are taken.

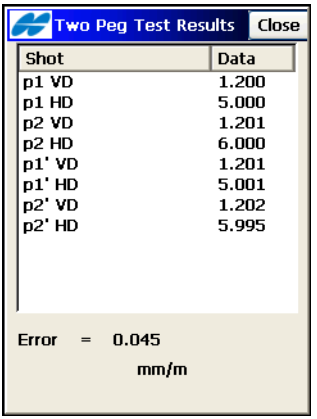


Figure 12-7. Two Peg Test Results

- The table displays all the shots taken.
- *Error* – 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.

Staking Out

To stake out points, tap the **Stake** icon in the main menu.

The Stake function is used to stake out Points, Lines, Offsets, DTM, Point in Direction, Point List, Curve, Road, Real Time Road, and Slope (Figure 13-1).

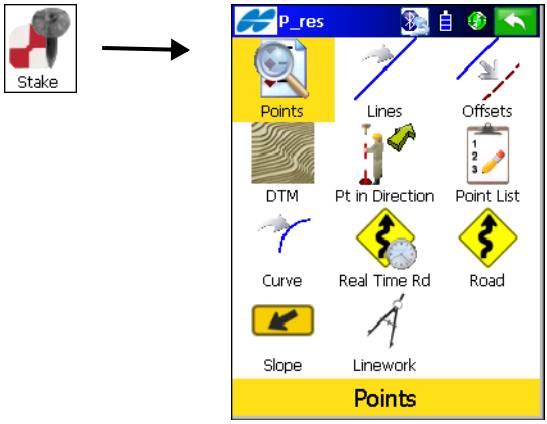
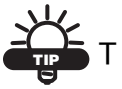


Figure 13-1. Stake Menu



If you need menu options that are not visible, tap **Configure/Menus** icons and enable these options in the ***Config Menus*** screen.

For stake out with digital levels, the menu options include Points, Point List and Elevation.

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for details see “Help Icon’s Pop-up Menu” on page 1-8).

Points

To stakeout a point, tap the **Points** icon. The ***Stakeout Pt*** screen (Figure 13-2) displays.

Stakeout Point

The ***Stakeout Point*** screen (Figure 13-2) contains initial data for the stakeout point.

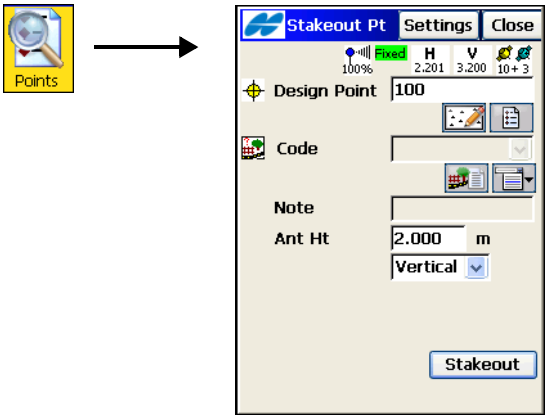


Figure 13-2. Stakeout Point

- *Design Point* – sets the identifier of the design point: enter either manual or select from the map or from the list.
- *Antenna Ht* (for GPS mode) – sets the height of the antenna reference point (ARP) above the mark and specifies the measurement type for the height, either *slant* or *vertical*.
- *HR* (for TS mode) – the height of the rod (target).
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).
- **Stakeout** – opens the ***Stakeout*** screen.

For GPS stakeouts, the Help Icon in the upper-left corner of the screen displays a pop-up menu with the following options:

- *Status* – opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).

- *Rover Antenna Setup* – opens the ***Antenna Setup*** screen to set the antenna for the current survey.
- *Config Radio* – opens the ***Configure Radio*** screen (see "Configure Radio" on page 8-26).
- *Edit Points* – opens the ***Points*** screen (see "Points" on page 13-2).
- *PTL Mode* – switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to ***Stakeout Point (PTL)***.) For details, see "PTL Mode" on page 11-6.
- *Inverse* – opens the *Two-Point Inverse* ***COGO*** task screen. For details see "Inverse" on page 14-3.
- *Help*: accesses the Help files.

For Total Station stakeouts, the Help Icon in the upper-left corner of stakeout screen displays a pop-up menu with the following options:

- *BS Setup* – opens the ***BS Setup*** screen (see "Backsight Survey" on page 10-2).
- *Config Link* (for Robotic mode only) – opens the ***Configure Link*** screen (see "Configure Link" on page 13-7).
- *Remote Control* (for Robotic mode only) – opens the ***Remote Control*** screen (see "Remote Control" on page 10-18).
- *Edit Points* – opens the ***Points*** screen (see "Points" on page 6-2).
- *PTL Mode* – switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to ***Stakeout Point (PTL)***.) For details, see "PTL Mode" on page 11-6.
- *Inverse* – opens the *Two-Point Inverse* ***COGO*** task screen. For details see "Inverse" on page 14-3.
- *Help* – accesses the Help files.

GPS+ Stakeout

The ***Stakeout*** screen (Figure 13-3) assists in the stakeout process.

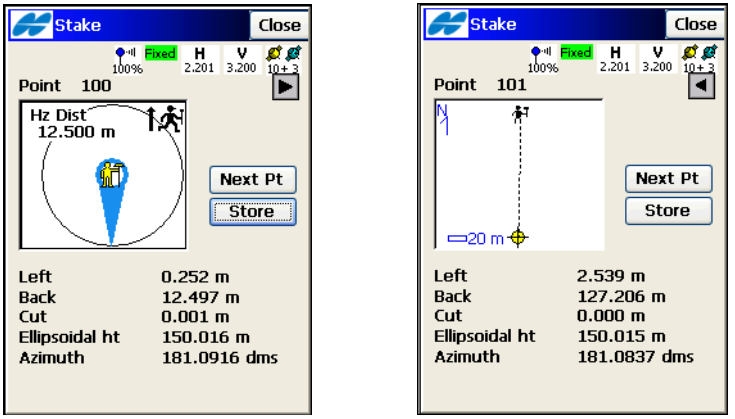


Figure 13-3. Stakeout

The graphic shows the north direction, the reference direction, and the target point, if the distance to the target is less than the horizontal distance tolerance. If the distance is greater than three meters, the arrow points to the target, showing the direction of movement. When the target is closer than the *Horizon Distance Tolerance* value, the graphic shows a bull's-eye target point on the screen. The panel on the right displays the parameters of the target.

- ▶ – opens the map of the layout of the target and current position.
- **Store** – saves the location. Check the parameters of the stored point in the ***Store Point Information*** screen (see Figure 13-8 on page 13-9).
- **Next Pt** – moves to the next point in the list.
- **Close** – closes the screen and returns to the ***Stakeout Point*** screen.
- The Help Icon in the upper-left corner of the screen displays a pop-up menu with the following options:
  - *Status*: opens the ***Status*** screen (see "GPS+ Survey Status" on page 8-12).

– *Rover Antenna Setup*: opens the ***Antenna Setup*** screen to set the antenna for the current survey.

– *Config Radio*: opens the ***Configure Radio*** screen (see "Configure Radio" on page 8-26).

– *mmGPS+ Options*: if mmGPS is used, opens the ***mmGPS+ Options*** screen (see "mmGPS+ Options" on page 8-32).

– *Auto Advance Sta*: if check marked (enabled), after storing a staked point, automatically opens the ***Stakeout*** screen for the next point.

– *Design Offsets*: opens the ***Design Elevation*** screen, allowing you to change the design point elevation height, road offsets, and DTM offsets (identical to "Design Offsets" on page 13-8).

– *Store Design Pt/Layer*: opens the ***Design Pt/Layer*** screen to select options to store the points (see "Store Design Pt/Layer" on page 13-7).

– *Display Coords*: select this option to display coordinates, instead of directions.

– *Edit Points*: opens the ***Points*** screen (see "Points" on page 6-2).

– *Inverse*: opens the *Two-Point Inverse* ***COGO*** task screen. For details, see "Inverse" on page 14-3.

– *Help*: accesses the Help files.

TS Stakeout

The ***Stakeout*** screen reflects the status of the stakeout. On the ***Stake*** out screen (Figure 13-4 on page 13-6), shows the current point name (in the upper-left corner of the screen), the layout of the target, and the current position, the direction, and the values of the distances to the target display.

- ▶ – opens the map of the target layout and the current position.
- **EDM** – select the distance measurement mode; either *Coarse*, *Fine*, or *Coarse Tracking*.

- **Next Pt** – switches to the next target.

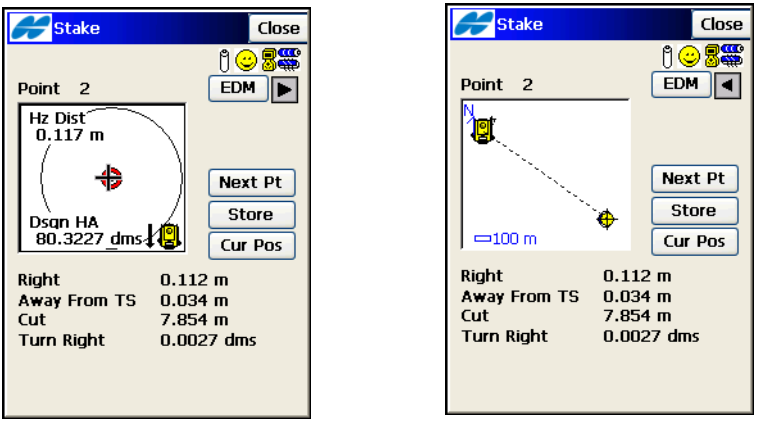


Figure 13-4. Stakeout Map

- **Store** – opens the ***Store Point Info*** screen to store the current position as a point (see "Store Point" on page 13-9).
- **Cur Pos** – causes a measurement to be made and displays the result on screen.
- **Search** – for robotic Total Stations, starts autotracking and instructs the TS to search for the prism. This function is useful for setting the stake and measuring the final position.
- **Stop** – for robotic Total Stations, stops autotracking. This function is useful for moving the pole to set the stake in the ground.
- **Close** – closes the screen.
- The Help Icon in the upper-left corner of the screen displays a pop-up menu with the following options:
  - *Rod Height*: opens the ***Enter Rod Height*** screen to change the rod height during stakeout.
  - *Remote Control* (for Robotic mode only): opens the ***Remote Control*** screen (see "Remote Control" on page 10-18).
  - *Config Link* (for Robotic mode only): opens the ***Configure Link*** screen.

  For the other options, see the GPS stakeout.

Configure Link

The ***Configure Radio*** screen (Figure 13-5) displays parameters for the radio modem.

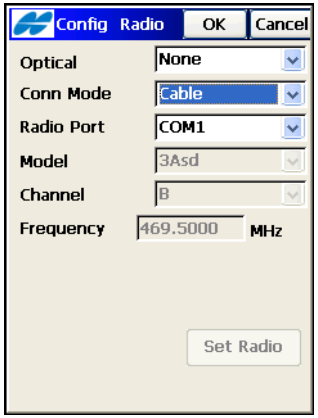


Figure 13-5. Configure Link

- *Conn Mode* – select the connection mode, either *Cable* or *Radios Only.*
- *Type* – shows the current modem type set for the current survey configuration. To change the modem, from the Survey menu, tap the **Configure** icon in the main menu.
- *Radio Port, Model, Channel, Frequency* – parameters for the radio connection.

Store Design Pt/Layer

The ***Store Des Pt*** screen (Figure 13-6 on page 13-8) selects parameters for storing staked points.

- *Display Store Pt Info* – check mark this box to display the ***Store Point*** screen before storing a staked point.
- *Layer* – selects a layer from the drop-down list.
- ... – opens the ***Layers*** screen to edit layers (see "Edit Layers" on page 6-23).

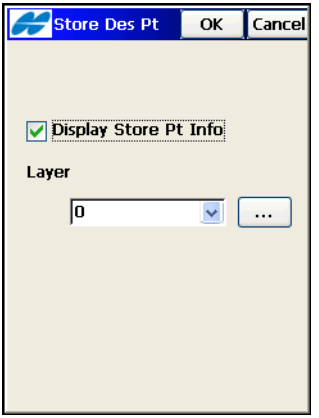


Figure 13-6. Design Pt/Layer

Design Offsets

The ***Design Elev*** screen (Figure 13-7) sets an offset to add to the elevation of the point when staking points, roads, or DTM's.

Figure 13-7. Design Elevation

Initially, the point height is shown. To set the elevation offset, check mark the appropriate box and enter the offset you want. Click **OK** to save the setting.

Store Point

The ***Store Pt Info*** screen (Figure 13-8) displays stakeout results before the point is stored.

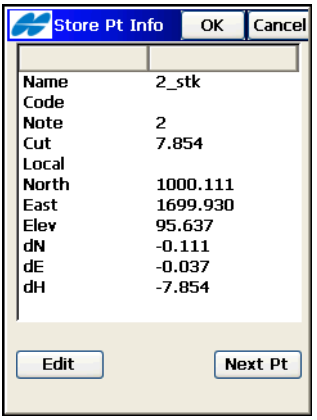


Figure 13-8. Store Point Information

- **Edit** – opens the ***Store Point*** screen (Figure 13-9) to edit point properties.
- **Next Pt** – selects the next point to stake.

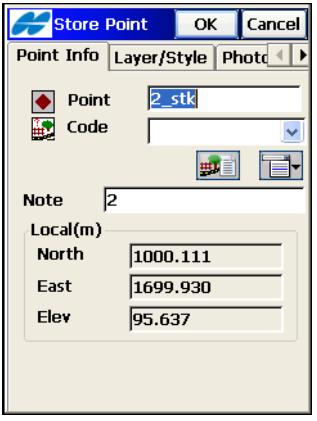


Figure 13-9. Staked Point Information

The *Point Info* tab (Figure 13-9 on page 13-9) on the ***Store Point*** screen contains the following fields:

- *Point* – sets the name of the point.
- *Code* – sets the code for the point: either enter manually or select a code from the drop-down list.
-  – the *Attributes List* icon opens the ***Code-Attributes*** screen to set the values for the attributes available for the code chosen (see "On the Select Layer" on page 6-10).
- *Note* – the name of the previous point.
- *Cut/Fill* – shows cut/fill information for the point if displayed before the point is stored.
- The *menu*  icon next to the *Attributes List* icon opens the following options:
  - *String*: toggles on the *String* field. Also, the  sign appears. For details, see "The Topo Menu" on page 9-3.
  - *Layer*: opens the ***Select Layer*** screen to place the point. For details, see "The Topo Menu" on page 9-3.
  - *Note*: opens the ***Note*** screen. For details, see "The Topo Menu" on page 9-3.

The *Layer/Style* tab (Figure 13-10 on page 13-11) on the ***Store Point*** screen contains the following fields:

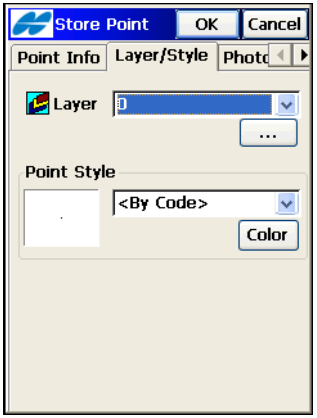


Figure 13-10. Store Point – Layer/Style Tab

- *Layer* – select the layer to locate the point.
- *Point Style* – select a point style from the drop-down list. The field to the left shows the symbol for the selected point.
- **Color** – opens the ***Select Color*** screen.

The *Photo Note* tab on the ***Store Point*** screen (Figure 13-11) adds a photo note to the stakeout point. Initially the screen is empty.

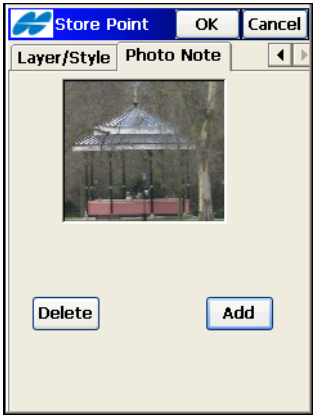


Figure 13-11. Store Point – Photo Note

- **Delete** – erases the image from the screen.

- **Add** – opens the **Select Image File** screen to browse for the necessary file in the controller.

DL Stakeout

The DL Stakeout of design points can be accessed from the main menu or the top-left menu on the ***Level Run*** screen (for details, see “Level Run” on page 12-2).

Stake Point

The ***Stake*** screen (Figure 13-12) selects a design point to determine the elevation and to compute a cut/fill value.

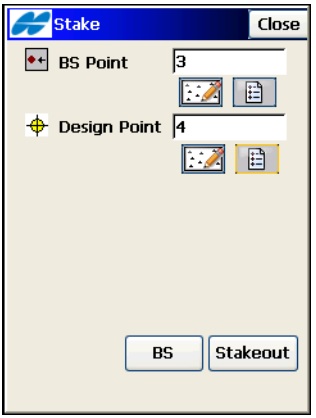


Figure 13-12. DL Stake Point

- *Design Point* – selects the point to stake (either enter manually or select from the map or list).
- *BS Point* – selects the backsight point for the stake measurement (entered manually or selected from the map or list).
- **BS** – if not already measured, takes a BS measurement before staking.
- **Stakeout** – opens the level ***Stakeout*** screen (Figure 13-13 on page 13-13).

Stakeout

The level ***Stakeout*** screen (Figure 13-13) displays the design point and the BS point. For every measurement taken, *Elevation* and *Cut/Fill* values are updated.

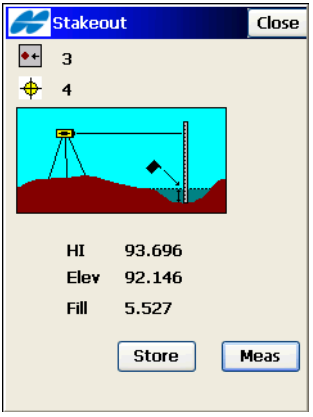


Figure 13-13. DL Stakeout

- **Store** – opens the ***Code-Attributes*** screen to set a code for the staked out point (see "On the Point Attributes" on page 6-7), and then opens the ***Edit Point*** screen (see "Editing a Point" on page 6-6).
- **Meas** – measures the elevation and computes a cut/fill value.

Staked out points are not added to the Level Run; instead they are listed as observed points on the ***Points*** screen (Figure 13-14 on page 13-14).

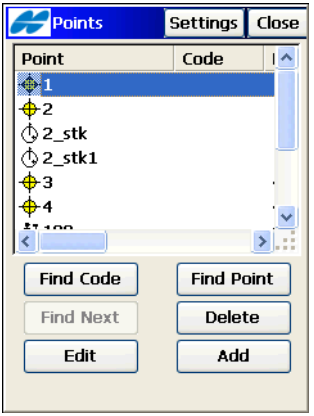


Figure 13-14. Points – Staked Out

Lines

To stakeout a line, select the **Lines** icon. The ***Line*** screen (Figure 13-15) contains the initial data for the line stakeout.

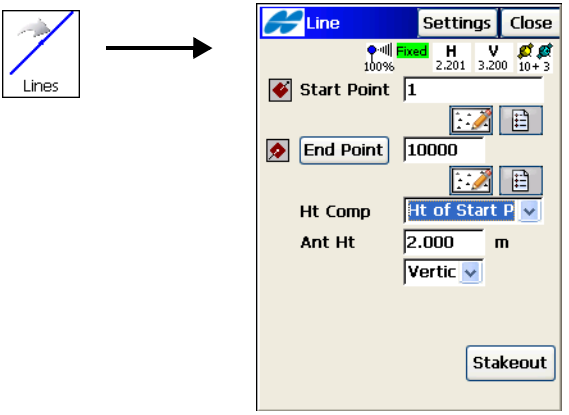


Figure 13-15. Stakeout Line

- *Start Point* – sets the starting point of the reference line.
- **End Point/Azimuth** – sets the direction of the reference line through another point or azimuth.
- *Ht Comp* – the type of height computations for the stakeout point.

  - *Ht of Start Pt* (height of starting point): the stakeout point has the same height as the starting point of the line.
  - *Interpolate Ht*: the height of the stakeout point will be computed through linear interpolation, using the height of the starting and ending points of the line.
- *Antenna Ht* (for GPS mode) – sets the height of the antenna reference point (ARP) above the mark. Also, specifies the measurement type for the height: either *slant* or *vertical*.
- *HR* (for TS mode) – the height of the rod (target).
- **Stakeout** – opens the second ***Stakeout Line*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen. For details, see "Stakeout Point" on page 13-2.

GPS+ Stakeout

The ***Stakeout Line*** screen (Figure 13-16) displays the north direction, the reference direction, the movement direction, and the target line. The panel on the right displays the parameters of the target.

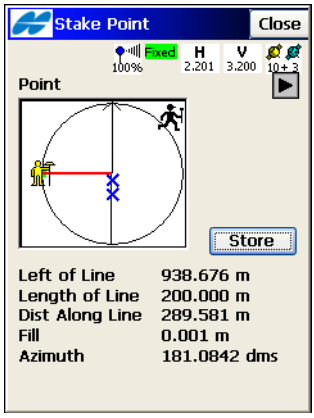


Figure 13-16. Stakeout Line

- **Store** – saves the location. Check the parameters of the stored point on the ***Add/Edit point*** screen.
- ▶ – opens the map of the target layout and the current position.

- **Close** – closes the screen and returns to the ***Stakeout Line*** screen.

For details on the Help Icon in the upper-left corner of the screen, see “Points” on page 13-2.

TS Stakeout

The ***Stake Point*** screen (Figure 13-17) displays the stakeout process, displaying the current point name (in the upper-left corner of the screen), the layout of the target and the current position, the direction, and the values of the distances to the target.

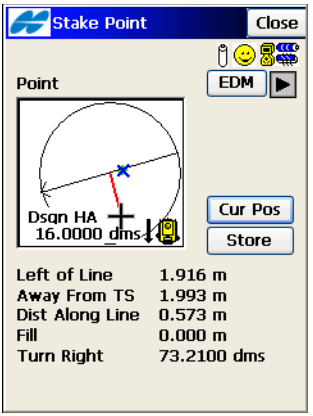


Figure 13-17. Stake Point

- ▶ – toggles between the scheme and the map of the target layout and the current position.
- **EDM** – selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Store** – takes a measurement and opens the ***Store Point*** screen to store the current position as a point (see “Store Point” on page 13-9).
- **Close** – returns to the ***Line*** screen (Figure 13-15 on page 13-14).

For details on the Help Icon in the upper-left corner of the screen, see “Points” on page 13-2.

Offsets

To stake Line, Intersection, Curve, 3 Pt Curves, or Spiral with Offsets, tap the **Offsets** icon.

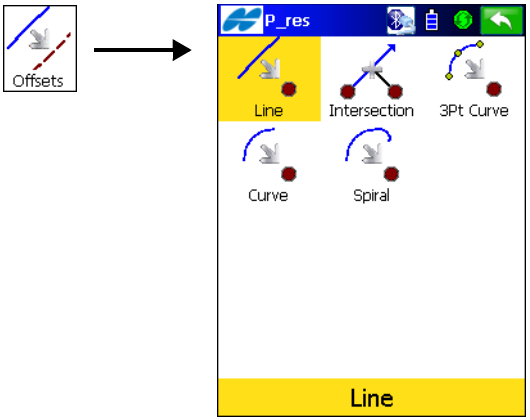


Figure 13-18. Offsets Menu

Line & Offsets

To stakeout lines and offsets, tap the **Line** icon. The ***Line&Ofs***t screen displays.

The ***Line & Offset*** screen (Figure 13-19 on page 13-18) performs a stakeout of a line with offsets in the Horizontal and Vertical directions.

- *Start Point* – the starting point of the line. The line is defined by the azimuth, the azimuth to another point, or the the *End Point* of the line.
- **End Point/Azimuth** – the direction of the line set through either the azimuth of the line or the ending point of the line.
- *Ht Comp* – the type of height computations for the stakeout point.
  - *Ht of Start Pt* (height of starting point): the stakeout point has the same height as the starting point of the line.

– *Interpolate Ht*: the height of the stakeout point will be computed through linear interpolation using the height of the starting and ending points of the line

- *Num Subs* – designates the number of subdivisions you want to subdivide the line. For instance, a value of 3 indicates the stakeout of four points by subdividing the line into three equal segments.
- *Start Sta* – the starting station (chainage) of the line.
- **Next** – opens the ***Sta&Ofst*** screen (Figure 13-20 on page 13-19) (see "Station & Offsets" on page 13-19).
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

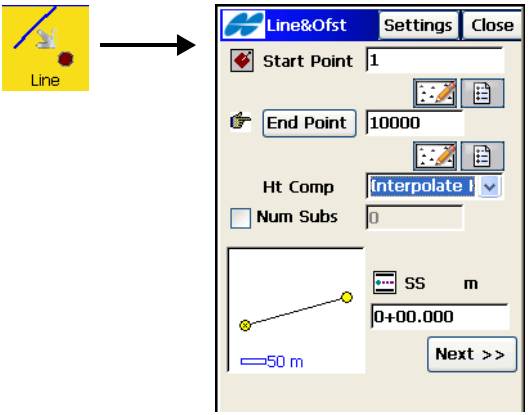


Figure 13-19. Stakeout Line & Offset

For details on the Help Icon in the upper-left corner of the screen, see "Points" on page 13-2.

Station & Offsets

The ***Sta&Ofst*** screen (Figure 13-20) contains the settings for the stakeout stations with offsets from the line.

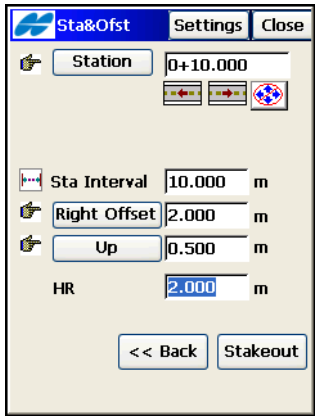


Figure 13-20. Stakeout

- *Station* – the station along the line being staked. The two arrows to the right decrease or increase the station by the interval specified in the *Sta Interval* shown in the next line.
-  –left/right arrows decreases/increases the distance by the station staking interval.
-  – uses the right/left arrow keys of the keyboard to increase or decrease the station.
- *Sta Interval* – the station staking interval.
- **Right Offset/Left Offset** – the right or left offset of the stakeout point, with respect to the line at the station shown in the *Station* field.
- **Up/Down** – the *Up* or *Down Height* offset, with respect to the height of the line at the station.
- *Antenna Ht* (for GPS mode) – sets the height of the antenna reference point (ARP) above the mark. Also, select either slant or vertical as the measurement type for the height.
- *HR* (for TS mode) – the height of the rod (target).

- **Back** – returns to the previous screen.
- **Stakeout** – starts stakeout process.

GPS+ Stakeout

The ***Stake*** screen (Figure 13-21) shows the north direction, and the relative position of the antenna and the target. The panel on the right displays the parameters of the target.

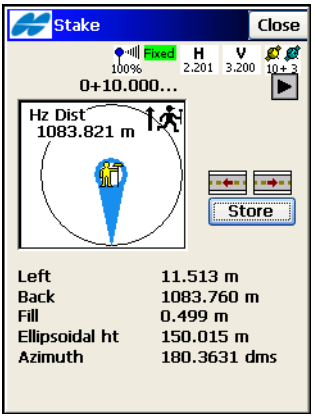


Figure 13-21. Stakeout

- **NextSta** – advances the station by the specified Station Interval for staking out points at the Next station.
- **Store** – saves the location. Check the parameters of the stored point in the ***Add/Edit point*** screen.
- **Close** – closes the screen and returns to the ***Stakeout Line*** screen.
- The Help Icon in the upper-left corner of the screen displays a pop-up menu of options. For details, see “Points” on page 13-2. In addition, the *Initial Point Name* option is available to name the first staked point (see “Initial Point Name” on page 13-21).

Initial Point Name

The ***Init Pt Name*** screen (Figure 13-22) specifies the starting name for the points calculated for the stakeout task.

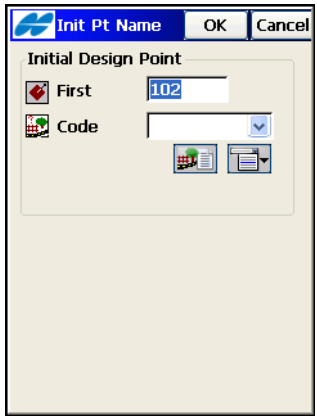


Figure 13-22. Calc Point Names

- *First* – the name of the first point.
- *Code* – the code of the points; either select from the list or enter manually.
-  – accesses the attributes of the chosen code, opens the ***Code-Attributes*** screen (see "On the Point Attributes" on page 6-7).
- The menu  icon next to the *Attributes List* icon displays the pop-up menu containing three items:
  - *String*: toggles on the *String* field. Also, the  sign appears. For details, see "The Topo Menu" on page 9-3.
  - *Layer*: opens the ***Select Layer*** screen to put the point. For details, see "The Topo Menu" on page 9-3.
  - *Note*: opens the ***Notes*** screen. For details, see "The Topo Menu" on page 9-3.
- **OK** – saves the changes and opens the ***Stakeout*** screen (Figure 13-21).

TS Stakeout

The ***Stakeout*** screen (Figure 13-23) reflects the progress of the stakeout, displaying the current station (in the upper-left corner of the screen), the layout of the target, and the current position, the necessary direction, and the values of the distances to the target.

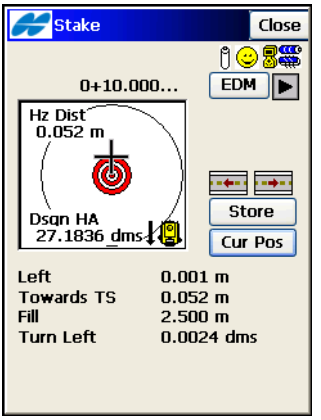


Figure 13-23. Stakeout

- **EDM** – selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- **Stop** – instructs the Robotic Total Station to stop tracking and go into "Stand By" mode.
- **Search** – instructs the Robotic Total Station to start searching for the prism.
-  – advances the station by the specified Station Interval for staking out points at the Next station.
- **Store** – takes a measurement and opens the ***Store Point*** screen to store the current position as a point (see "Store Point" on page 13-9).
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.

- **Close** – saves the changes and closes the screen.

Tapping in the current station string enables the floating information screen to display the point name, the note, design elevation (if enabled), the station number and the offset value of the current point. (Figure 13-25 on page 13-24).

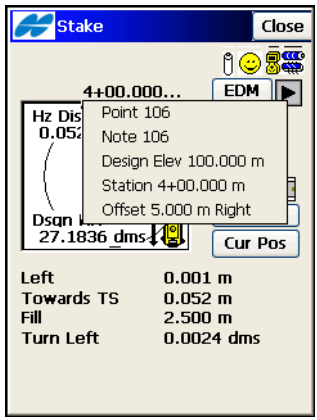


Figure 13-24. General Stakeout information

- The Help Icon in the upper-left corner of the screen displays the pop-up menu of options. For details, see “Points” on page 13-2.

Stakeout Intersections & Offsets

To stakeout Intersection & Offsets, tap the **Intersection** icon. The ***2Line&Ofst*** screen (Figure 13-25 on page 13-24) stakes out the intersection point of two lines parallel to two other lines at specified offsets. The first screen defines one line (Line 1) and the offset of the first parallel line. The second screen (Figure 13-26 on page 13-25) defines another line (Line 2) and the offset of the second parallel line. The intersection point of these two parallel lines defines the stakeout point.

The first screen contains parameters for Line 1.

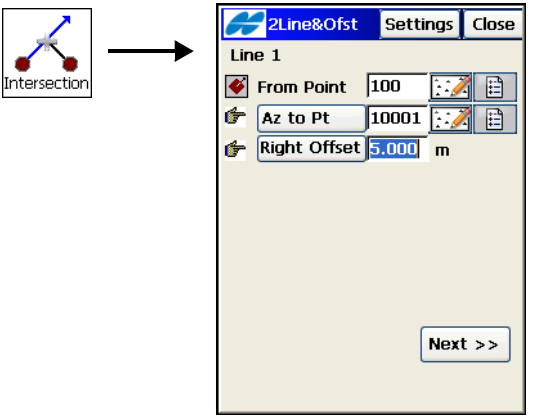


Figure 13-25. Intersection & Offsets – Line 1

- *From Point* – starting point of Line 1.
- **Az to Pt/Azimuth** – the direction of the line; set through the azimuth of the line, the azimuth from the start point to the point selected.
- **Right Offset/Left Offset** – the right or left offset of the stakeout point, with respect to the line.
- **Next** – opens the second ***2Line&Ofst*** screen (Figure 13-26 on page 13-25).
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

The Help Icon in the upper-left corner of the screen displays the same options as for the ***Line & Offsets*** screens.

The second screen contains the parameters of Line 2 (Figure 13-26 on page 13-25).

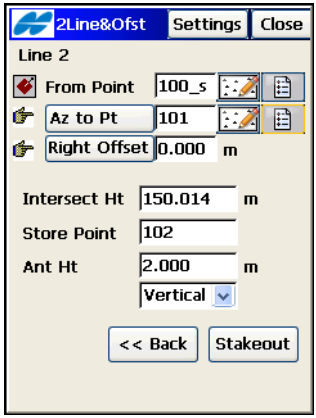


Figure 13-26. Intersection & Offsets – Line 2

- *From Point* – starting point of Line 2.
- **Az to Pt/Azimuth** – the direction of the line; set through the azimuth of the line, the azimuth from the start point to the point selected.
- **Right Offset/Left Offset** – the right or left offset of the stakeout point, with respect to the corresponding line.
- *Intersect Ht* – the height of the intersection point.
- *Store Point* – the name of the intersection point.
- *Ant Ht* (for GPS mode) – the height of the antenna.
- *HR* (for TS mode) – the height of the rod (target).
- **Stakeout** – opens the ***Stakeout*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen. See “Stake Parameters” on page 3-44.

GPS+ Stakeout

The ***Stake*** screen (Figure 13-27 on page 13-26) reflects the progress of the stakeout, displaying the current point name (in the upper-left corner of the screen), the layout of the target and the current position, the direction, and the distance to the targets.

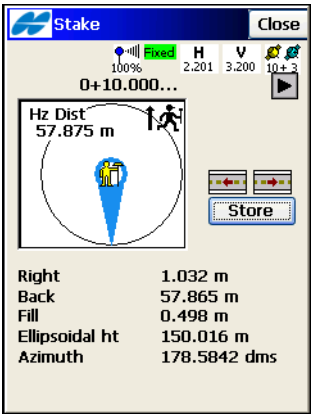


Figure 13-27. Stakeout

- **Store** – saves the location. Check the parameters of the stored point in the ***Add/Edit point*** screen.
- **Close** – returns to the ***2Line&Ofst*** screen (Figure 13-26 on page 13-25).

TS Stakeout

The ***Stake*** screen (Figure 13-28) reflects the progress of the stakeout, displaying the current station (in the upper-left corner of the screen), the necessary direction, and the value of the distance to the targets.

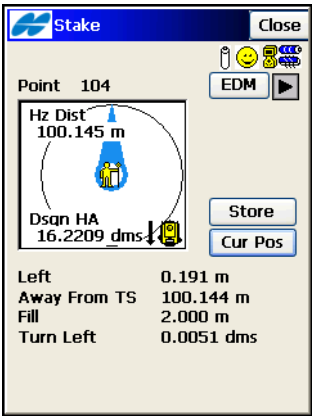


Figure 13-28. Stakeout

- **EDM** – selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- **Store** – opens the ***Store Point*** screen to store the current position as a point (see "Store Point" on page 13-9).
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Close** – saves the changes and closes the screen.

The Help Icon in the upper-left corner of the screen displays the same option as for the Line @ Offsets.

Three Point Curve & Offsets

To stakeout a Three Point Curve and Offset, select the **3Pt Curve** icon (Figure 13-29).

The ***3 Pt Curve*** screen (Figure 13-29) creates a curve by selecting three points: PC point, PT point and either any curve point or the RP point.

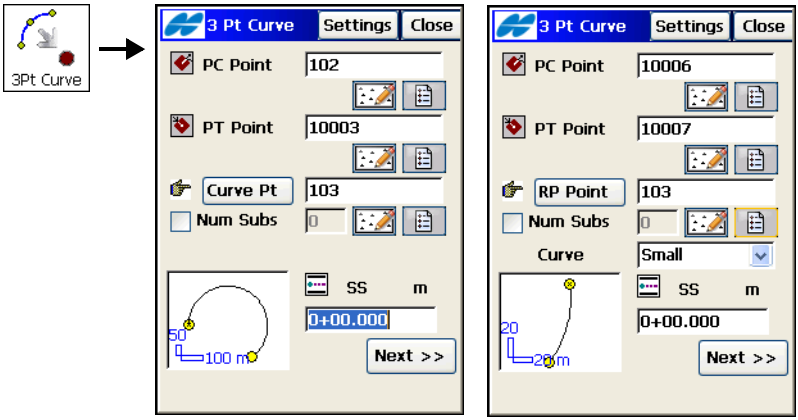


Figure 13-29. Three Point Curve

The screen displays changes, depending on the first point chosen. Enter either manually or select from the list or map the following sets of points:

- *PC Point, PT Point, Curve Point* – the starting PC (Point of Curvature) and ending PT (Point of Tangency) points on the circle, and a third point on the curve.
- *PC Point, PT Point, RP Point* – 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 the RP and PC should be equal to the distance between the RP and PT. The radius, and the PC/PT points, define two curves: one with delta less than or equal to180° (small curve), the other with delta greater than or equal to 180° (large curve). The value of *Small* or *Large* can be selected from the **Curve** drop-down box to indicate which of these two curves should be used for staking.
- *SS* – the starting station (chainage) of the line.
- **Next** – opens the ***Station and Offset*** screen (see "Station & Offsets" on page 13-19).
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

The Help Icon in the upper-left hand corner displays the same pop-up menu as for the ***Line & Offset*** screen (see "Line & Offsets" on page 13-17).

GPS and TS stakeouts are performed in the same way described in "Line & Offsets" on page 13-17.

Curves & Offsets

To stakeout Curves & Offsets, select the **Curve** icon (Figure 13-30).

The ***Curv&Ofst*** screen (Figure 13-30) function performs a stakeout of a curve (section of an arc) at a specified horizontal and vertical offset from the curve.

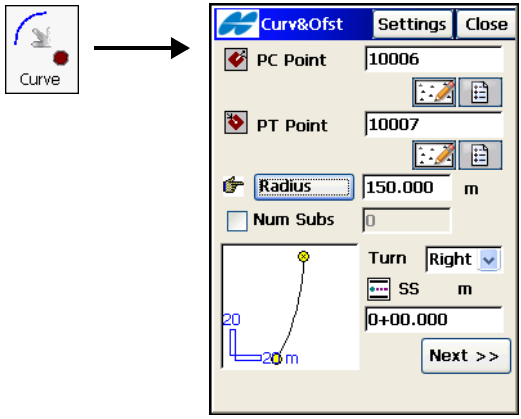


Figure 13-30. Stakeout Curve & Offset

- *PC Point* – the Point of Curve, the starting point of the arc.
- *PT Point* (Tangent Azi) – the azimuth of the *Tangent* of the curve (arc) at the PC point.
- **Radius/Deg Curve/Deg Chord** – the radius parameters of the curve.
- *Num Subs* – check and enable to designate the number of subdivisions you want to subdivide the line. For instance, a value of 3 indicates a calculation of four points by subdividing the line into three equal segments.
- *Turn* – the direction of turn, relative to the PC Point.
- *SS* – the starting station (chainage) of the line.
- **Next** – opens the ***Station and Offsets*** screen (see “Station & Offsets” on page 13-19).
- **Settings** – opens the ***Stakeout Parameters*** screen (see “Stake Parameters” on page 3-44).

The Help Icon in the upper-left hand corner displays the same pop-up menu as for the ***Lin&Ofst*** screen (see “Line & Offsets” on page 13-17).

GPS and TS stakeouts are performed in the same way as described in “Line & Offsets” on page 13-17.

Spiral & Offset

To stakeout Spirals & Offset, select the **Spiral** icon (Figure 13-31).

On the ***Spiral&Ofst*** screen (Figure 13-31) you can stake points at specified *Horizontal* and *Vertical* offsets with respect to a specified spiral.

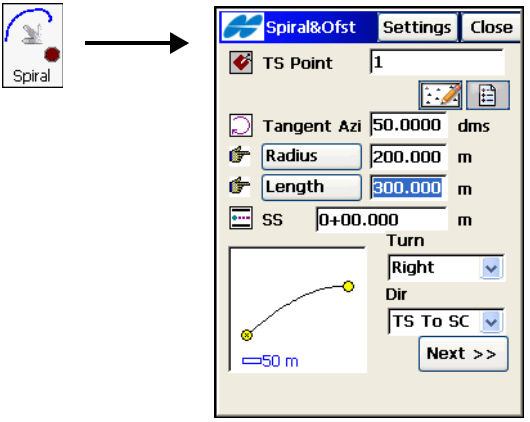


Figure 13-31. Stakeout Spiral & Offset

- *TS Point* – enter a *Tangent* to the *Spiral* point (the starting point of the spiral).
- *Tangent Azi* – the azimuth of the tangent to the spiral at the point TS.
- **Radius/Deg Chord/Deg Curve** – the radius parameter of the spiral at the ending point.
- **Length/Sp Const** – the length of the spiral at the ending point, or the *Spiral Constant* (the constant of the spiral).

For any spiral point $R \times Length = (SpiralConst)^2$, where R is the *Radius,* and *Length* is the length of the spiral, both at the same specified point.

- *SS* – the starting station (chainage) of the line.
- *Turn* – specifies whether the spiral turns right or left.
- *Dir* – the direction of "moving":
  - *TS -> SC*: Tangent Spiral->Spiral Circle. The incoming spiral to the internal circle.
  - *CS -> ST*: Circle Spiral->Spiral Tangent. The outgoing spiral from the circle to the Tangent.
- **Next** – opens the ***Station & Offsets*** screen (see "Station & Offsets" on page 13-19).
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).
- **Close** – closes the screen without any settings being made.

The Help Icon in the upper-left hand corner displays the same pop-up menu as for the ***Line&Ofst*** screen (see "Line & Offsets" on page 13-17).

GPS and TS stakeouts are performed in the same way as described in "Line & Offsets" on page 13-17.

Digital Terrain Model Stakeout

To start the DTM (Digital Terrain Model) stakeout, select the **DTM** icon. The ***DTM Stk*** screen displays (Figure 13-32).

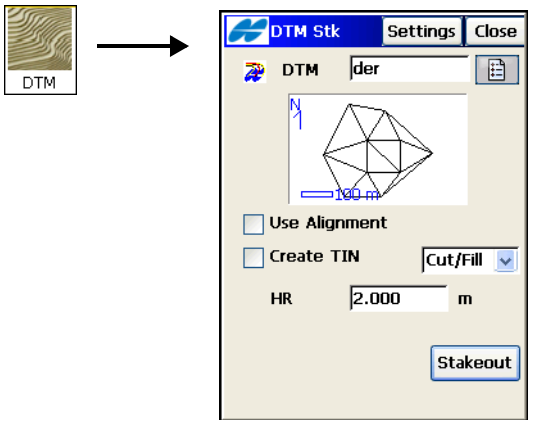


Figure 13-32. DTM Stakeout

- *DTM* – the name of the TN3 file, which is stored on disk.
- *Ant Ht* and *m* (for GPS+ stakeout) – the antenna height and method of height measurement.
- *Use Alignment* – check mark and enable to report stations and offsets.
- *Create TIN* – check mark and enable to generate a TIN (TN3 file) cut/sheet model.
- *HR* – for TS stakeout, the height of reflector.
- **Stakeout** – opens the ***Initial Point Name*** screen (see "Initial Point Name" on page 13-21) and then the ***Stakeout*** screen by pressing **OK**.
- **Close** – closes the screen without any settings being made.

Open DTM

On the ***Open DTM*** screen (Figure 13-33), select a surface file to open.

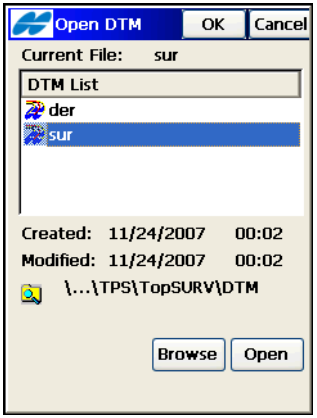


Figure 13-33. Open DTM

- *Current File* – displays the file that is currently open.
- *DTM List* – lists all surface files in the DTM directory on the controller.
- **Browse** – searches for the file on disk.
- **Open –** opens the selected file in the ***DTM Stk*** screen (Figure 13-32 on page 13-32).

GPS+ Stakeout

The ***Stake(out)*** screen (Figure 13-34) shows the relative position of the antenna.

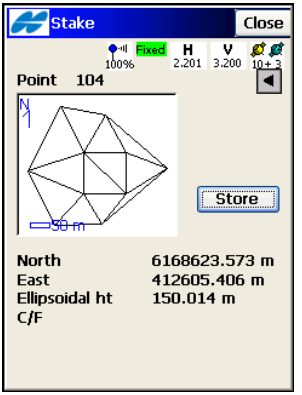


Figure 13-34. Stakeout -DTM

TS Stakeout

The ***Stake(out)*** screen (Figure 13-35) reflects the relative position of the target. The current point name displays at the top of the screen.

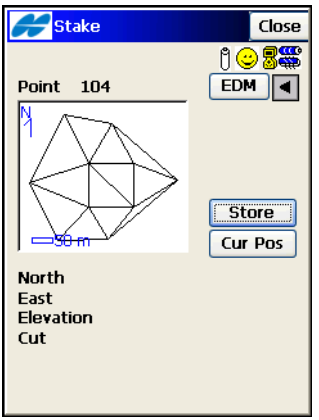


Figure 13-35. Stakeout (TS)

NOTICE

If a stakeout point is located on the outside of the DTM for the job, TopSURV neither calculates nor writes the coordinates of this point.

- **EDM –** selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- **Store –** saves the location. Check the parameters of the stored point in the ***Add/Edit point*** screen.
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Close –** saves the changes and closes the screen.

The Help Icon in the upper-left corner displays the pop-up menu that contains the same options as in the **Offsets** stakeout.

Point in Direction

To perform the Point and Direction stakeout, select the **Point in Direction** icon (Figure 13-36).

On the ***Point in Dir*** screen (Figure 13-36) you can stakeout a point using a known point, the azimuth, and the offsets from the azimuth line.

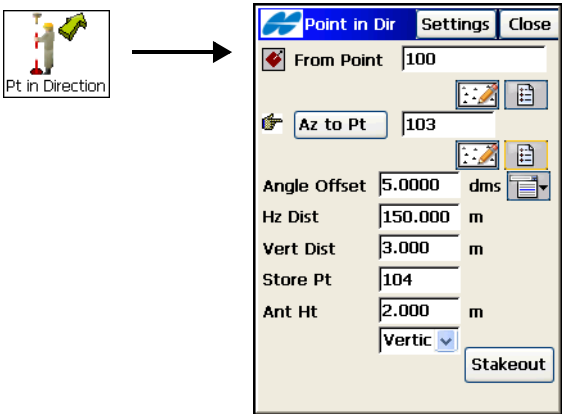


Figure 13-36. Stakeout Point & Direction

- *From Point* – the starting point. Enter the name manually or select a name either from the list or from the map.
- *Az to Pt* – the azimuth can be set by value or as the direction to another known point.

- *Angle Offset* – the angle offset from the azimuth line.
- *Hz Dist* – the distance offset along the angle offset line.
- *Vert Dist* – the height offset.
- *Store Pt* – enter a point in this field to store the computed point to the data set.
- *Ant Ht* (for the GPS mode) – sets the height of the antenna reference point (ARP) above the mark. Also, specifies the measurement type: either *slant* or *vertical*.
- *HR* (for the TS mode) – the height of the rod (target).
- **Stakeout** – opens the ***Stakeout*** screen to perform the stakeout.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stakeout Parameters" on page 3-66).
- **Close** – saves the changes and closes the screen.

See the Points stakeout for a description on the options that display by the Help Icon in the upper-left corner of the screen.

GPS+ Stakeout

The ***Stake(out)*** screen (Figure 13-37 on page 13-37) shows the status of the stakeout, displaying the current point name (in the upper-left corner of the screen), the layout of the target and the current position, the direction, and the values of the distances to the target.

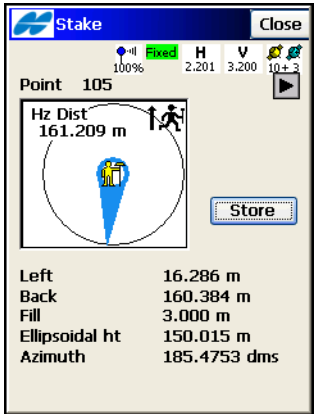


Figure 13-37. Point in Direction – Stakeout

- **Store** – performs the measurement and opens the ***Store Point*** screen to store the current position as a point.
- **Close** – saves the changes and closes the screen.

TS Stakeout

The ***Stakeout*** screen (Figure 13-38 on page 13-38) reflects the progress of the stakeout, displaying the current point name (in the upper-left corner of the screen), the layout of the target and current position, the necessary direction, and the values of the distances to the target.

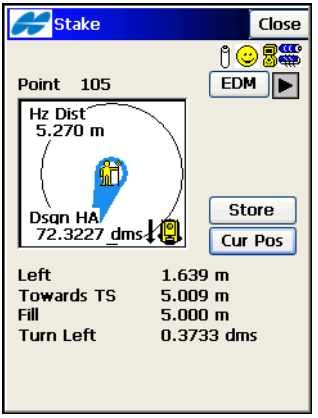


Figure 13-38. Point in Direction – Stakeout

- **EDM** – sets the distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- ▶ – toggles between the scheme and the map of the layout of the target and of the current position.
- **Store** – opens the ***Store Point*** screen to store the current position as a point (see "Store Point" on page 13-9).
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Close** – saves the changes and closes the screen.

The Help Icon in the upper-left corner displays the pop-up menu that contains the same options as in the Offsets stakeout.

Point List

To stakeout points from a list, select the **Point List** icon (Figure 13-39 on page 13-39).

The stakeout of points from the list can be enabled from the Main View (see "Actions on the Map" on page 15-4). Press **Alt** on the controller's keyboard and tap the linework. The *Stakeout Vertices* item from the pop-up menu appears.

The ***Point List*** screen (Figure 13-39) performs a stakeout of existing points from a point list, selects the starting stakeout point, and lists stakeouts in direct or reverse order.

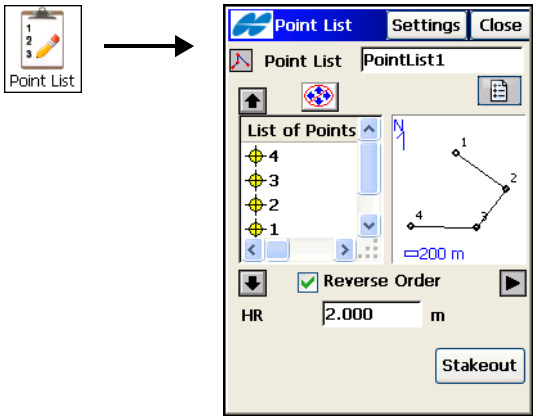


Figure 13-39. Stakeout Point List

- *Point List* – the preexisting points list: either select from the list or enter manually.
- *List of Points* – the list of currently selected points.
- Up and down arrows moves the highlighted point(s) up and down in the order of the points.
- – if activated, uses the up/down arrows on the keyboard to move the highlighted point up and down.
- – deletes the highlighted point from the list.
- – closes the scheme of the polygon. Only the list of points are available.
- *Ant Ht* (for GPS mode) – sets the height of the antenna reference point (ARP) above the mark. Also, specifies the measurement type for the height: either *slant* or *vertical*.
- *HR* (for the TS mode) – the height of the rod (target).
- *Reverse Order* – check mark and enable to start a stakeout from the end of the Point List.
- **Stakeout** – opens the ***Stake(out)*** screen.

See the Points stakeout for a description of the options on the Help Icon in the upper-left corner of the screen.

Stakeout (GPS and TS)

GPS and TS stakeouts are performed in the same way as described in "Stakeout Point" on page 13-2.

The Help Icon in the upper-left corner displays the pop-up menu that contains the same options as in the Offsets stakeout.

Here, points can be staked out in any order by selecting the next stakeout point using an additional option from the Help Icon menu in the upper-left corner: *Select Stakeout Point* opens the ***Select Point*** screen to select a stakeout point from the list.

Select Point for the Stakeout

The ***Select Point*** screen (Figure 13-40 on page 13-41) displays the Point List being staked, from which points can be randomly selected to continue the stakeout.

The new starting point can be selected from the list or by double-tapping a point on the map to the right of the list.

- *Show Remaining Points* – check mark and enable to show all the points that have not yet been staked out.
- *Show Staked Points* – check mark and enable to display points in the list that have already been staked out.
- *Reverse Order* – check mark and enable to stakeout points from the last point in the list to the first.

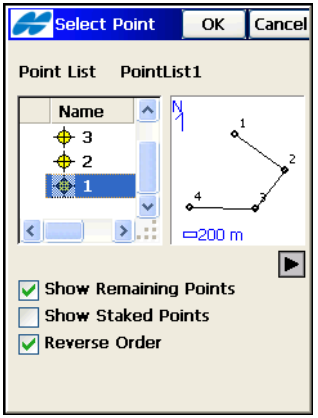


Figure 13-40. Select Point

Digital Level Stakeout

DL Stakeout of point lists can be accessed from the main menu or the top-left menu icon in the Level Run screen (for details, see “Level Run” on page 12-2).

The level ***Stake Point List*** screen (Figure 13-41 on page 13-42) selects a list of design points to determine the elevation and compute a cut/fill value at every point on the list.

- *BS Point* – the backsight point for the stake measurement (either enter manually or select from the map or list).
- *Point List* – the point list point to stake (either enter manually or select from the list). The point list is displayed in the tab and in the plot.
- *Reverse Order* – stakes in reverse order of the point list.
- **BS** – if not already measured, takes a backsight measurement before staking.
- **Stakeout** – opens the level ***Stakeout*** screen for every point of the list (see Figure 13-13 on page 13-13).

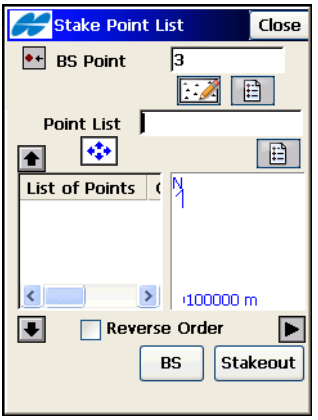


Figure 13-41. DL Stake Point List

DL Stakeout of Elevations

The DL Stakeout of elevations can be accessed from the main menu by selecting the **Elevation** icon (Figure 13-42) or from top-left menu in the Level Run screen (for details, see “Level Run” on page 12-2).

On the ***Stakeout Elev*** screen (Figure 13-42), select a backsight point and the elevation to determine the elevation.

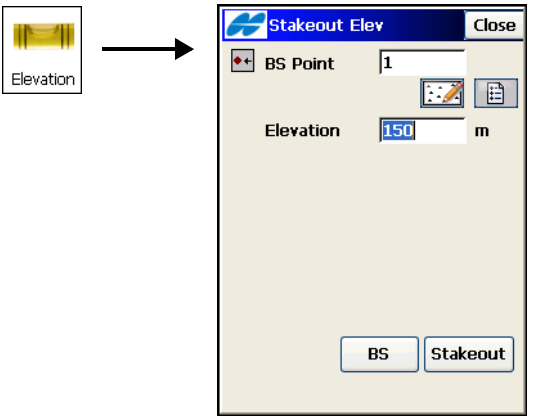


Figure 13-42. Stakeout Elevation

- **BS –** if not already measured, takes a BS measurement before staking.
- **Stakeout –** opens the level ***Stakeout*** screen for the elevation you want. This screen is identical to that shown in Figure 13-13 on page 13-13.

Curve

To stakeout along a horizontal curve, select the **Curve** icon (Figure 13-43). The ***Curve*** screen displays to select two points of the curve.

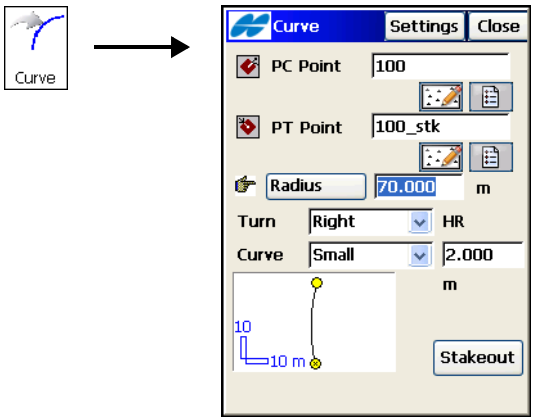


Figure 13-43. Curve

- *PC Point, PT Point* – manually enter or select from the list or the map the starting PC (*Point of Curvature*) and ending PT (*Point of Tangency*) points on the circle.
- **Radius/Deg Chord/Deg Curve** – the radius parameter of the curve at the ending point.
- *Turn* – specifies whether the curve turns right or left.

  The radius, and the PC/PT points, define two curves: one with delta less than or equal to180° (small curve), the other with delta greater than or equal to 180° (large curve). The value of *Small* or

Large can be selected from the **Curve** drop-down box to indicate which of these two curves should be used for staking.

- *Antenna* (for GPS+) – the antenna height.
- *HR* (for TS) – the rod (target) height.
- **Stakeout** – opens the ***Stakeout Curve*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

The Help Icon in the upper-left hand corner displays the same pop-up menu as for the ***Line & Offset*** screen (see "Line & Offsets" on page 13-17).

GPS+ Stakeout

The ***Stake Point*** screen (Figure 13-44) shows the GPS antenna position graphically and display the distance along the curve and offset values.

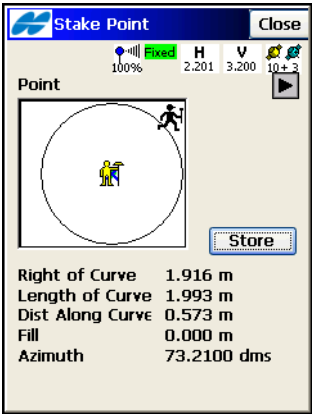


Figure 13-44. Stakeout Curve

- **Store** – saves the location. Check the parameters of the stored point in the ***Add/Edit point*** screen.
- **Close** – closes the screen and returns to the ***Stakeout Line*** screen.

The Help Icon in the upper-left corner displays the pop-up menu that contains the same options as in the Offsets stakeout.

TS Stakeout

The ***Stake Point*** screen (Figure 13-45) displays the rod position graphically and reports the necessary direction, and the values of the distances to the curve.

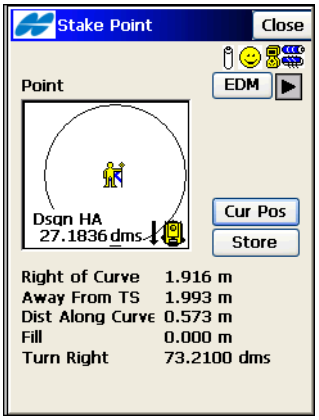


Figure 13-45. Stakeout

- **EDM** – selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
- **Stop** – instructs the Robotic Total Station to stop tracking and go into "Stand By" mode.
- **Search** – instructs the Robotic Total Station to start searching for the prism.
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Store** – takes a measurement and opens the ***Store Point*** screen to store the current position as a point (see "Store Point" on page 13-9).
- **Close** – saves the changes and closes the screen.

The Help Icon in the upper-left corner displays the pop-up menu that contains the same options as in the Offsets stakeout.

Real Time Road

To start the road stakeout in real time, select the **Real Time Rd** icon (Figure 13-46). The ***Stakeout Road*** screen displays.

The ***Stk Road*** screen (Figure 13-46) selects a road for stakeout and displays the plan of the chosen road.

The Help Icon in the upper-left hand corner displays the same pop-up menu as the ***Line&Ofst*** screen.

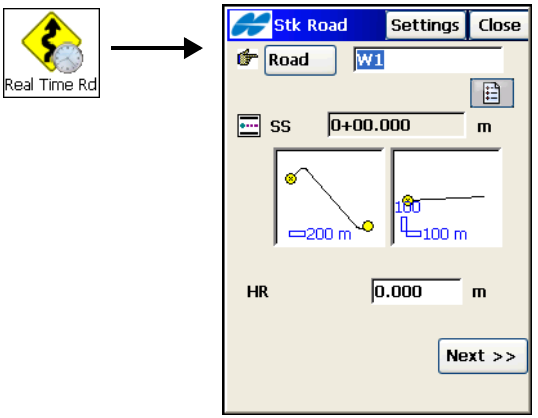


Figure 13-46. Stakeout Road

- **Road/H Alnt/HV Alnt** – the road, horizontal alignment, and horizontal/vertical alignments to be staked-out. Can be entered manually or chosen from the list.
- *SS* (Start Stn) – the starting point of the stakeout, the distance from the beginning of the road.
- *Antenna* (for GPS+) – the antenna height.
- *HR* (for TS) – the rod (target) height.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stakeout Parameters" on page 3-66).
- **Close** – saves the changes and closes the screen.

- **Next** – opens another ***Stk Road*** screen (Figure 13-47) to enter *Cut/Fill Slope* parameters.

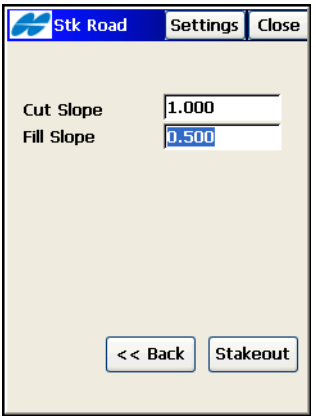


Figure 13-47. Stakeout Road – Cut/Fill

- **Back –**
- **Stakeout** – opens the ***Stakeout*** screen.

The *Stakeout* screen reports the cut/fill values computed for the current observed point. The design elevation of the road is automatically calculated for the observed point, using the alignment and the templates.

GPS+ Stakeout

The ***Stakeout*** screen (Figure 13-48 on page 13-48) shows the relative position of CL and antenna.

The screen displays the parameters of the antenna: Northing, Easting, and Elevation if the antenna is not on the road; and a Station, an Offset, and Cut/Fill values once on the road.

- **Store** – saves the location. Check the parameters of the stored point in the ***Add/Edit Point*** screen.

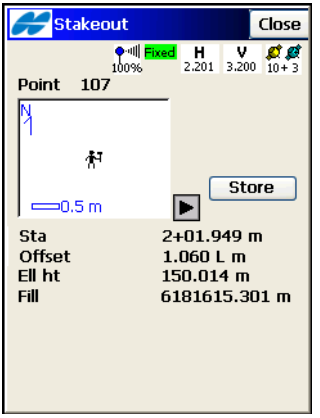


Figure 13-48. Stakeout

TS Stakeout

The ***Stakeout*** screen (Figure 13-49) reflects the relative position of CL and target. The screen displays the current point name (in the upper-left corner of the screen) and the parameters of the target.

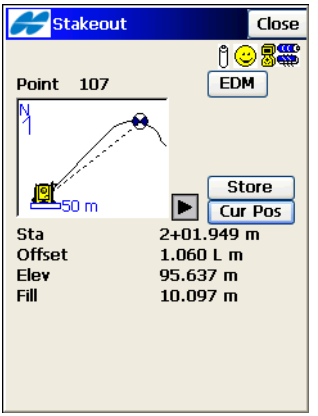


Figure 13-49. Stakeout Real Time Road

- **Store** – stores the current position as a point.
- **Cur Pos** – measures the target.

Road

To start the Road stakeout, select the **Road** icon (Figure 13-50). The ***Stakeout Road*** screen displays.

The ***Stk Road*** screen (Figure 13-50) selects the road for stakeout and displays the plan of the chosen road.

The Help Icon in the upper-left corner displays the same pop-up menu as the ***Line & Offsets*** screen (see "Line & Offsets" on page 13-17).

- **Road/H Alnt/HV Alnt** – the road, horizontal alignment, and horizontal/vertical alignments to be staked-out. Can be entered manually or chosen from the list.
- *SS* (Start Stn) – the starting point of the stakeout, the distance from the beginning of the road.
- *Antenna* (for GPS+) – the antenna height.
- *HR* (for TS) – the rod (target) height.
- *Include Trans Point* – check mark and enable if the transition point should be included, in spite of the station distance.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

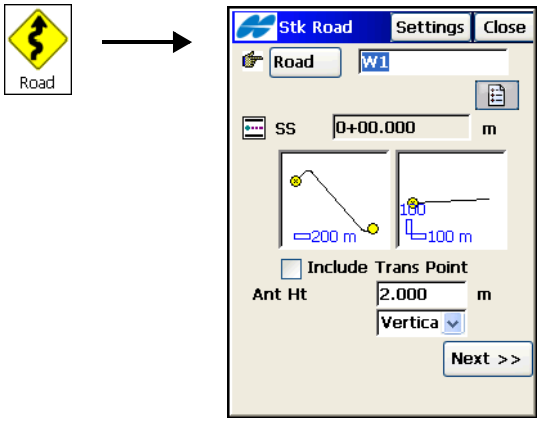


Figure 13-50. Stakeout Road

- **Next** – opens the second ***Stakeout Road*** screen.

- **Close** – saves the settings and closes the screen.

The second ***Stk Road*** screen (Figure 13-51) displays the properties of the cross section on the stakeout station and performs the stakeout of all selected points.

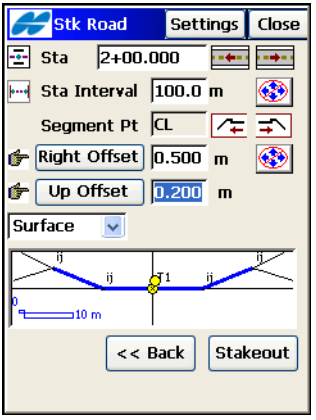


Figure 13-51. Stakeout Road

- *Station* – the station where the stakeout is performed. The arrow buttons change the station number by the value of Station Interval.
-  – advances the station by the specified Station Interval for staking out points at the Next station.
- *Sta Interval* – the interval of the station increment.
- *Segment Pt* – the point code of the current segment. The arrow icons  next to this field moves the current segment point along the cross-section. The result displays on the scheme at the bottom of the screen.
- *Right/Left Offset* – the horizontal offset from the current segment point.
- *Up/Down Offset* – the vertical offset from the current segment point.
- Select the type of template offsets:

  - *Centerline*: both the horizontal and vertical offset starts at the centerline.
  - *Segment*: the horizontal offset starts at the beginning of the segment; the vertical offset starts at the centerline.
  - *Surface*: the horizontal offset starts at the beginning of the segment; the vertical offset starts at the point on the surface of the segment that corresponds with the horizontal offset.
-  – switches on/off the arrow keys on the keyboard. The upper button stands for the station increment/decrement, the lower button stands for the current segment point location. Only one button can be enabled at a time.
- **Back** – returns to the first ***Stakeout Road*** screen.
- **Stakeout** – opens the ***Initial Point Name*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).
- **Close** – saves the settings and closes the screen.

GPS+ Stakeout

The ***Stakeout*** screen (Figure 13-52) displays the relative position of the antenna and the target. The panel on the right displays the parameters of the target.

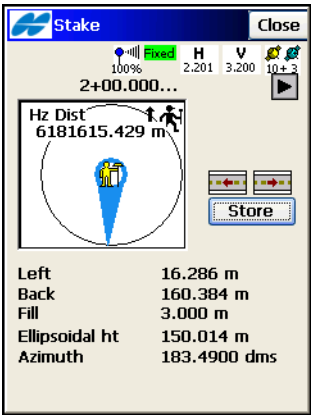


Figure 13-52. Stakeout

-  – advances the station by the specified Station Interval for staking out points at the Next station.
- **Store** – saves the location. Check the parameters of the stored point in the ***Add/Edit Point*** screen.
- **Close** – closes the screen and returns to the ***Stakeout Roads*** screen.

TS Stakeout

The ***Stk Slope*** screen (Figure 13-54 on page 13-54) reflects the progress of the stakeout, displaying the current station (in the upper-left corner of the screen), the layout of the target and the current position, the necessary direction, and the value of the distance to the targets (see Figure 13-53 on page 13-53).

Tapping in the current station string enables the bitmap menu to display the station number and the offset value of the current point.

- **EDM** – selects distance measurement mode: either *Coarse*, *Fine*, or *Coarse Tracking*.
-  – advances the station by the specified Station Interval for staking out points at the Next station.
- **Store** – takes a measurement and opens the ***Store Point*** screen (see “Store Point” on page 13-9) to store the current position as a point.
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Close** – saves the changes and closes the screen.

The Help Icon in the upper-left corner displays a pop-up menu that contains the same options as in the Offsets stakeout.

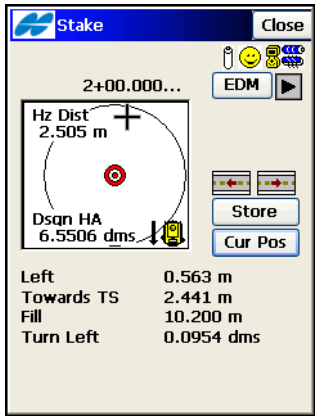


Figure 13-53. Stakeout Road – Stakeout

Slope

To start the slope stakeout, select the **Slope** icon (Figure 13-54 on page 13-54). The ***Stk Slope*** screen displays.

The ***Stk Slope*** screen selects which slope should be staked out (see Figure 13-54 on page 13-54).

The Help Icon in the upper-left corner displays the same pop-up menu as for the ***Line & Offsets*** screen.

- **Road/H Alnt/HV Alnt** – the road, horizontal alignment, horizontal/vertical alignments to be staked-out. Can be entered manually or chosen from the list.
- *SS (Start Stn)* – the starting point of the stakeout, the distance from the beginning of the road.
- *Antenna* (for GPS+) – the antenna height.
- *HR* (for TS) – the rod height.
- *Include Trans Point* – check mark and enable if the transition point should be included in spite of the station distance.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).

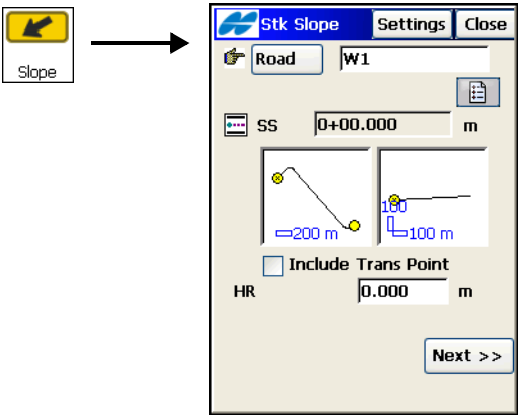


Figure 13-54. Stakeout Slope

- **Next** – opens another ***Stakeout Slope*** screen.
- **Settings –** opens the ***Stakeout Parameters*** screen (see "Stakeout Parameters" on page 3-66).
- **Close** – saves the settings and closes the screen.

This second ***Stk Slope*** screen (Figure 13-54) displays the properties of the cross-section at the stakeout station and helps to perform the stakeout of the catch point (the point where the slope crosses the surface of the terrain) and/or the offset of the catch point.

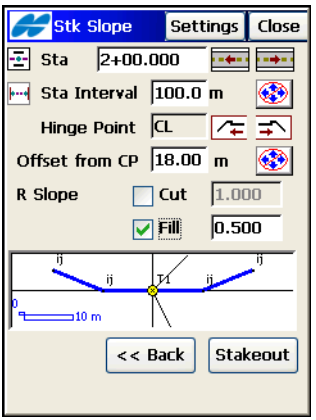


Figure 13-55. Stakeout Alignment

- *Sta* – the station where the stakeout is performed. The arrow buttons change the station number on the value of the *Station Interval*.
- *Sta Interval* – the interval of the station increment.
- *Hinge Point* – the hinge point code. The hinge point is a point of rotation of the Cut/Fill slopes. The arrow in this field moves the hinge point along the cross section. This is reflected on the scheme in the bottom of this screen.
- *Offset from CP* – the offset from the catch point.
- *Right/Left Slope* – the values of the *Cut/Fill* slope parameters applied to the hinge point.
-  – switches the keyboard arrow keys on/off. The upper arrows stands for the station increment/decrement, the lower arrows stands for the current hinge point location. Only one set of arrows can be enabled at a time.
- **Back** – returns to the ***Slope Stakeout*** screen.
- **Stakeout** – opens the ***Stakeout*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen (see “Stakeout Parameters” on page 3-66).
- **Close** – saves the settings and closes the screen.

GPS+ Stakeout

The ***Stake(out)*** screen (Figure 13-56) shows the direction to target and the parameters of the target. *Cut/Fill* values are computed from *Cut/Fill Slope*; other offsets are computed using the *Catch Point*.

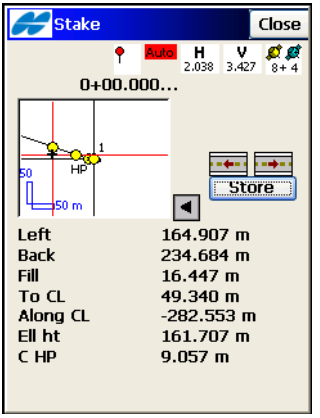


Figure 13-56. GPS Stakeout Slope

-  – advances the station by the specified Station Interval for staking out points at the Next station.
- **Store** – saves the location. Edit the parameters of the stored point in the ***Add/Edit Point*** screen.
- **Close** – closes the screen and returns to the ***Stakeout Roads*** screen.

The Help Icon in the upper-left corner displays a pop-up menu that contains the same options as in the Offsets stakeout.

TS Stakeout

The ***Stake (Stakeout Catch Point)*** screen (“TS Stakeout Slope” on page 13-57) reflects the progress of the stakeout, displaying the current station (in the upper-left hand corner of the screen), the layout of the target and the current position, and the parameters of the

stakeout. *Cut/Fill* values are computed from *Cut/Fill Slope*; other offsets are computed using the *Catch Point*.

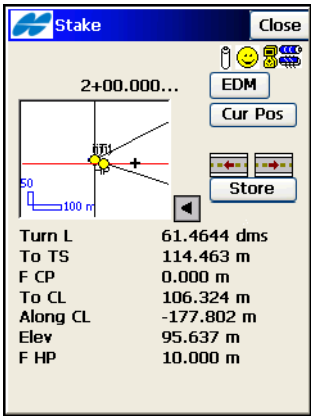


Figure 13-57. TS Stakeout Slope

- **EDM** – selects distance measurement mode: either *Coarse*, *Fine* or *Coarse Tracking*.
- **Cur Pos** – causes a measurement to be made and displays the result on the screen.
- **Store** – takes a measurement and opens the ***Store Point*** screen (see "Store Point" on page 13-9) to store the current position as a point.
- *Turn L/R* – the horizontal angle to the left/right on which to turn the total station.
- *To TS* – the distance to move.
- *F CP* – cut/fill computed from cut/fill slope.
- *To CL* – distance away from the center line.
- *Along CL* – distance along the center line.
- *Elev* – the fill with respect to the Hinge Point.
- – advances the station by the specified *Station Interval* for staking out points at the Next station.
- **Close –** saves the changes and closes the screen.

Linework

To start a Linework stakeout, select the **Linework** icon (Figure 13-58). The ***Linework*** screen displays (Figure 13-58). Select a desired code and string available for this code.

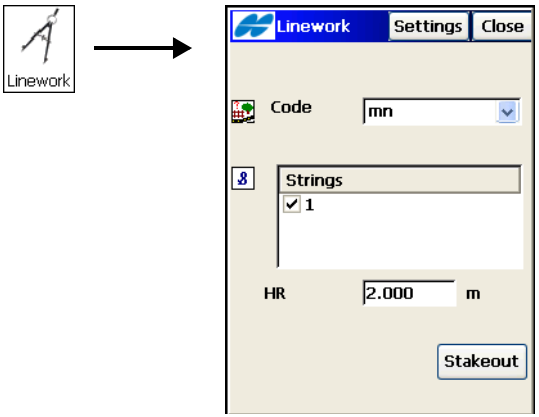


Figure 13-58. Limework

- **Stakeout** – opens the ***Stakeout*** screen.
- **Settings** – opens the ***Stakeout Parameters*** screen (see "Stake Parameters" on page 3-44).
- **Close** – saves the changes and closes the screen.

GPS and TS stakeouts are performed in the same way as described in "Point List" on page 13-38.

The Help Icon in the upper-left corner displays a pop-up menu that contains the same options as in the Offsets stakeout.

COGO Calculations

To calculate a COCGO task, tap on the COGO icon in the main menu.

The COGO menu (Figure 14-1 on page 14-2) allows calculation of the following tasks:

- Inverse
- Point in Direction
- Intersection
- Calculator
- Curves
- Area
- Corner Angle
- Line Offset
- Curve Offset
- Road Offset
- Adjust
- Traverse

Also, it provides a Calculator for various calculations and conversions.

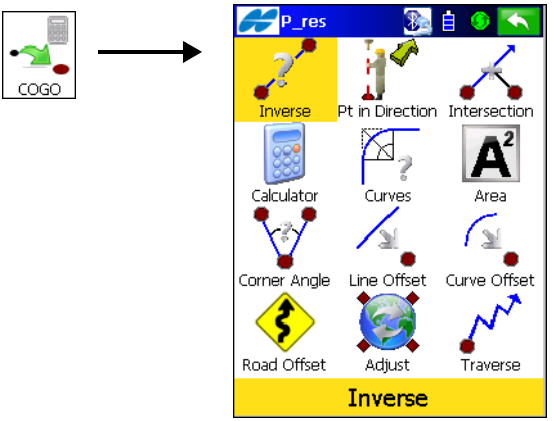


Figure 14-1. Cogo Menu

If the menu options you need are not visible (available), tap on the **Configure/Menus** icons to enable these options in the ***Config Menus*** screen.

The Help Icon opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see “Help Icon’s Pop-up Menu” on page 1-8).
The thumbnail image (icons) to the left of the tabs for every COGO screen displays the type of task being performed. Tap this image to open a larger map (see Figure 14-4 on page 14-5). Tap the large image to hide it.

Inverse

To perform an Inverse task, tap the **Inverse** icon (Figure 14-2). The ***P_res*** screen displays.

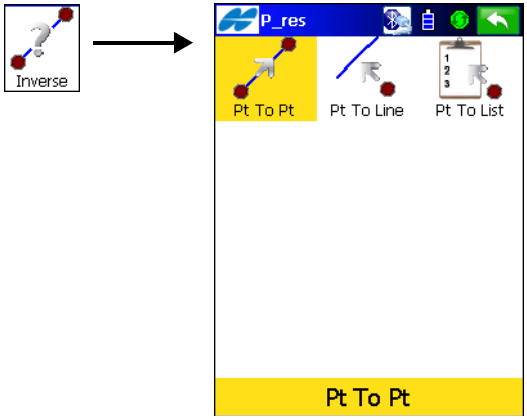


Figure 14-2. Inverse Menu

Point to Point

To calculate the Point-to-Point Inverse, tap the **Pt To Pt** icon (Figure 14-2). The ***Two-Point Inverse*** screen displays (Figure 14-3 on page 14-4).

On the ***Two-Point Inverse*** screen, compute the inverse between two known points. Inverse is comprised of the azimuth from one point to the other and the distance between these points.

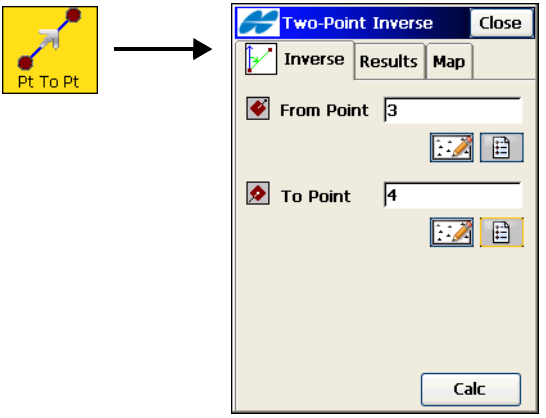


Figure 14-3. Two-Point Inverse

The *Inverse* tab contains initial data for the following parameters:

- *From Point* – the first point name; either enter manually or select from the map or from the list.
- *To Point* – the second point name; either enter manually or select from the map or from the list.
- **Calc** – calculates the inverse.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen (see “Points” on page 6-2).
- *Help* – accesses the Help files.

Tap the icon to the left of the tabs to open a larger map of the task being performed (Figure 14-4 on page 14-5). Tap the large image to hide it.

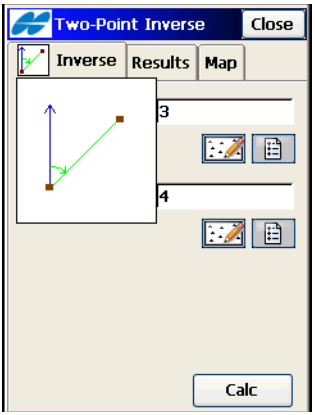


Figure 14-4. Large Image of COGO Task

The *Results* tab shows the initial data (*From Point, To Point*) and the results of the calculation (Figure 14-5). The results can vary, based on whether a geodesic display system is selected or not.

When *Grid* or *Ground* is the selected display system, the results tab lists the following parameters (Figure 14-5).

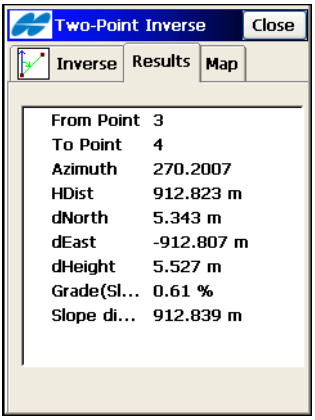


Figure 14-5. Two-Point Inverse – Results in Non-Geodesic Display System

- *Azimuth* (or *Bearing)* – to the second point from the first point.
- *HDist* (Horizontal Distance)/*VDist* (Vertical distance) – from one point to another (Horiz). The "-" sign means that the height of the second point is lower than the height of the first point (Vert).

- *dNorth* – the increment of the North coordinate.
- *dEast* – the increment of the East coordinate.
- *dHeight* – the increment of the height.
- *Grade(Slope)* – the increment of the height in percent.
- *Slope distance* – the computed distance between two points.

When selecting a geodesic display system, the following parameters display (Figure 14-6):

- *Forward Azimuth* – the forward geodesic azimuth.
- *Backward Azimuth* – the backward geodesic azimuth.
- *Geodesic Dist* – the shortest distance between two points on an ellipsoid.
- *Ground Dist From* – the horizontal distance on the geodetic horizon plane, at the height of the *From Point*.
- *Ground Dist To* – the horizontal distance on the geodetic horizon plane, at the height of the *To Point*.
- *Delta Ell ht* – the difference in ellipsoidal heights.

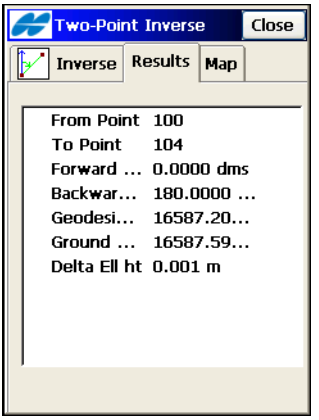


Figure 14-6. Two-Point Inverse – Results in Geodesic Display System

The *Map* tab shows the illustration for the results (Figure 14-7).

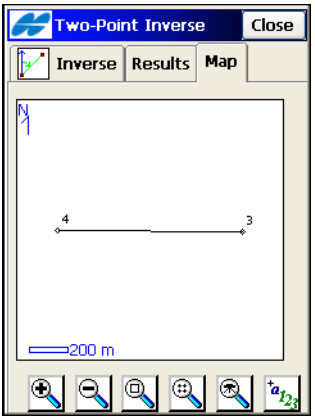


Figure 14-7. Two-Point Inverse – Map

For a description of the icons to the left, see “Toolbar” on page 15-2

Point to Line

To calculate the station of the known point inverse to the known line, select the **Point to Line** icon. The ***Inverse Point to Line*** screen displays (Figure 14-8).

On the *Inverse Point to Line* tab, enter the following parameters.

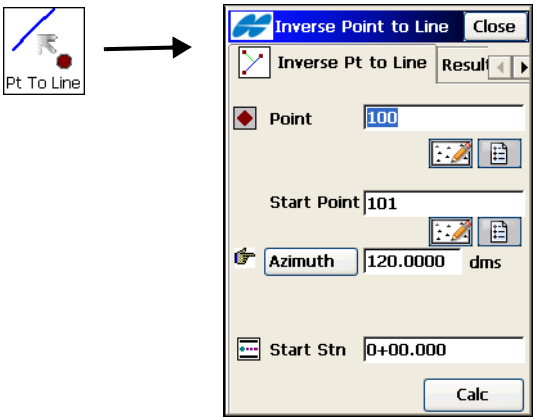


Figure 14-8. Inverse Point to Line

- *Point* – sets the current point name: either enter manually, or select from the map or from the list.
- *Start Point* – the starting point of the reference line.
- **Azimuth/Az to Pt –** sets the azimuth of the reference line. Rotates through selections when tapped.
  - **Azimuth:** sets the azimuth from the starting point by value.
  - **Az to Pt:** sets another known point to which the direction is calculated and input as azimuth.
- *Start Stn* – the starting station of the reference line.
- *Store PTL Point* – store the point as PTL point (see "PTL Mode" on page 11-6).
- **Calc** – calculates the inverse and displays the results on the *Results* tab.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see "Points" on page 6-2).
- *Help* – accesses the Help files.

The *Results* tab (Figure 14-9) shows the initial data and the results of the calculation: *Station*, *Offset*, and *Height* parameters.

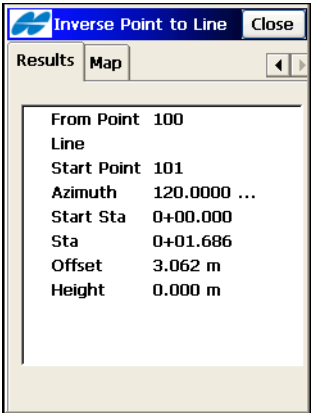


Figure 14-9. Inverse Point to Line – Results Tab

The *Map* tab (Figure 14-10) shows the results graphically.

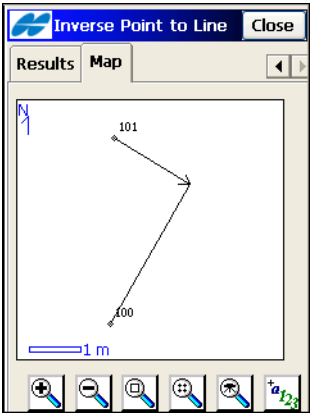


Figure 14-10. Inverse Point to Line – Map Tab

Point to Points List

To calculate the inverse for all the points in the Points list with respect to a known point, tap the **Point to List** icon. The I***nverse Point to Point List*** screen displays (Figure 14-11).

The *Inverse Pt to Pt List* tab illustrates the point inverse operation.

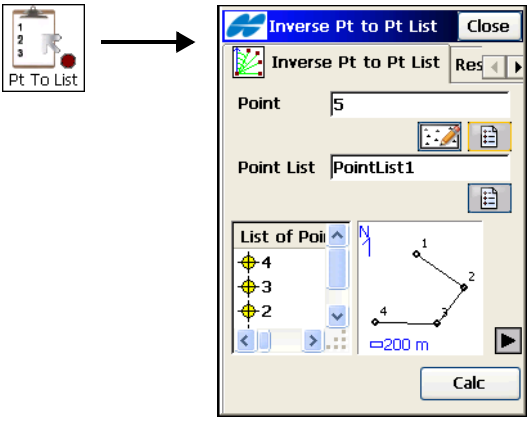


Figure 14-11. Inverse Point to Point List

- *Point* – sets the known point name: either enter manually or select from the map or from the list.

- *Point List* – the Point List name: either enter manually or from the list of Point Lists.
- *List of Points* – the list of currently selected points. For details see "Point Lists" on page 6-33.
-  – closes the plot of the polygon. Only the list of points is available.
- **Calc** – calculates the inverse and displays the results on the *Results* tab.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing three items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see "Points" on page 6-2).
- *Edit Point Lists* – opens the ***List of Point Lists*** screen to edit the point lists (see "Point Lists" on page 6-33).
- *Help* – accesses the Help files.

The *Results* tab (Figure 14-12) shows the initial data and the results of the calculation: *closest point, azimuth, distance, height, slope* and *grade* parameters.

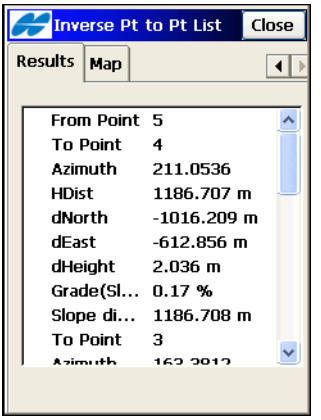


Figure 14-12. Inverse Point to Point List – Results Tab

The *Map* tab shows the inverse point to point operation results graphically.

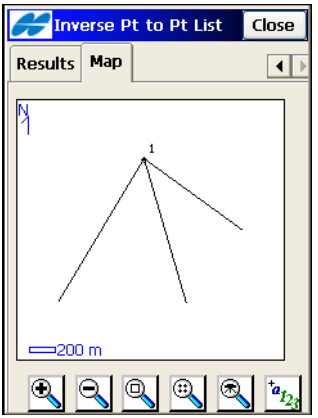


Figure 14-13. Inverse Point to Point List – Map Tab

Point in Direction

To calculate the coordinates of a point, using a known point, the azimuth, the angle offset from the azimuth line, and the distance offsets from the From Point, tap the **Point in Direction** icon. The ***Point in Direction*** screen displays (Figure 14-14).

On the *Point in Direction* tab, enter the following parameters.

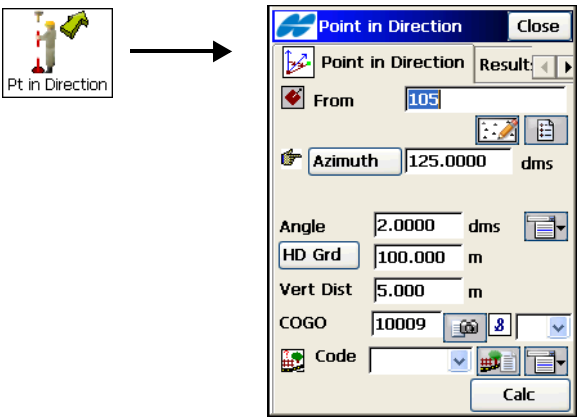


Figure 14-14. Point in Direction

- *From Point* – the starting point: either enter manually or select from the list or from the map.
- **Azimuth/Az to Pt** – sets the azimuth of the line from the From Point. Rotates through selections when tapped.
  - **Azimuth:** sets the azimuth by value.
  - **Az to Pt:** sets another known point to which the direction is calculated and input as azimuth.
- *Angle (Offset)* – the angle offset from the azimuth line.
- *Hz Dist* – the distance offset along the angle offset line.
- *Vert Dist* – the height offset.
- *Cogo Pt* – the computed point name.
- *Code* – the computed point code.
- **Calc** – calculates the coordinates and displays the results on the *Results* tab.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see "Points" on page 6-2).
- *Help* – accesses the Help files.

The *Results* tab (Figure 14-15) on the ***Point in Direction*** screen (Figure 14-15 on page 14-13) shows the initial data and results of the calculation.

Tap **Save** to save the results of the calculation

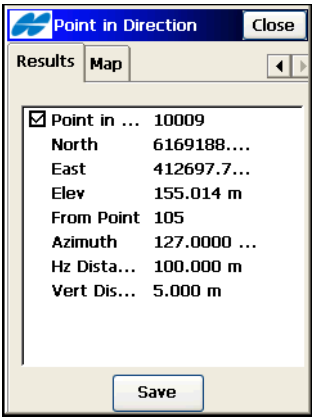


Figure 14-15. Point in Direction – Results Tab

The *Map* tab (Figure 14-16) shows the results graphically.

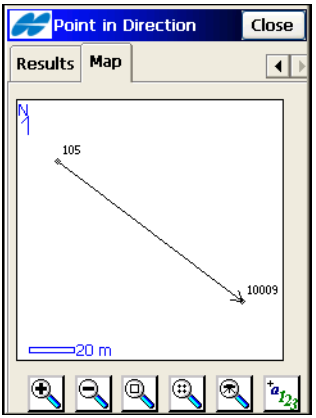


Figure 14-16. Point in Direction – Map Tab

Compute the Intersection Point

To compute the intersection point or points when given two known points and either the directions or distances from the known points, tap the **Intersection** icon. The ***Intersection*** screen displays (Figure 14-17).

The *Intersection* tab contains initial data for the intersection task (Figure 14-17).

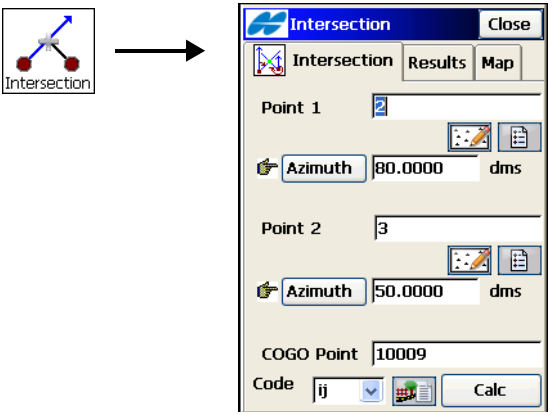


Figure 14-17. Intersection

- *Point 1* – the first point; either enter manually or select from the map or the list.
- **Azimuth/Distance/Az to Pt**: rotates through selections.
  - **Azimuth**: sets the azimuth from the first point to the unknown point.
  - **Distance**: sets the distance between the first point to the unknown point.
  - **Az to Pt**: sets another known point to which the direction will be calculated and input as azimuth.
- *Point 2* – the second point; either enter manually or select from the map or the list.

- C*OGO Point* – enter the name and code for the resulting point of the calculation. The code can be selected from the menu or entered manually. Also, the Attributes can be selected through the *Attribute List* bitmap. Note that the *Code/String* field remembers and displays the last user-saved code/string.
- **Calc** – starts the calculation process.

To edit angles, azimuths, distances, and so forth, use the entry fields to add/subtract angle and linear values directly or by using the Calculator.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see "Points" on page 6-2).
- *Help* – accesses the help files.

The *Results* tab shows the results of the calculation (Figure 14-18).

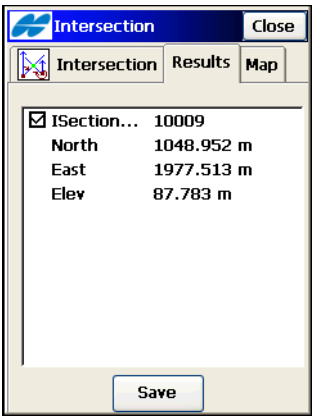


Figure 14-18. Intersection – Results Tab

- *North* – the North local coordinate of the corresponding point.
- *East* – the East local coordinate of the corresponding point.
- *Elev* (Height) – the height of the first corresponding point.
- **Save** – saves the result of the calculation.

The *Map* tab (Figure 14-19) shows the solution of the task graphically. In the example below, there are two solutions for the *Intersection* calculation.

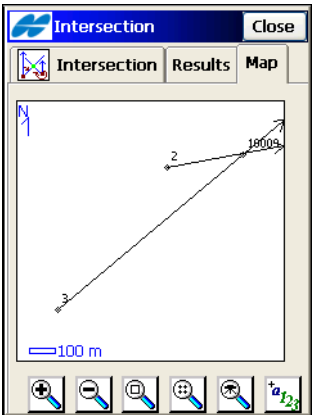


Figure 14-19. Intersection – Map Tab

For a detailed description of the Map view, see “Viewing Map” on page 15-1.

If Distances instead of Azimuths are specified between the known points to the unknown points in the *Intersection* tab (see Figure 14-17 on page 14-14), then there can be two points of intersection to save (Figure 14-20).

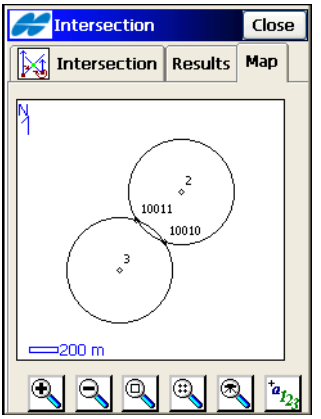


Figure 14-20. Two Points of Intersection

Calculator

A built-in calculator in TopSURV performs calculations and conversions. To access the calculator, tap the **Calculator** icon. The ***Calculator*** screen displays (Figure 14-21).

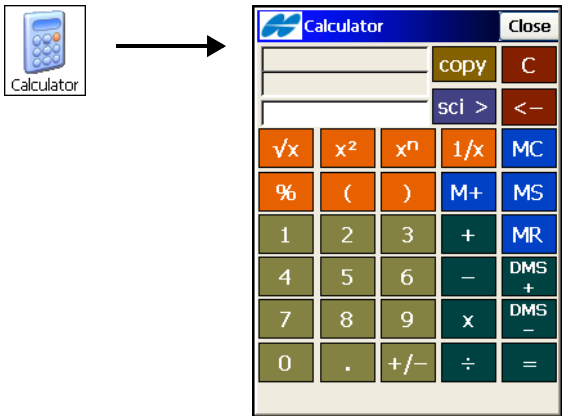


Figure 14-21. Calculator

To enter a calculated value to any entry field in TopSURV, start the calculator from this field by pressing the F1 button on the controller keyboard, or by tapping the  button on the pop-up keyboard for controllers with soft input panels.

- *Input* field – enter the entire equation here, then press the **equals** [=] button to calculate the result.
- *Result* field – shows calculation results. This field is also used as the 'y' or 'theta' values for rectangular/polar conversions.
- *Previous Result* field – once equals is pressed, the previous result is moved up to this field. This field is also used as the 'x' or 'r' values for rectangular/polar conversions.
- **MC** – clears the memory.
- **MR** – recalls the memory value, indicated by M in the Input field.
- **MS** – saves the already computed result into memory.

- **M+** – adds the already computed result to the value in memory.
- **C** – clears all the fields.
- **backspace (<-)** – removes the last entry.
- **copy** – if the calculator was started from a field in TopSURV, copies calculation results to that field; closes the calculator in case it was started from the COGO menu.
- **sci** – brings up the scientific calculator.

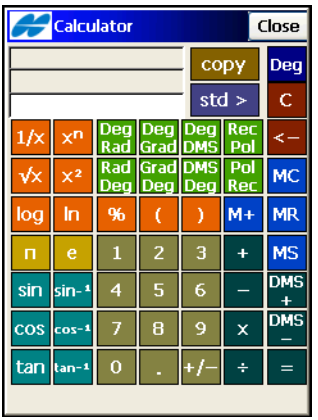


Figure 14-22. Scientific Calculator

Curve Solutions

A Curve is part of a circle and can thus 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 PT (Point of Tangency). Using these values, the Curve Solutions finds other Curve parameters.

Tap the **Curve** icon to access the Curve menu for various curve solutions: Curve, Three-Points Curve, PI & Tangents, and Radius & Points.

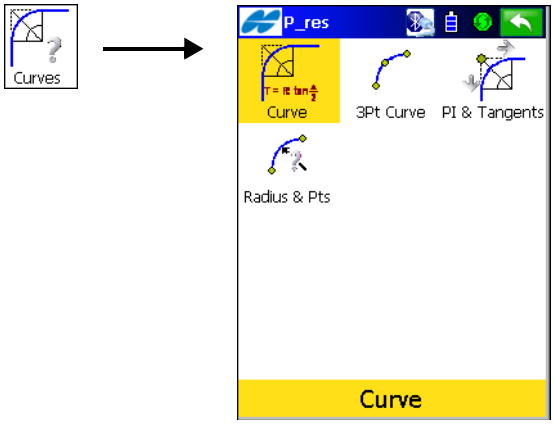


Figure 14-23. Curve Menu

Calculating the Parameters of a Curve

To calculate the full set of parameters for any curve, given one for each of the curvature parameter and the length parameter of the curve, tap the **Curve** icon. The ***Curve Solution*** screen displays (Figure 14-24).

The *Curve Solution* tab (Figure 14-24) contains the initial data and a window for the curve plan.

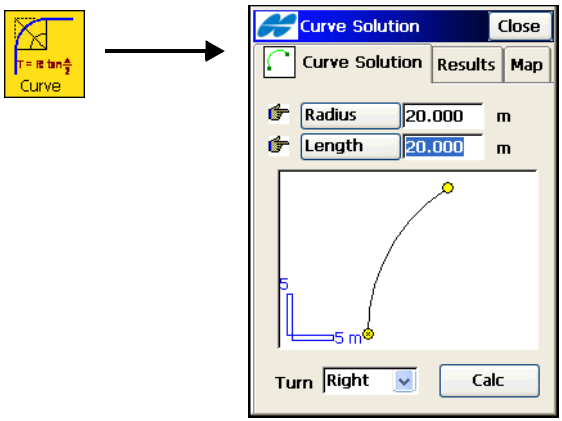


Figure 14-24. Curve Solution

- **Radius/Deg Chord/Deg Curve** – the curvature parameters of the curve.
- **Length/Chord/Tangent/Mid Ord** – the length parameters of the curve.
- *Turn* – the direction of turn relative to the starting point.
- **Calc** – press to calculate the parameters of the curve.

The *Results* tab shows the calculated parameters (Figure 14-25).

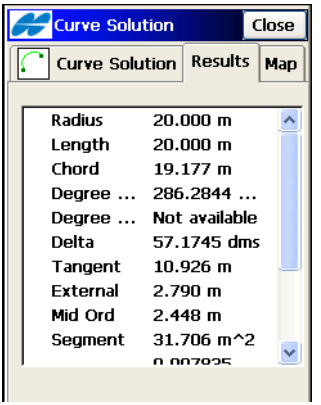


Figure 14-25. Curve Solution – Results Tab

The first three parameters display the radius and the length of the curve and the length of the chord connecting the PC and PT points.

- *Chord* – PC-PT length. If the Chord is defined, then taking into account, that

$$\sin\frac{Delta}{2} = \frac{Chord}{2}/(R)$$

the Length can be calculated as $Length = R \times Delta$

(note that delta is the angle subtended at the center).

The *Degree Curve* defines the angle in degrees, which is used to compute the radius of a curve with a length of 100 units:

$$\frac{DegreeCurve \times \pi}{180} = \frac{100}{R}$$

where R is *Radius*.

The *Degree Chord* defines the angle in degrees, which is used to compute the radius of a curve whose chord is 100 units long. So

$$\sin\frac{DegreeChord \times \pi}{180}/2 = \left(\frac{100}{2 \times R}\right)/R$$

where R is *Radius*.

- *Delta* – internal angle from center to tangent points (PC-RP-PT).
- *Tangent* – the PI-PT length, where PI is the Point of Intersection. If the Tangent is defined, then taking into account, that:

  $$\tan\frac{Delta}{2} = \frac{Tangent}{R}$$

  where R is the *Radius*, the Length is *Length = R x Delta*.

  Mid Ord – mid ordinate, the piece of PI-RP section from the curve to the chord. If the Mid Ord is known, then assuming that:

  $$\cos\frac{Delta}{2} = \frac{R - MidOrd}{R}$$

  where R is the *Radius*, the Length is *Length = R x Delta*.
- *External* – the piece of PI-RP section from PI to the curve. If the External is defined, then assuming that:

  $$\cos\frac{Delta}{2} = \frac{R + External}{R}$$

  where R is the *Radius*, the Length is *Length = R x Delta*.
- *Sector* – the area of a circle bounded by two radii and the minor arc they determine.
- *Segment* – the area of a circle bounded by a chord and the minor arc that it cuts off.
- *Fillet* – the area between the arc of a circle and the two tangents at the end points of the arc.

The *Map* tab (Figure 14-26 on page 14-22) shows graphically the results of the calculation.

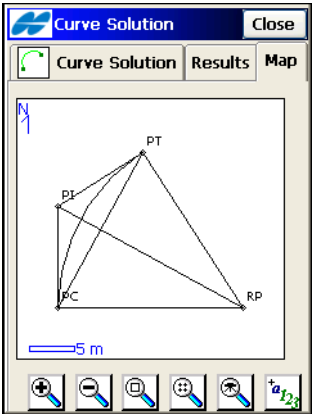


Figure 14-26. Curve Solution – Map Tab

Three-Points Curve

To define the curve using three points: PC point, any curve point, and PT point or the RP, PC, and PT points, tap the **Three Pt Curve** icon. The ***Three Pt Curve*** screen displays (Figure 14-27). The screen display changes, depending upon the first point selected.

The *Three Points Curve* tab displays the initial data.

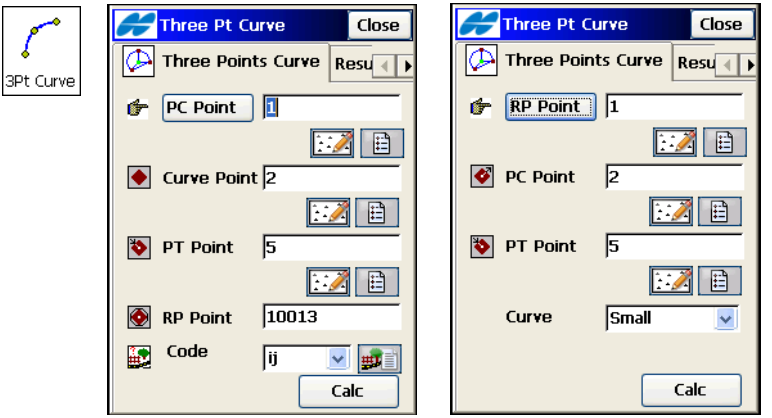


Figure 14-27. Three Pt Curve

Either enter manually or select from the list or from the map, the following sets of points.

- *RP Point, PC Point, PT Point* – for these set of points, the distance between the RP Point and the PC point should be an equal distance between the RP Point and the 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* value or *Large* value from the **Curve** drop-down list to indicate which of these two curves should be used for computations.
- *PC Point, Curve Point, PT Point* – for these set of points, the coordinates for the RP Point are calculated, along with curve parameters. The name and the code for this calculated point can be set.
- **Calc** – press to calculate the curve parameters.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see "Points" on page 6-2).
- *Help* – accesses the Help files.

The *Results* tab (Figure 14-28) displays the results of the calculation.

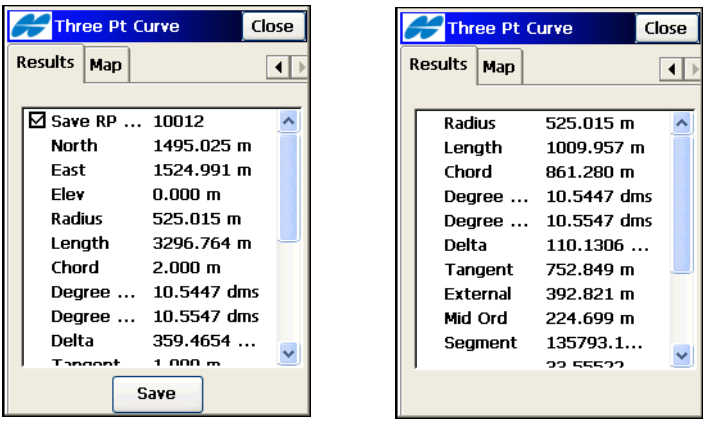


Figure 14-28. Three Pt Curve – Results Tab

For a description of curve parameters, see “Calculating the Parameters of a Curve” on page 14-19.

- **Save** – press to store the point being found.

The *Map* tab (Figure 14-29) displays the results of the calculation graphically.

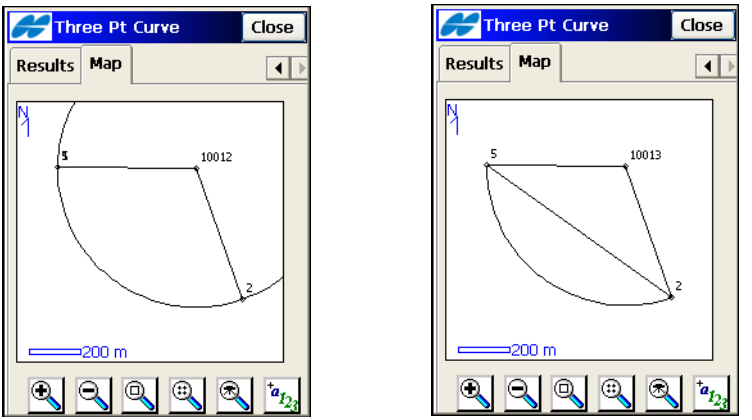


Figure 14-29. Three Pt Curve – Map Tab

PI & Tangents

To compute the 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, tap the **PI & Tangents** icon. The ***PI & Tangents*** screen displays (Figure 14-30 on page 14-25).

The *PI & Tangents* tab contains the initial data.

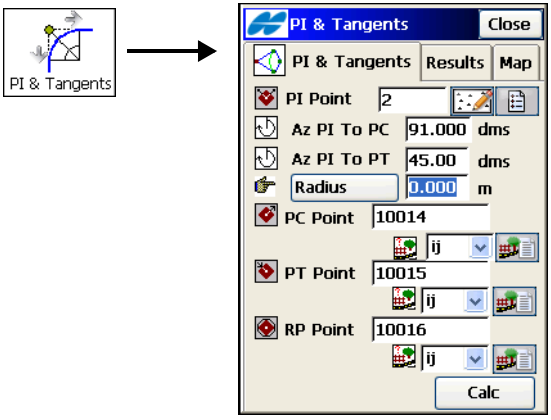


Figure 14-30. PI & Tangents

- *PI Point* – the Point of Intersection. Can be manually entered, or chosen from the map or from the list.
- *Az PI to PC* – the azimuth from the PI point to the starting curve point.
- *Az PI to PT* – the azimuth from the PI point to the ending curve point.
- **Radius/ Deg Curve/Deg Chord/Tangent** – the radius parameters of the curve.
- *PC Point* – the name and the code for the calculated starting curve point.
- *PT Point* – the name and the code for the calculated ending curve point.
- *RP Point* – the name and the code for the calculated radius point.
- **Calc** – calculates the parameters of the curve and the coordinates of the PC, PT, and RP points.

The *Results* tab (Figure 14-31 on page 14-26) shows the results of the calculation.

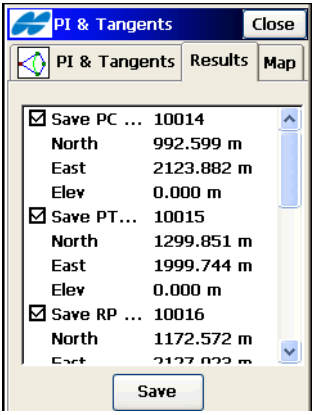


Figure 14-31. PI & Tangents – Results Tab

Put a check mark next to the points you want to save, then press the **Save** button.

The *Map* tab shows graphically the results of the calculation.

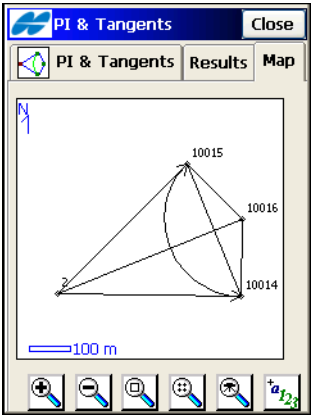


Figure 14-32. PI & Tangents – Map Tab

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two options: *Edit Points* (see "Points" on page 6-2) and *Help* to access the help files.

Radius & Points

To define a curve using the PC and PT points, and a radius parameter, tap the **Radius & Points** icon. The ***Radius* & Points** screen displays (Figure 14-33).

The *Radius & Point* tab contains the initial data for the task.

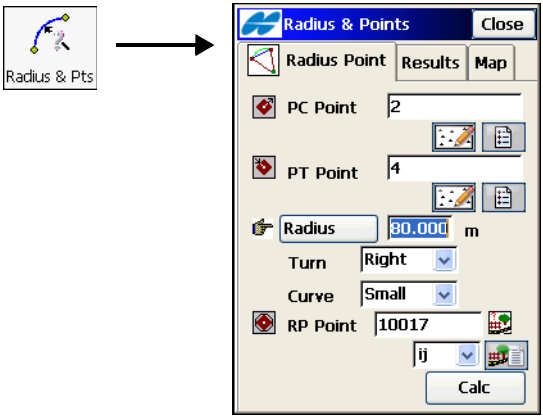


Figure 14-33. Radius & Points

- *PC Point* – the Point of Curvature: either enter manually or select from the map or from the list of points.
- *PT Point* – the Point of Tangency: either enter manually or select from the map or from the list of points.
- **Radius/Deg Curve/Deg Chord** – the radius parameters of the curve.
- *Turn* – the direction of turn, relative to the PC Point.
- *Curve* – defines the curve in the circle that should be considered. 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).
- *RP Point* – the point to be defined. Enter the name and select the code, if necessary.
- **Calc** – press to calculate the curve parameters.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two options: *Edit Points* (see "Points" on page 6-2) and *Help* to access the help files.

The *Results* tab (Figure 14-34) displays the results of the calculation.

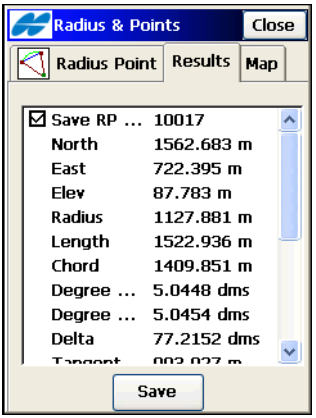


Figure 14-34. Radius & Points – Results Tab

For a description of curve parameters, see "Calculating the Parameters of a Curve" on page 14-19.

- **Save** – press to store the point being found.

The *Map* tab (Figure 14-35) displays the results of the calculation graphically.

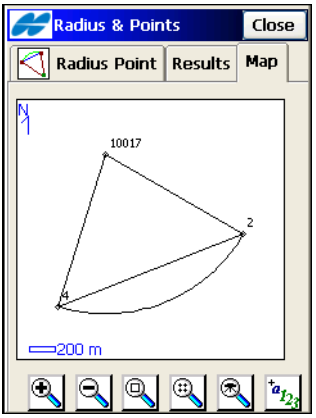


Figure 14-35. Radius & Points – Map Tab

Area

Tap the **Area** icon to access the Area menu to calculate the area of a polygon formed by any points or the coordinates of a point/points that forms a polygon of the desired area

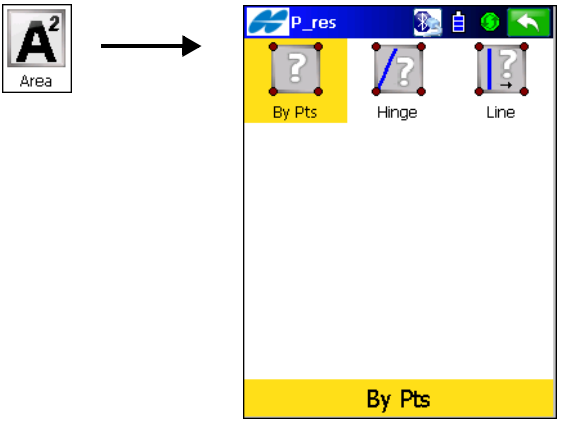


Figure 14-36. Area Menu

By Points

To calculate the area of a polygon formed by any points, tap the **By Points** icon. The ***Comp Area*** screen displays (Figure 14-37).

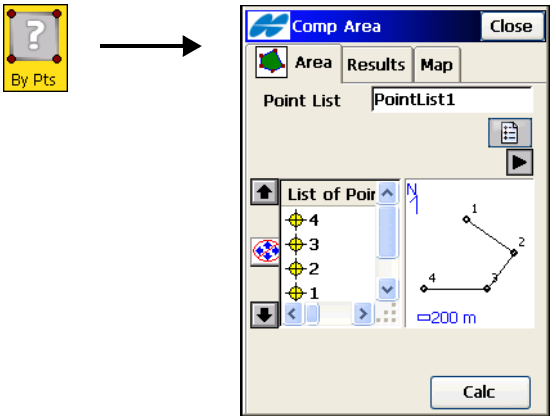


Figure 14-37. Area by Points

The *Area* tab contains the list of points, vertices of the polygon, and the plot of the polygon.

- *Point List* – the Point List name, either enter manually or select from the Point Lists drop-down box.
- *List of Points* – the list of currently selected vertices for the polygon.
- Up and down arrows move the highlighted point up and down in the order of the points.

NOTICE

For the correct operation of the application, the sides of the polygon should not cross each other.

-  – switches the keyboard arrow keys on/off (duplicates the operation of the arrows on the screen).
-  – closes the plot of the polygon. Only the list of points is available.
- **Calc** – calculates the area of the polygon and displays it on the *Results* tab.

The *Results* tab (Figure 14-38) shows the results of the calculation.

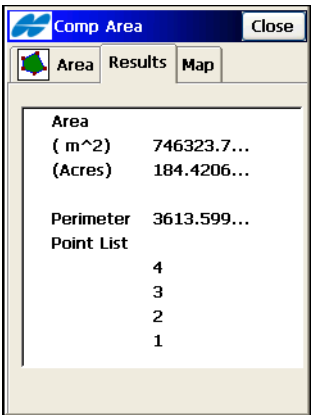


Figure 14-38. Area – Results Tab

The *Map* tab (Figure 14-39) shows a view of the polygon.

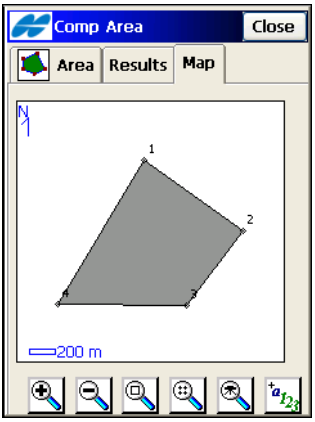


Figure 14-39. Area – Map Tab

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two options: *Edit Points* (see "Points" on page 6-2) and *Help* to access the help files.

The Hinge Method

The Hinge method generates a polygon of the desired area by rotating a ray from a fixed rotation point. This method calculates the coordinates of a point of intersection of the ray with the boundary formed by selected points in a list.

NOTICE

For the correct operation of the application, the sides of the polygon should not cross each other, that is, the polygon should be simple and convex.

To start the Hinge task, select the **Hinge** icon. The ***Known Area - Hinge*** screen displays (Figure 14-40 on page 14-32).

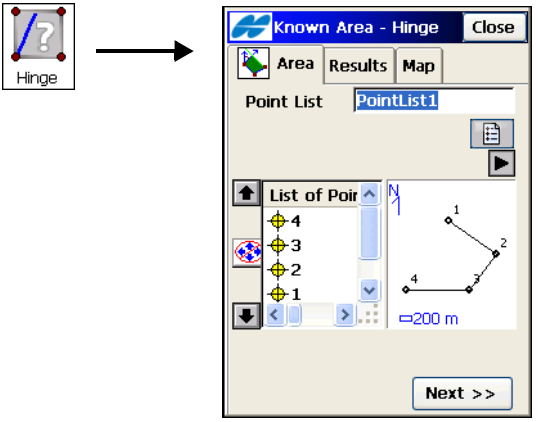


Figure 14-40. Hinge – Area Tab 1

The *Area* tab contains the initial data of the Hinge task.

- *Point List* – the Point List name: either enter manually or from the *Point List* drop-down box.
-  – closes the plot of the polygon. Only the list of points is available.
- *List of Points* – the list of currently selected vertices of the polygon.
- Up and down arrows move the highlighted point up and down to change the order of the points.
-  – switches the keyboard arrow keys on/off (duplicates the arrows on the screen).
- **Next** – opens the second screen of the *Area* tab (Figure 14-41 on page 14-33).

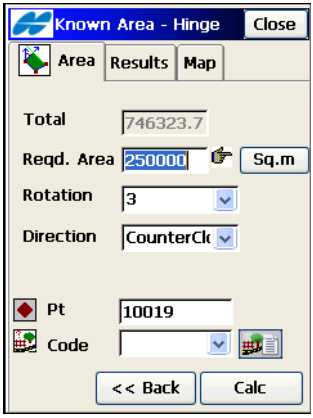


Figure 14-41. Known Area Hinge – Area Tab 2

- *Total (Area)* – the calculated area of a polygon formed with the currently selected points of the point list.
- *Reqd. Area* – the requested known area.
- **Sq.m** (Job Units)**/Acres**: press to set the area units.
- *Rotation (Pt)* – the point in the list that fixed for rotation of a ray to the new point to form a polygon of the requested area.
- *Direction* – the direction of rotation.
- *COGO Point* – the name of the new point calculated.
- *Code* – select the code from the drop-down list, or press the *attributes list* icon to open the list of available attributes.
- **Back** – returns to the previous screen.
- **Calc** – calculates the coordinates of the new point and displays it on the *Results* tab.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items: *Edit Point Lists* (see “Edit Point List” on page 6-34) and *Help* to access the help files.

The *Results* tab (Figure 14-42 on page 14-34) shows the results of the calculation.

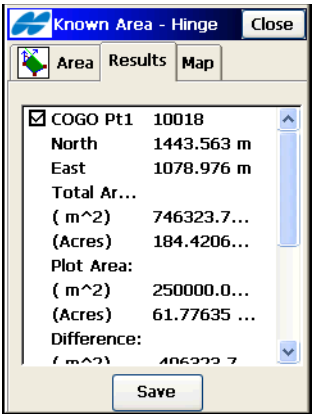


Figure 14-42. Hinge – Results Tab

The *Map* tab (Figure 14-43) shows the view of the polygon.

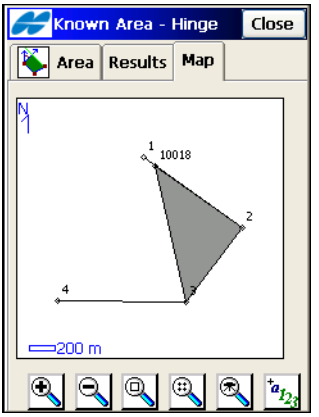


Figure 14-43. Hinge – Map Tab

The Line Method

The Line method computes the coordinates of two points that, along with two other known points, form a quadrilateral of the known area.

To start the Line task, select the **Line** icon. The ***Known Area - Line*** screen (Figure 14-44 on page 14-35) displays.

The *Area* tab (Figure 14-44) contains the initial data of the *Line* task.

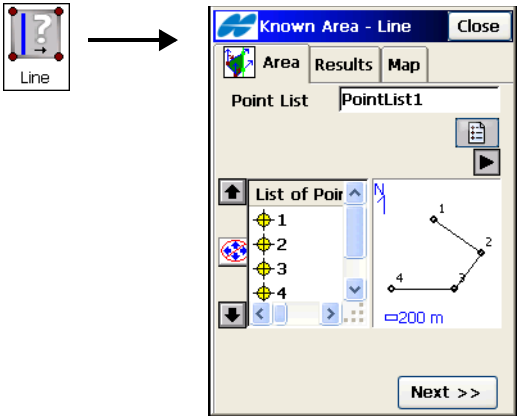


Figure 14-44. Line – Area Tab 1

For details on description of this screen, see "The Hinge Method" on page 14-31.

- **Next** – opens the second screen of the *Area* tab (Figure 14-45).

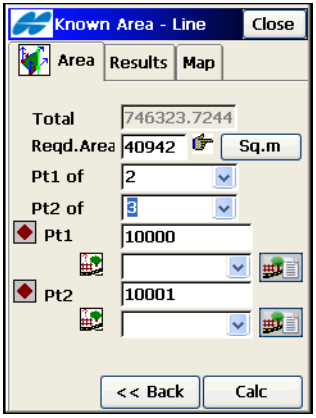


Figure 14-45. Line – Area Tab 2

- *Total Area* – the calculated area of a polygon formed with the currently selected points of the point list.
- *Reqd. Area* – the requested known area.
- *Pt1 of Edge, Pt2 of Edge* – the known points of the quadrilateral.

- *COGO Pt 1*, *COGO Pt 2* – the calculated points on the lines emanating from the *Pt1 of Edge* and *Pt2 of Edge*, respectively.
- *Area* – the known area.
- **Sq.m** (Job Units)**/Acres** – press to set the area units.
-  – press to enter a code, select a code from the drop-down list, or press the  icon to open the list of available attributes.
- **Calc** – calculates the coordinates of the line points and displays it on the *Results* tab.

For the correct operation of the application, the sides of the polygon should not cross each other, that is, the polygon should be simple and convex.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items: *Edit Points* (see "Points" on page 6-2) and *Help* to access the help files.

The *Results* tab (Figure 14-46) shows the results of the calculation.

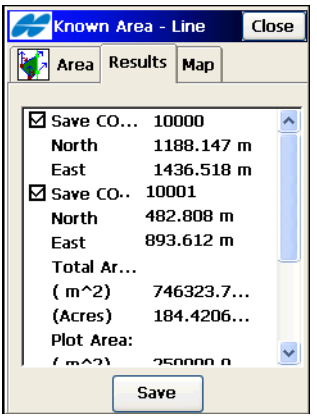


Figure 14-46. Line – Results Tab

The *Map* tab (Figure 14-47 on page 14-37) shows the view of the quadrilateral.

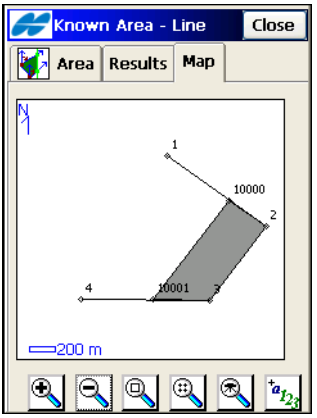


Figure 14-47. Line – Map Tab

Corner Angle

To calculate a corner angle, tap the **Corner Angle** icon (Figure 14-48). The ***Corner Angle*** screen displays.

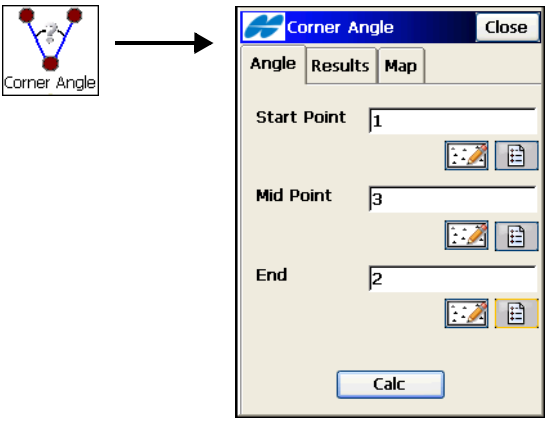


Figure 14-48. Corner Angle

The *Angle* tab contains initial data for the angle creation and calculates the angle:

- *Start Point* – the point that defines the first side of the angle; either enter manually or select from the map or from the list.

- *Mid Point* – the point that defines the corner of the angle; either enter manually or select from the map or from the list.
- *End (Point)* – the point that defines the second side of the angle; either enter manually or select from the map or from the list.
- **Calc** – calculates the corner angle.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing three items:

- *Edit Points* – opens the ***Points*** screen (see "Points" on page 6-2).
- *Calculator* – accesses the calculator (see "Calculator" on page 14-17).
- *Help* – accesses the Help files.

The *Results* tab shows the results of the calculation: calculation of various angles, distances, and azimuths to the start and end points.

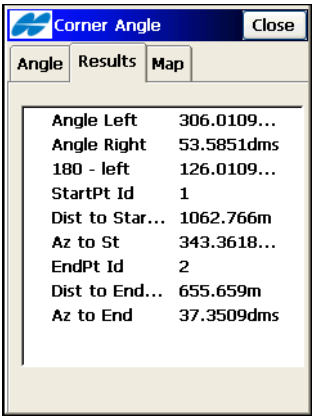


Figure 14-49. Corner Angle – Results Tab

The *Map* tab (Figure 14-50 on page 14-39) shows the view of the angle.

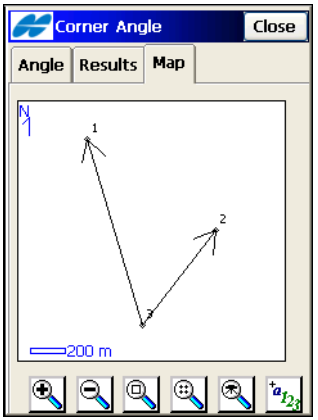


Figure 14-50. Corner Angle – Map Tab

Line Offset

To calculate the coordinates of points along a line, tap the **Line Offset** icon (Figure 14-51). The ***Line & Offsets*** screen displays.

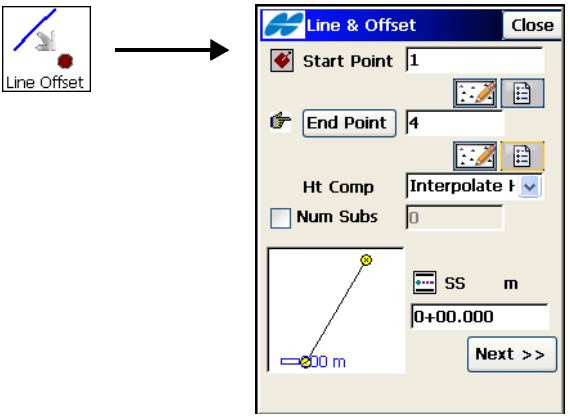


Figure 14-51. Line & Offset

- *Start Point* – the starting point of the line. The line is defined by the End point of the line or the azimuth to another point: either enter manually or select from the map or from the list.

- **End Point/Azimuth** – the ending point of the line / the azimuth to another point: either enter manually or select from the map or from the list.
- *Ht Comp* – select the type of height computations for the calculated points from one of the following:
  - *Interpolate Ht*: the height of the calculated point will be computed through linear interpolation using the height of the starting and ending points of the line.
  - *Ht of Start Pt* (height of starting point): the calculated point will have the same height as the starting point of the line.
- *Num Subs* – check and enable to designate the number of subdivisions you want to subdivide the line. For instance, a value of 3 indicates a calculation of four points by subdividing the line into three equal segments.
- *SS* (Start Sta) – enter the starting station (chainage) of the line.
- **Next** – opens the ***Station (Chainage) & Offsets*** screen.

Station & Offset

The ***Sta&Ofst*** screen (Figure 14-52) contains the settings for the calculated stations with offsets from the line.

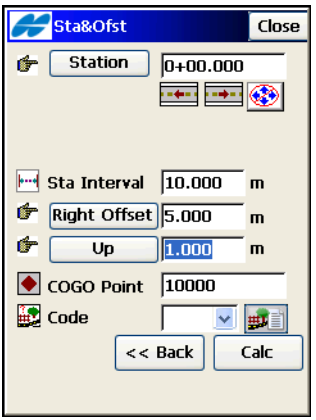


Figure 14-52. Station & Offsets

- *Station* – enter the station along the line. The two arrows to the right decrease or increase the station by the interval specified in the *Sta Interval* shown in the next field.
-  – left/right arrows decreases/increases the distance by the station interval.
-  – uses the right/left arrow keys of the keyboard to increase or decrease the station.
- *Sta Interval* – the station interval calculated.
- **Right Offset/Left Offset** – the right or left offset of the calculated point with respect to the line at the station shown on the *Station* field above.
- **Up/Down** – the Up or Down Height offset, with respect to the height of the line at the station.
- *COGO Point* – sets the starting name for the points calculated.
- *Code* – the code of the point.
- **Back** – returns to the previous screen.
- **Calc** – calculates the points along the line. A successful message displays.

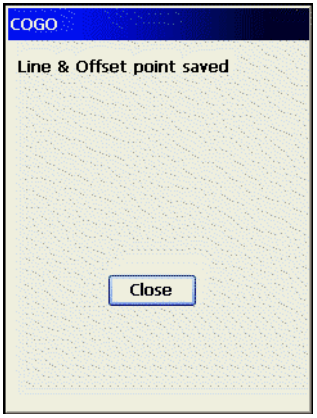


Figure 14-53. Successful Message

Curve Offset

To calculate the coordinates of points along a curve, tap the **Curve Offset** icon. The ***Curv & Offset*** screen (Figure 14-54) displays.

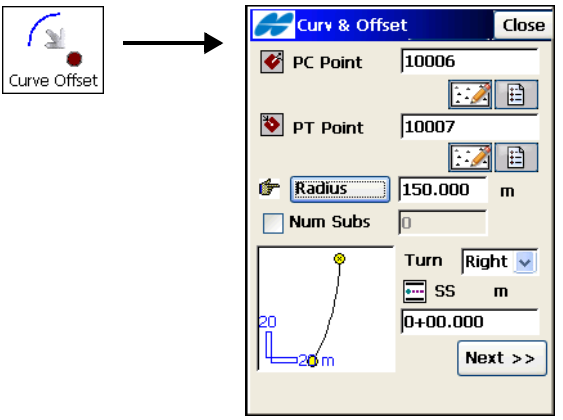


Figure 14-54. Curve & Offset

- *PC Point* – the Point of Curve, the starting point of the arc; either enter manually or select from the map or from the list of points.
- *PT Point* – the Point of Tangency; either enter manually or select from the map or from the list of points.
- **Radius/Deg Curve/Deg Chord** – the radius parameters of the curve.
- *Num Subs* – check and enable to designate the number of subdivisions you want to subdivide the curve. For instance, a value of 3 indicates a calculation of four points by subdividing the curve into three equal segments.
- *Turn* – the direction of turn, relative to the PC Point.
- *SS* – the starting station (chainage) of the curve.
- **Next** – opens the ***Station (Chainage) & Offsets*** screen.
- **Close** – saves the changes and closes the screen.

The ***Sta&Ofst*** screen (Figure 14-55) contains the settings for the calculated stations with offsets from the curve.

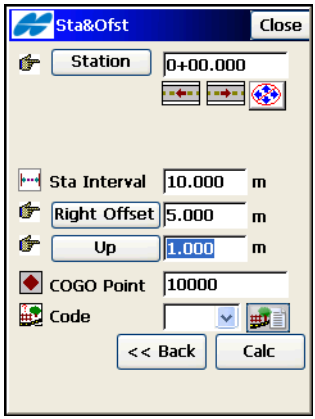


Figure 14-55. Station & Offsets

- *Station* – the station along the curve. The two arrows to the right decrease or increase the station by the interval specified in the *Sta Interval* shown in the next field.
- –left/right arrows decreases/increases the distance by the station interval.
- – uses the right/left arrow keys of the keyboard to increase or decrease the station.
- *Sta Interval* – the station interval calculated.
- **Right Offset/Left Offset** – the right or left offset of the computed point with respect to the curve at the station shown on the *Station* field.
- **Up/Down** – the Up or Down Height offset with respect to the height of the curve at the station.
- *COGO Point* – sets the starting name for the points calculated.
- *Code* – the code of the point.
- **Back** – returns to the previous screen.
- **Calc** – calculates the points along the curve. A successful message displays.

Calculating a Road Offset

To calculate the coordinates of points along a road, tap the **Road Offset** icon (Figure 14-56). The ***Road Offset*** screen displays.

The ***Road Offset*** screen selects the road to calculate the offset points and displays the plan of the chosen road.

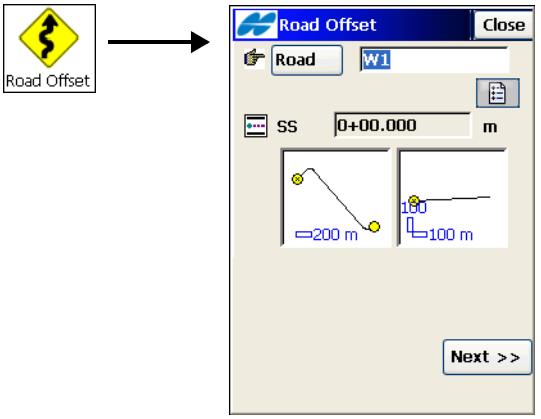


Figure 14-56. Road Offset

- **Road/H Alnt/HV Alnt** – the road/horizontal/horizontal and vertical alignments to calculate the offset points: either enter manually or select from the map or from the list of points.
- *SS (Start Stn)* – the starting point of the calculated points, the distance from the beginning of the road.
- **Next** – opens the ***Station (Chainage) & Offsets*** screen (Figure 14-57 on page 14-45).

The ***Sta&Ofst*** screen contains the settings for the calculated stations with offsets from the road.

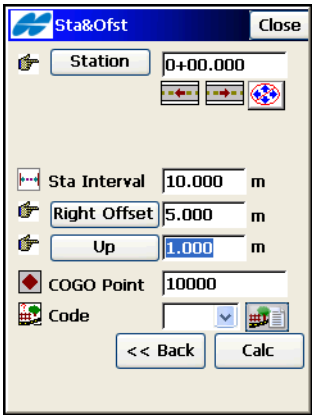


Figure 14-57. Station & Offsets

- *Station* – the station along the road. The two arrows to the right decrease or increase the station by the interval specified in the *Sta Interval* shown in the next field.
- – left/right arrows decreases/increases the distance by the station interval.
- – uses the right/left arrow keys of the keyboard to increase or decrease the station.
- *Sta Interval* – the station interval.
- **Right Offset/Left Offset** – the right or left offset of the stakeout point with respect to the road at the station shown on the *Station* field.
- **Up/Down** – the Up or Down Height offset with respect to the height of the road at the station.
- *COGO Point* – sets the starting name for the points calculated.
- *Code* – the code of the point.
- **Back** – returns to the previous screen.
- **Calc** – calculates the points along the road. A successful message displays.

Adjusting Points

To transform points or perform traverse adjustment, tap the **Adjust** icon (Figure 14-58). The Adjust menu opens to access the *Rotate*, *Translate*, *Scale*, *2D Transform,* and *Traverse* options.

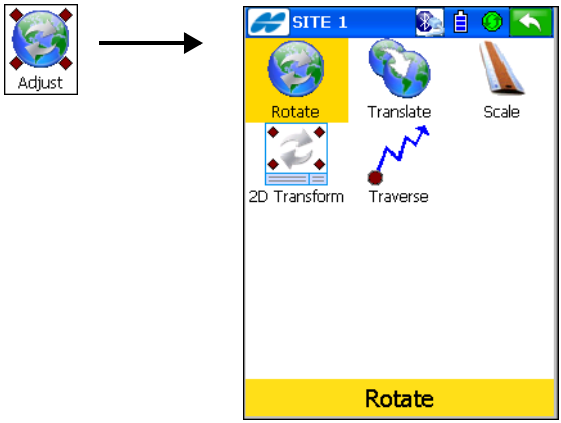


Figure 14-58. Adjust Menu

Rotate

To rotate points, tap the **Rotate** icon. The ***Rotate*** screen displays (Figure 14-59 on page 14-47).
To rotate the selected points around a specific point, select a rotation method: either *Rotation Angle* or *Azimuth*.

- *Select points* – select the point/points to be rotated by one of the following methods:
  - **By Range**: press to display the ***By Range*** screen. For a description of the ***By Range*** screen, see "Select Points by Range" on page 14-47.
  - Select points for rotation from the map or the list using the icons to the right.
  - Tap the **Layer** icon to rotate all points on a layer selected in the Layers screen.

- *Rotation Point* – sets the center of rotation: either enter manually or select from the map or the list.
- *Rotation Method* – select either *Rot. Angle* (if the rotation angle is input directly) or *Azimuth* (as a difference between the new and old azimuths/bearings).
- *Rotation Angle* – enter the value of the rotation right angle.
- *Old Azimuth* – enter the value of the old azimuth.
- *New Azimuth* – enter the value of the new azimuth.

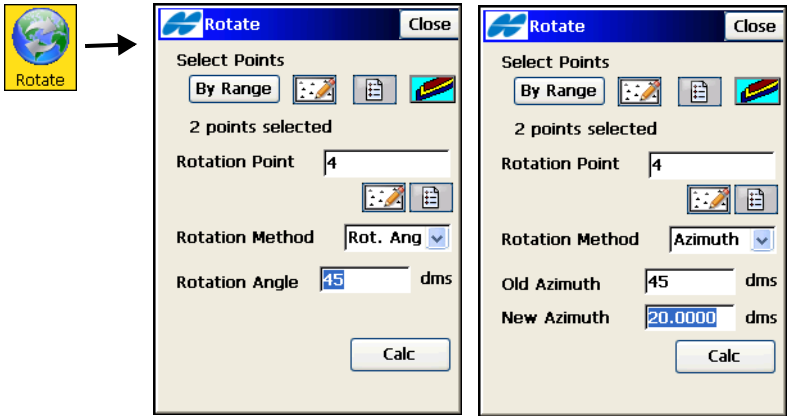


Figure 14-59. Rotate

- **Calc** – press to rotate the selected points. A successful message displays.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen (see “Points” on page 6-2).
- *Help* – accesses the Help files.

Select Points by Range

In the ***Range of Points*** field on the ***By Range*** screen (Figure 14-60 on page 14-48), the range can be set by enumeration of the points separated by commas, or by specifying the first and the last pointincluded in the range. Press the **OK** button to save the specified

range. The number of points selected display on the corresponding task screen in the *Select Points* field.

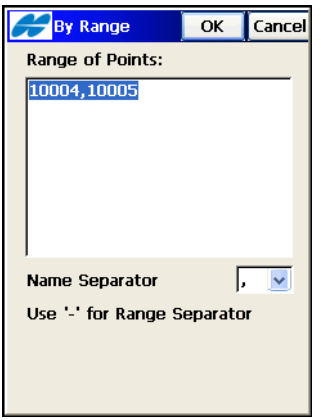


Figure 14-60. Select Points by Range

Translate

To translate a set of points, tap the **Translate** icon. The Translate screen (Figure 14-61 on page 14-49) displays.

To move a group of points selected on the ***Translate*** screen, select a translation method: select either *Coords/Pts* or *Az/Brg, Dist, Ht*.

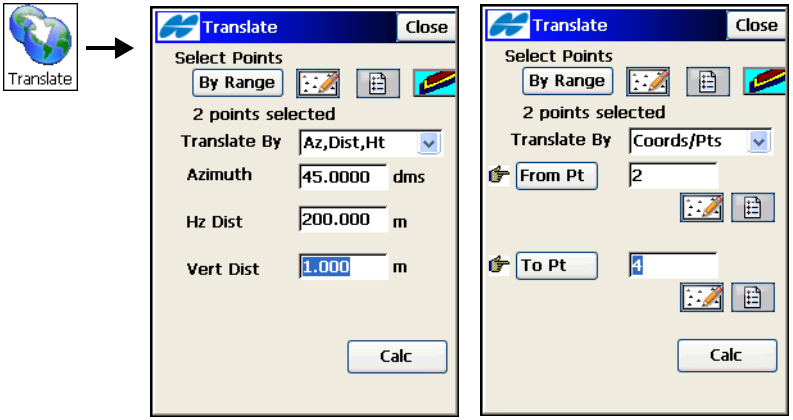


Figure 14-61. Translate

- *Select points* – select the points for translation from one of the following methods:
  - **By Range**: press to display the ***By Range*** screen. For a description of the ***By Range*** screen, see "Select Points by Range" on page 14-47.
  - Select points for rotation from the map or the list using the icons to the right.
  - Tap the **Layer** icon to rotate all points on a layer selected in the Layers screen.
- *Translate By* – select either *Coords/Pts* or *Az/Brg, Dist, Ht* as the translating method.
  - *Coords/Pts*: all the selected points are 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, define the local coordinates and the height of the location.
  - *Az/Brg, Dist, Ht*: all the selected points are moved in the specified direction by a specified distance. These parameters

are set through the *Azimuth(Bearing)* field, *Hz Dist* and *Vert Dist* fields.

- **Calc** – press to translate the selected points. A successful message displays.

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

Scale

To scale a set of points, tap the **Scale** icon. The ***Scale*** screen displays. To scale the distance of a range of points relative to a Base Point on the Scale screen, set the following parameters.

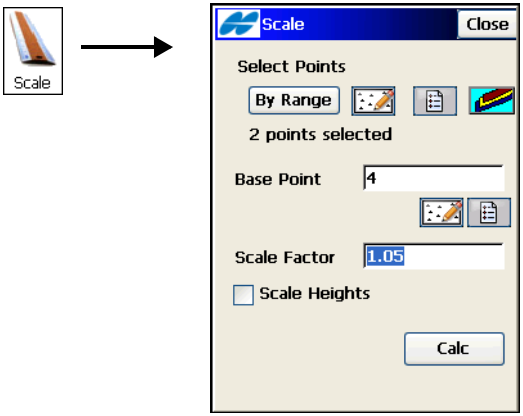


Figure 14-62. Scale

- *Select points* – select the points to scale using one of the following methods:
  - **By Range**: press to display the ***By Range*** screen. For a description of the ***By Range*** screen, see "Select Points by Range" on page 14-47.
  - Select points for rotation from the map or the list using the icons to the right.

– Tap the Layer icon to rotate all points on a layer selected in the Layers screen.

- *Base Point* – sets the reference point for the scale transformation: either enter manually or select from the map or from the list.
- *Scale Factor* – the scale factor for the coordinate transformation.
- *Scale Heights* – check mark and enable this box if the height values should be scaled also.
- **Calc** – press to scale the selected points. A successful message displays.

2D Transform

To perform a linear two dimensional transformation of a set of points, tap the **2D Transform** icon. The ***2D Transform*** screen (Figure 14-63) displays.

The ***2D Transform*** screen contains a list of point pairs used for getting the transformation parameters. Initially this screen is empty.

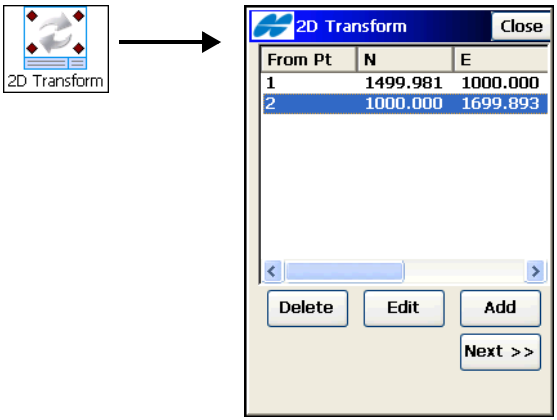


Figure 14-63. 2D Transform

- **Add** – press to enter pairs of points or coordinates in the ***Point Pair Info*** screen (Figure 14-65 on page 14-53).
- **Edit** – press to change the information about the point pair highlighted.

- **Delete** – press to erase the point pair selected.
- **Close** – closes the screen.
- **Next** – opens another ***2D Transform*** screen with the transformation parameters calculated (Figure 14-64).

The second ***2D Transform*** screen displays the transformation parameters which will be applied to the set of points needing transformation.

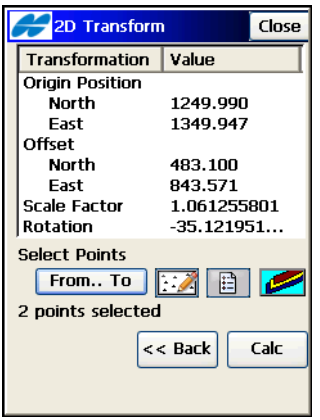


Figure 14-64. 2D Transformation Parameters

- *Select points* – select the points to convert using one of the following methods:
  - **From.. To**: press to display the ***By Range*** screen. For a description of the ***By Range*** screen, see "Select Points by Range" on page 14-47.
  - Select points for transform from the map or the list using the icons to the right.
  - Tap the Layer icon to transform all points on a layer selected in the Layers screen.

  Once the set of desired points is specified, the number of points selected will display on the *2D Transform* screen.
- **Back** – returns to the previous screen.

- **Calc** – performs the two dimensional transform and displays a successful message.
- **Close** – returns to the *2D Transform* screen.

Point Pair Info

The ***Point Pair Info*** screen (Figure 14-65) selects the pairs of points or coordinates to obtain transformation parameters.

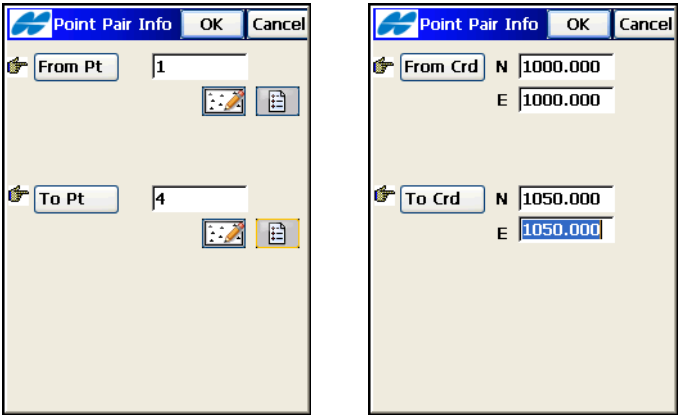


Figure 14-65. Point Pair Information

- **From Pt/From Crd** – changes the field to enter either the point or coordinates from which the parameters will be calculated.
- **To Pt/To Crd** – changes the field to enter either the point or coordinates to which the parameters will be calculated.
- **OK** – returns to the *2D Transform* screen with the pair added.
- **Cancel** – returns to the *2D Transform* screen without changes made.

Traverse Adjustment

Traverse adjustment is performed to provide a mathematically closed figure and at the same time, to get the best estimates for positions of all the traverse stations.

To perform an adjustment of a surveyed traverse, tap the **Traverse** icon. The ***Adjustment*** screen displays (Figure 14-66).

Adjustment Parameters

The first ***Adjustment*** screen contains general settings for adjustment:

- *Start Point* – the station on which the traverse originates; either enter manually or select from the map or from the list of points.
- *End Point* – the station on which the traverse closes; either enter manually or select from the map or from the list of points.
- *Adjust Elevations* – check mark and enable this box to include adjusting elevations if elevations were determined in the traverse.
- *Adjust Sideshots* – check mark and enable this box to include adjusting side shots.
- *Curvature refraction* – if needed select an Earth curvature refraction value from 0.14 and 0.2
- *Job to store the results* – the **New** button opens the ***New Job*** screen to create a new job to store the adjusted traverse stations.
- **Next** – opens the next ***Adjustment*** screen to perform adjustment.

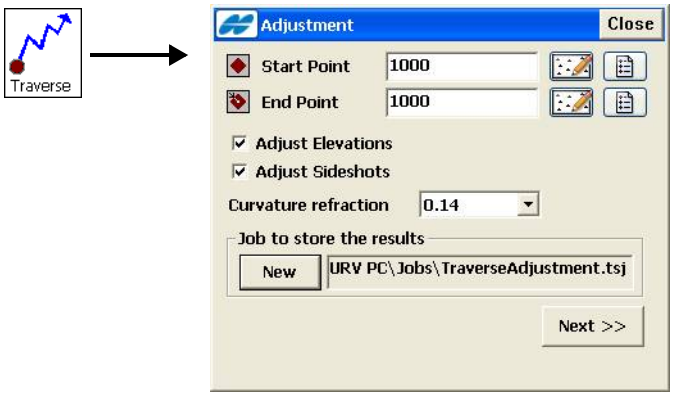


Figure 14-66. Adjustment Settings

Adjustment

The next ***Adjustment*** screen (Figure 14-67) selects the method of traverse adjustment to use and a technique to close the traverse if it is unclosed.

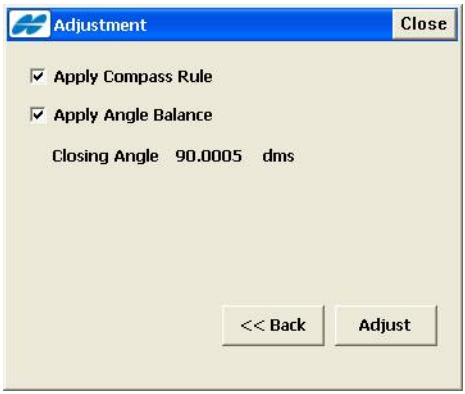


Figure 14-67. Adjustment

- *Apply Compass Rule* – check mark and enable this box to adjust the traverse by the compass rule.
- *Apply Angle Balance* – check mark and enable this box to adjust the traverse by the angle balance.
- *Closing Angle* – shows the closing angle for the traverse adjustment.
- **Adjust** – press to adjust the traverse. The ***Adjustment Results*** screen opens to display results. The traverse points adjusted will be saved in the new job as calculated points.

Traverse

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

To start a Traverse task, tap the **Traverse** icon (Figure 14-68). The ***Traverse Calc*** screen displays.

The *Traverse Calc* (Figure 14-68) tab displays the initial data for the traverse task.

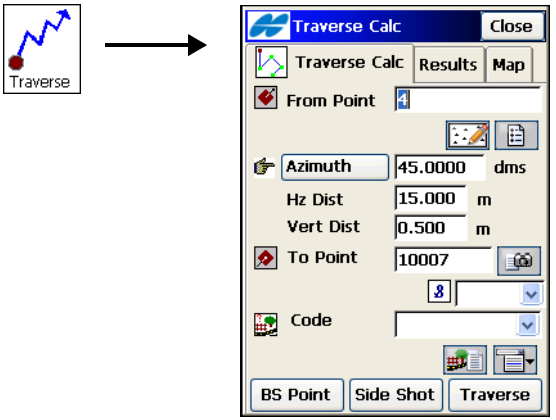


Figure 14-68. Traverse Calc

- *From Point* – indicates the occupation (the traverse point): either enter manually or select from the map or list.
- **Azimuth/Angle Right/Angle Left/Deflection** – determines the azimuth from the known point to the calculated point (To Point). 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.
  - **Azimuth**: sets the azimuth by value.
  - **Angle Right**: angle to the right is the angle at the known point from the backsight point to the calculated point in a clockwise direction.

  - **Angle Left**: angle to the left is the angle at the known point from the backsight point to the calculated point in an counter clockwise direction.
  - **Deflection**: the angle at the known point between the prolongation of the line from the backsight point and the line to the calculated point

- *Hz Dist* – the Horizontal Distance along the azimuth line.
- *Vert Dist* – the Vertical Distance along the azimuth line.
- *To Point* – the name of the calculated point. The *photo note*  icon opens the ***Add Photo Notes*** screen to enter a photo note for the point.
- *Code* – the code associated with the calculated point.
- **BS Point** – displays the ***BS Point*** screen for entering the Backsight Point or Backsight Azimuth (Figure 14-70 on page 14-58). If a BS point has not been entered, an Azimuth is required. In this case, if an angle value is entered as *Angle Right, Angle Left*, or *Deflection*, this value is considered to be azimuth.
- **SideShot** – if pressed, the coordinates of the *To Point* are calculated based on the entered values for *Azimuth/Angle Right/ Angle Left/Deflection*, *Horizontal* and *Vertical* distances. The *From Point* parameter does not change and the *To Point* parameter is incremented to the next new Point in the database.
- **Traverse**: if pressed, the coordinates of the To Point are calculated based on the entered values for (Azimuth/Angle Right/ Angle Left/Deflection), Horizontal and Vertical distances. The *From Point* changes to the *To Point*, and the *To Point* changes to the next new name in the database.

The Help Icon in the upper-left corner of the screen displays a pop-up menu containing two items:

- *Edit Points* – opens the ***Points*** screen to edit the points (see “Points” on page 6-2).
- *Help* accesses the Help files.

The *Results* tab (Figure 14-69) shows the initial data and results of the calculation. The *Map* tab shows the results graphically.

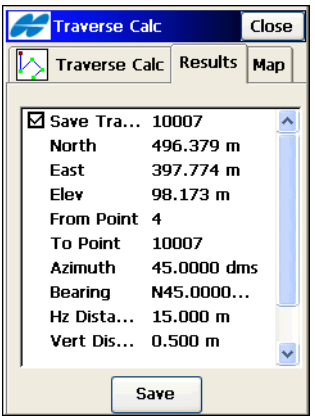


Figure 14-69. Traverse Calc – Results Tab

BS Point

The ***BS Point*** screen (Figure 14-70) enters the parameters for the *Backsight Point* or *Backsight Azimuth*. Tap the **BS Point/BS Azimuth** button to determine which parameters will display.

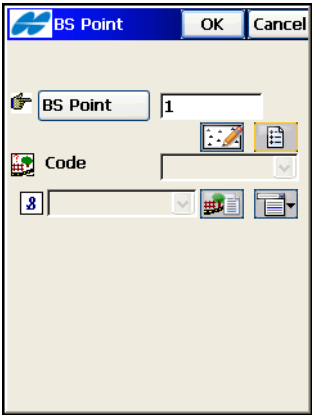


Figure 14-70. BS Point

Viewing Map

The **Map** Icon in the main menu opens a map on the main screen for the current job.

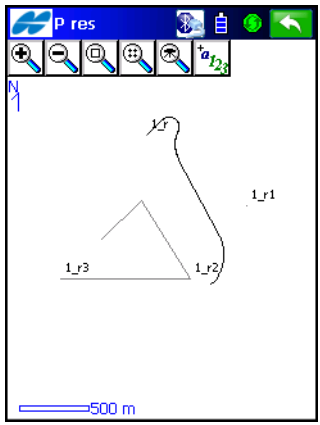


Figure 15-1. Job Map

The Map screen displays the plot of the current job, the toolbar and the scale bar. The Map maintains the scale after changing the status of the main map.

The Help Icon  opens a pop-up menu giving access to the help files, module activation codes, port data logging, changing menu interface, and information about the TopSURV used (for detail see “Help Icon’s Pop-up Menu” on page 1-8).

Toolbar

The Toolbar of the Map screen contains icons of the viewing options.

Figure 15-2. Toolbar Viewing Options

Table 15-1 describes the toolbar icons.

Table 15-1. View Menu Toolbar Options

Toolbar Icon	Icon Description
	Zooms the plot inwards
	Zooms the plot outwards
	Selects a frame of objects for zoom-in display; draw from left to right to get the object you want.
	Displays all points in the job
	Opens the ***Points*** screen to select a point to center the plot
	Opens the ***Properties*** screen

Select Point

The ***Select Point*** screen selects a point from the list to center the plot.

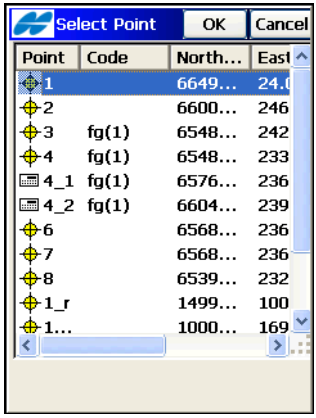


Figure 15-3. Select Point

Properties

The ***Properties*** screen (Figure 15-4) customizes the map view by adding properties to the points or setting the application to adjust the scale automatically.

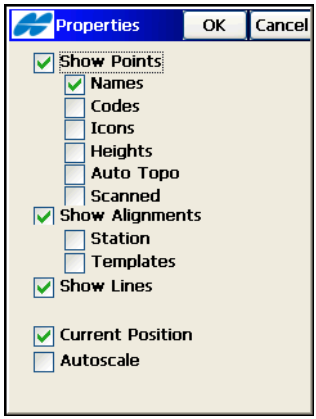


Figure 15-4. Map Properties

Place the check mark in the corresponding boxes to:

- Display, along with the points, their names, codes, icons and heights.
- Show Auto topo and scanned points.
- Display roads, turn on the linework on the map.
- Perform autoscaling (the *Autoscale* field). Autoscaling works to display the 30 most recent points of a survey on the map screen.
- Start each time from the current position. If the current position moves off the edge of the map, it will automatically snap back to the center if you place a check mark in the Current Position box.

Actions on the Map

The main Map screen not only displays spatial job overview but also provides access the job database by actions on the map view. It is realized by pop-up menus which offer the relevant actions on particular objects.
On the main ***Map*** screen, you can:

- Tap on the desired object (point, line, road) to select/deselect objects on the map.
- Press the  button and draw a frame from right to left to highlight selected objects.
- Press **Alt** on the controller's keyboard and tap the object, or press and hold the stylus on the selected object to display map options. A pop-up menu displays the options available for the selected object (Figure 15-5 on page 15-5):
  - *Stakeout*: performs stakeout of the selected point, point in direction, line vertices and road.
  - *Edit:* changes properties of a single selected object (point, line, road).
  - *Delete:* deletes selected objects.
  - *Add to Layer:* places selected objects on a selected layer.
  - *Create a Road:* creates a new road.

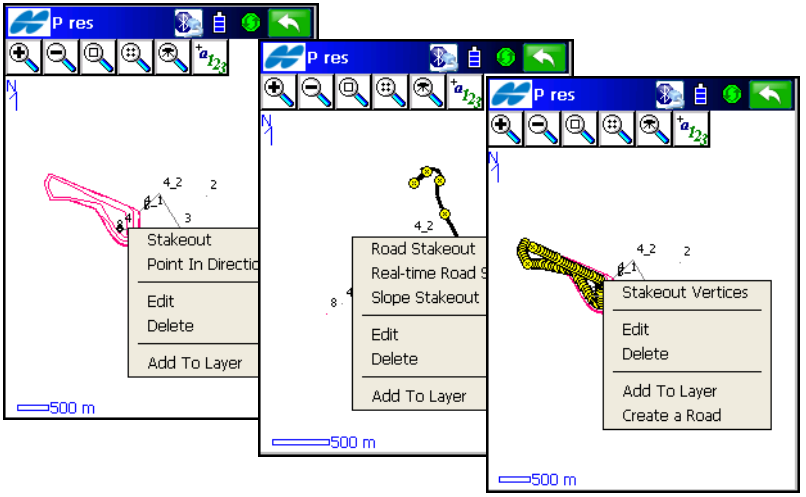


Figure 15-5. Map Options

Most TopSURV functions can be performed on the Map opened in a TopSURV task (for example, see Figure 15-6 for a Topo survey). Depending upon the task, the appearance of the view changes. Mostly the controls located on the main task page are duplicated. There are also some controls that are independent of the function being performed. These controls correspond to the viewing options and customized display options.

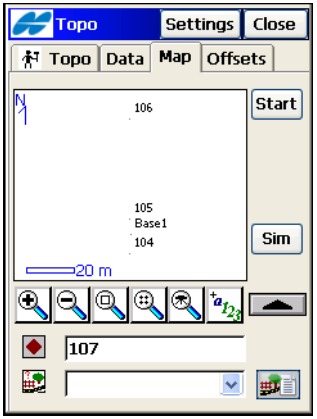


Figure 15-6. Topo – Map

Notes:

Switching Instruments

The Mode Icon sets the instrument mode for surveying. The ***Observation Mode*** screen displays (Figure 16-1).

Observation Mode

On the ***Observation Mode*** screen, select the instrument type and wireless control options.

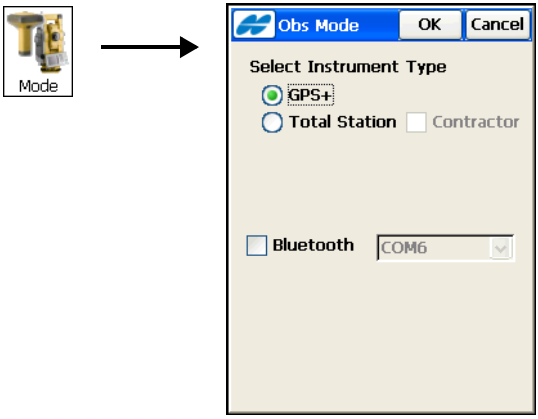


Figure 16-1. GPS+ Observation Mode

- *Select Instrument Type* – sets the operation mode for surveying; select either *GPS+* or *Total Station*. If Total Station mode is selected, you can choose Contractor mode, a scaled down version of the existing Total Station mode.
- *Bluetooth* – the option for remote (wireless) control on short distances. Only available if a Bluetooth device is available.

The Help Icon in the upper-left corner of the screen displays the *Help* option to access the help files.

Notes:

File Formats

The following sections describe the formats used to import/export different file types.

Point Coordinate Formats

The files used to import/export point data can be in different formats: text formats such as DXF, MOSS, and many others, or binary formats such as DWG and CR5.

Text (Custom Format)

This format contains a set of user-defined fields in the user-defined order. This format can contain points and lines. Lines are defined by continuous list of the points with the same name.

The following fields are available:

Name

N(Lat)

E(Lon)

Elev

Ell ht

Notes

Codes

Codes&Strings

Codes&Attributes

FullCodes

Four variants of code fields are available to support all code features in TopSURV:

1. Codes - includes only codes: Code1, Code2,..., CodeN...

2. Codes&Strings - includes only code names and strings:

Code1&"code string1",…, CodeN&"code stringM"...

3. Codes&Attributes - includes only code names and attributes:

Code1:[attribute name1].[type of the attribute]="value of the attribute"… $Code1:[attribute nameN].[type of the attribute]="value of the attribute"...

4. FullCodes - includes code names, attributes, code strings and control codes:

Code1:[attribute name1].[type of the attribute]="value of the attribute"&"code string"@"control code"… $Code1:[attribute nameN].[type of the attribute]="value of the attribute"&"code stringM"@"control codeK"…

Select only one type of the code output to one file. Selection of several Codes fields for export is not supported

FC-4

The FC-4 format is as follows:

Name, Northing, Easting, Elevation, Code

Example:

101
12.32000
45.10000
23.12000
a
102
34.20000
9.40000
3.22000

103
2.33400
8.45000

45.00000

b

104

78.60000

45.00000

56.60000

FC-5

Example:

OutPut

_+BS_ f+012500000m_ g+011500000m_ h+000050000m_+PJ1_ f+012000000m_ g+011002106m_ h+000049970m_+PJ11_ f+012000000m_ g+011002106m_0063

h+000049970m_+PJ12_ f+011994478m_ g+011004703m_ h+000050025m_+PJ13_ f+011990588m_ g+011003698m_ h+000049863m_+PJ2_ f+011994476m1051

InPut

_+BS_ x+012500000m_ y+011500000m_ z+000050000m_+PJ1_ f+012000000m_ g+011002106m_ h+000049970m_+PJ11_ f+012000000m_ g+011002106m_0063

h+000049970m_+PJ12_ f+011994478m_ g+011004703m_ h+000050025m_+PJ13_ f+011990588m_ g+011003698m_ h+000049863m_+PJ2_ f+011994476m1051

GTS-6

GTS-6 coordinate input and output is the same format. Refer to the GTS-6 interface manual to confirm details.

The format of GTS-6 is the same as FC-5 coordinate input.

FC-6/GTS-7

The format of FC-6 is the same as GTS-7 coordinate format. The GTS-7 format is as follows:

ptno, X(easting), Y(northing), Z(elevation)

Example:

1,1000.0000,1000.0000,100.0000
2,990.0000,1010.0000,100.0000
101,994.8159,1000.9684,100.1130
102,993.9304,1007.7991,100.8000
103,998.5150,1009.6329,100.4026
104,1002.0648,1002.5682,100.3421
1001,1004.7210,997.6496,100.1153
1002,1003.7027,990.8382,100.7989
1003,998.7911,990.3286,100.4033
1004,997.3111,998.0951,100.3421

GTS-7 with strings

The GTS-7 with strings format is as follows:

ptno, X(easting), Y(northing), Z(elevation), pt code, string

Example:

1,1000.0000,1000.0000,100.0000,STN,001
2,990.0000,1010.0000,100.0000,STN,001
101,994.8159,1000.9684,100.1130,STN,002
102,993.9304,1007.7991,100.8000,STN,001
103,998.5150,1009.6329,100.4026,STN,002
104,1002.0648,1002.5682,100.3421,STN,001
1001,1004.7210,997.6496,100.1153,PT,09
1002,1003.7027,990.8382,100.7989,PT,05
1003,998.7911,990.3286,100.4033,PT,09
1004,997.3111,998.0951,100.3421,PT,05

GT

The GT Format is as follows:

0 Code Name North East Elev 0 0

Example:

0	a	101	12.320	45.100	23.120	0 0
0		102	34.200	9.400	3.220	0 0
0	b	103	2.334	8.450	45.000	0 0
0		104	78.600	45.000	56.600	0 0

GT-FIN

The File Extension for this format is *.GT

Format is 8,8,8,8,14,14,14:

1: Surface (Eight marks)

2: Line (Eight marks)

3: Code (Eight Marks)

4: Point (Eight marks)

5: X-coordinate (N) (fourteen marks)

6: Y-Coordinate (E) (fourteen marks)

7: Z-Coordinate (H) (fourteen marks)

Example:

9 1 0 1 44318.541 72090.844 0.000

where

9 = Surface Code (ctrl code)

1 = Line Code (String code)

0 = Code

1 = Point number

44318.541 = North

72090.844 = East

0.000 = Height

MMH360

The File Extension for this format is *.360

MMH360-format is as follows:

1: Empty (Four marks)

2: Control Code (three marks)

3: String (Four Marks)

4: Point (pointnumber: seven marks)

5: Empty (four marks)

6: Code (Three marks)

7: Control Code 2 (two marks)

8: Empty mark (One mark)

9: X-coordinate (N) (11 marks, three after comma)

10: Empty mark (One mark)

11: Y-coordinate (E) (11 marks, three after comma)

12: Empty (Eight marks)

13: Z-coordinate (H)(8 marks, three after comma)

Example:

```
25  4    10   60101 7062800.100 3513639.300          17.800
```

where

25 = Control code

4 = String

10 = Point Number

601 = Code

01 = Control Code 2

7062800.100 = North

3513639.300 = East

17.800 = Height

DXF

AutoCAD® DXF (Drawing eXchange Format) is the native vector file format of Autodesk's AutoCAD application.

KOF

KOF is a Norwegian format that consists of a set of data blocks.

Example:

```
00 Starting off with total station:
02 P10                                1.690 31
09 40
03 100      45      100.1230 100.1230  100.123  1.670
03 101      45      200.3210 100.3210  200.321  1.670
03 101      45        .3215 299.6786  200.322  1.670
03 100      45      300.1236 299.8770  100.134  1.670
09 40
03 100      45      200.1260 299.8770  100.126  1.670
03 101      45      300.3350 299.6791  200.345  1.670
03 101      45      100.3206 100.3215  200.256  1.670
03 100      45        .1247 100.1234  100.139  1.670
09 39
03 2        7002    110.0000 101.3955   50.002  1.350
03 3        7002    125.3600 100.2500   48.369  1.350
03 4        7002    136.2300 100.2500   48.369  1.350
09 91
03 5        7002    148.0000 100.2500   48.369  1.350
03 6        7002    150.0000 100.2500   48.369  1.350
03 7        7002    158.0000 100.2500   48.369  1.350
03 8        7002    168.0000 100.2500   48.369  1.350
03 9        7002    170.0000 100.2500   48.369  1.350
03 10       7002    180.0000 100.2500   48.369  1.350
09 99
00 Then a couple of coordinates:
```

```
05 100      1000      134721.459  9867.343  21.633
05 101      1000      134741.349  9881.834  21.514
00 And some GNSS-vectors:
42 Bauta            2210658.5530 618726.6390 5930812.0680 1.341
43 D1                  4.5619    230.4119    -47.0982 2.054
44  1.4314  0.6481  4.5640 1.0000 0.4382 0.8757 1.0000 0.4811 1.0000
42 Bauta            2210658.5530 618726.6390 5930812.0680 1.341
43 D2                 -0.6466    176.7444    -33.8989 2.054
44  0.2134  0.1012  0.5657 1.0000 -0.0395 0.8015 1.0000 -0.1045 1.0000
```

The examples shown are not complete blocks, but show typical use of the blocks. Several of the blocks have a two-digit code that describes the kind of measurement being done.

The relevant values are:

30 = TS, Traverse

31 = TS, Free station / eccentric station

32 = TS, Known station

33 = TS,Other

91 = GPS, code differential (DGPS)

92 = GPS, autonomous

96 = GPS, RTK fixed

97 = GPS, RTK float

Block 00 - Header

```
 DB   FreeText
^I2 ^ A64
```

Example:

```
 00 This is just a comment!!
```

Block 02 - Station

```
 DB  Station  Feat.Code  NR   Press  Temp Ih    Type   Comm
^I2 ^A10     ^A8       ^ I8 ^ I8   ^ I8 ^ F6.3 ^ I2   ^ A7
```

Example:

```
 02 P100      1000                          1.723
```

DB is the data bloc-number (02), Station is name of station (point where total station is situated), Feat. Code is feature code, NR could be left blank. Pressure in mmHg and temperature in C. Ih=instrument height, Type is type of measurement, and Comm is comment.

Block 03 - Total Station observations 1

```
 DB   AimPoint  Feat.Code  Hor   Vert   Dist   Ph    Type  Comm
^I2 ^ A10     ^ A8       ^ F8.4 ^F8.4  ^F8.3 ^ F6.3 ^ I2   ^A7
```

Example:

```
 03 PP230      7002     100.1230 100.1230  100.123  1.670
```

DB is data block-number (03). Aim Point is point name of point at which the total station is aimed. Feature code is feature code of Aim Point. Hor is horizontal angle (gon). Vert is vertical angle (gon). Dist is slope distance. Ph is pole height / prism height. Type is type of observation, and Comm is comment.

Block 04 - Total Station observations 2

```
 DB   AimPoint  Feat.Code  Hor    Dh     DistH   Ph    Type  Comm
^I2 ^ A10     ^ A8       ^ F8.4 ^ F8.3 ^ F8.3  ^ F6.3 ^I2  ^ A7
```

Example:

```
 04 PP231      7002     100.1230    2.113  144.341  1.670
```

DB is data block (04). Aim Point is the point at which the total station is aimed. Feat.Code is feature code for Aim.Point. Hor is horizontal angle (gon). Dh is height difference. DistH is horizontal distance. Ph is pole height / prism height. Type is type of observation, and comm is comment.

Block 05 - Coordinates

```
 DB   Pointname  Feat.Code  North    East     Height   Type  Comment
^I2 ^ A10      ^ A8       ^ F12.3 ^ F11.3 ^ F8.3   ^ I2  ^ A7
```

Example:

```
 05 P101       1000       134741.349    9881.834   21.514
```

DB is datablock (05). Pointname is occupation name (point name). Feat.Code is feature code. North, East, Height is coordinate in selected system. Type is type of calculation/ measurement, and comment is a free-text comment.

Block 09 - Program information

```
 DB   PI   Connection   Free text
^I2 ^ I2 ^ A10       ^ A50
```

Example (line coding):

```
 09 91
05 P100      1000      134654.123   9800.123   21.000
05 P101      1000      134741.349   9881.834   21.514
 09 99
```

DB is datablock (09). PI is program information, which is a code that can give extra information to the program reading the KOF file, and can be used to start/end lines in a coordinate export. Connection is sometimes used and is a point number of an existing point.

Block 41 - GNSS base, no coordinate

```
 DB   BaseName   Feat.Code  Bk Spaces  Ant.H. Type  Comm.
^I2 ^ A10      ^ A8       ^ I8 x31    F6.3  ^I2  ^ A7
```

Example::

```
 41 Bauta                                      1.341
```

This block brings on base point name and antenna height. It has the same layout as block 42 (fields are described there), except that the coordinates are replaced by spaces.

Block 42 - GNSS base, with coordinate

```
 DB  BaseName  Feat.Code X     Y     Z     Nr Ant.H. Bk  Comm.
^I2 ^A10     ^ A8       ^F12.4^F12.4^F12.4^I8^F6.3  ^I2  ^ A7
```

Example:

```
 42 Bauta             2210658.5530  618726.6390 5930812.0680  1.341
```

DB is data-block (42). BaseName is the point name of the base. Feat.Code is feature code. X, Y, and Z is coordinate of base in WGS84 geocentric coordinates. Nr should be left blank. Ant.H is antenna height. Bk should be left blank, and Comm. is a freetext comment.

Block 43 - GNSS vector

```
 DB   PointName  Feat.Code  dX    dY    dZ     Ant.H  Bk  Comm
^I2 ^ A10      ^ A8       ^F12.4^F12.4^F12.4^ F6.3  ^I2   ^A7
```

Example:

```
43 P1                    4.5619     230.4119     -47.0982  2.054
```

This is the vector. DB is data-block (43). PointName is the (rover) occupation name (point name). Feat.Code is feature code. dX, dY, and dZ is the vector components in WGS84 geocentric coordinates. Ant.H is antenna height of the rover. Bk is not used, and Comm. is a freetext comment.

Block 44 - GNSS RMS and correlation coefficients, geocentric

```
DB  sX   sY   sZ   rXX  rXY  rXZ  rYY  rYZ  rZZ  Comm
^I2 ^ F8.4 ^F8.4^ F8.4^ F7.4^ F7.4^ F7.4^ F7.4^ F7.4^ F7.4^ A7
```

Example:

```
44  1.4314  0.6481  4.5640  1.0000  0.4382  0.8757  1.0000  0.4811  1.0000
```

This block follows block 43 with additional data on the vector. DB is data-block (44). sX, sY, sZ is the vector components standard deviation (or RMS-values). The r-fields are correlation coefficients between the vector components. rXX, rYY, rZZ are all equal to 1.

Block 45 - Coordinates in geocentric system (WGS84)

```
DB  PointName   Feat.Code X     Y     Z     Ant.H. Bk  Comm.
^I2 ^A10        ^ A8      ^F12.4^F12.4^F12.4^ F6.3  ^I2  ^ A7
```

Example:

```
42 P1048      1234     2210658.5530  618726.6390 5930812.0680
```

DB is data-block (45), PointName is occupation name (pointname), and Feat.Code is feature code. X, Y, and Z is the coordinate in WGS84 geocentric coordinates. Ant.H is antenna height. NB be left blank if coordinate is already adjusted for antenna height. Bk is left blank, and Comm. is a freetext comment.

Block 46 - Additional GNSS information

```
DB   Date   Time(UTC)  #SVs   PDOP   Ant.Height  Epochs   Type
^I2 ^ I8   ^ I2:I2:I2 ^ I2   ^ F5.2 ^ F6.3      ^ I3     ^ I3
```

Example:

```
46 31122004 23:59:59 13  1.45        001 96
```

DB is data-block (46), Date is date in format DDMMYYYY, Time is UTC-time in format HH:MM:SS (24h notation), #SVs is

number of satellites included in position calculation, PDOP is PDOP, Ant height is antenna height. NB should be left blank if coordinate (or vector) is already adjusted for antenna height. Epochs is number of epochs measured, and type is type of solution, from this list:

Block 50 - coordinate in selected system, with ellipsoidal height

```
 DB   Pointname Feat.Code North   East    Ell.H   Type   Comm.
^I2 ^ A10      ^ A8       ^ F12.3 ^ F11.3 ^ F8.3  ^ I2   ^ A7
```

Example:

```
 50 Point2345  1000       134741.349    9881.834   62.643
```

DB is data-block (50), PointName is the name of the occupation (point), and Feat.Code is feature code. North, East is coordinate from the measurement in selected system. Ell.H is ellipsoidal height in WGS84. Type is left blank. Comm. is a free text comment.

Block 51 - GNSS RMS and correlation coefficients, NEU (North,East,Up)

```
 DB   sN   sE   sU   rNN  rNE  rNU  rEE  rEU  rUU  Comm
^I2 ^ F8.4 ^F8.4^ F8.4^ F7.4^ F7.4^ F7.4^ F7.4^ F7.4^ F7.4^ A7
```

Example:

```
 50 Point2345  1000       134741.349    9881.834   21.514   62.643    2.054
```

This block follows block 05 or 50 (coordinate) with additional data on the measurement. DB is data-block (51). sN, sE, sU is the coordinate components' standard deviation (RMS-values), and the r-fields are correlation coefficients between the coordinate components. rNN, rEE, rUU are all equal to 1.

SHP

SHP is an ArcView® GIS data format used to represent a set of geographic features.

Refer to the following website for details:

http://dl1.maptools.org/dl/shapelib/shapefile.pdf

Cut Sheet Standard

Cut Sheet Standard format is as follows:

Header:

Date

Time

Job Name

Dist Units (Meter, US. Feet, Int. Feet, US. Inches, Int. Inches)

Design Point Record:

Point Name

Code

North East Elev

Stakeout Station Record:

Station Name

North East Elev

deltaNorth deltaEast deltaElev Cut

Cut Sheet User Defined

This format contains a set of user-defined fields in the user-defined order.

The following fields are available:

Design Point

Code

Staked Point

Cut

Fill

Cut(Fill)

Time Stamp

Station

Offset Direction

Offset Distance

Design North

Design East

Design Elevation

Station North

Station East

Station Elevation

Delta North

Delta East

Delta Elevation

Check Sheet

Check Sheet format is as follows:

Header:

Date

Time

Job Name

Dist Units (Meter, US. Feet, Int. Feet, US. Inches, Int. Inches)

Observed Point Record:

Point Name

Code

North East Elev

Check Station Record:

Station Name

North East Elev

deltaNorth deltaEast deltaElev

PTL Sheet

PTL Sheet format is as follows:

Header:

Date

Time

Job Name

Dist Units (Meter, US. Feet, Int. Feet, US. Inches, Int. Inches)

Point Record:

PointName North East Elev Code FirstReferencePointName SecondReferencePointName

CMM

The ASCII format file that consists of two files with extentions *.cor and *.lev containing coordinates and heights, respectively.

Land XML

LandXML is a standard data exchange format.

Refer to LandXML Website for details:

http://www.landxml.org/schema/landxml-1.0/Documentation/LandXMLDoc.htm

CR5

This is a file format of TDS-48 Coordinate file. The TDS Coordinate File is a binary file consisting of a 38 byte header,

followed by coordinate point records 45 bytes in length.

CR-5 format is as follows:

Header:

Bytes 1- 10 is the file name in ASCII

Bytes 11- 20 are not used

Bytes 21- 34 is the starting point number in MS long integer format. This record is -1 if the file is non-sequential

Bytes 35- 38 is the last point number in MS long integer format

Coordinate Point Records:

Bytes 1- 4 is the point number in MS long integer format. This record is -1 if the point is unused (sequential files only)

Bytes 5- 12 is the northing of the point in MS double precision real

Bytes 13- 20 is the easting of the point in MS double precision real

Bytes 21- 28 is the elevation of the point in MS double precision real

Bytes 29- 45 is the point descriptor in ASCII

MOSS GENIO

Example:

```
GENIO  D:\J0119A
001,FORMAT(3F14.4)
003,ORDR,4=1,1,2,3
080,PT01,7=3
    1002.6092    1013.9337       2.3165
    1007.5266     992.8522       1.9564
       0.0000       0.0000       0.0000
080,PT02,7=3
     991.2378    1002.7609       1.5545
     993.2974    1014.3845       2.3475
       0.0000       0.0000       0.0000
080,CD02,7=3
    1002.6079    1013.9361       2.3148
       0.0000       0.0000       0.0000
080,CD03,7=3
    1007.5318     992.8488       1.9562
       0.0000       0.0000       0.0000
```

```
080,OCC,7=3
    1000.0000    1000.0000       0.0000
       0.0000       0.0000       0.0000
080,PT01,7=3
    1002.6079    1013.9361       2.3148
    1007.5318     992.8488       1.9562
     991.2376    1002.7602       1.5557
     993.2994    1014.3841       2.3509
       0.0000       0.0000       0.0000
999
FINISH
```

NEZ

NEZ format is as follows:

Name, North, East, Elev, Code

Example:

```
101,12.3200,45.1000,23.1200,a
102,34.2000,9.4000,3.2200,
103,2.3340,8.4500,45.0000,b
104,78.6000,45.0000,56.6000,
```

This format is also used for PTL coordinate system. In this case the NEZ format is:

Name, North, East, Elev, Code, First Reference Point Name, Second Reference Point Name

NEZ with strings

The NEZ with strings coordinate format is as follows:

Name, North, East, Elev, Code, String

Example:

```
101,12.3200,45.1000,23.1200,a,123
102,34.2000,9.4000,3.2200,,
103,2.3340,8.4500,45.0000,b,
```

104,78.6000,45.0000,56.6000,,

This format is also used for PTL coordinate system. In this case the format is:

Name, North, East, Elev, Code, String, First Reference Point Name, Second Reference Point Name

Custom Format with Quality Control information

This format contains a set of user-defined fields in the user-defined order.

The following fields are available:

Name
E(Lon)
N(Lat)
Ell ht
Elevation
Notes
Codes
Codes&Strings
Codes&Attributes
FullCodes
Date
Solution Type
VRMS
HRMS
Time
PDOP
HDOP
VDOP
Num. of GPS
Num. of GLONASS
Design Elevation
Station North

Station East

Station Elevation

Delta North

Delta East

Delta Elevation

Code Libraries

The following sections describe the code formats used in the import/ export code libraries.

Topcon Data Dictionary Format (TDD)

Topcon's Data Dictionary Format supports String, Integer, Float and List types as fields of the codes. The Draw properties is also supported. All exported codes are stored in the one file. Each code is placed on a new line.

The format is as follows:

CodeName#1<Point?R*G*B?MStyle|Line?R*G*B?DashStyle?Width> (field#1(FIELD_TYPE),… field#N(FIELD_TYPE))

CodeName#2<Point?R*G*B?MStyle|Line?R*G*B?DashStyle?Width> (field#1(FIELD_TYPE),… field#N(FIELD_TYPE))

Comments:

Point, Line – types of the supported objects

R,G,B – color of the objects with such code

MStyle – mark style of the points with such code:

0 = Dot

1 = Filled Rectangle

2 = Filled Diamond

3 = Filled Circle

4 =Filled Triangle

5 = Rectangle

6 = Diamond

7 = Circle

8 = Triangle

9 = Cross

DashStyle – dash style of the lines with such code:

0 = Solid

1 = Dash

2 = Dot

3 = Dash Dot

4 = Dash Dot Dot

Width – width of the lines with such code

FIELD_TYPE can be: String, Integer, Float, List.

For FIELD_TYPE List we use next format:
List(item#1,…,item#N).

Example:

test_code(menu_item<Point?255*128*255?3|Line?255*255*128?3?1>(List(blue, green,red)), text_item(String), int_item(Integer), real_item(Float))

XML File as Storage of the Code Library (XML)

The XML Code Library format supports String, Integer, Float and List types as fields of the codes. The format also supports Layers dictionary and draw information for each code. All exported codes are stored in one file. The format uses the XML syntax and is as follows:

Example:

```
<?xml version="1.0"?>
<CodeDictionary version="1.1">
    <Layers>
        <Layer name="lay1" active="1" plot="1" notes="first">
        <Params type="Line">
        <DrawParams colorRValue="87" colorGValue="65" colorBValue="189"
        dashStyle="1" width="2"/>
        </Params>
        </Layer>
```

```
        <Layer name="lay2" active="1" plot="1" notes="second">
        <Params type="Line">
        <DrawParams colorRValue="153" colorGValue="98" colorBValue="156"
        dashStyle="2" width="3"/>
        </Params>
        </Layer>
        <Layer name="0" active="1" plot="1">
        <Params type="Line">
        <DrawParams colorRValue="128" colorGValue="128" colorBValue="128"
        dashStyle="0" width="1"/>
        </Params>
        </Layer>
    </Layers>
    <Code name="code1" layer="0">
        <Params type="Point">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        markStyle="-1"/>
        </Params>
        <Params type="Line">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        dashStyle="-1" width="1"/>
        </Params>
        <Attributes/>
    </Code>
    <Code name="code2" layer="0">
        <Params type="Point">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        markStyle="-1"/>
        </Params>
        <Params type="Line">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        dashStyle="-1" width="1"/>
        </Params>
        <Attributes/>
    </Code>
    <Code name="code3" layer="0">
```

```
        <Params type="Point">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        markStyle="-1"/>
        </Params>
        <Params type="Line">
        <DrawParams colorRValue="255" colorGValue="255" colorBValue="255"
        dashStyle="-1" width="1"/>
        </Params>
        <Attributes/>
    </Code>
</CodeDictionary>
```

Data Base Format as Storage of the Code Library (DBF)

This format supports String, Integer, Float types as fields of the codes. The List type is unsupported. Each exported code is stored in a separate file. The format uses DBF syntax. This is a binary format.

Roads Formats

The following sections describe the road formats used in the import/ export of road data.

SSS Road

Alignments are uploaded as elements, and begins with the START definition which includes the starting chainage and a coordinate. The elements are: PT, STRAIGHT, ARC or TRANSITION.

The general format for each record is:

KEYWORD nnnn, nnnn [,nnnn]

where:

START chainage, easting, northing

STRAIGHT bearing, distance

ARC radius, length

SPIRAL radius, length

PT easting, northing[, radius[, A1, A2: clothoid length]]

Example 1:

START 1000.000, 8.8888, 199.1200

STRAIGHT 25.0000, 48.420

SPIRAL 20.000, 20.000

ARC 20.000, 23.141

SPIRAL 20.000, 20.000

STRAIGHT 148.3000, 54.678

Example 2:

START 1000, 1050, 1100

PT 1750, 1300, 100, 80, 80

PT 1400, 1750, 200

PT 1800, 2000

TDS Road

TDS road file has a file extension of ".RD5". This format is divided into eight sections. Each section is started with a line that has a two letter code and is followed by exactly 50 '+' characters. These section header lines have to be included in the file even if there is no definition under them. For example, super-elevation and widening are not required, but their header lines must exist. Each header line may be followed by component definitions of that section.

Section codes:

HR : Start Horizontal alignment

VR : Start Vertical alignment

XR : Start Right Template

XL : Start Left Template

SR : Start Right Super Elevation

SL : Start Left Super Elevation

WR : Start Right Widening

WL : Start Left Widening

Example:

```
HR++++++++++++++++++++++++++++++++++++++++++++++++++++
HL,25.49380,630.000
HS,-1.000000,1000.000,200.000,R,T
HC,-1.000000,1000.000,895.900,R
HS,-1.000000,1000.000,200.000,R,C
HL,-1.00000,250.000
VR++++++++++++++++++++++++++++++++++++++++++++++++++++
VG,271.840,-2.000
VC,500.000,-2.000,1.800
VG,1254.060,1.800
VG,150.000,1.800
XR++++++++++++++++++++++++++++++++++++++++++++++++++++
RT,100,0.000,NORMAL
XL++++++++++++++++++++++++++++++++++++++++++++++++++++
LT,100,0.000,NORMAL
SR++++++++++++++++++++++++++++++++++++++++++++++++++++
RS,106,30.000,108,30.000,-2.000,-6.000,0,0,0.000,0.000
RS,117,25.900,119,25.900,-6.000,-2.000,0,0,0.000,0.000
SL++++++++++++++++++++++++++++++++++++++++++++++++++++
LS,104,30.000,108,30.000,-2.000,6.000,0,0,0.000,0.000
LS,117,25.900,121,25.900,6.000,-2.000,0,0,0.000,0.000
WR++++++++++++++++++++++++++++++++++++++++++++++++++++
RW,104,35.000,105,35.000,22.000,14.000,0
RW,106,35.000,107,35.000,14.000,22.000,0
WL++++++++++++++++++++++++++++++++++++++++++++++++++++
LW,104,35.000,105,35.000,22.000,14.000,0
LW,106,35.000,107,35.000,14.000,22.000,0
```

Component definitions:

Horizontal Alignments

HL,%.5lf,%.3f Horizontal Line

Azimuth of line (DMS) %.5lf

(-1 if tangent to previous segment)

Horiz distance of line (ft or meter) %.3f

HC,%lf,%.3f,%.3f,%c Horizontal Curve

Tangent azimuth %lf

(-1 if tangent to previous segment)

Radius %.3f

Arc length %.3f

Turn (R-Right or L-Left) %c

HS,%lf,%.3f,%.3f,%c,%c Horizontal Spiral

Tangent azimuth %lf

(-1 if tangent to previous segment)

Radius %.3f

Arc length %.3f

Turn %c (R-Right or L-Left)

Direction %c (T-Tangent or C-Curve)

Vertical Alignments

VG,%.3f,%.3f Vertical Grade

Horiz distance %.3f

Grade %.3f

VC,%.3f,%.3f,%.3f Vertical Parabolic Curv

Horiz distance %.3f

Begin grade %.3f

End grade %.3f

Cross section Templates

RT,%d,%.3f,%s Right or Left Cross Section Template

LT,%d,%.3f,%s

Station number %d

Station offset %.3f

Template name %s

Super Elevation

Right or Left Super Elevation

RS,%d,%.3f,%d,%.3f,%.3f,%.3f,%c,%c,%.3f,%.3f or

LS,%d,%.3f,%d,%.3f,%.3f,%.3f,%c,%c,%.3f,%.3f

Start Station number %d

Start Station offset %.3f

End Station number %d

End Station offset %.3f

Start slope %.3f

End slope %.3f

End of SE flag %c

(0-End station number and End station offset are in fields 3 and 4

1-length of SE interval is in field 4)

Hinge on center or edge %c

of road (0-center,1-edge)

Parabolic transition length %.3f

at start of SE

Parabolic transition length %.3f

at end of SE

Widening

Right or Left Widening

RW,%d,%.3f,%d,%.3f,%.3f,%.3f,%c or

LW,%d,%.3f,%d,%.3f,%.3f,%.3f,%c

Start Station number %d

Start Station offset	%.3f
End Station number	%d
End Station offset	%.3f
Width at start of widening	%.3f
Width at end of widening	%.3f
End of widening flag	%c

(0-End station number and End station offset are in fields 3 and 4 1-length of widening interval is in field 4)

MC Road

MC road file has a file extension of ".RD3" and is a binary file.

LandXML Road

LandXML is a standard data exchange format.

Refer to LandXML website for details:

http://www.landxml.org/schema/landxml-1.0/Documentation/LandXMLDoc.htm

TopSURV Road format v.2.0

TopSURV road format consists of three files:

1. *.thl: contains a horizontal alignment and must start with the START definition which includes the starting chainage and coordinates.

   The elements are: PT, STRAIGHT, ARC or SPIRAL.

   The general format for each record is:

   KEYWORD nnnn, nnnn [,nnnn]

   where:

   START chainage, easting, northing

   STRAIGHT bearing, distance

ARC	radius, length [, bearing]
SPIRAL	first radius, second radius, length [, bearing]
PT	easting, northing[, radius[, A1, A2]]
	(A1, A2 : clothoid length)

- If the horizontal alignment starts with ARC or SPIRAL, the 'direction' field is used to define the start bearing of the horizontal alignment.
- If the spiral isn't a avoid clothoid, the corresponding not used radius equal zero.

Example1:

```
START 1000.000, 8.8888, 199.1200
STRAIGHT 25.0000, 48.420
SPIRAL 20.000, 20.000
ARC 20.000, 23.141
SPIRAL 20.000, 20.000
STRAIGHT 148.3000, 54.678
```

Example 2:

```
START 1000, 1050, 1100
PT 1750, 1300, 100, 80, 80
PT 1400, 1750, 200
PT 1800, 2000
```

2. *.tvl: contains a vertical alignment with long sections (LS). Every LS requires chainage, level and curve length.

   Starting and ending curve lengths should be zero.

   The format is:

   chainage, level, length

   Example:

```
1000.000, 100.000, 0.000
1100.000, 125.000, 50.000
1250.000, 100.000, 60.000
```

3. *.trd: contains cross sections set.

The format is:

Chainage, Template name, Turn (Left or Right), Cut, Fill, Segment name, Horizontal Offset, Vertical Offset

CLIP

The CLIP file format is a europe road format.

Example:

*ALZ1

Calzada Derecha Ajustada

16512.029, 699.021C, 0.000T
18374.058, 749.296C, 10000.000R
19101.891, 785.687C,-15000.000R
19693.957, 807.105C,-25000.000R
20010.319, 815.960C, 25000.000R
20322.145, 829.250C, 22500.000R
21305.065, 878.500C,-12750.000R
21629.230, 888.160C, 14500.000R
21770.000, 894.966C, 0.000R
22000.000, 906.790C, 0.000T
22100.000, 911.900C, 25000.000R
22230.000, 918.790C,-10000.000R
22380.000, 4.975P, 50000.000R
22500.000, 932.525C,-20000.000R
22800.000, 947.100C, 50000.000R
22970.000, 955.547C,-25000.000R
23100.000, 961.800C,-10000.000R
23200.000, 966.370C, 22500.000R
23320.000, 972.200C, 45000.000R
23600.000, 986.660C,-100000.000R
23786.000, 5.000P,-10000.000R
23982.080, 1002.100C, -8250.000R
24258.306, 1005.121C, -9250.000R

24693.967, 991.888C, 15000.000R

25903.863, 985.839C, 9894.424R

27440.115, 997.484C, -0.968F

28690.632, 991.237C, -1.995F

ISPOL

The ISPOL file format is a europe road format.

Example:

```
#-----------------------------------------------------
# FIchero   : EJE1.RAS
# FOrmato   : ispol-V.7.04  29 Abr 2001 22:39  773
# PRoyecto  : PRUEBAS PARA EJEMPLOS :
# EJe       : 1 : Eje con todas las clotoides. Al final una de vert
# COmentario:
# COmentario:
#-------------------------------------------------------------------------------
#     V E R T I C E     | TG. E N T R A D A  | TG. S A L I D A    |
#   Pk          Cota    |   Pk        Cota   |   Pk        Cota   |Pendiente (%)     K.V.
#------------ ------------ ------------ ------------ ------------ ------------ ---------------- ---------
----
   -19.4700    1070.9622      0.0000      0.0000      0.0000      0.0000       0.000000
0.0000
    236.4537    1085.3733    146.4537    1080.3054    326.4537    1083.2497
5.631030    2252.6586
    504.7339    1079.0432    452.9464    1080.2651    556.5214    1081.3971      -
2.359528    1500.0000
    649.1019    1085.6054    649.1019    1085.6054    649.1019    1085.6054
4.545471       0.0000
   705.1867    1082.4506      0.0000      0.0000      0.0000      0.0000      -5.625043
0.0000
# fin de fichero ----------------------------------
```

MX GENIO

MX GENIO format is a GENeralized Input/Output format that is used to import and export model information to and from Infrasoft's MX Professional. MX is a roadway design CADD application that uses a string-based modeling concept rather than a template-based approach used by civil design applications developed by other vendors.

MX GENIO format can be used to import a wide variety of string types into MX, including master alignment strings and geometry strings created from horizontal and vertical alignment definitions.

This is an example of a GENIO file that will create a 3D feature string in MX.

```
MOSS
GENIO,DESIGN
017,NORM
001FORMAT(3D23.17)
003,ORDR,4=1,1,2,3,
080,CECI,7=3
0.86278740486024506D+060.23557974062420847D+060.51777335135235114D+03
0.86278725732131349D+060.23558072925923113D+060.51778031070319832D+03
0.86278720921827410D+060.23558172768451227D+060.51778404785966120D+03
0.86278726103175664D+060.23558272592411647D+060.51778561243843410D+03
0.86278741224405798D+060.23558371400396363D+060.51778605405621181D+03
0.86278766134431469D+060.23558468205148648D+060.51778642232968866D+03
0.86279182182447857D+060.23559013383718926D+060.51787511440594790D+03
0.86281114482140180D+060.23559653051477592D+060.52051708265943284D+03
0.86281131684491527D+060.23559658416659472D+060.52054181820995780D+03
0.86281591805419116D+060.23559801922184543D+060.52113322369797083D+03
0.86281609007772699D+060.23559807287367119D+060.52115270941608628D+03
0.86281706168931420D+060.23559837590624942D+060.52126223300564516D+03
0.00000000000000000D+000.00000000000000000D+000.52126223300564516D+03
999
```

A detailed explanation of each of the lines in this file follow.

MOSS

MX files begin with this line to clear any previous errors

GENIO,DESIGN

Begin the GENIO option. Include the model name that the string(s) will be created in.

017,NORM

This command changes the Angular Input format for the file. 017,NORM will use the system default format for MX which is typically radians. Other alternatives for this are:

DEGR - Decimal Degrees

DMS - Degrees - Minutes - Seconds (in the format D23.17)

RADI - Radians

GRAD - Grads

QUAD - Quads

To specify angles in one of these other formats, substitute the appropriate Keyword for “NORM”.

001FORMAT(3D23.17)

Formats The INPUT Information in the Data Block.

The format is described by a number of field descriptors separated by commas and is contained within parentheses.

A field descriptor in a format specification has the form:

[r]Cw[.d]

where

r represents a repeat count which specifies the field descriptor is to be applied for ‘r’ successive fields. The default is 1 if omitted.

C is a format code: I - Integer, A - Alpha character, X - Space, F - Real number, D and E - Double precision.

w specifies the width of the field.

d specifies the number of decimal places.

Example: 3D23.17 specifies that each data line will consist of 3 double-precision records representing the X, Y, and Z coordinates of each point. Each field will be 23 columns wide, and each number will have 17 decimal places.

003,ORDR,4=1,1,2,3,

Change Order - This command changes the order of the items of information in a string element. The first two dimensions of a point on a string are always Cartesian Coordinates, but the other dimensions may describe different properties of the point. In this example, the first part of the line “003,ORDR” will always remain the same. The last part of the command line indicates how the data block is organized.

4=1 indicates that 1 row of data in the data block is used to define each point. (for 3D features this is pretty straight-forward, but MX had more complex string types such as Geometry Strings that have 12-dimensional points that may be described over a number of lines.)

,1,2,3, indicates the string point dimensions the data should be assigned to. (X,Y,Z for a 3D string.)

080,CECI,7=3

String Input - This command indicates what type of string is being created. The MX string label

being created in this example is **CECI**, and each point on this string will have 3 dimensions (**7=3**).

0.86278740486024506D+060.23557974062420847D+060.51777335135235114D+03

0.00000000000000000D+000.00000000000000000D+000.52126223300564516D+03

Data Block - These lines define the points for string CECI as defined in the 080 line above. Each is in the format specified in the 001Format line, 3D23.17, which is 3 fields of 23 columns in double-precision format, and 17 places to the right of the decimal point.

To end the data block defining this string's points, a final data line is added with the X and Y coordinates set to **0.000**. The data in the 3rd column of this row is of no concern other than the fact an appropriate value of the specified type must be provided. In most cases, it will suffice to provide the same Z coordinate as the preceding line (the last actual point on the string.)

In the example above, a string was created that consisted of a continuous series of points. In many cases, you may want to create strings that have gaps in them (i.e. discontinuities). To represent the point on the beginning of a discontinuity (gap), set the X value of that point to a negative value. The point representing the end of a discontinuity (gap) should have the Y value set to a negative value.

Add a new "080" command to specify the new string.

999

999 - Tell MX to end the GENIO command.

Tekla XRoad & XStreet (VGP)

This format has the extension *.vgp.

Horizontal Elements

Every line starts with feature information with element information following. Line's mark combines from three characters: Road's badge, alternative's badge, line's badge. KEYWORD is on every line and after that the parameters.

Parameters are: c = text, inf = integer, f = decimal number; with coordinates 4 decimals. Parameters are separated with spaces.

ROAD

Road's badge

TIE badge

c10

ROAD ALTERNATIVE

Alternative's badge

TIEVE badge

c10

LINE

Line's badge, description code (survey line, road's side etc), start sta

LINJA badge description start sta

c10 int f

ELEMENT

Element's informations are: Element's number; description code (for drawing) if different than line's description code (if not, then 0), geometry (1 = straight, 2 = circle, 3 = circular arch, 13 = circular arch over half circle, 4 = clothoid), start radius, end radius, clothoid's parameter (a)

ELEM number description geometry r1 r2 a

int int int f f f

ELEMENT P1

Element's start sta information: Element's number, start sta, x1, y1

ELEMP1 number start sta x1 y1

int f f f

ELEMENT P2

Element's end sta information: Element's number, end sta, x1, y1

ELEMP2 number end sta x1 y1

int f f f

ELEMENT CP

Circle's centre point's information: Element's number, x, y

ELEMCP number x y

int f f

Vertical Elements

ROAD

Road's badge

TIE badge

c10

ROAD ALTERNATIVE

Alternative's badge

TIEVE badge

c10

LINEZ

CL's badge, horiz line badge (stations)

LINJAZ badge hl badge

c10 c10

ELEMENTZ

Tangents intersections informations: point number, sta, z and radius between tangents. With first and last the radius = 0.

ELEMZ number sta z radius

int f f f

Example:

```
Horizontal Elements:
TIE       V9aito
TIEVE     b
LINJA     ml                    6101005                  0.000
ELEM         1        0   3     135.000     135.000      0.000
ELEMP1       1        0.000  6825003.0699  2497735.2184
ELEMP2       1        1.073  6825003.8922  2497734.5289
ELEMCP       1 6825090.2157 2497838.3233
12345678901234567890123456789012345678901234567890123456789012345678901234567890123
```

```
Vertical Elements:
TIE       V9aito
TIEVE     b
LINJAZ             ml                  ml
ELEMZ        1     20.0000    111.4300       0.000
ELEMZ        2     47.0000    110.4000     500.000
ELEMZ        3    120.0000    112.4000       0.000
12345678901234567890123456789012345678901234567890123456789012345678901234567890123
```

X-sect Templates Formats

Cross section is defined by templates. Each template is stored in a file. A template file consists of a series of segments and each segment has a horizontal and a vertical component. The following sections describe the formats used in the import/export of X-section Template data.

SSS Template

SSS Template format is as follows:

Template Record:

Template Name, 0, Cut, Fill

Segment Record:

Template Name, 1, Offset, Height[, Code]

Example:

SIMP,0,6.000,6.000

SIMP,1,1.000,0.000,1

NAME,0,4.000,4.000

NAME,1,1.000,-0.250,EP

NAME,1,0.000,0.150,1

NAME,1,0.500,0.000,2

NAME,1,0.200,-1.000,3

NAME,1,0.300,0.000,4

TDS X-section Template

The following sample template file describes a cross section in two segments.

Number of segments: 2, Cut slope: 0.500 %, Fill slope: 1.000 %

First segment: hd: 22.000 ft slope: -2.000 %

Second segment: hd: 2.000 ft vd: -2.000 ft

Example:

TH,2,0.500,1.000

TS,22.000,-2.000,0,roadbed

TS,2.000,-2.000,1,ditch

Definition of components in template file:

TH : Template Header format: TH,%d,%.3f,%.3f

Number of segments %d

Slope cut %.3f

Slope fill %.3f

TS : Template Segment format: TS,%.3f,%.3f,%c,%s

Segment length %.3f

Vertical dist or %.3f

Slope %

Vertical flag %c (0-Slope % is in field 2

1-Vertical dist is in field 2)

Segment name %s

TopSurv Template

TopSURV Template format is as follows:

Template Name, Code, Offset, Height

Example:

SIMP, 1, 1.000, 0.000

NAME, EP, 1.000, -0.250

NAME, 1, 0.000, 0.150

NAME, 2, 0.500, 0.000

NAME, 3, 0.200, -1.000

NAME, 4, 0.300, 0.000

Localization Format

GC3

This is a binary file containing localization data.

Roads Survey Formats

The following sections describe the data formats used in the export of road raw data.

X-Section Surveys

The format is as follows:

chainage, offset, level [,code]

Example:

0.000,-4.501,18.527
0.000,-3.500,18.553
0.000,0.000,18.658,CL01
0.000,3.500,18.553
0.000,5.501,18.493
12.669,-4.501,18.029
12.669,-3.500,18.059
12.669,-0.000,18.164,CL01
12.669,3.500,18.059
12.669,5.501,17.999

Find Station Report

The format is as follows:

FindChainageReport:
    Reference road
FindChainage:
    PointName Chainage Offset North East Elev [Cut]

Raw Data Formats

The following sections describe the formats used in the export of raw data.

FC-5

Refer to the FC-5 interface manual to confirm details on FC-5 data format.

Example:

!SAMPLE"SOMEONE_#GX0021_$06/01/
95_%24C_&990HP_'X1000_(_)1.200_+A001_ a+2755858d_ b0881003d
c+00010942m_*NS001_,1.200_+A002_ a+0006

3265752d_ b0952330d c+00003366m_*NS001_,1.200_+A003_ a+0420820d_
b0894549d c+00006913m_*NS001_,1.200_

1002

GTS-6

The data is GTS-6 and FC-5 unformatted data.

Refer to the GTS-6 interface manual to confirm details.

Example:

!SAMPLE"SOMEONE_#GX0021_$06/01/
95_%24C_&990HP_'X1000_(_)1.200_+A001_
?+00010942m0881003+2755858d+00010936***+**+**054_*NS001_,0064

1.200_+A002_
?+00003366m0952330+3265752d+00003351***+**+**063_*NS001_,1.200_
+A003_ ?+00006913m0894549+0420820d+00006912***+**+**1039

055_*NS001_,1.200_

2037

FC-6/GTS-7

The format of the GTS-7 data is the same as the FC-6 data format.

The general format of each record is as follows:

CONTROL WORD field1 . . . . ,fieldn

Where:

CONTROL WORD is terminated by a space.

Fields 1 to n-1 are terminated by commas.

Field n is terminated by the end-of-line.

Each field may be preceded by a number of space characters which should be ignored but may contain spaces after the first non-space character.

GTS-600 v3.1

JOB	job name, description
DATE	date, time
NAME	surveyors name
INST	instrument id
UNITS	Meter/Feet, Degree/Gon
SCALE	grid factor, scale factor, elevation
ATMOS	temp, press
STN	ptno, ins ht, stn id
XYZ	X(easting), Y(northing), Z(elevation)
BKB	ptno, backsight bearing, backsight angle
BS	ptno[, target height]
FS	ptno, target height, pt code[,string number]
SS	ptno, target height, pt code[,string number]
CTL	control code[,pt code 2[,string no 2]](optional)
HV	HA, VA
SD	HA, VA, SD

OFFSET radial offset, tangential offset, vertical offset

PTL_OFF offset along ref. line, offset perpendicular to line, vertical offset

NOTE comments

MLM from point, to point, delta HD, delta VD, delta SD

RES_OBS ptno, target height, observation count

XYZ if present follows the STN record

BKB if present follows the BKB record or STN record if no BKB.

CTL if present follows the FS or SS header record.

HV, SD or HD must follow a BS, FS or SS header and follows the CTL if present.

OFFSET may follow any SD or HD record.

Example:

```
GTS-600   v3.1
JOB       TEST1,TOPO COLLECTION
NAME      FRED
INST      GTS-7
UNITS     M,D
STN       1,1.500,STN
SS        1001,1.500,BLDG,01
SD        0.0000,84.4650,9.746
SS        1002,1.500,BLDG,01
SD        0.0000,84.4650,9.746
SS        1003,1.500,BLDG,01
SD        0.0000,84.4650,9.747
SS        1004,1.500,BLDG,01
CTL       CL
SD        359.1740,84.4650,9.747
SS        1005,1.500,NS
SD        359.1740,84.4650,9.747
```

```
SS          1006,1.500,NS
SD          359.1740,84.4650,9.747
FS          2,1.500,NS
SD          179.1740,84.4650,9.747
STN         2,1.500,STN


GTS-600  v3.1
JOB         TEST2, SET COLLECTION
NAME        FRED
INST        GTS-7
UNITS       M,D
STN         1,1.500,STN
XYZ         1000.000,1000.000,100.000
BKB         2,315.0000,0.0000
BS          2,1.500
HV          344.0620,86.3810
FS          101,1.500,STN
SD          325.3420,88.4750,5.275
FS          102,1.500,STN
SD          7.0610,85.2210,9.914
FS          103,1.500,STN
SD          36.1350,87.3800,9.755
FS          104,1.500,STN
SD          83.4730,84.0410,3.313
FS          104,1.500,STN
SD          263.4820,275.5530,3.313
FS          103,1.500,STN
SD          216.1430,272.2150,9.755
FS          102,1.500,STN
SD          187.0650,274.3730,9.916
FS          101,1.500,STN
SD          145.3520,271.1510,5.27
```

BS 2,1.500

HV 164.0640,273.2340

Land XML

LandXML is a standard data exchange format.

Refer to LandXML Website for details:

http://www.landxml.org/schema/landxml-1.0/Documentation/LandXMLDoc.htm

TDS RawData

Example:

JB,NMA_meas,DT03-15-02,TM15:17:53

MO,AD0,UN1,SF1.000000,EC0,EO0.0000

SP,PN1,N 90.0000,E 200.0000,EL 50.0000,--man

OC,OP1,N 90.0000,E 200.0000,EL 50.0000,--man

LS,HI1.0100,HR0.0000

--user has entered the following Azimuth

BK,OP1,BP2,BS0.0000,BC65.4618

--SS,OP1,FP2,AR65.4618,ZE102.0935,SD4.7720,--DOOR

LS,HI1.0100,HR2.5600

SS,OP1,FP3,AR61.1834,ZE84.2723,SD6.5740,--BEN

TopSURV can import/export localization data from/to this file and can only export GPS and TS observations.

MOSS Survey

Both traverse and detail raw data formats can be exported.

Example:

SURVEY D:\J0119A

017,DMS

190,,,DECR,0900000

180,,,9000,,1000.000,1000.000,0.000

200,9000,9001,SDVA,3595958,,,1.600,,1.000000
201,,,PT01,0103620,14.194,0870623,0.000,,,1001
201,,,PT01,1333115,10.386,0880200,0.000,,,1002
201,,,PT02,2872920,9.187,0901702,0.000,,,1003
201,,,PT02,3350057,15.887,0871812,0.000,,,1004
201,CD2,02,PP01,0103555,14.196,0870649,0.000,,,1005
201,CD2,03,PP01,1333053,10.392,0880209,0.000,,,1006
201,,,P101,2872902,9.187,0901634,0.000,,,1007
201,,,P101,3350118,15.886,0871727,0.000,,,1008
999
FINISH

Field Book

Field Book files are text files that contain the observed point data. Data from a data collector can be exported to a Field Book file to import into a drawing and project.

Example (for GPS data):

!NOTE Start Survey Date/Time DT07-30-2007,TM19:08:23
!NOTE End Survey Date/Time DT07-31-2007,TM18:35:21
UNIT FOOT DMS
HORIZ ANGLE RIGHT
PRISM CONSTANT 0
PRISM OFFSET 0
EDM OFFSET 0
CR OFF
TEMP 20 C
PRESSURE 1013.300 MM
COLLIMATION OFF
JOB gr3r
VERT ANGLE ZENITH
NEZ 999 9950.370 10012.484 1202.250 "BASE"
NEZ 1000 10000.000 10000.000 1200.000 "SSB"
NEZ 1001 10270.261 10001.970 1193.982 "SSB"
NEZ 1002 10330.897 10227.397 1193.548 "5/8"
NEZ 1003 10288.979 9594.926 1192.965 "SSB"

```
NEZ 1004 9998.380   9593.835   1193.349    "1/2"
NEZ 1005 7698.778   12840.197  1209.085    "5/8"
NEZ 1 10029.789  10076.702  1199.442    "TP"
NEZ 2 9756.259   10244.498  1199.587    "TP"
```

Example (for TS data):

```
!NOTE  Start Survey Date/Time  DT08-23-2005,TM02:40:28
!NOTE  End Survey Date/Time  DT08-24-2005,TM20:11:01
UNIT FOOT DMS
HORIZ ANGLE RIGHT
PRISM CONSTANT 0
PRISM OFFSET 0
EDM OFFSET 0
CR OFF
TEMP 68 F
PRESSURE 760.037 MM
COLLIMATION OFF
JOB OFFICE
VERT ANGLE ZENITH
NEZ 107 0.000      0.000      100.000
STN 107 0.000
NEZ 108 0.000      0.000      100.000
AZ 107 108 0.000000
BS 108
PRISM 0.000000
END
AD VA 108 359.594000 00.000 51.580000 "AZMK"
END
F1 VA 102 61.310500 10.740 60.515000
F1 VA 103 35.332500 7.800 65.022000
F1 VA 104 359.583000 8.440 51.573500
AZ 107 102 61.312500
BS 102
PRISM 0.000000
END
AD VA 102 61.323500 00.000 51.582000 "AZMK"
END
AZ 107 104 359.585000
BS 104
```

PRISM 0.000000
END
! BS Circle Check : angular err= 0.000
! BS Circle Check : angular err= 0.000
AD VA 104 61.323500 00.000 51.582000 "AZMK"
END
AZ 107 10001 359.585000
BS 10001
PRISM 0.000000
END
AD VA 103 93.430000 00.000 77.232500 "AZMK"
END
F1 VA 106 86.192000 12.240 86.512500

Berlin GNSS

This format is a German format that consists of two separate files of quality report: GNSS-Messprotokoll and GNSS-Mittelwerte.

Scanning Data Format

Scanning data includes an orientation file, control points for orientation and Camera calibration file for DI-3000.

DI-3000

Project:

Header(FIELD_SCAN_FSC_FILEVER1.0)

*Text Format

Orientation Information File:

Name of Image

Size of Image Width[pixel] Height[pixel]

Number of Image Coordinates of Orientation Points

Image coordinates of Orientation point:

: Point Name,X,Y

*Text Format

Control Point(Terrain) For Orientation File:

Point Name,X,Y,Z

*CSV Text Format

Results of Orientation Calculation(Single Orientation):

ERR MAX,X Maximum Error,Y Maximum Error, 0.000000

ERR RMS,X Standard Dev[Pixel],Y Standard Deviation[Pixel], 0.000000

Discrepancy of each orientation point[Pixel]

*Text Format

Camera Calibration For Digital Camera:

7.955772 // focal length [mm]

1.866217 // x of principal point [m]

1.375943 // y of principal point [m]

2 // distortion model

4 // number of distortion parameters

3.596956e-003 // distortion parameter 1

-1.414950e-004 // distortion parameter 2

-1.786501e-004 // distortion parameter 3

4.303863e-004 // distortion parameter 4

0.005600 // x resolution [mm/pixel]

0.005600 // y resolution [mm/pixel]

0 // number of fiducial marks

0 // number of radial distortion values

*Text Format

Setting Information:

Instrument Point,X,Y,Z

Backsight Point,X,Y,Z

mh 0.0000 0.0000 IH(Instrument Height)

*Text Format

Point Clouds(Scanning Data):

Header(SFILE_VER01)

point name,X,Y,Z,Wide Image name,Tele Image Name,,Layer Name,Point Attribute

*Binary Format(Fix)

Point Clouds(Scanning Data):

point name,X,Y,Z,Layer Name

*CSV Format

Job History

Job history can be exported to the CSV file or text report.

CSV

All job history data are represented in text format with comma separated values.

Report

In the current version only resection data are output.

The completed resection measurements prints out or writes to a file in the order of measuring. Also, all changes made when editing raw data are visible in the report file.

Example:

+++ TopSURV Version 5.04 +++ Date, Time

==========

Resection

==========

Job : Job-Name

Occ-point name : PPPPPPPPPP (E: EEEEEEE.EEEE[m], N: NNNNNNN.NNNN[m], Z: ZZZZ.ZZZZ[m])

Instr. height : ii.iiii[m]

Surveyor : name

Temperature : TT.T[°C]

Pressure : xxx (mmHg)

Date/Time : JJJJ-MM-DD HH:MM:SS

Dim-Type : 2D or 3D

Orientation : ggg.gggg[gon] (Standarddev.: dg.gggg[mgon])

OCC.Std.deviation : dE: dE[mm] dN: dN[mm] dZ: dZ[mm]

Scale : fix/calculated 1.00000000

Backbearing-Name Hz [gon] V [gon] SD [m] dHz[mgon] dV[mgon] dS[m] tH[m]

East [m] North [m] Height [m] dE[m] dN[m] dZ[m] USE(HVSD)

BKB1ppppppppppp HHH.HHHH VVV.VVVV DDDD.DDDD dH.HHHH dV.VVVV dS.SSS t.ttt

EEEEEEE.EEEE NNNNNNN.NNNN ZZZZ.ZZZZ dE.EEE dN.NNN dZ.ZZZ HVSD

BKB2ppppppppppp HHH.HHHH VVV.VVVV DDDD.DDDD dH.HHHH dV.VVVV dS.SSS t.ttt

EEEEEEE.EEEE NNNNNNN.NNNN ZZZZ.ZZZZ dE.EEE dN.NNN dZ.ZZZ HV-

BKB3ppppppppppp HHH.HHHH VVV.VVVV DDDD.DDDD dH.HHHH dV.VVVV dS.SSS t.ttt

EEEEEEE.EEEE NNNNNNN.NNNN ZZZZ.ZZZZ dE.EEE dN.NNN dZ.ZZZ HVSD

BKB4ppppppppppp HHH.HHHH VVV.VVVV DDDD.DDDD dH.HHHH dV.VVVV dS.SSS t.ttt

EEEEEEE.EEEE NNNNNNN.NNNN ZZZZ.ZZZZ dE.EEE dN.NNN dZ.ZZZ HVSD

Notes:

Index

A

Alarms **2-9**
Alignment **7-2**
Attribute **6-16**

C

Code **6-16**
COGO
- intersection **14-14**
- two point inverse **14-4**

Configuration
- GPS+ configuration **3-3**
- survey configuration **2-3**
- TS configuration **3-51**

Control code **6-7**
Co-Op tracking **3-48**
Coordinate system **2-5**, **3-72**, **4-18**, **5-18**
Cross Section Templates **7-27**

D

Datum **2-5**, **3-72**
Degree of chord **7-12**
Degree of curve **7-12**
Distance averaging **3-64**

E

Elevation mask **3-7**, **3-21**, **8-15**
Export
- to device **4-10**
- to job **4-2**

F

Feature **6-16**
Find station **11-27**

G

GPS+
- GPS+ status **8-13**
- start base **8-2**

H

HAL **7-7**
- circular arc **7-12**
- intersection point **7-2**, **7-14**
- line **7-11**
- spiral **7-13**

I

Import
- from file **5-13**, **5-14**
- from job **5-2**

J

Job
- job list **2-10**
- new job **2-2**
- open job **2-10**
- select job **4-2**, **5-2**

L

Localization **8-8**

M

Missing line **11-31**
mmGPS **3-4**, **3-39**

Modem
GSM **3-13**
Multipath reduction **3-48**

O

Observation mode **16-1**
Offset
hidden point **11-16**
Offsets
sideshots **11-9**
topo survey **9-9**

P

Pattern **3-60**
Point guide **3-64**
Points **6-2**
Post processing
kinematic **3-5**
static **3-5**
Prism constant **3-64**
Projection **2-5**, **3-72**, **3-74**

R

Raw data **6-36**
Receiver
base receiver **3-7**, **3-21**
Reference direction **3-45**
Road **7-2**
Rover known point **8-34**
RTK **3-4**

S

Scan range **3-62**
Sensitivity **3-61**
Sideshot **11-4**
Signal-to-noise ratio **8-21**
Slope **7-27**
Stakeout
angle sequence **3-63**
line (GPS+) **13-14**
meas method **3-62**
point & direction **13-35**
point (GPS+) **13-2**
road **13-49**
slope **13-46**, **13-53**
Stakeout parameters
for GPS+ **3-45**
for Total Station **3-66**
Survey
auto topo **9-18**
backsight survey **10-2**
topo **9-2**
Survey parameters
for GPS+ **3-41**
for Total Station **3-62**

T

Tape dimension **11-29**
reference line **11-29**
Tolerances **3-63**
Total Station
models **3-54**
Track speed **3-61**

U

Units
angle units **2-7**
distance units **2-6**
pressure **2-7**
temperature **2-7**

V

VAL **7-24**
elements **7-17**
long section **7-17**
vertical grade **7-22**

X

X-section **7-29**, **11-25**
cut and fill **7-27**
template **7-26**

Topcon Positioning Systems, Inc.
7400 National Drive, Livermore, CA 94550
800·443·4567 www.topcon.com

ISO 9001:2000
FM 68448

TopSURV Reference Manual
P/N: 7010-0492 Rev K 11/08
©2008 Topcon Corporation All rights reserved. No unauthorized duplication.