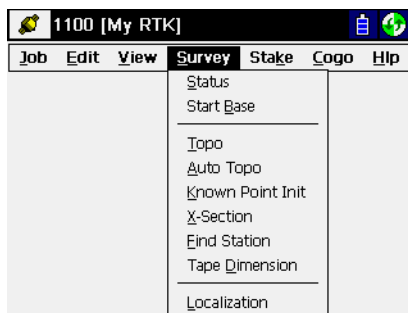


# GPS Survey

The Survey menu appearance depends upon the survey type selected and can include the following menu items:

- Status
- Start Base
- Init mmGPS+ (only for mmGPS+ RTK)
- Topo
- Auto Topo
- Known Point Init
- X-Section
- Find Station
- Tape Dimension
- Static Occupation (only for PP Static)
- Localization



**Figure 5-1. RTK Survey Menu**

# Status

To check the status of a GPS+ survey, tap **Survey ▶ Status**.

The **Status** screen contains information about the position of the receiver, RTK status, and the satellite constellation.

The bitmap in the upper-left corner of the screen displays a menu that varies depending on the configuration type used:

- *Rover Antenna Setup*: opens the **Antenna Setup** Screen (see “Config: Rover Antenna” on page 2-45).
- *Config OmniSTAR*: opens the **OmniSTAR** screen to view the status for OmniSTAR service (see “OmniSTAR” on page 5-9).
- *Config Beacon*: opens the **Beacon** screen to view the status for Beacon service (see “Beacon” on page 5-10).
- *Config Radio*: opens the **Configure Radio** screen (see “Config: Rover Radio” on page 2-37).
- *Reset RTK* or *Reset DGPS*: reinitializes the receiver.
- *mmGPS+ Options*: opens the **mmGPS+ Options** screen.
- *Help*: accesses the Help files.

The **Position** tab displays the following information:

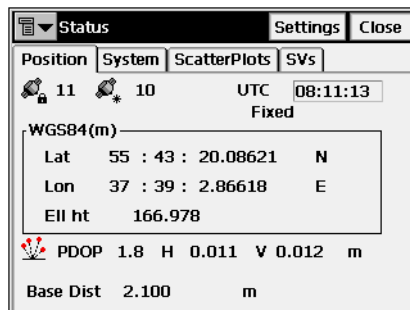



Figure 5-2. Status – Position

- 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.

- When using a mmGPS system, the *Position* tab displays a mmGPS icon . This icon displays when the receiver calculates mmGPS heights.
- *UTC*: the current UTC time.
- *WGS84*: the coordinates of the antenna 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 2-7), and the chosen 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 will depend on the measurement errors. PDOP is proportional to the estimated position uncertainty.
- *H* and *V*: stand for HRMS and VRMS, the RMS<sup>1</sup> values of the horizontal and vertical coordinates, respectively.
- *Base Dist*: slope distance to base antenna. The field is empty if no differential corrections are received

The *System* tab displays information about the current state of RTK measurements.

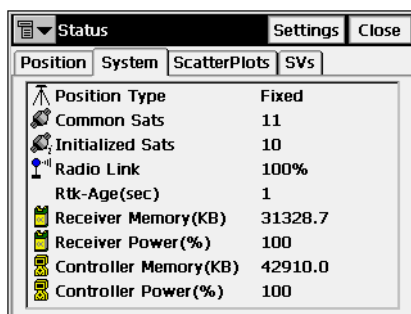


Figure 5-3. Status – System

- *Position Type*: the type of the position calculation method: Autonomous, Fixed, Float, Code Differential.

---

1. RMS means Root Mean Square – a factor that characterizes the precision of the collected coordinates.

- *Common Sats*: the number of satellites common to the base and rover.
- *Initialized Sats*: the number of satellites contributing to the solution.
- *Radio Link*: the quality of the radio link
- *RTK Age*: the number of seconds since the last RTK message was received from the base.
- *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.
- **Settings**: opens the *Elevation Mask* screen.

## Elevation Mask

The *Elevation mask* screen sets the value for the minimum threshold; data from satellites below this elevation angle will not be used.



Figure 5-4. 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 chosen above.

If the rover receives CMR+ corrections from more than one base, an additional tab called *Multi Base* will appear in the Status screen at the rover side. Muti Base mode is set in the *Start Base* screen (see Figure 5-17 on page 5-14).

The *Multi Base* tab displays a list of the base stations with their parameters (age, link quality, type, etc.).

Use	ID	Base	Age	Lin...	Type	Dist(n)
<input checked="" type="checkbox"/>	3	1	100	Fixed	1054.	
<input type="checkbox"/>	4	-	1	100	-	4466.
<input type="checkbox"/>	5	-	1	100	-	1709.

Figure 5-5. Status – Multi Base Tab





- *Use*: selects/deselects the desired base for RTk processing.



#### NOTICE

*Currently, TopSURV supports processing RTK baselines only from one base at a time.*

The *Scatter Plots* tab displays the current receiver position (Figure 5-6 on page 5-6).

-  : zooms the plot inwards.
-  : zooms the plot outwards.
-  : switches the vertical scatter plot to the horizontal one.
-  : switches the horizontal scatter plot to the vertical one.

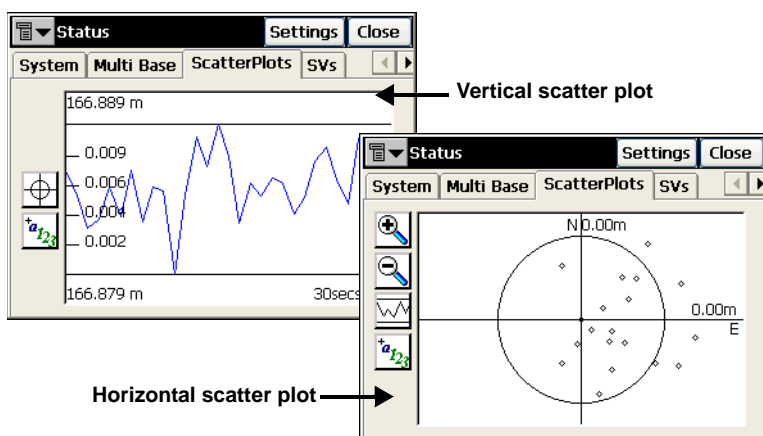


Figure 5-6. Status – Scatter Plots

- : opens the **Properties** screen from which to set graphical features for the scatter plots (Figure 5-7).

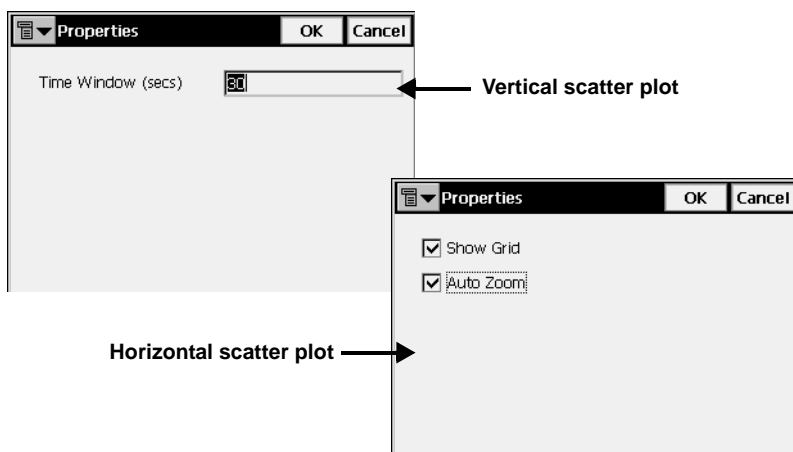


Figure 5-7. Properties (Scatter Plot)

- *Time Window*: duration in seconds for the time axis.
- *Show Grid*: if selected, displays the local coordinate axes
- *Auto Zoom*: if selected, automatically scales the horizontal scatter plot to fit into the screen.

The *SVs* tab of the **Status** screen displays the graphical position of the satellites on the sky.

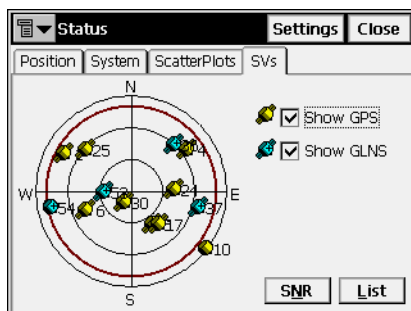


Figure 5-8. Status – SVs Plot

- *Show GPS*: shows/hides the GPS satellites images.
- *Show GLNS*: shows/hides the GLONASS satellite images. GLONASS satellites are marked with a “+” sign.
- **SNR**: toggles the appearance of the screen to a table displaying the signal-to-noise ratio of each of the satellites (Figure 5-9).

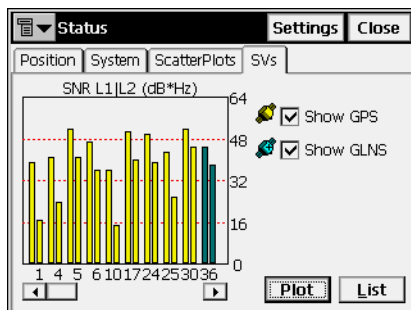


Figure 5-9. Status – SVs SNR

- **List**: toggles the appearance of the screen to the table displaying the table of the satellites parameters (Figure 5-10 on page 5-8).
  - *PRN*: shows the number of the satellite.
  - *H/U*: shows whether healthy or unhealthy.
  - *EL*: shows the elevation angle of the satellite.
  - *AZ*: shows the azimuth of the satellite.
  - *SNRI*: L1 signal to noise ratio.

– SNR2: L2 signal to noise ratio.

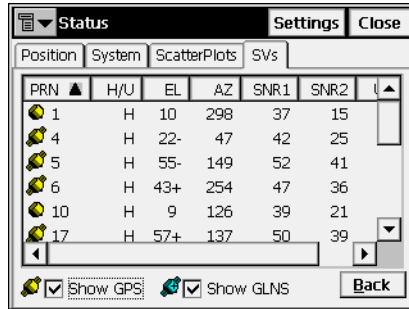


Figure 5-10. Status – SVs List

- **Back:** toggles between this screen and the sky plot view.
- **Close:** closes the screen.



## NOTICE

*The absence of “wings” on the satellite image means that the signal from this satellite is not used in the positioning for some reason (for example, below elevation cutoff).*



## OmniSTAR

The *OmniSTAR* screen starts the OmniSTAR service for DGPS survey type. To open this screen, select the *Config OmniSTAR* item from the bitmap menu in the upper left corner of the *Status* screen.

The same item is accessible from the *Topo* and *Auto Topo* screens.

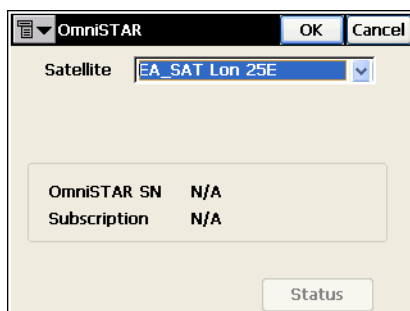


Figure 5-11. OmniSTAR

- *Satellite*: selects the satellite that the receiver is subscribed to.
- The lower field shows the OmniSTAR serial number and subscription.
- **Status**: opens the OmniSTAR screen to view information on OmniSTAR link and the receiver OmniStar board (Figure 5-12).

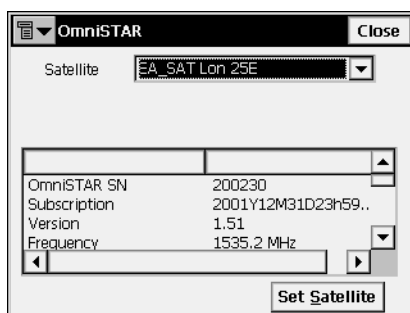


Figure 5-12. OmniSTAR Status

- **Set Satellite**: connects to the selected satellite and begins logging data from this satellite.

## Beacon

The **Beacon** screen starts the Beacon service for DGPS survey type. To open this screen, select the *Config Beacon* item from the bitmap menu in the upper left corner of the **Status** screen.

The same item is accessible from the **Topo** and **Auto Topo** screens.

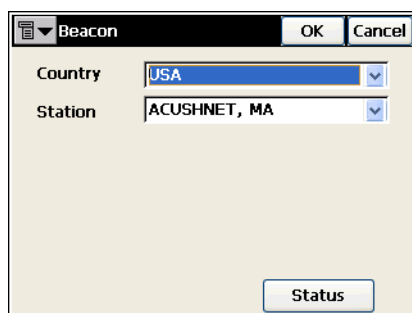


Figure 5-13. Beacon

- **Country:** the country where the radio-beacon differential service is located.
- **Station:** the station that provides broadcasting differential corrections for the rover.
- **Status:** opens the **Beacon Status** screen to view information on beacon link and the receiver beacon board (Figure 5-14).

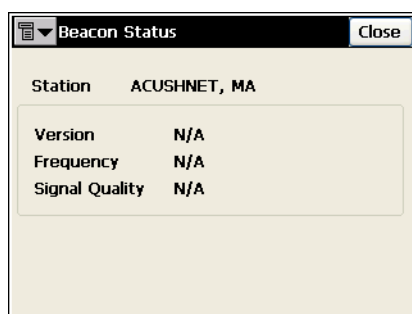


Figure 5-14. Beacon Status

## mmGPS+ Options

The *mmGPS+ Options* screen displays the status of mmGPS+ in RTK survey type. To open this screen, select the *mmGPS+ Options* item from the bitmap menu in the upper left corner of the *Status* screen.

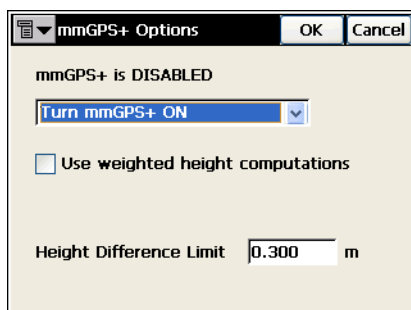


Figure 5-15. mmGPS+ Options


- Select “Turn mmGPS+ ON” to enable the use of mmGPS+ in height computation.
- *Use weighted height computations*: select to combine mmGPS elevations and GPS elevations. When selected, this option will force the receiver/sensor to always consider the angle and distance when determining the elevation, then combine the two elevations accordingly. This option works well at large (300m) distances and steep angles.
- *Height Difference Limit*: sets the threshold for the difference between GPS and mmGPS+ height measurements.

## Start Base

To start a Base, tap **Survey ▶ Start Base**.

The **Start Base** screen contains information about the Base receiver and can be used for the Base Receiver setting in a PP enabled RTK survey.


Figure 5-16. Start Base

- **Point:** selects the name of the point of the Base receiver location from a map or list, or entered manually. The  button opens the **Add Photo Notes** screen to enter a photo note for the point.
- **Code:** the code of the point. Can be selected from the list, or entered manually. Also the attributes can be selected with the help of the *Attributes List* bitmap. The bitmap next to the *Attributes List* bitmap displays the list of additional features: *String* and *Note*. For details, see “Topo” on page 5-24.
- **WGS84:** (for RTK mode) the coordinates of the antenna in the selected coordinate system. Changes its name based on the chosen value in the Coordinate System screen; that is, *WGS84* or *Local* (see “Coordinate System” on page 2-5), the Display screen (see “Display” on page 2-7), and the chosen 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 it to stop position averaging. The average of the coordinates displays and the *Pos* field appears with the number of measurements used for averaging.

- *Ant Ht*: the antenna height and type of measurement (vertical or slant).
- *Duration and Remaining Time* (for PP Kinematic mode): displays the time passed and remained since the beginning of the survey.
- **Start Base**: sets the receiver as a Base transmitting data.

The bitmap on the upper-left corner displays the pop-up menu which can display the following items depending on the survey type chosen:

- *Status*: opens the **Status** screen (see “Status” on page 5-2).
- *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 (see “Config: Rover Antenna” on page 2-45).
- *Config Radio* (for RTK mode): opens the **Configure Radio** screen. For details, see “Config: Rover Radio” on page 2-37.
- *Multi Base* (for RTK survey type): opens the **Multi Base** screen to set the multi base mode. This mode allows the base stations to use a single frequency for transmitting data. Setting a transmission delay for each station prevents signals from colliding.

## 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.



### NOTICE

*All transmitters (Base receivers) must be configured to transmit at the same frequency and must transmit CMR+ format corrections.*

**NOTICE**

*The Rover receiver must be configured to receive only CMR+ messages.*

The **Multi Base** screen sets parameters for base stations.

- **Base Station ID:** the ID of the current base station. Choose any ID from 0 to 30 (31 is the default ID for Trimble transmitters.)
- **Transmit Delay:** sets a signal transmission delay for the current base.
- **Use Multi Base:** when checked, enables multi base mode for surveying. In the Status screen at the rover side, the Multi-Base tab will appear where to select the desired base.

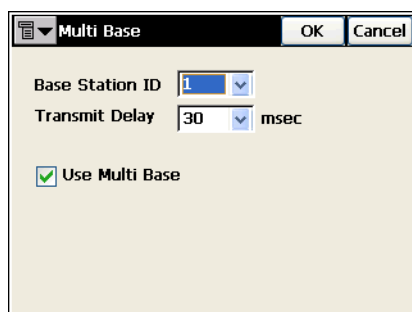


Figure 5-17. Multi Base

## Init mmGPS+

To setup mmGPS+ system for RTK surveying, tap **Survey ▶ Init mmGPS+**.

The **Init mmGPS+** screen contains information about the calibration of the laser transmitter and initialization of the sensor.

The **Trans Data** tab (Figure 5-18 on page 5-15) 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 to get the transmitter data.
- **Edit:** opens the *Transmitter* screen to change the information on the transmitter.
- **Delete:** removes the transmitter from the list.

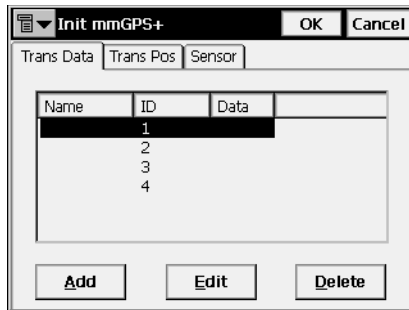


Figure 5-18. Initialize mmGPS – Data Tab

The bitmap in the upper-left corner of the screen displays a floating menu of the following 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.
- **Help:** accesses the Help files.

# Transmitter

The *Transmitter* screen sets the transmitter parameters.

The screenshot shows a window titled "Transmitter" with a toolbar containing "OK" and "Cancel" buttons. The main area contains four labeled fields: "Name" with the value "12", "Com Port" with a dropdown menu showing "COM2", "ID" with the value "3", and "Calibration Data" with the value "OK". At the bottom, there are two buttons: "Clear Data" and "Get Data".

Figure 5-19. Transmitter

- *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 with the calibration data shown.

The *Trans Pos* tab allows setting up the transmitter's height and location at the jobsite.

The screenshot shows a window titled "Init mmGPS+" with a toolbar containing "OK" and "Cancel" buttons. Below the toolbar are three tabs: "Trans Data", "Trans Pos" (which is selected), and "Sensor". The "Trans Pos" tab contains a table with three columns: "Name", "ID", and "Point". The table has four rows, with the first row highlighted. The values in the rows are: Row 1: (empty), 1, (empty); Row 2: (empty), 2, (empty); Row 3: (empty), 3, (empty); Row 4: (empty), 4, (empty). At the bottom, there are three buttons: "Resect", "Edit", and "Delete".

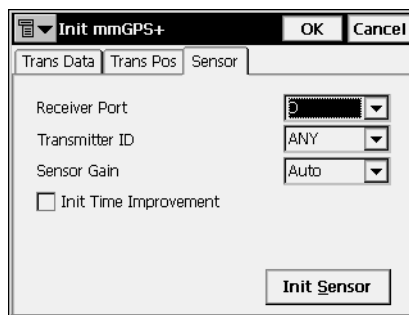
Figure 5-20. Initialize mmGPS – Position Tab

- *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* screen to perform 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.

The *Sensor* tab uploads transmitter calibration information to the sensor and sets up the sensor for receiving the transmitter's laser beam.



**Figure 5-21. Initialize mmGPS – Sensor Tab**

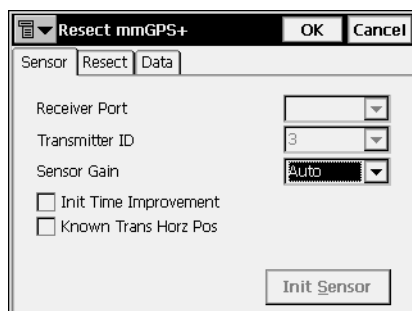
- *Receiver Port*: the receiver port that connects the receiver and sensor.
- *Transmitter ID*: the transmitter's channel. The ANY selection will allow the sensor to independently select the transmitter with the smallest error rate.
- *Sensor Gain*: sets the sensitivity of the sensor to the transmitter's laser beam.
- *Init Time Improvement*: check this box to improve the RTK fix time for the receiver.
- **Init Sensor**: starts the initialization process.

## Resection

The *Resect mmGPS+* screen is used to measure an unknown transmitter location using the rover and three or more points (Figure 5-22).

### Sensor

The *Sensor* tab is identical with the title tab on the *Init mmGPS+* screen and used to set up the sensor.



**Figure 5-22. Resection – Sensor Tab**

- *Receiver Port*: sets the receiver port that connects the receiver and 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*: select 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 selected, then after pressing the **Init Sensor** button, the **Known Point** screen displays. Select the point over which the transmitter is setup.

## Known Point

The *Known Point* screen is used to select the known point over which the transmitter is setup and enter the transmitter height.

Figure 5-23. Known Point

- *Point*: the point the transmitter is installed over; selected using the map or list buttons.
- *Transmitter*:
  - *Name*: displays the name of the transmitter.
  - *ID*: displays the transmitter's 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*: this box can be checked if using a 2 meter fixed tripod.
- **OK**: uploads the transmitter calibration information to the sensor.

## Resect

The *Resect* tab is used to perform the resection calculation from the rover point to the point over which the transmitter is installed.

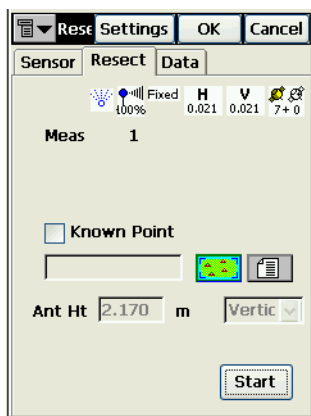







Figure 5-24. Resection – Resect Tab

The upper-right corner 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 the satellites tracked and used in position calculation, respectively.
- *Meas*: the number of measurement.
- *Known Point*: enable this when occupying a known point, and select a point to occupy using the map and list buttons.

- *Ht* and *m*: the antenna's height and method of height measurement.
- **Start**: starts the measurement process. After pressing, the button changes its name 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

The *Data* tab is used to view the results of resection measurements. Data will display only after three or more points have been measured.

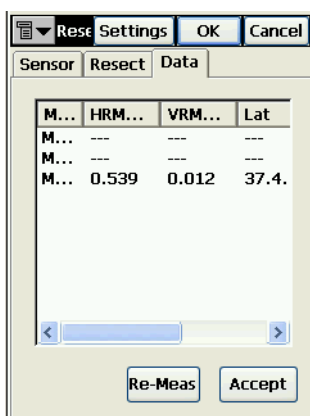


Figure 5-25. Resection – Data Tab

- **Re-Meas**: clears all data and restarts the resection process.
- **Accept**: opens the *Add Point* screen to view the point information for the transmitter.

## Add Point

The *Add Point* screen is used to view and save the transmitter location.

The 'Add Point' dialog box is shown. It has a title bar with 'Add Point', 'OK', and 'Cancel' buttons. The main area is divided into sections. The 'Point Info' section contains a 'Point' field with the value 'Transmitter21', a 'Code' field (empty), and a 'Note' field with the value 'Transmitter'. Below this is a 'WGS84(m)' section with fields for 'Lat' (37.410513599), 'Lon' (-121.533006595), and 'Ell ht' (80.463). At the bottom is a 'Control Point' checkbox which is unchecked.

Figure 5-26. Add Point

## Calibration

The *Calibration* screen selects the transmitter for field calibration.

The 'Calibration' dialog box is shown. It has a title bar with 'Calibration' and a 'Close' button. The main area contains the text 'Set Transmitter to Field Calibration mode.' Below this is a 'Transmitter Name' field with a dropdown menu showing '12'. At the bottom right is a 'Next >>' button.

Figure 5-27. Calibration

- *Transmitter Name*: the name of the transmitter to calibrate
- **Next**: starts the process of auto-leveling.

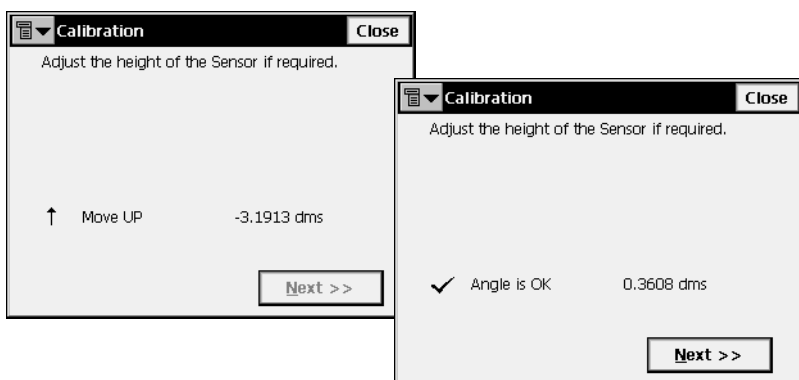


Figure 5-28. Check Angle of Sensor

- **Next:** opens the *Calibrate* screen with instructions to follow.

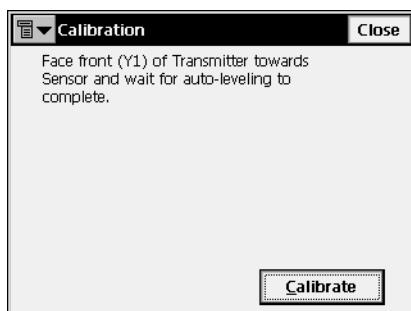


Figure 5-29. Calibrate

After the auto-leveling process completes, pressing the **Calibrate** button collects calibration data.

# Topo

To set up a survey with topo points, tap **Survey ► Topo**.

The **Topo** screen records stop and go survey.

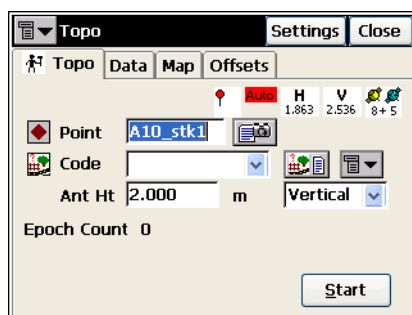




Figure 5-30. Topo

The **Topo** tab contains the initial data for the survey and displays the progress of the survey. The upper-right corner of the screen displays the status of information on the **Status** screen. For details, see “Status” on page 5-2.

- The bitmap on the upper-left corner displays the following pop-up menu that varies depending on survey mode used:
  - *Status*: opens the **Status** screen (see “Status” on page 5-2).
  - *Rover Antenna Setup*: opens the **Antenna Setup** screen (see “Config: Rover Antenna” on page 2-45).
  - *Config Radio*: opens the **Configure Radio** screen. For details, see “Config: Rover Radio” on page 2-37.
  - *Config OmniSTAR*: opens the **OmniSTAR** screen to start the OmniSTAR service. For details, see “OmniSTAR” on page 5-9.
  - *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.



- *Notes*: opens the **Notes** screen (see below).
  - *Edit Points*: opens the **Points** screen.
  - *Inverse*: opens the *Two-Point Inverse* COGO task screen. For details see “Inverse” on page 9-2.
  - *PTL Mode*: switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to **Topo (PTL)**.) For details see “PTL Mode” on page 6-16.
  - *Grid Setup*: opens the **Grid Setup** screen to set a grid to be displayed with the Map.
  - *Help*: accesses the Help files.
- *Point*: displays the current point name. The  button 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.
  -  : tap on this icon to open the *Code-Attributes* screen to set the attributes for the selected code.

The **Code-Attributes** screen sets attributes for the selected code.

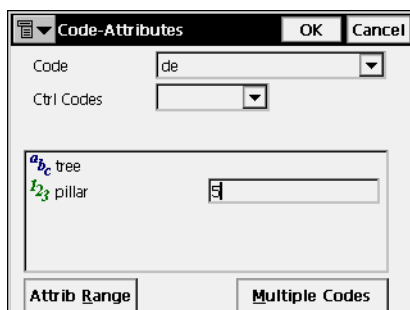


Figure 5-31. Code – Attributes

- *Code*: shows the code selected.
- *Ctrl Code*: shows all the control codes used. The Control Code is a special type of code that can be used by the graphic tool for the interpretation of the survey results.

- The field below shows the available attributes with a field to enter its value.
- **Attrib Range:** opens the *Attribute Ranges* screen.

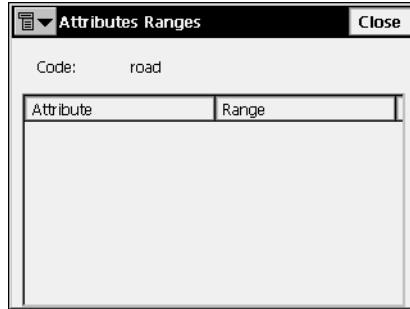


Figure 5-32. Attributes Ranges

- **Multiple Codes:** opens the *Multiple Code-Attributes* screen. To add several codes, attributes and control codes to an object, use the Multiple Codes tool.

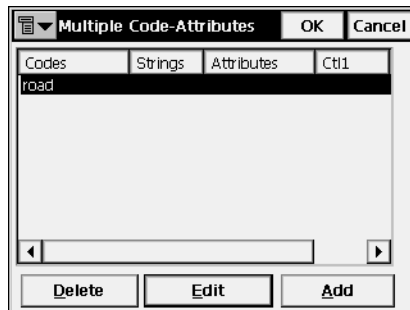



Figure 5-33. Multiple Code – Attributes

- **Add/Edit:** opens the *Code-Attributes* screen to add/edit a code string to the table.
- **Delete:** removes the code string from the table.
- **OK:** saves the changes and returns to the *Topo* screen.

The String and Ctrl Code fields appear only if the *String* and *Show Second Ctrl Code* options have been enabled, respectively, in the pop-up menu opened by the bitmap in the upper-left corner of the screen.

- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: toggles on the *String* field on the *Topo* tab. Also, the  sign appears.

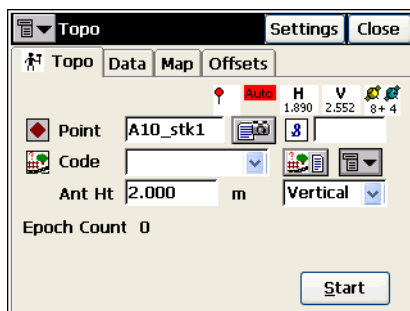


Figure 5-34. Topo – String

- *Note*: opens the *Note* screen (Figure 5-35). The *Note* screen is used for additional information. The text of the note should be typed in the *Note* field. Press **OK** to store the Note.

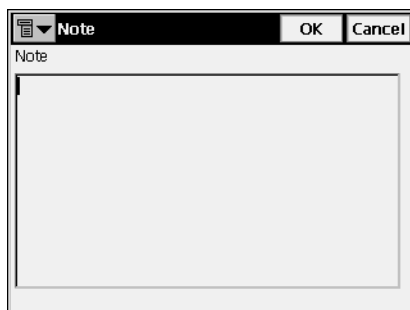


Figure 5-35. Note

- *Ant Ht*: sets the antenna height and its type (slant or vertical).
- *Epoch count*: shows the number of accepted epochs.
- *Rem Time*: shows remaining time to stop logging when in PP Kinematic or PP DGPS mode.
- *String* is a specifying parameter for a code for grouping of objects with one code according to some specified attribute. For example, the code “tree” also has “Jones” string. When processing the

points, only trees with the Jones string will be taken into consideration, not any other trees.

- **Start:** starts the survey process. After pressing, the button changes its name on **Accept** and a new button **Cancel** appears along with the counter of the epochs collected (Figure 5-36).

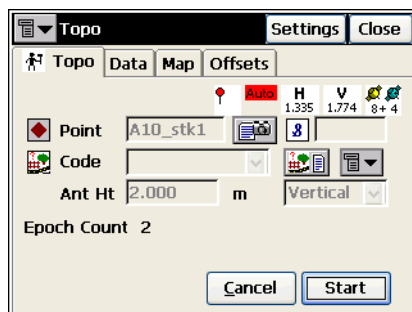




Figure 5-36. Topo – Start

- **Settings:** opens the *Survey Parameters* screen. See “Config: Survey Parameters” on page 2-49.
- **Start Log** (for RTK&PP, PP Kinematic, and PP DGPS): starts logging file in the receiver. When pressed, the button changes its appearance to **Stop Log**.

In the PP Kinematic mode, instead of an icon displaying the RTK status, the symbol  displays, showing the status of the log file.

If the file is opened, it changes its appearance to .

When file logging is started, the *Status* screen also displays the *Log History* tab (Figure 5-37).

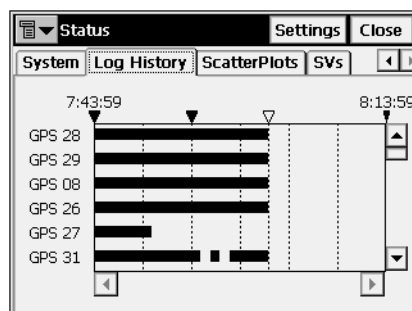


Figure 5-37. Status – Log History Tab

The *Log History* tab graphically displays the usage of satellites over time. The field is divided to 5-minute portions along dotted lines with the starting time and each next hour marked.

If the base is started in autonomous mode, and an observed Topo point has known coordinates stored in the job, the *Duplicate Points* screen displays additional options to correct the base coordinates.

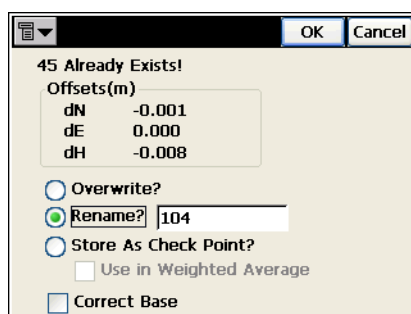


Figure 5-38. Duplicate Point

- *Overwrite*: overwrites the existing point.
- *Rename*: the point will be renamed. The new name is noted in the field and will be the point with observed coordinates.
- *Store As Check Point?*: if selected, the observed point will be stored as check point of the existing point.
- *Use in Weighted Average*: if selected the **OK** button opens the **Weighted Average** screen (see “Weighted Average” on page 5-33 for details).
- *Correct Base*: if selected, the existing coordinates of the observed point will not be replaced by the coordinates of the observed point. Instead the known coordinates of this point will be 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.

The *Data* tab shows the result of the survey.

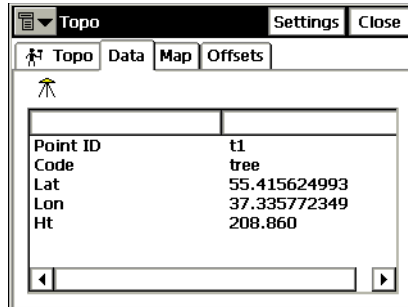


Figure 5-39. Topo – Data

The *Map* tab shows the stored point graphically and performs the same actions as the *Topo* tab. For a detailed description of the Map view see “Properties” on page 4-7.

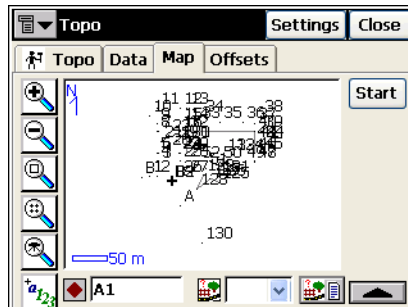







Figure 5-40. Topo – Map

The icons displayed stand for the following fields:

-  : the name of a point.
-  : the code of a point.
-  : attributes for the code.
-  : toggles between the **Start** button and status icons on the right part of the screen. When pressed, changes its appearance to  .

## Grid Setup

Select the Grid Setup option from the top left menu in the *Topo* screen to open the *Grid Setup* screen. The *Grid Setup* screen is used to setup a grid to be displayed with the Map to help while collecting data.

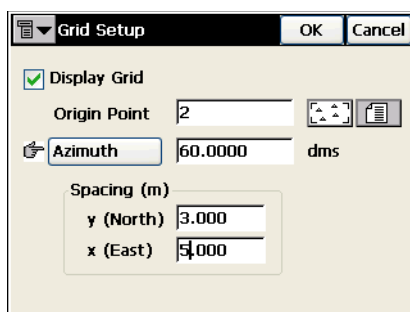


Figure 5-41. Grid Setup

- *Display Grid*: when this box is checked, a grid will be displayed in the Map page.
- *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*: specifies the intervals between the grid lines along the y(North) and x(East) axes.
- **OK**: displays the grid in the *Map* page with the specified settings.

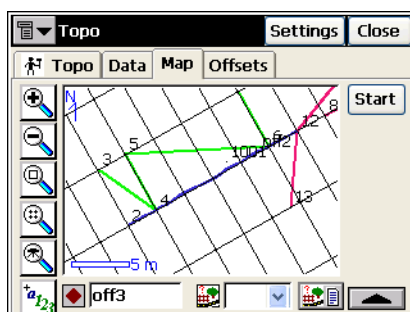


Figure 5-42. Grid in Map

The *Offsets* tab sets the offset point for the measurement.

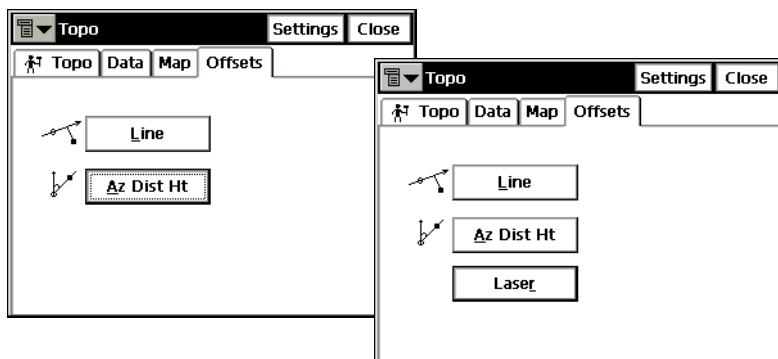


Figure 5-43. Topo – Offsets

- **Line:** opens the *Line* screen to define a point, set by the offset from a line.
- **Az Dis Ht:** opens the *Azimuth-Distance-Height* screen to define a point specified by the offset from a point.
- **Laser:** only available when a laser has been added in the Config Survey, opens either the *Config Laser* screen or the *Laser BS Meas* screen to define a point specified through a backsight.
- **Settings:** opens the *Survey Parameters* screen. See “Config: Survey Parameters” on page 2-49.



## Weighted Average

The *Weighted Average* screen displays coordinate residuals of the check point.

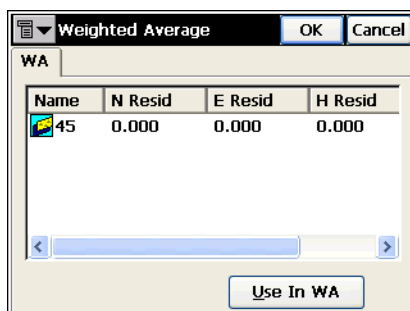


Figure 5-44. Weighted Average

- **Use In WA:** uses the check points in weighted averaging positions.

## Line

The *Line* screen is used to enter the parameters defining a point that are not available physically relative to some reference line.

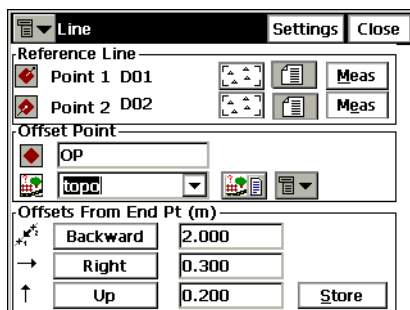



Figure 5-45. Line



- **Reference Line:** a line is specified by two known or measured points. They can be selected from the map, from the list or measured 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* bitmap, see “Code-Attributes” on page 3-10 for details)
  - The bitmap next to the *Attributes List* bitmap displays the following list:
    - *String*: switches on the *String* field. (The  sign also appears.)
    - *Note*: opens the *Notes* screen (see “Note” on page 5-27).
- *Offsets*: the offset values:
  - **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 left or right of the line.
  - **Up/Down**: the height difference from the target point.
- **Store**: calculates the coordinates of the offset point and saves the point to the database.
- The bitmap on the upper-left corner displays the following pop-up menu:
  - *Antenna Setup*: opens the *Antenna Setup* screen (see “Config: Base (Static) Antenna” on page 2-28)
  - *Help*: accesses the Help files
- **Settings**: opens the *Survey Parameters* screen. See “Config: Survey Parameters” on page 2-49.

## Azimuth-Distance-Height

The *Azimuth-Distance-Height* screen defines an offset point using the current point as a reference.

Figure 5-46. 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. Can be entered manually or chosen from the drop-down list.
-  : the *Attributes List* bitmap opens the *Code-Attributes* screen (see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: enables the *String* field. (The  sign also appears.)
  - *Note*: opens the *Notes* screen (see “Note” on page 5-27).
- **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 bitmap on the upper-left corner displays the following pop-up menu:
  - **Antenna Setup:** opens the *Antenna Setup* screen (see “Config: Rover Antenna” on page 2-45).
  - **Help:** accesses the Help files.
- **Settings:** opens the *Survey Parameters* screen (see “Config: Survey Parameters” on page 2-49).

## Laser BS Meas

When the selected laser has an Encoder, the *Laser BS Meas* screen defines an occupation point and backsight azimuth or point.

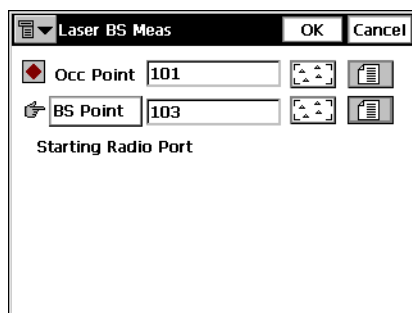



Figure 5-47. Laser BS Meas

- **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 for lasers with an Encoder.

## Config Laser

For lasers with an Encoder, the *Config Laser* screen defines the laser height and point information.


Figure 5-48. 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. Also, the  sign appears.
- *Code*: displays the current point code. Can be entered manually or chosen from the drop-down list.
- **BS Meas**: returns to the *Laser BS Meas* screen to set up a new BS.
- **OK**: saves the settings and returns to the *Topo* screen.

## Config Laser

When the selected laser does not have an Encoder, the *Config Laser* screen defines an occupation point and backsight azimuth or point, as well as defines the laser height and point information.

Figure 5-49. Laser BS Meas

- *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. Also, the  sign appears.
- *Code*: displays the current point code. Can be entered manually or chosen from the drop-down list.
- **OK**: saves the settings and returns to the *Topo* screen.

# Auto Topo Survey

To set up a survey with automatic topo points, tap **Survey ▶ Auto Topo**.

The *Auto Topo* initiates a kinematic survey.

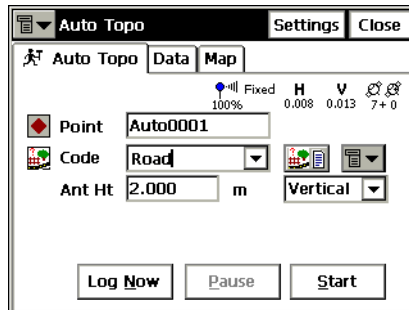




Figure 5-50. Auto Topo

The *Auto Topo* tab contains the initial data for the survey and displays the progress of the survey (Figure 5-50). The upper-right corner of the screen displays the status of information on the **Status** screen. For details see “Status” on page 5-2.

- The bitmap on the upper-left corner displays the following pop-up menu:
  - *Status*: opens the **Status** screen (see “Status” on page 5-2).
  - *Topo*: opens the Topo screen (see “Topo” on page 5-24).
  - *Rover Antenna Setup*: opens the **Antenna Setup** Screen (see “Config: Rover Antenna” on page 2-45).
  - *Config Radio*: opens the **Configure Radio** screen (see “Config: Rover Radio” on page 2-37).
  - *Config OmniSTAR*: opens the **OmniSTAR** screen to start the OmniSTAR service (see “OmniSTAR” on page 5-9).
  - *Reset RTK*: resets the ambiguities and sets the receiver in the rover RTK mode. The settings being used are based on 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.
- *Note*: opens the **Notes** screen (see “Note” on page 5-27).
- *Edit Points*: opens the Points screen (see “Points” on page 3-2).
- *PTL Mode*: switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to **Auto Topo (PTL)**.) For details see “PTL Mode” on page 6-16.
- *Point*: displays the current point name.
- *Code*: displays the current point code. Can be entered manually or chosen from the drop-down list.
-  : the *Attributes List* bitmap, opens the **Code-Attributes** screen (for details see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field. (The  sign also appears.)
  - *Note*: opens the **Note** screen (see “Note” on page 5-27).
- *Ant Ht*: sets the antenna height and its type (slant or vertical).
- **Log Now**: immediately stores the current position of the receiver antenna.
- **Pause**: interrupts the survey. After pressing, the button changes its name to **Resume**.
- **Start**: starts the survey process. After pressing, the button changes its name to **Stop** and the **Pause** button becomes available (Figure 5-51 on page 5-41).
- **Settings**: opens the **Survey Parameters** screen. See “Config: Survey Parameters” on page 2-49.



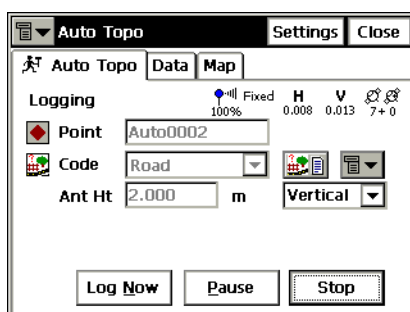


Figure 5-51. Auto Topo – Start

The *Data* tab shows the properties of the last stored point: the Point name and its coordinates.

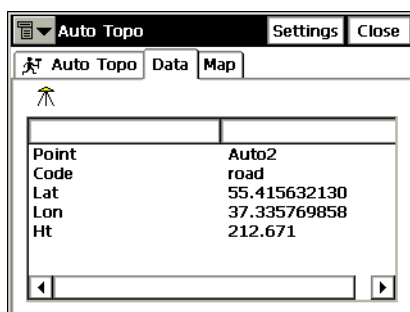


Figure 5-52. Auto Topo – Data

The *Map* tab shows the stored points graphically. All survey processes can be done through this page, as well as from the *Auto Topo* tab, as all the controls are duplicated.

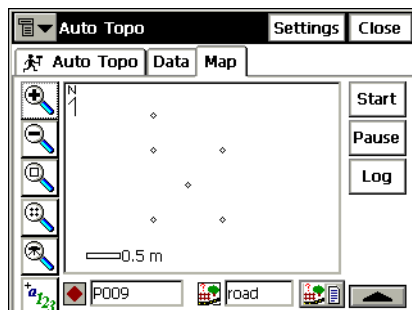







Figure 5-53. Auto Topo – Map

The icons displayed stand for the following fields:

-  : the name of a point.
-  : the code of a point.
-  : the *Attributes List* bitmap, opens the **Code-Attributes** screen (for details, see “Code-Attributes” on page 3-10).
-  : toggles between the buttons and status icons on the right part of the screen. When pressed, changes its appearance to  .

For a detailed description of the Map view, see “Properties” on page 4-7.

# Known Point Init

To set up a survey with known points, tap **Survey ▶ Known Point Init**.

The **Known Point Init** screen 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 5-54. Known Point Rover

- **Point:** sets the name of the point, and can be selected from a list or from a map.
- **WGS84:** the coordinates of the point in the current coordinate system. (Use the **Job ▶ Config ▶ Coord Sys** menu selection to change the system and the name of the field, its contents will also change.)
- **Ant Ht:** the height of the antenna reference point (ARP) above the mark, and the type of the height measurement (vertical or slant).
- **Initialize:** sends the information to the rover receiver.
- The bitmap on the upper-left corner displays the following pop-up menu:
  - **Status:** opens the **Status** screen (see “Status” on page 5-2).
  - **Rover Antenna Setup:** opens the **Antenna Setup** Screen (see “Config: Rover Antenna” on page 2-45).
  - **Config Radio:** opens the **Configure Radio** screen (see “Config: Rover Radio” on page 2-37).
  - **Help:** accesses the Help files.

## **X-Section**

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 “Cross-Section” on page 6-29 and “Topo” on page 5-24.

## **Find Station**

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 6-31 and “Topo” on page 5-24.

## **Tape Dimension**

The 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 6-33 and “Topo” on page 5-24.

# Static Occupation

In the PP Static mode of GPS survey, the Survey menu contains only two items: Status and Static Occupation. The Status screen is discussed in “Status” on page 5-2.

To open the *Static Occupation* screen, choose the *PP Static* configuration in the *Select Survey Config* screen (**Job ▶ Config ▶ Survey**) and select **Survey ▶ Static Occupation**.

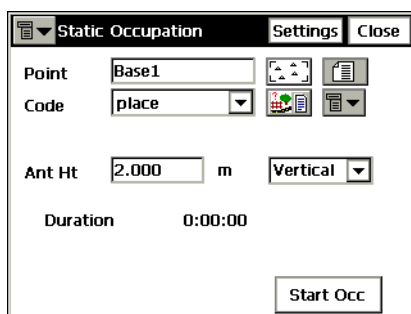




Figure 5-55. Static Occupation

- The bitmap on the upper-left corner displays a floating menu of the following items:
  - *Status*: opens the *Status* screen (see “Status” on page 5-2).
  - *Static Antenna Setup*: opens the *Antenna Setup* Screen (see “Config: Rover Antenna” on page 2-45).
  - *Help*: accesses the Help files.
- *Point*: displays the current point name, which can be entered manually or chosen from the map or point list.
- *Code*: displays the current point code, which can be entered manually or chosen from the drop-down list.
-  : the *Attributes List* bitmap, opens the *Code-Attributes* screen (for details, see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field. (The  sign appears.)

- *Note*: opens the **Note** screen, (see “Note” on page 5-27.)
- *Ant Ht*: sets the antenna height and its type (slant or vertical).
- *Duration*: displays the time passed from the beginning of survey.
- *Settings*: opens the Static Receiver screen. (For details, see “Config: Base (Static) Receiver” on page 2-17.)
- **Start Occ**: starts the survey in the static occupation mode. When pressed, changes its appearance on **Stop Occ**.

## Localization

To set up a survey with localization, tap **Survey ▶ Localization**.

Localization is used for transforming coordinates between a local system and a WGS84 system.

The **Localization** screen 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 will toggle the display between “used” and “not used”.

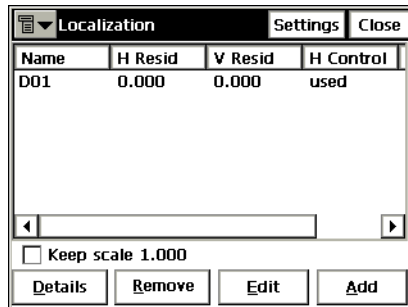


Figure 5-56. Localization

**NOTICE**

*For localization to work properly, enter or import the local coordinates with Projection and Datum set to <none> in the Coord System screen and Coord Type set to Ground in the Display screen.*

- The bitmap on the upper-left corner displays a floating menu of the following items:
  - *Config Radio*: opens the Configure Radio screen. (For details, see “Config: Rover Radio” on page 1-28).
  - *Help*: accesses the Help files.
- **Keep scale 1.000**: preserves localization from scale transformation.
- **Details**: opens the **Localization Results** screen.
- **Remove**: removes the highlighted points.
- **Edit**: creates localization parameters, using the localization points.
- **Add**: opens the **Add Localization Point** screen to add a point to use in localization.
- **Settings**: opens the Survey parameters screen. For details, see “Config: Survey Parameters” on page 2-49.


**TIP**

The more localization points used, the more precise the localization can be. 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 Localization Point* screen contains the coordinates of the control points.

Figure 5-57. Add Localization Point

- The *Local Point* field contains the name and coordinates of the point in the local coordinate system.
  - *Point*: sets the name of the control point. Select a point from the map, or from the list, or enter a new point name.
  - *Use Horizontal*: specifies that a point should be used for the horizontal localization.
  - *Use Vertical*: set if the point should be used for the vertical localization.
- The *WGS84 Point* field contains the name and global coordinates of the control points.
  - *Point*: sets the name of the control point. Enter a new point name, 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* bitmap, opens the *Code-Attributes* screen to set the values for the attributes available for the code chosen (Figure 3-13 on page 3-10).



- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: toggles on the *String* field. Also, the  sign appears. For details, see “Topo” on page 5-24.
  - *Layer*: opens the **Select Layer** screen to put the point. For details, see “Topo” on page 5-24.
  - *Note*: opens the **Note** screen. For details, see “Topo” on page 5-24.
- **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 a point with such name already exists, the application will open the **Point Check** notification screen. Overwrite, rename, or store the point as a check point.
- **OK**: saves the point and opens the Localization screen with a newly added point being displayed.

## Localization Results

The Localization Results screen contains the calculated parameters of the localization: the global coordinates, the corresponding local coordinates, the scale parameter, the azimuth, and the plane slope angles (deflections) corresponding to north and east directions.

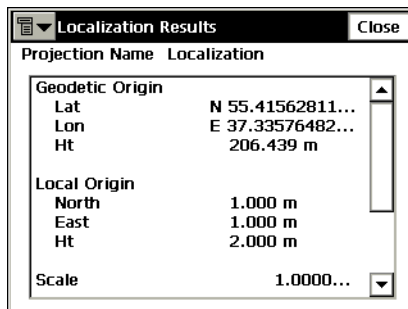


Figure 5-58. Localization Results

## Notes:

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

# Total Station Survey

The Survey menu includes the following menu items for Total Station surveys:

- Occ/BS Setup
- Observations
- Resection
- Elevation
- X-Section
- Find Station
- Tape Dimension
- Missing Line (optional)
- Auto Topo (for Robotic mode)
- Scanning (for Robotic mode)
- Monitor (for Robotic mode)
- Remote Control (for Robotic mode)

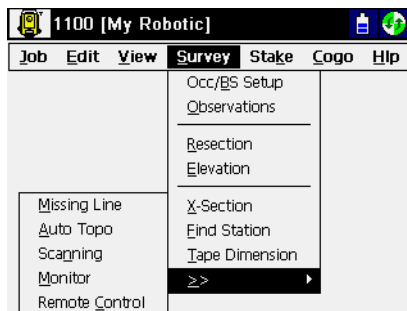


Figure 6-1. TS Survey Menu

# Occupations and Backsight Survey Setup


To set up a survey with localization, tap **Survey ▶ Occ/BS Setup**.




## Backsight Survey

The **Backsight Survey** screen contains Backsight station parameters.

The **BS Setup** tab contains following parameters.

Figure 6-2. Backsight Survey

- **Occ. Point:** the name of the point where the total station is located.
-  : opens the map for choosing the occupation point.
- The bitmap next to the Map icon in the **Occ. Point** field opens a floating menu of four items:
  - **From List:** opens the list of points.
  - **Resection:** opens the **Resection** screen from which to determine the occupation point coordinates by solving the resection task, using the known point's coordinates.
  - **Elevation:** opens the **Elevation** screen.
  - **Properties:** opens the **Add/Edit Point** screen that displays the properties of the current point, or can create a new point if no point is chosen yet.

- **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 bitmap next to the Map icon in the *BS Point* field displays the following list:
  - *From List*: opens the list of points.
  - *Multiple BS*: opens the **Multi-Point BS** screen, to involve several Backsight points for performing survey.
  - *Properties*: opens the **Add/Edit Point** screen that displays the properties of the current point, or suggests to create a new point if no point is chosen yet.
- **BS Circle**: displays the horizontal circle reading corresponding to the backsight point.
- The bitmap next to the *BS Circle* field displays the floating menu that suggests to set the BS Circle value to zero, azimuth, or to change the value by +/- 90 or 180 degrees.
- **Measure distance to BS**: set if the distance to backsight point should be measured.
- **Fixed HR at BS**: set if the height of the backsight point is fixed for the whole set of measurements. When checked, an additional HR box appears. This is useful when one target is mounted at the BS for the duration of an occupation and another is used for the sideshots.
-  : shows the battery and memory status for the controller.
-  : shows the battery status for the total station.
-  : shows the status of communication between the controller and total station.
- **Check BS**: opens the **Check Backsight** screen for the backsight point checking.

- **HC Set:** sets the horizontal circle as defined in the *BS Circle* field.
- **Meas BS:** measures the Backsight point.
- **Settings:** opens the *Mode* screen (identical to the screen “Config: Survey Parameters” on page 2-49).
- The bitmap on the upper-left corner displays the following pop-up menu:
  - *Edit Points:* opens the *Points* list (see “Points” on page 3-2).
  - *Edit Raw:* opens the *Raw Data* screen (see “Raw Data” on page 3-45).
  - *Remote Control* (for Robotic mode only): opens the *Remote Control* screen (see “Remote Control” on page 6-52).
  - *Config Link* (only for the Robotic mode): opens the *Configure Link* screen (see “Configure Link” on page 8-7).
  - *Inverse:* opens the *Inverse* COGO screen (see “Inverse” on page 9-2).
  - *Intersection:* opens the *Intersection* COGO screen (see “Intersection” on page 9-7).
  - *Help:* opens the Help files.

The *Data* tab displays the available values of the backsight point parameters.

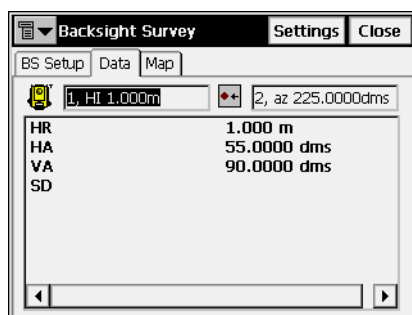


Figure 6-3. Backsight – Data

- *HR* (Height of Rod/target) and *HA* (Horizontal Angle)
- *VA* (Vertical Angle) and *SD* (Slope Distance)

There are two fields in the top of the page that display the height of the instrument and the azimuth.

The *Map* tab shows all points in a graphic mode. For details on map properties and customizing, see “Properties” on page 4-7.

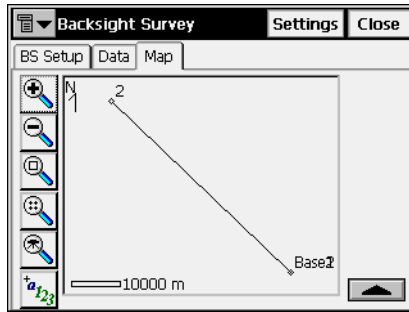


Figure 6-4. Backsight – Map

## Resection

To access the **Resection** screen, tap **Survey ▶ Resection**.

Alternatively, tap **Survey ▶ Occ/BS Setup**, then press the bitmap next to the Map icon in the *Occ. Point* field and select the *Resection* item.

The method of resection computes the coordinates of a point using measurements from two (or more) points with known coordinates.

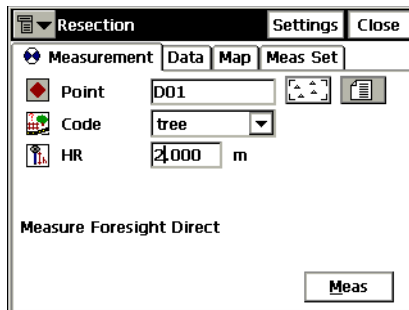


Figure 6-5. Resection

- *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).
- **Meas**: takes the sideshot to the point.
- **Settings**: opens the **Mode** screen (see “Config: Survey Parameters” on page 2-49).
- The bitmap on the upper-left corner displays the following pop-up menu:
  - *Edit Points*: opens the **Points** list (see “Points” on page 3-2).
  - *Inverse*: opens the **Inverse** COGO screen (see “Inverse” on page 9-2).
  - *Notes*: opens the **Note** screen for adding notes to the measurement session.
  - *PTL Mode*: switches on the PTL (Point-To-Line) Mode. (The screen changes its appearance to **Points (PTL)**.) For details, see “PTL Mode” on page 6-16.
  - *Remote Settings* (for Robotic mode only): opens the **Search/Track Parameters** screen (see “Config: Stakeout Parameters” on page 2-68).
  - *Config Link* (only for the Robotic mode): opens the **Configure Link** screen (see “Configure Link” on page 8-7).
  - *Options*: opens the **Resection Options** screen.
  - *Help*: opens the Help files.

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 “Properties” on page 4-7.

The **Meas Set** tab displays the result of the sideshots being done during one set (Figure 6-6 on page 6-7).



Point	Res HA	Res VA	Res SD	Use
BSN	-0.0002	-0.0003	-0.000	HVSD
BSE	0.0002	-0.0002	0.001	HVSD
BSS	-0.0001	0.0004	-0.001	HVSD
BSW	0.0000	0.0002	0.000	HVSD

Sd E: 0.0025    Sd N: 0.0024    Sd H: 0.0041

Ground to Grid: 0.999972

Buttons: Use Ctrl, Re-Meas, Accept

Figure 6-6. Resection – Meas Set Tab

- *Sd N, Sd E, Sd H*: displays Standard deviations for North, East and Height, respectively.
- *Ground to Grid*: displays the calculated scale factor.
- **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.
- **Re-Meas**: replaces the current measurement with a new measurement.
- **Accept**: stores the new coordinates in the database.

## Resection Options

The *Resection Options* screen calculates along the scale factor and set the resection type: whether to calculate the height (3-D) or just the horizontal coordinates (2-D).

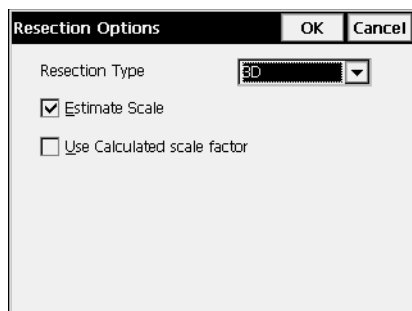


Figure 6-7. Resection Options

## Elevation

To access the *Elevation* screen, tap **Survey** ► **Elevation**.

Alternatively, tap **Survey** ► **Occ/BS Setup**, then press the bitmap next to the Map icon in the *Occ. Point* field and select the *Elevation* item.

Computation or estimation of elevation (vertical coordinate) will typically use measurements from two or more points with known coordinates.

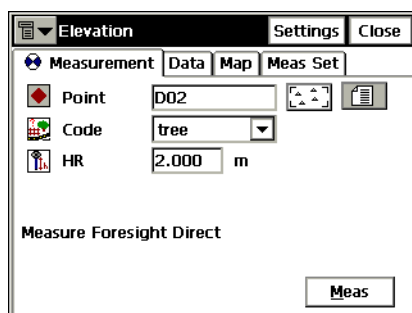


Figure 6-8. Elevation

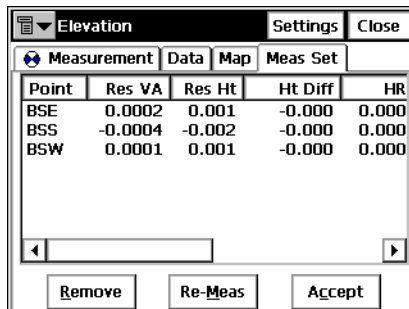
- *Point*: the known point name, which can be selected from the map or from the list.
- *Code*: the known point code.

- **HR**: the height of the rod (target).
- **Meas**: takes the sideshot to the point.
- **Settings**: opens the **Mode** screen (see “Config: Survey Parameters” on page 2-65).
- The bitmap on the upper-left corner displays the same pop-up menu except of the *Options* item, as for the Resection task.

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 “Properties” on page 4-7.

The *Meas Set* tab displays the results of the sideshots being done during one set, the same as for the **Resection** task.



Point	Res VA	Res Ht	Ht Diff	HR
BSE	0.0002	0.001	-0.000	0.000
BSS	-0.0004	-0.002	-0.000	0.000
BSW	0.0001	0.001	-0.000	0.000

Figure 6-9. Elevation – Meas Set Tab

The table 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, etc.) The *Ht Diff* column represents the difference between the calculated height and the height of that measurement.

- **Use Ctrl**: toggles through specific measurements in the resection, for example the horizontal angle, but not the vertical, or vice versa.
- **Re-Meas**: replaces the current measurement with a new measurement.
- **Accept**: stores the new coordinates in the database.

## Multi-Point Backsight

To access the *Multi-Point BS* screen, tap **Survey ▶ Occ/BS Setup**, press the bitmap next to the Map icon in the *BS Point* field and select the *Multiple BS* item.

Multiple backsight points can generate more precise measurements.

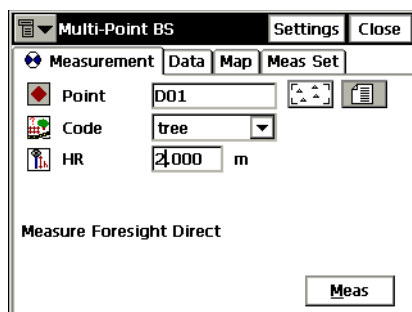


Figure 6-10. Multi-Point BS

- *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).
- **Meas**: takes the sideshot to the point.
- **Settings**: opens the *Mode* screen (see “Config: Survey Parameters” on page 2-65).
- The bitmap on the upper-left corner displays the same pop-up menu as for the Resection task.

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 graphic mode. For details on map properties and customizing, see “Properties” on page 4-7.

The *Meas Set* tab displays the result of the sideshots being done during one set.

Point	Res HA	HR	HA	
BSN	0.0000	0.000	0.0001	90.0
BSS	0.0001	0.000	179.5957	90.0
BSW	-0.0002	0.000	269.5957	90.0

Figure 6-11. Multi Point BS – Meas Set Tab

The table represents the result list of the measurements being made: the residuals of the horizontal angles, the measured and initial parameters (HR, HA, etc.)

- **Use Ctrl:** toggles through specific measurements in the resection; for example the horizontal angle, but not the vertical, or vice versa.
- **Re-Meas:** replaces the current measurement with a new measurement.
- **Accept:** stores the new coordinates in the database.

## Check Backsight

The *Check Backsight* screen contains information about the backsight point errors. Note, that HD and VD will not appear if only an azimuth (direction) has been entered for the backsight.

The screenshot shows the 'Check Backsight' window with the following data:

Measurement	Value
Instrument Height	S2, HI 0.000m
Backsight Azimuth	BSN, az 0.0003
HD Error	0.002 m
VD Error	-0.001 m
HA Error	-0.0002 dms
BS Azimuth	0.0003 dms
HA	359.5958 dms
VA	90.0003 dms
CS	188.883 dms

At the bottom, there are controls for 'Turn To BS' (unchecked), 'Check Distance' (checked), and buttons for 'Check' and 'HC Set'. A value of 0.0000 is displayed next to the 'Turn To BS' checkbox.

Figure 6-12. Check Backsight

There are two fields in the top of the page for the height of the instrument and the azimuth.

- **Turn To BS** (available only for the Robotic mode): check to turn the total station to Backsight Point.
- **Check distance to BS**: set if necessary to check the distance to backsight point along with the angle measurement (when pressing the **Check** button).
- **Check**: checks the errors in angle and distance measurements and displays them on the screen.
- **HC Set**: sets the horizontal circle to the selected value.

# Observations

Toggling between the sideshot modes is performed from the *Measurement Method* field in the two **Mode** screens opened by the **Settings** button in the *Sideshot-Dir* (*Sideshot Sets-Dir/Rev*, or *Ang/dist Sets-Dir/Rev*) screen (for a description of other parameters on this screen, see “Config: Survey Parameters” on page 2-49):

**Figure 6-13. Mode**

- *Sideshot-Dir*: defines that the measurement to a single point is taken using the Direct position of the Total Station.
- *Sideshot Sets-Dir/Rev*: defines that the measurement to a single point is taken using the Direct Position and the Reverse Position of the Total Station (i.e., Plunge - Flip and Rotate the Total station by 180 degrees to get the reverse measurement). One set consists of one direct and one reverse measurement. These measurements are used to eliminate the Vertical and Horizontal circle centering errors. This measurement method is known as Multiple, in which case the word Multiple appears in the title of the sideshot screen.
- *Ang/dist sets-Dir/Rev*: defines that during the measurement, the instrument will use the specified Angle sequence to perform repeated measurements. 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 centering errors in the horizontal and vertical circles.

## Sideshot - Direct

The *Measurement* tab of the *Sideshot-Dir* screen contains the initial data for the performing single sideshots and displays the information during survey.

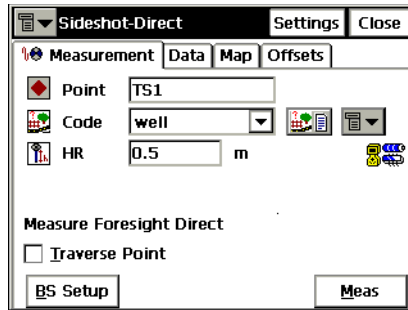



Figure 6-14. Sideshot-Dir – Measurement Tab

- **Point:** sets the current point name. During the survey the numerical part of the name changes automatically by one.
- **Code:** sets the Code for the current point. Can be entered manually or chosen from the drop-down list.
-  : accesses the attributes of the chosen code, opens the **Code-Attributes** screen (for details see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - **String:** adds a string to the point (see “Topo” on page 5-24).
  - **Note:** opens the **Notes** screen (see “Note” on page 5-27).
- **HR:** sets the height of the target above the mark (rod height).
- **BS Setup:** opens the **Backsight Survey** screen for setting the backsight point. The information displayed is the same as has been entered.



- The bitmap on the upper-left corner of the screen displays the following pop-up menu:
  - *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
  - *Inverse*: opens the ***Inverse*** COGO screen
  - *Notes*: opens the ***Notes*** screen.
  - *PTL Mode*: opens the **PTL Mode** screen (see “PTL Mode” on page 6-16).
  - *Help*: opens the Help files.
- *Traverse Point*: if checked, opens the screen to set the coordinates of the point manually.

**TIP**

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. Upon selecting OK, the Backsight screen displays and automatically updates, as in the case when one TP point is available.

- **Meas**: takes the sideshot to the point. The result is given in the information window.
- **Settings**: opens the ***Mode*** screen (for a description of parameters on this screen, see “Config: Survey Parameters” on page 2-49).

## PTL Mode

The Point-To-Line mode (PTL) is a method of interpretation of the point coordinates. The coordinates are defined through the two reference points. The line trace through these points is set as one axis and its perpendicular as another.

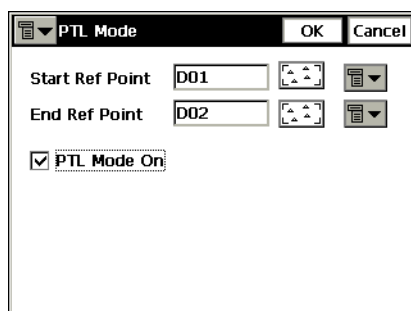


Figure 6-15. PTL Mode

- *Start Ref Point, End Ref Point*: the names of the reference points. Select these points from the map or select 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 contains the results of the measurements along with the initial data.

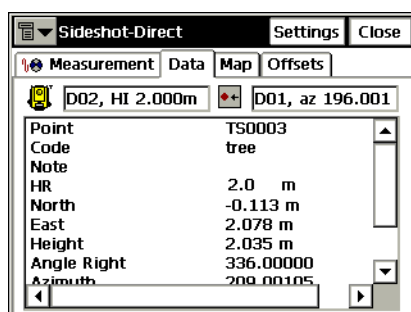


Figure 6-16. Sideshot-Dir – Data Tab

The *Map* tab performs sideshots in the graphic mode. The buttons on the right duplicate the controls on the first page.

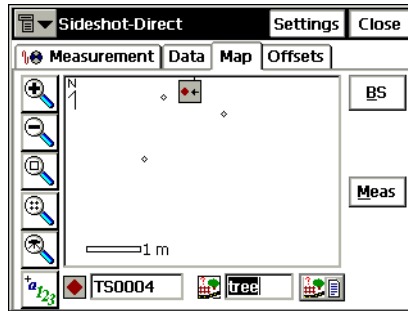


Figure 6-17. Sideshot-Direct – Map Tab

For details on map properties and customizing, see “Properties” on page 4-7.

In the *Sideshot Sets-Dir/Rev* and *Ang/dist Sets-Dir/Rev* modes a new *Meas Set* tab appears.

The page contains the data collected during the measurements, grouped by sets: one set for Multiple mode contains two measurements; one set of the Repeat mode contains four measurements).

Point	Res HA	Res VA	Res SD	HR
RS3	-0.0001	-0.0002	0.001	0.000
RS3	0.0005	-0.0001		0.000
RS3	0.0001	0.0002	-0.001	0.000
RS3	-0.0004	0.0000		0.000

Figure 6-18. Ang/dist Sets-Dir/Rev – Meas Set Tab

- The columns are:
  - Point: the name of the point.
  - Res HA: Difference of each HA measurement within the set from the average of all the HA's in the set.

- Res VA: Difference of each VA measurement within the set from the average of all the VA's in the set.
- Res SD: Difference of each SD measurement within the set from the average of all the SD's in the set.
- HR: the height of the rod (target).
- HA: Horizontal Angle measurement within the corresponding set.
- VA: Vertical Angle measurement within the corresponding set.
- SD: Slope Distance measurement within the corresponding set.
- **Remove:** deletes all measurements from the set.
- **Re-Meas:** displays the sideshot page to measure a new set of angles.
- **Accept:** saves the measured point.
- **Settings:** opens the *Mode* screen (see “Config: Survey Parameters” on page 2-49).

## Offsets

The *Offsets* tab contains a set of tools for defining the offsets.

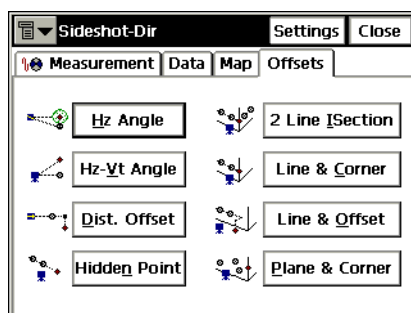


Figure 6-19. Offsets


- *Hz Angle*: defines a point using the horizontal angle from one point and the distance to another.
- *Hz-Vt Angle*: defines a point using the horizontal and vertical angles.

- *Dist. Offset*: defines a point giving the ability to add or subtract distances, horizontally and vertically.
- *2 Line ISection*: determines a point by the intersection of the two lines. Each line is defined by two points or two measurements.
- *Line & Corner*: determines a point on the corner using one line defined by two points and 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 defined by three points and horizontal and vertical angle measurements.

## Horizontal Angle Offset

The *Measurement* tab of the *Horizontal Angle Offset* screen contains data for definition of a point using the horizontal angle from one point and the distance to another.

Figure 6-20. Horizontal Angle Offset – Measurement Tab

- *Point*: name for the offset point to be stored.
- *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 the list of available attributes (for details see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field on the *Topo* tab (for details, see “Topo” on page 5-24).

- *Note*: opens the **Notes** screen (see “Note” on page 5-27).
- **HR**: sets the target height above the mark (rod height).
- **Settings**: opens the **Mode** screen for setting the backsight point.
- **Side and Center**: take measurements to Center and obtain vertical angle and horizontal angle measurements, then a Side measurement provides VA, HA, and distance measurements. With these two sets of measurements, the computation can be made for point at center of a tree; for example, when taking measurements, a comment will appear on the screen.
- The bitmap on the upper-left corner of the screen displays the following pop-up menu:
  - *Edit Points*: opens the **Points** list.
  - *Edit Raw*: opens the **Raw TS** screen (see “Raw Data” on page 3-45).
  - *Inverse*: opens the **Inverse** COGO screen (see “Inverse” on page 9-2).
  - *Intersection*: opens the **Intersection** COGO screen (see “Intersection” on page 9-7).
  - *Note*: opens the **Notes** screen. (See “Note” on page 5-27.)
  - *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.
  - *PTL Mode*: opens the **PTL Mode** screen (see “PTL Mode” on page 6-16).
  - *Help*: opens the Help files.

The following three tabs are similar to the Offset tasks:

- The *Data* tab contains the data collected during the offset measurement.

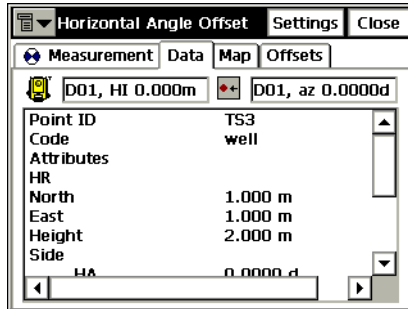


Figure 6-21. Horizontal Angle Offset – Data Tab

- The *Map* tab contains the graphic view and duplicated controls from the *Measurement* tab. For the details on viewing properties customizing, see “Properties” on page 4-7.

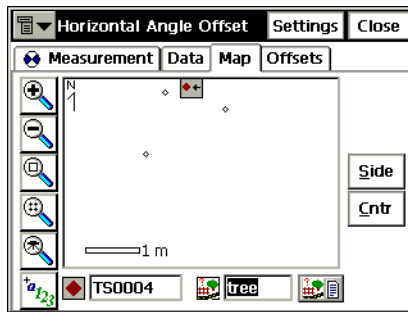


Figure 6-22. Horizontal Angle Offset – Map Tab

- The *Offsets* tab switches to another offset task.

## Horizontal/Vertical Angle

The *Measurement* tab in the Horizontal/Vertical Angle mode contains data for definition of a point using the horizontal and vertical angles.

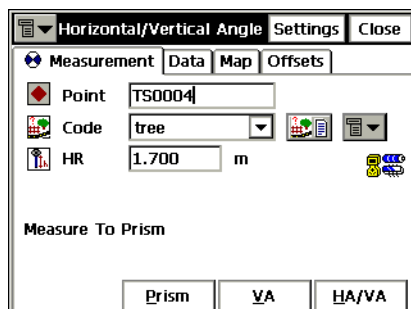



Figure 6-23. Horizontal/Vertical Angle – Measurement Tab

- *Point*: name for the offset point to be stored.
- *Code*: code for the offset point to be stored, which can be entered manually or chosen from the drop-down list.
-  : the *Attributes List* bitmap, lists available attributes (see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the same list as for the *Horizontal Angle Offset* task.
- *HR*: sets the target height (Rod Height).
- *Prism*: stores horizontal distance and horizontal angle measurements (to prism).
- *VA*: combines vertical angle measurement with Prism mode measurements to determine point location.
- *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 backsight point.

The *Data*, *Map* and *Offsets* tabs are similar to that of the *Horizontal Angle Offset* measurement.



## Distance Offset

The *Measurement* tab of the *Distance Offset* screen contains the data for definition of a point giving the ability to add or subtract distances, horizontally and vertically.

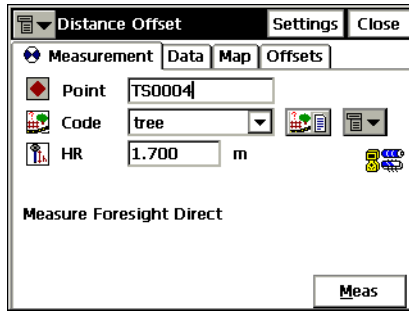




Figure 6-24. Distance Offset – Measurement Tab

- *Point*: name for the offset point to be stored.
- *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 the list of available attributes.
- The bitmap next to the *Attributes List* bitmap displays the same list as for the *Horizontal Angle Offset* task.
- *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 will be displayed and contains the following three parameters for the offset:

- **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.

- **Meas:** performs the measurement.
- **Settings:** opens the *Mode* screen for setting the backsight point.
- The *Data*, *Map* and *Offsets* tabs are similar to that of the *Horizontal Angle Offset* measurement.

## Hidden Point

The *Measurement* tab of the *Hidden Point* screen defines a point on the ground surface, with a slanted rod touching the ground point. The rod has two targets.

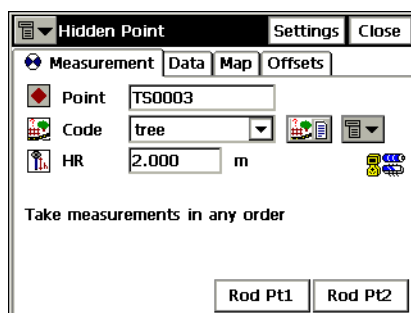




Figure 6-25. Hidden Point – Measurement Tab

- **Point:** name for the offset point to be stored.
- **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 bitmap next to the *Attributes List* bitmap displays the same list as for the *Horizontal Angle Offset* task.
- **Single:** toggles between the *Single* and *Repeat* sideshot modes.
- **Fine:** toggles between the *Fine* and *Coarse* sideshot modes.
- **Rod Pt1:** measures the first target on the rod.
- **Rod Pt2:** measures the second target on the rod.

## Two Line Intersection

The *Measurement* tab of the **Two Line Intersection** screen contains data for determination of a point by the intersection of the two lines. Each line is defined by two points or two measurements.

Figure 6-26. Two Line Intersection – Measurement Tab

- *Point*: name for the offset point to be stored.
- *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 the list of available attributes.
- The bitmap next to the *Attributes List* bitmap displays the same list as for the **Horizontal Angle Offset** task.
- *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 first line.
- **Line 2 Pt 1** and **Line 2 Pt 2**: obtains measurements to determine the first and second points defining second line.
- **Settings**: opens the *Mode* screen for setting the backsight point.

The *Data*, *Map* and *Offsets* tabs are similar to that of the **Horizontal Angle Offset** measurement.

## Line and Corner

The *Measurement* tab of the **Line and Corner** screen contains data for determination of a point on the corner using one line defined by two points.

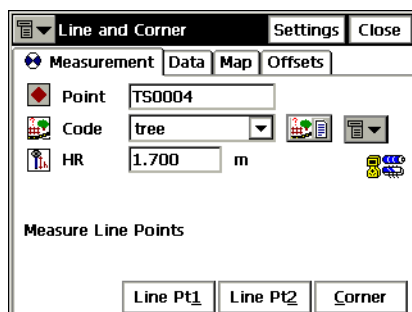



Figure 6-27. Line and Corner – Measurement Tab

- **Point**: name for the offset point to be stored.
- **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 bitmap next to the *Attributes List* bitmap displays the same list as for the **Horizontal Angle Offset** task.
- **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 horizontal angle to locate point on line at corner.
- **Settings**: opens the **Mode** screen for setting the backsight point.

The *Data*, *Map* and *Offsets* tabs are similar to that of the **Horizontal Angle Offset** measurement.

## Line and Offset

The *Measurement* tab of the *Line and Offset* screen contains data for determination of a point distant from a line defined by two points.

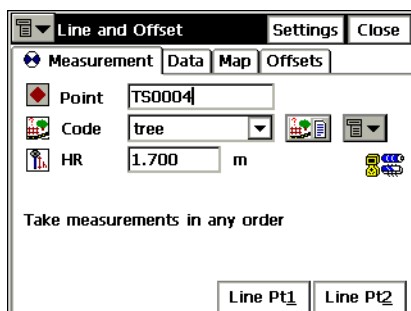



Figure 6-28. Line and Offset – Measurement Tab

- *Point*: name for the offset point to be stored.
- *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 bitmap next to the *Attributes List* bitmap displays the same list as for the *Horizontal Angle Offset* task.
- *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 backsight point.

After the lines are measured, the *Enter Distance Offsets* screen will be displayed and contains the following three parameters for the offset:

- **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 of the **Plane and Corner** screen helps determine a point (Corner) using a plane defined with three points and an angle measurement.

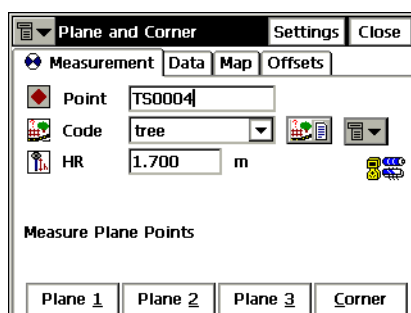



Figure 6-29. Plane and Corner – Measurement Tab

- *Point*: name for the offset point to be stored.
- *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 for the chosen code.
- The bitmap next to the *Attributes List* bitmap displays the same list as the **Horizontal Angle Offset** task.
- *HR*: sets the target (rod) height above the mark.
- **Plane 1**: obtains measurements to determine first point in a plane.
- **Plane 2**: obtains measurements to determine second point in a plane.
- **Plane 3**: obtains measurements to determine third point in a plane.

- **Corner:** obtains horizontal and vertical angle measurements to determine corner point in a plane.

### NOTICE

*The three points defining a plane must be not be colinear (all on the same line).*

- **Settings:** opens the **Mode** screen for setting the backsight point.

The *Data*, *Map* and *Offsets* tabs are similar to that of the **Horizontal Angle Offset** measurement.

## Cross-Section

The Cross-Section task surveys of the cross section. To start working, select the **Survey ▶ X-Section**.

The **Cross Section** screen contains the settings of the station, where the cross section survey is to be performed.

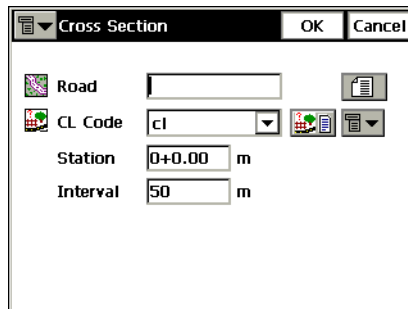



Figure 6-30. Cross Section

- **Road:** select the road from the drop-down menu, or from the list, if the road is not present in the **Roads** list.
- **CL Code:** the code of the center line points. Insert manually, or select one from the drop-down list.
-  : the *Attributes List* bitmap, opens the list of available attributes (for details see “Code-Attributes” on page 3-10).

- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field (see “Topo” on page 5-24).
- *Station*: sets the station where the cross section is surveyed. For the first cross section, this field is shown only if the road is set.
- *Interval*: the increment of distance towards the next station.

### NOTICE

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

- The bitmap in the upper-left corner of the screen displays the menu of two items:
  - *Edit Roads*: enables the Roads screen. See “Roads” on page 3-23.
  - *Help*: opens Help files.
- OK: saves the changes and opens the *XSect-Direct* screen.

The *XSect-Direct* screen performs the usual observation work relative to the cross section.

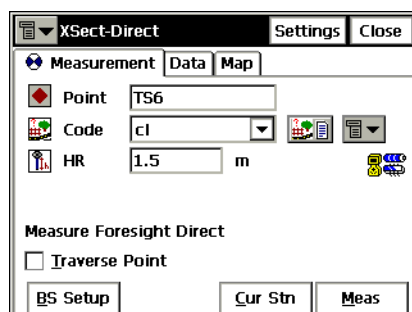


Figure 6-31. XSect-Direct

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 each next point has a different code, for example A, B, C, cl, D, E, F. After the **Close** button is pressed, the station number automatically changes. The application will suggest that the survey on the next station using the same codes in the opposite order: F, E, D, cl, C, B, A. The line will be created along the points with “cl” code.

For a detailed description of the survey process, see “Observations” on page 6-13. The only difference lies in the presence of the **Cur Stn** 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 **Survey ► Find Station**.

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

Figure 6-32. Find Station – Measurement Tab

- *Road*: type the name for the road, or select it from the list.
- *Point*: the name of the point.
- *Code*: the code. Can be entered manually or chosen from the drop-down list.

-  : the *Attributes List* bitmap, opens a list of available attributes (for details, see “Code-Attributes” on page 3-10).
-  : shows the battery and memory status for the controller.
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field (see “Topo” on page 5-24)
  - *Note*: opens the *Notes* screen (see “Topo” on page 5-24).
- *HR*: sets the target height above the mark (rod height).
- **BS Setup**: opens the *Backsight Survey* screen for setting the backsight point. The information displayed is the same as has been entered.
- **Pt Stn**: computes the result.
- **Cur Stn**: computes the result, 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 reflects in the *Result* tab.
- **Settings**: opens the *Mode* screen (see “Total Station Configuration” on page 2-55).
- The bitmap in the upper-left corner of the screen displays the following pop-up menu:
  - *Edit Points*: opens the *Points* list (see “Points” on page 3-2).
  - *Inverse*: opens the *Inverse* COGO screen (see “Inverse” on page 9-2).
  - *Notes*: opens the *Notes* screen (see “Observations” on page 6-13).
  - *PTL Mode*: opens the *PTL Mode* screen (see “PTL Mode” on page 6-16).
  - *Help*: opens 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. For details on map properties and customizing, see “Properties” on page 4-7.

The *Meas Set* tab (if available) displays the result of the sideshots being done during one set.

## Tape Dimension

To start working, select **Survey ► Tape Dimension**.

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 the so called *reference line*.

The *Ref Line* tab contains information about the two points comprising the reference line.

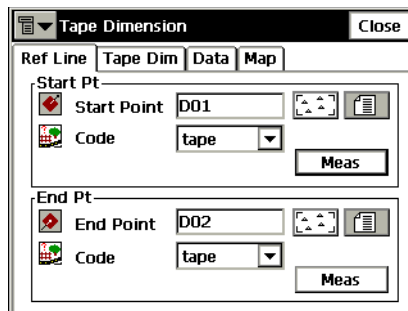


Figure 6-33. Tape Dimension Ref Line Tab

- *Start Pt*: contains properties of the starting point: the name (can be entered manually or chosen from the map or list) and code. Also, the point can be measured by pressing the **Meas** button.
- *End Pt*: contains properties of the ending point: the name (can be entered manually or chosen from the map or list) and code. Also, the point can be measured by pressing the **Meas** button.

The *Tape Dim* tab contains the settings for performing the survey.

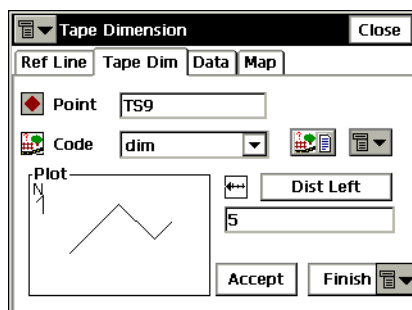



Figure 6-34. Tape Dimension – Tape Dim Tab

- *Point*: the name of the next point in the survey.
- *Code*: the code of the point. Can be entered manually or chosen from the drop-down list.
-  : the *Attributes List* bitmap, opens the list of available attributes (for details see “Code-Attributes” on page 3-10).
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field (see “Topo” on page 5-24).
  - *Note*: opens the *Notes* screen (see “Topo” on page 5-24).
- **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 bitmap 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 **Survey ► Missing Line**.

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

Figure 6-35. 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.

Figure 6-36. Missing Line – Data Tab

The same results are reflected in the **Raw Data** screen.

The *Map* tab shows the relative position of the points and the measured line.

# Auto Topo

This function is activated only with Robotic instruments, and collects points by Time and Distance. To open the **Auto Topo** screen, select **Survey ▶ Auto Topo** in the Robotic mode.

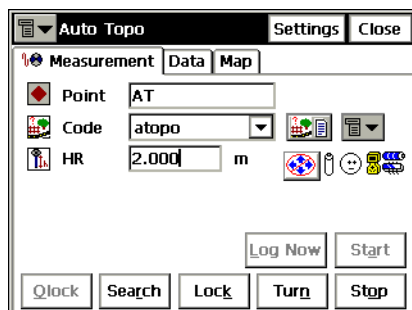




Figure 6-37. Auto Topo

The bitmap on the upper-left corner displays the following pop-up menu:

- *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 6-16).
- *Remote settings*: opens the **Search/Track Parameters** screen (see “Config: Stakeout Parameters” on page 2-68).
- *Config Link*: opens the **Configure Link** screen (see “Configure Link” on page 8-7).
- *BS Setup*: opens the **Backsight Survey** screen (see “Backsight Survey” on page 6-2).
- *Help*: opens the Help files.

The *Measurement* tab contains the initial data for the survey:

- *Point*: displays the current point name.
- *Code*: displays the current point code. Can be entered manually or chosen from the drop-down list.

-  : selects attributes for the indicated code.
- The bitmap next to the *Attributes List* bitmap displays the following list:
  - *String*: switches on the *String* field. (The  sign also appears.)
  - *Note*: opens the *Notes* screen (see “Note” on page 5-27).
- *HR*: the height of the rod (target).
- **Log Now**: immediately stores the current position.
- **Start**: starts the survey process. After pressing, the button changes its name to **Stop**.
- **Qlock**: sends the “Quicklock” or “Turn Around” command which will cause the Total Station to search for the RC-2<sup>1</sup>.
- **Search**: make the instrument search for the prism.
- **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.
- **Stop**: makes the total station to stop tracking the prism and go into “Standby” mode.
- **Settings**: opens the *Mode* screen. Press **Next** to access the Auto Topo settings (Figure 6-38 on page 6-38):
  - 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.

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

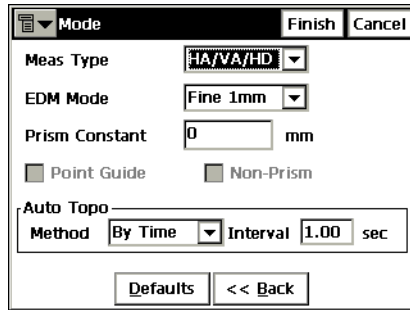


Figure 6-38. Mode Screen – Auto Topo Settings

The *Data* tab displays the data being surveyed.

The *Map* tab shows the surveyed data graphically and duplicates the controls from the *Measurement* tab to perform the survey to work in the map mode.

## Scanning

This function is activated only with robotic/reflectorless and motorized/reflectorless total stations. To open the **Scanning** screen, select **Survey ► Scanning** in the Robotic mode.

In the Scanning screen select a desired scan type: either *Scan with Image* or *Scan w/o Image*.

*For Scanning without Image* (Figure 6-39).

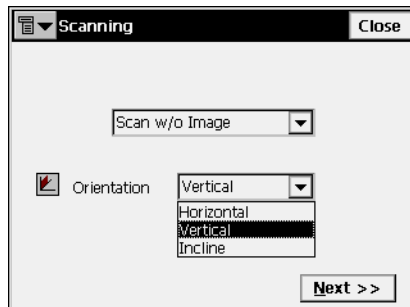


Figure 6-39. Scan without Image



- **Orientation:** sets the type of scan orientation; either Vertical, Horizontal, or Incline.
- **Next:** opens the *Area* screen.

*For Scan with Image (Figure 6-40).*

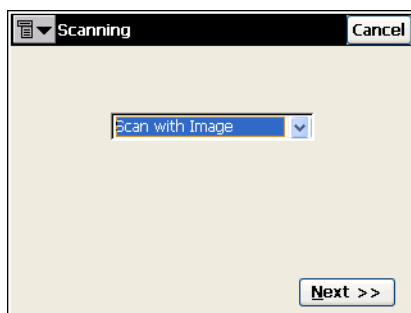


Figure 6-40. Scan with Image

- **Next:** opens the screen to enter information on the scan session.

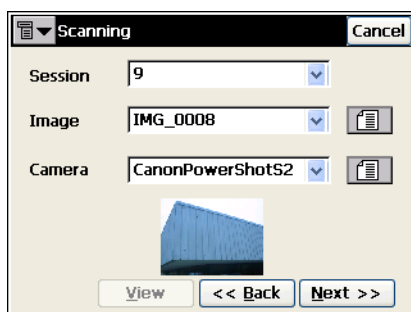


Figure 6-41. Enter Scan Session Information

- **Session:** sets a Session name.
- **Image:** sets an Image file. Select a previous Image or browse for a new one (Images are stored as JPEG with the \*.jpg file extension).
- **Camera:** sets the Camera information. If the Image exists in the Job, the Camera information will be selected automatically. Otherwise, select a previous Camera or browse for a new one (Cameras are stored as a text file with the \*.cmr extension).
- **View:** opens the *View Scan* screen.

- **Back:** returns to the previous screen.
- **Next:** once all fields are filled, clicking the button opens the *Orientation* screen.

## View Scan

The *View Scan* screen displays the image along with orientation and scanned points for completed scan sessions.

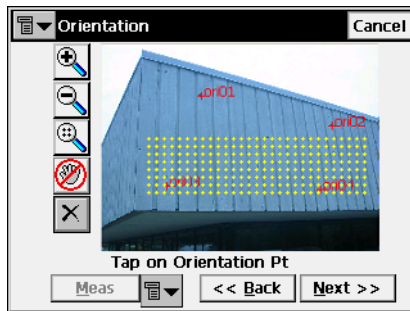







Figure 6-42. View Scan

-  : zooms in the image
-  : zooms out
-  : 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.

## Orientation

The *Orientation* screen associates a position on the image (x, y) with known N, E, Z coordinates.

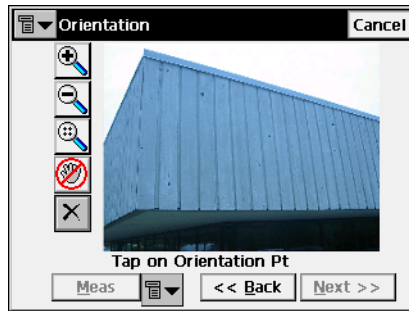







Figure 6-43. Orientation

-  : zooms in the image
-  : zooms out
-  : 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 will zoom to this point and show a crosshair. The position of the crosshair can be adjusted.

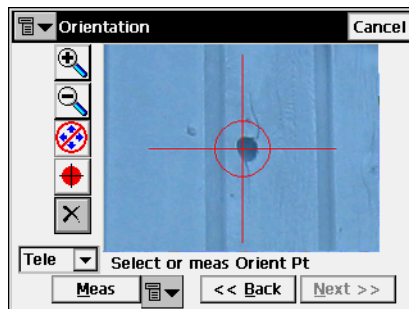





Figure 6-44. Select Orientation Point

-  /  : switches on/off the keypad arrow keys 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 contains two options to view the image (Figure 6-45):
  - *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.

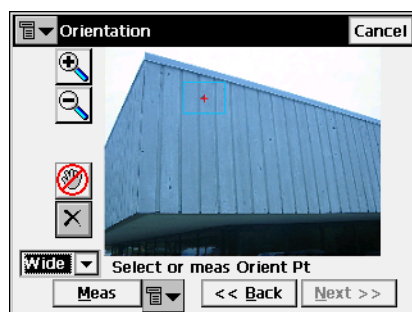



Figure 6-45. Select Orientation Point – Wide View

- **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.

-  : opens the **Orientation Results** screen to delete the selected orientation points (Figure 6-46).

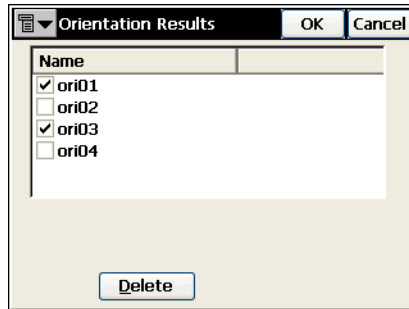


Figure 6-46. Delete Orientation Points

- **Next:** when four or more orientation points have been established click this button on the **Orientation** screen to display the orientation results (Figure 6-45).

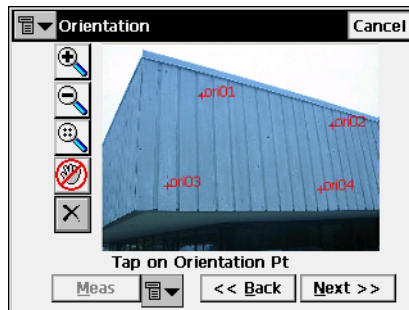


Figure 6-47. Calculate Image Orientation

## Orientation Results

The *Orientation Results* screen displays the results of the image orientation. The results for each orientation point is displayed as dX and dY in image pixels.

Name	dX[pixel]	dY[pixel]	
<input type="checkbox"/> ori03	1.0	1.0	BAD
<input type="checkbox"/> ori04	-1.2	0.3	GOOD
<input type="checkbox"/> ori01	1.0	-0.6	BAD
<input type="checkbox"/> ori02	-0.8	-0.6	GOOD

MAX dX:1.2 dY:1.0 GOOD

RMS dX:1.0 dY:0.7 BAD

Buttons: Delete, << Back, Next >>

Figure 6-48. Orientation Results

- **Back:** continues to the *Scan* screen to select areas for scanning.
- **Delete:** removes the selected point to adjust the orientation calculation. If four points still remain, the new results are displayed. If there are less than four orientation points, then the Orientation Results screen will close automatically to continue the orientation procedure.

## Scan Area, Selecting

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 6-49 on page 6-45, left image).

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 6-49 on page 6-45, right image).

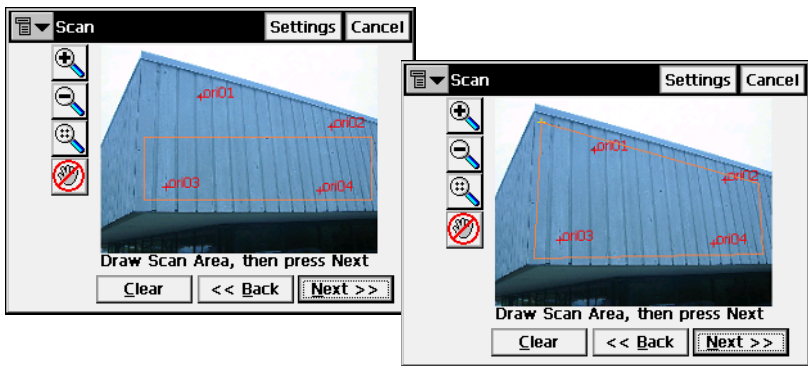


Figure 6-49. Select Scan Area

- **Next:** when the areas are set, pressing this button begins the scan, first opens the *Interval* screen to set the scanning settings.
- **Clear:** erases all drawn areas.
- **Settings:** opens the *Mode* screen (for a description of parameters on this screen, see “Config: Survey Parameters” on page 2-49). This is the same screen as the Settings button opens in the Observation and Occ/BS Setup screens. The main use is set the instrument to “Non-Prism” mode which is required for scanning and also to change the measurement mode (Fine, Coarse).

## Interval

The *Interval* screen sets the starting point and horizontal and vertical intervals for scanning.

The figure displays two versions of the 'Interval' screen from a surveying instrument. Both screens have a title bar with a printer icon, the word 'Interval', and a 'Cancel' button. The left screen shows the 'Interval' dropdown menu set to 'Angle'. Below it, the 'HA' and 'VA' fields are both set to '0.3000' with 'dms' units. The right screen shows the 'Interval' dropdown menu set to 'Num Points'. Below it, the 'Num H' and 'Num V' fields are both set to '10'. Both screens have 'Start Pt' set to 'SCAN2348', 'Scan Mode' set to 'Fine', and 'Meas Mode' set to 'Normal NP'. At the bottom of each screen are '<< Back' and 'Next >>' buttons.

Figure 6-50. Scanning Interval

- *Start Pt*: sets the starting name for the scanned points.
- *Scan Mode*: sets scanning mode to either *Fine* or *Coarse*.
- *Meas Mode*: sets measuring mode to:
  - *Normal NP*: normal Non-Prism measurements.
  - *Long NP*: long distance Non-Prism measurements; only available for GPT-8200 and GPT-7000 Total Stations.
  - *Normal/Long NP*: attempts to take a normal NP measurement. If unsuccessful, the instrument will automatically switch to long NP mode for the measurement; only available for GPT-8200 and GPT-7000 Total Stations.
- *Interval*: sets the scanning intervals either as Angle values or Numbers of points.
- *HA/Num H*: sets the interval in the horizontal direction.
- *VA/Num V*: sets the interval in the vertical direction.
- **Next**: saves the settings and opens the *Estimate Time* screen.



## Time Estimate

Before scanning begins, the *Estimate Time* screen displays the scanning information including the total number of points to be scanned and an estimate of the time it will take to complete the scan. If the estimated time is too long, click **Cancel** and enter larger intervals.

Estimate Time		Finish	Cancel
Start Pt	100		
Scan Mode	Fine		
Meas Mode	Normal NP		
H Interval	0.0148	dms	
V Interval	0.0148	dms	
Areas	1		
Points	1156		
Time	07:21:12	<< Back	

Figure 6-51. Estimate Time

- **Finish:** begins scanning points.

## Scanning in Progress

As the total station measures points within the predefined area, each point will be displayed on the image.

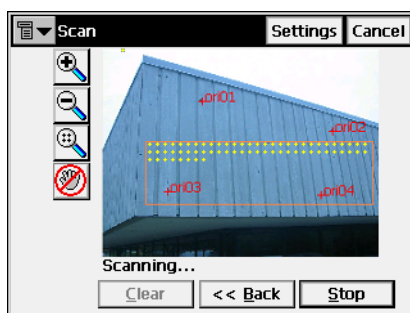


Figure 6-52. Scanning in Progress

- **Stop:** immediately stop the scan.

# Area

The *Area* screen selects the starting and ending points for the scanning area.

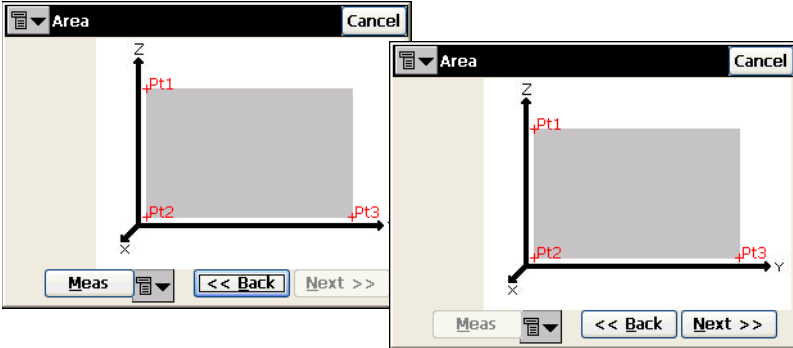



Figure 6-53. Select Area

- **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.
- **Next:** displays the same *Interval* and *Estimate Time* screens as for Scanning with Image mode (see “Interval” on page 6-46 and “Time Estimate” on page 6-47).

# Scan

As the total station measures points within the predefined area, each point will be displayed on the screen.

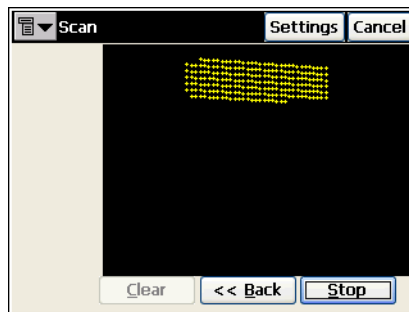



Figure 6-54. Scanning in Progress

- **Clear:** removes measured points from the screen and return to the *Area* screen.
- **Stop:** immediately stop 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  icon denotes the scanned points in the list of points.

## Monitor

This function is activated only with robotic total stations. To enable the monitor survey, select **Survey ► Monitor** in the Robotic mode. The *Monitor Pointlist* screen displays.

### Monitor PointList

The points to be measured are added to a point list which is then loaded using the *Monitor Pointlist* screen:

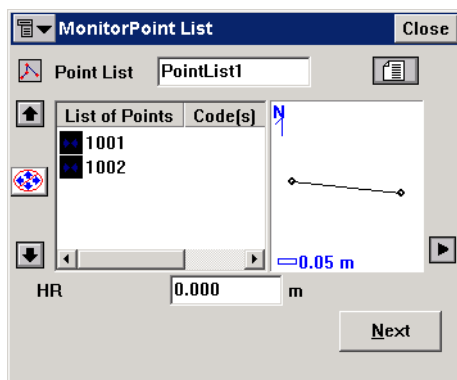


Figure 6-55. Monitor Point List

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 the FC-6 or GTS-7 formats. The output format and destination is accessed from the Monitor Options screen when configuring the total station (see “Config: Instrument” on page 2-56).

The **Monitor** screen is used to control the monitor survey.

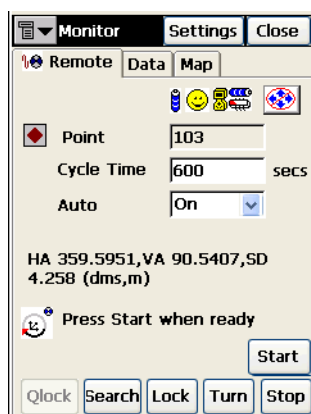




Figure 6-56. Monitor

- *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 will rotate to the next point in the sequence.
- *Auto*: If the Auto combobox is set to ON, the total station automatically rotates to the next point in the sequence and records a measurement. If it is set to OFF, the total station rotates to the point, but allows the user to verify or correct the centering to the prism prior to taking a measurement. The monitor function will always complete the entire sequence, even if the measurements take longer than cycle time.


- **Start:** initiates the sequence of measurements which repeats at the desired interval.
- **Qlock:** sends the “Quicklock” or “Turn Around” command which will cause the Total Station to search for the RC-2<sup>1</sup>.
- **Search:** make the instrument search for the prism.
- **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.
- **Stop:** makes the total station to 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:

 – 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 “Properties” on page 4-7.

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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.

# Remote Control

To set up a survey with remote control, tap **Survey ▶ Remote Control**.

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.

## Remote Control

The *Remote Control* tab controls the total station through the radio.

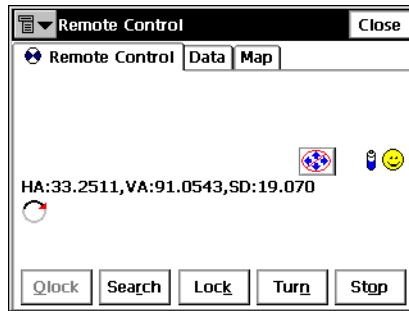





Figure 6-57. Remote Control

The *Remote Control* tab shows the current values of the total station measurements and provides a set of tools for control:

-  : switches the keyboard control on and off, shows the current status of the switch.
-  : shows the battery status for the total station.
-  : shows the status of communication between the controller and total station.

- **Qlock:** sends the “Quicklock” or “Turn Around” command which will cause the Total Station to search for the RC-2<sup>1</sup>.
- **Search:** make the instrument search for the prism.
- **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.
- **Stop:** makes the total station to stop tracking the prism and go into “Standby” mode.
- The Data Indicator above the **Qlock** button shows the current state of the Total Station. There are four types: no data, querying status, turning, and receiving data.
- All the observations can be done in the remote mode as well if the instrument chosen is robotic.
- The bitmap on the upper-left corner displays the following pop-up menu:
  - *Edit Points:* opens the **Points** list.
  - *Inverse:* opens the *Inverse* COGO screen.
  - *Notes:* opens the *Notes* screen (see “Note” on page 5-27).
  - *PTL Mode:* opens the **PTL Mode** screen (see “PTL Mode” on page 6-16).
  - *Remote Settings:* opens the *Search/Track* screen.
  - *Config Link:* opens the *Configure Link* screen (for details, see “Configure Link” on page 8-7).
  - *Help:* opens the Help files.

The *Map* tab shows all points in a graphic mode. For details, on map properties and customizing, see “Properties” on page 4-7.

When the Robotic total station operates in the Remote Control Mode, some of the screens change their appearance, the remote control tools appear on the *Measurement* tab (Figure 6-58 on page 6-54).

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

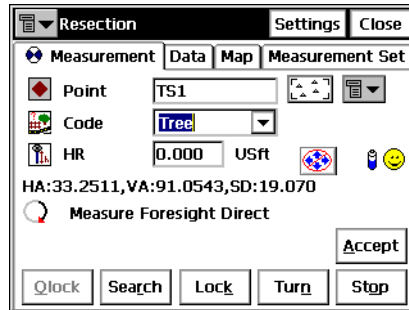


Figure 6-58. Sample Screen for Remote Control Mode

## Rotate

The *Rotate* screen contains settings for the remote total station rotation (Figure 6-59 on page 6-54).

- *Rotation Angles*: sets the values of the horizontal and vertical rotation angles.
- **Turn**: sends the data to the total station.
- *Rotate to Point*: selects a point by typing its name, selecting it from the map or a list, inserting the HR value (height of rod or target), and pressing the **Turn** button.
- **Plunge TS**: press to plunge the instrument (rotate the telescope and the body by 180 degrees).

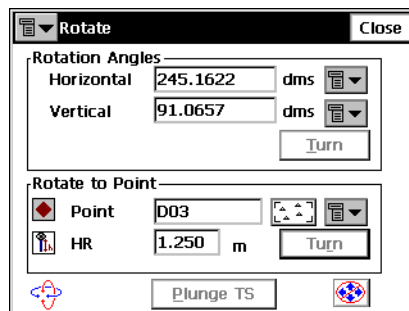


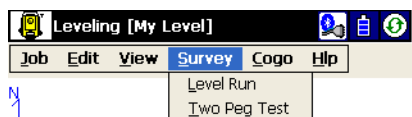
Figure 6-59. Rotate



# Level Survey

The Survey menu includes two items for Level survey:

- Level Run
- Two Peg Test



50 m

Figure 7-1. Level Survey Menu

## Level Run

To set up a Level survey in running mode, tap **Survey ▶ Level Run**.

The *Level Run* screen creates a new level run.

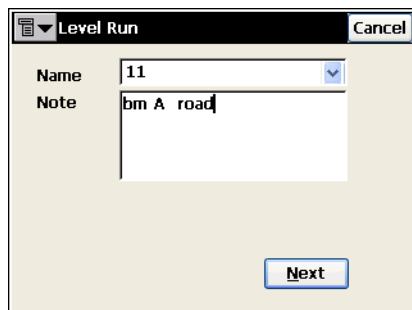


Figure 7-2. New Level Run

- *Name*: sets a name of the new level run.

- **Note:** adds optional information on the level run.
- **Next:** opens the screen to make leveling measurements.

## DL Level Run

The *DL* tab of the **Level Run** <run name> screen displays all leveling data in progress and contains tools to conduct leveling.

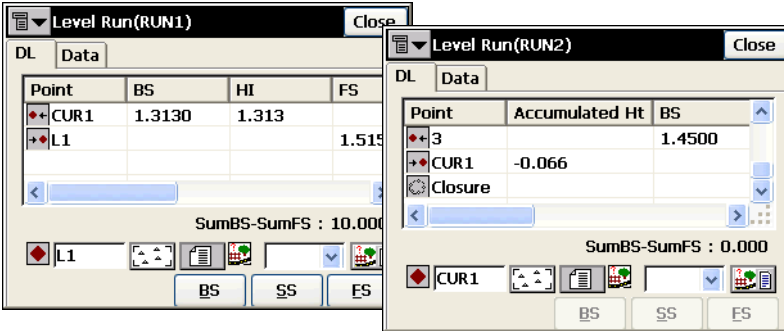




Figure 7-3. DL Level Run

-  : sets the point for rod reading; selected from the map or the list of points.
-  : sets the code for the measured point. The bitmap next to the field opens the **Code-Attributes** screen to set a new code. For details, see “Code-Attributes” on page 3-10.
- **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



– sideshot point



– foresight 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 foresights.
- *Notes*: any additional information on the point.



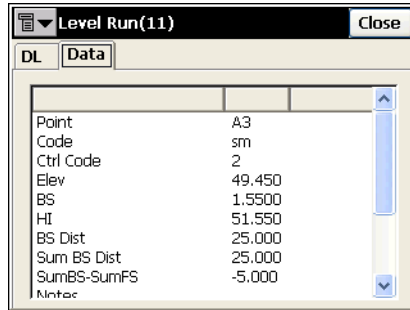
### TIP

All columns except PT Name can be selected to display (see “Display Settings” on page 7-4).

- The bitmap in the upper-left corner of the screen displays the following pop-up menu:
  - *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 8-19).
  - *Stake Elev*: opens the ***Stake Elev*** screen to stake out at a rod point (see “Stakeout Elevation” on page 8-20).
  - *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 9-2).
- *Help*: opens the Help files.

The **Data** tab of the **Level Run <run name>** screen displays information related to the current measurement.



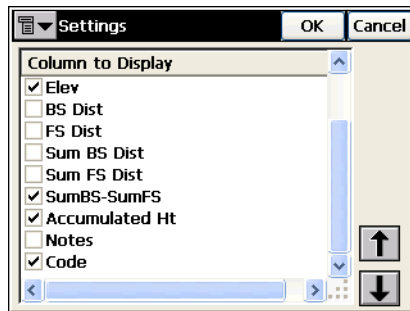
The screenshot shows a window titled "Level Run(11)" with a "Close" button. Below the title bar are two tabs: "DL" and "Data", with "Data" being the active tab. The main area contains a table with two columns. The first column lists survey parameters, and the second column shows their corresponding values.

Point	A3
Code	sm
Ctrl Code	2
Elev	49.450
BS	1.5500
HI	51.550
BS Dist	25.000
Sum BS Dist	25.000
SumBS-SumFS	-5.000
Notes	

Figure 7-4. Level Run - Data

## Display Settings

The **Settings** screen selects the columns to display using. The Up/Down arrows are used to change the order of the selected column.



The screenshot shows a "Settings" dialog box with "OK" and "Cancel" buttons. It contains a list box titled "Column to Display" with several items, each preceded by a checkbox. Below the list box are two buttons with up and down arrows for reordering.

Column to Display
<input checked="" type="checkbox"/> Elev
<input type="checkbox"/> BS Dist
<input type="checkbox"/> FS Dist
<input type="checkbox"/> Sum BS Dist
<input type="checkbox"/> Sum FS Dist
<input checked="" type="checkbox"/> SumBS-SumFS
<input checked="" type="checkbox"/> Accumulated Ht
<input type="checkbox"/> Notes
<input checked="" type="checkbox"/> Code

Figure 7-5. 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 execute the Two Peg Test, tap **Survey ► Two Peg Test**.

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

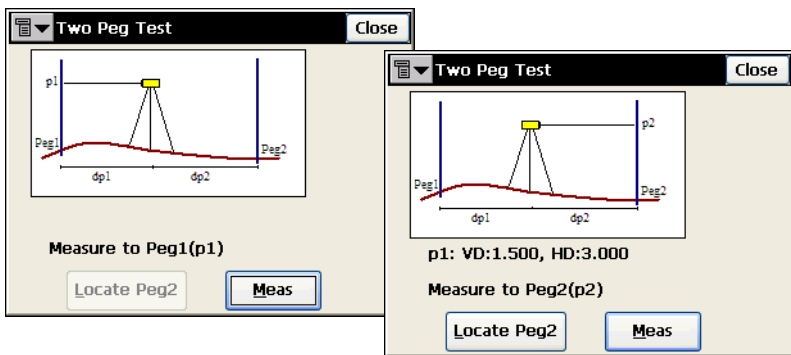


Figure 7-6. Two Peg Test

- **Locate Peg2:** measures the horizontal distance to Peg2 and compares it with the already taken measurement to Peg1. This measurement is not used in the error computations.
- **Meas:** takes measurements for the displayed prompted Peg. The results are displayed.

# Two Peg Test Results

The *Two Peg Test Results* screen displays the results of the test after all measurements are taken.

The screenshot shows a window titled "Two Peg Test Results" with a "Close" button. Inside is a table with two columns: "Shot" and "Data". The table contains the following data:

Shot	Data
p1 VD	1.500
p1 HD	3.000
p2 VD	1.800
p2 HD	33.000
p1' VD	1.600
p1' HD	3.000
p2' VD	1.800
p2' HD	33.000

Below the table, the error is displayed as: Error = -2.778 mm/m

**Figure 7-7. 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.