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Home Screen

The <u>Home Screen</u> allows you to create customized menus with your frequently used functions.

You can navigate to the <u>Home Screen</u> from any menu in Survey Pro by tapping on the home icon at the upper left corner of the screen. If you are on the <u>Home Screen</u> you can return to the main menu by tapping the menu icon at the upper left corner of the screen. If you are currently on a sub menu screen, you can return to the main menu by tapping on the menu up icon at the upper right corner of the screen.

You can tap and hold on any Survey Pro sub menu item to add it to the home screen. When you tap and hold on a menu item, select **Add to Home** to place this menu item on your home screen. When you do so, the home screen will appear in the edit mode, and the following icons appear on the home screen positions:

- **Open square**: Tap at this location to place the new menu item in an unused position on the home screen. When the home screen is in edit mode, you can change pages to access a different page to place the item on.
- **Closed square**: Tap at this location to place the new menu item in an already occupied position on the home screen. The existing menu item at this location will be moved down.

You can tap and hold on the home screen to bring up a context menu to customize the placement of items and pages of the home screen. The menu allows you to:

- **Move Item**: Places the home screen in edit mode, and you can move items to a different location, including to a different page of the home screen.
- **Remove Item**: Removes the selected menu item from the home screen.
- **Insert Page Before**: Adds a new home screen page before the current page. You can have a maximum of four pages on your home screen.
- **Insert Page After**: Adds a new home screen page after the current page. You can have a maximum of four pages on your home screen.
- **Remove Page**: Removes the current page from the home screen. If the current page has items on it, you will be prompted before you can remove it. You can not remove the last page of the home screen.

Main Menu

The <u>Main Menu</u> is the starting point where all the other screens described in this manual are accessed.

The area at the bottom of the screen is called the *command bar*. The small buttons in the command bar are used as follows:

Map View

Opens a [Map View] of the current job can be displayed by tapping the button.

Surveying Mode

The instrument icon indicates which collection mode the software is running in. There are three possible surveying modes:

- Conventional
- RTK GNSS
- Post Processing GNSS

Tapping this icon will open a list of options to do any of the following:

- Switch to another instrument mode.
- Select a different instrument profile.
- Quickly access the [Instrument Settings] screen.

Battery Level

The battery icon at the bottom of the <u>Main Menu</u> displays the condition of the data collector's rechargeable battery. The icon has five variations depending on the level of charge remaining: 100%, 75%, 50%, 25%, 5% and charging.

Tapping the battery icon is a shortcut to the Microsoft <u>Power Settings</u> screen. You can get more information while viewing this screen from the online help.

Quick Pick

The (Quick Pick) button is used to quickly access any of a variety of commonly-used routines. The list of routines available is customizable using the [Quick Pick Editor].

Online Help

Tapping the button opens the online help, which allows you to access information similar to the information you would find in the reference manual for each screen.

Other Command Bar Buttons

The following command bar buttons are available in screens other than the Main Menu. Each is described below.

 (OK): Performs the desired action then closes the current screen.

 (Cancel): Closes the current screen without performing the action intended by the screen.

(Close): Closes the current screen.

(Settings): Opens the <u>Settings</u> screen associated with the current screen.

(GPS Status): This is used to view the current status and access the settings for a GPS receiver when using the GeoLock feature. It is only available from the [Remote Control](#) and [Remote Shot](#) screens when using a Trimble or Geodimeter robotic total station.

File Menu

The File Menu contains routines to open or create a new job, import and export different file formats, and transfer files between the Data Collector and another device.

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Open / New

[**File**] [**Open / New**]

The Open / New screen is used to open a recent job or create a new one. This screen also appears when the software is first started.

[**Open**]: opens the job selected in the Open a Recent Job list.

[**Browse…**]: will open the Open screen where an existing job to open can be selected.

[**New…**]: will open the New screen where a new job can be created.

New Job

[**File**] [**Open / New**] [**New…**]

The New Job screen is used to create a new job.

Create a New Job - File Name Screen

Directory: displays the directory where the current job will be stored.

Job Name: is where the name of the new job is entered. The default name is the current date.

[**Browse…**]: allows you to select a different directory where to store the new job.

Current Settings: displays the last used settings for creating a job. These settings will be used to create a new job when you tap [**Create Job Now**].

[**Create Job Now**]: creates a new job with the job name using the current new job settings.

[**Settings >**]: opens the Units and Format Screen where you can modify the default settings for creating a new job.

❌ (Cancel): cancels the creation of a new job and brings you back to the Main Menu.

Create a New Job – Units and Format Screen

Azimuth Type: specifies if you are surveying with a North Azimuth or South Azimuth.

Grid Direction: specifies if your grid coordinates are increasing positive in the North East or the South West direction.

Units for Distances: specifies if your distances will be entered in International Feet, US Survey Feet, or Meters.

Note: You can enter a distance in any distance field in units other than what is set for the job by appending the distance value with the following characters:

- **f** or **ft** or **ift** = International Feet
- **usf** or **usft** = US Survey Feet
- **i** or **in** = Inches
- **m** = Meters
- **cm** = Centimeters
- **mm** = Millimeters
- **c** or **ch** = Chains

Once the cursor leaves that field, the distance will be converted automatically. (A space between the value and the unit abbreviation is optional.)

Units for Angles: specifies if angles will be entered in Degrees or Grads.

Earth Curvature & Refraction: Allows you to select the earth curvature and refraction correction coefficient. Select **None** to turn Earth Curvature & Refraction correction off.

Note: To use a scale factor with a job, go to the [Scale Settings](#) card to configure the scale factor mode. If you select a mapping plane coordinate system, your scale settings will automatically be configured.

[**Next >**]: opens the [Select Control File Screen](#), where you can select a control file to load into the new job.

❌ (Cancel): cancels the creation of a new job and brings you back to the [Main Menu](#).

Create a New Job – Select Control File Screen

Use a Control File: check to import control points into the new job.

[**Browse…**]: allows you to select a .JOB or a .SURVEY file to import control points from.

[**<Back**]: returns you to the [Units and Format Screen](#).

[**Next >**]: opens the [Select Coordinate System Screen](#), where you can specify the coordinate system to use for the new job.

Create a New Job – Select Coordinate System Screen

Select Coordinate System: check to select a coordinate system from the database. Leave this box unchecked if you are doing a survey in a flat earth plane coordinate system.

Note: If you are doing a GNSS survey and there is no projection and no datum to relate your local coordinates to latitude, longitude and height, then leave this box unchecked and the GNSS survey will start in Default Ground Calibration mode.

If [**Select Coordinate System**] is checked, select the coordinate system from the data base using the following controls:

[**Region**]: select the coordinate system region.

[**Zone**]: select the coordinate system zone.

[**Datum**]: displays the datum for the selected zone, or, allows you to select a datum for zones in the database that have no preset datum.

[**Use Geoid**]: check to use a geoid model with the selected coordinate system.

[**Geoid**]: select the geoid model to use with the zone when [**Use Geoid**] is checked.

[**<Back**]: returns you to the [Select Control File Screen](#).

Next >]: opens the [Enter First Point Screen](#) where you can enter a coordinate for your first point in the new job.

Create a New Job – Enter First Point Screen

Enter First Point: when this box is checked, the additional fields will appear allowing you to create a new point.

Note: You can create a job with no initial point.

Point Name: is the name of the initial point.

Northing: is the Y-coordinate of the initial point.

Easting: is the X-coordinate of the initial point.

Elevation: is the elevation of the initial point.

Description: is the description of the initial point.

Note: When you are doing a survey in a south west grid system, the meaning of the X/Y axes are reversed, so the south coordinate is labeled on the X axis and the west coordinate is labeled on the Y axis .

[**< Back**]: returns you to the Select Coordinate System Screen.

[**Finish**]: creates the new job and stores the .survey file with the initial settings.

❌ (Cancel): cancels the creation of a new job and brings you back to the Main Menu.

Open

[**File**] [**Open/New**] [**Browse…**]

The Open screen is used to open any existing job and is required to open a job that is not listed in the Recent Job list in the Open / New screen.

A list of all the jobs in the current directory is displayed. Simply tap on the job name that you want to open and then tap ✅.

Note: A *.CR5 file can be opened just like any *.JOB file. When a *.CR5 file is opened, it is automatically converted and stored to a *.JOB file with the same name. If a matching *.RW5 raw data file exists, it too will be converted and saved to a *.RAW file with a note inserted indicating that the conversion took place.

When a job is being opened, the Loading JOB file screen will open briefly and display the status of the loading process.

Save As

[**File**] [**Save As**]

The Save As screen allows you to save a copy of the current job under a new name. The copy that is created will then become the current job.

The Save As screen is identical to that found in other Windows applications. Simply enter a new name for the current

job and then tap the [**Save**] button.

Note: It is not necessary to include the .survey extension since it will automatically be added for you.

Import

[**File**] [**Import**]

The Import screen is used to add the points from another source into the current job or import the data from a LandXML file to the current job.

Warning: Coordinate values can change when they are imported!

Importing coordinates from any source other than a Survey Pro file (*.survey | *.JOB | *.JXL) requires that the distance units used in the source file be specified. It is not necessary to specify the distance units when importing coordinates from a Survey Pro file since those units are written within the file.

If importing coordinates where the distance units in the source file are different than the distance units for the current job, the imported coordinates will be converted to the current job's distance units when they are imported. This is normally the desired result, but it can cause a problem if any distance units were set incorrectly. This situation can most commonly occur when working with International Feet and US Survey Feet where the conversion from one to the other is not always obvious.

Usually the difference between International Feet and US Survey Feet is negligible (2 parts per million), but when dealing with State Plane or UTM mapping plane coordinates, which are often very large in magnitude, the difference can be substantial if the coordinates are converted from one format to the other.

If importing coordinates from a source, such as an HP 48, where you are not sure if the units are in International Feet or US Survey Feet into a job that is set to International Feet or US Survey Feet, you will usually just want to import them without any conversion being performed. To do this, be sure to select the same distance units for the source file as those set for the current job.

Coordinates from a variety of file types can be imported into the current job. The first Import screen is used to select from the file types listed below. The next screen that opens depends on the selection made here.

- **Survey Files** (***.survey**): import coordinates from a Survey Pro version 5 file.
- **Job Files** (***.JOB**): import coordinates from a Survey Pro version 4 file.
- **Coordinate Files** (***.CR5**): import coordinates from a CR5 coordinate file.
- **Text Files** (***.TXT**): text files can contain coordinates in several different possible formats. The Import ASCII Wizard is used to define the format of the text file being imported.
- **Text Files** (***.CSV**): this is a simplified text file import routine where the source file is comma delimited and has a *.CSV extension.
- **LandXML Files** (***.xml**): imports points, alignments, polylines, and parcels from a LandXML file.
- **JobXML Files** (***.jxl**): imports points and coordinate system from a JobXML file.

Import Survey Pro version 5 (*.survey) Coordinates

When importing coordinates from another *.survey file, the Import screen is used.

A list of all the .survey files available in the current directory is displayed. Simply tap on the job name that you want to import and then tap
the ✅ button. The points in the selected job will be added to the points in the current job.

Import Survey Pro version 4 (*.JOB) Coordinates

When importing coordinates from another *.JOB file, the Import screen is used.

A list of all the jobs available in the current directory is displayed. Simply tap on the job name that you want to import and then tap
the ✅ button. The points in the selected job will be added to the points in the current job.

Import *.CR5 Coordinates

The Import CR5 screen will open when importing coordinates from a *.CR5 coordinate file after selecting a layer.
Simply select the distance units that the coordinates were stored in and tap ✅.

Import *.TXT Coordinates

Since the coordinates in an ASCII *.TXT file can be stored in a variety of formats, two screens are used to define the format of the file that is being imported once a layer is selected. The source *.TXT file can contain either plane coordinates or geodetic coordinates.

Delimiters: is the character that separates each column of text in the ASCII file.

Units: are the units that the distances in the file were stored in.

Coordinates: is used to specify if the coordinates are plane coordinates, geodetic coordinates in degrees-minutes-seconds format, or geodetic coordinates in decimal format.

Skip the first row: should be checked if the first line in the ASCII file contains non-coordinate information, such as a heading.

[**Next >**]: opens the second screen.

Import *.TXT Coordinates – Screen Two

[**> Name Column No.**] / [**> Start Point Name**]: When the first option is selected here, the column number used for the name field in the *.TXT file is specified here. When the second option is selected, it is assumed that the *.TXT file does not contain point names and will assign the first point the name specified here and increment to the next available point name for the remaining points.

Columns: is where the column number for each specified coordinate exists in the source *.TXT file. The coordinates types displayed here can either be for plane coordinates or geodetic coordinates depending on the selections made in the previous screen. If a coordinate has a checkbox, which is unchecked, it is assumed that the source *.TXT file does not contain columns for that type of coordinate.

Specify Missing Elevation Threshold: if the source file was created from coordinates with no elevations, but the file contains an elevation column with values, such as 0, check this box and indicate the value in the field that will appear to the right.

[**Preview**]: opens the <u>ASCII Import Preview</u> window containing all the point data that will be imported. This is useful to check for errors before actually importing new data.

[**< Back**]: returns to the <u>previous screen</u>.

[**Finish**]: imports the new point data into the current project.

Import LandXML Coordinates

Points, alignments, polylines, and parcels can be imported from a LandXML file.

The way the LandXML data is imported depends on how the data is stored in the source file and how the settings are configured in the screens described here.

Consult the User's Manual for more information on the conditions that affect how the data is imported.

On specified layer: will import all the data on the specified layer.

On different layers by groups: will import points, alignments, and parcels to layers named by the group name for the data in the source file. If the group name is an invalid layer name (e.g., it is empty or contains invalid characters), the data will be stored to the active layer.

[**Next >**]: opens the second configuration screen.

Import polylines, alignments and parcels: When this is checked, polylines, alignments and parcels will be imported, as well as the points. When unchecked, only the points will be imported.

Import parcels to the specified layer: When this is checked, imported parcels will be stored to the selected layer. If unchecked, parcels will be stored to the layer specified in the previous screen.

For more information on how parcels are imported, consult the User's Manual.

Point and Line Descriptions: You can select what information to use as the description for imported lines and points in the corresponding two fields.

Lines can either be assigned the name or description from the source file and points can either be assigned the description or code from the source file.

[**Back**]: returns to the previous screen.

[**Import**]: imports the specified data into the current project. A results screen will open listing the details of the imported data.

Import JobXML Coordinates

Points and coordinate system information can be imported from a JobXML file.

Once a *.JXL file is selected, you will be prompted to select the layer where you want to put the imported points.

Layer: will import all the data on the specified layer.

If no coordinate system is configured for the current job, a dialog asks if you want to set the coordinate system for the current job to the coordinate system used in the *.JXL source file.

Confirm Point Replace

If a point being imported has the same name and the same coordinates as a point that is already in the current job, it is ignored and a message will be displayed after the remaining points are imported indicating this.

If an imported point is encountered with the same name, but with different coordinates as a point in the current project, the Confirm Point Replace screen will open.

[**Yes**]: will replace the point in the current job with the point being imported.

[**Yes to All**]: will replace the point in the current job with the point being imported and perform the same action for any remaining duplicate points.

[**No**]: will not import the duplicate point, keeping the coordinates for the existing point unchanged.

[**No to All**]: will not import the duplicate point, keeping the coordinates for the existing point unchanged and perform the same action for any remaining duplicate points.

[**Rename**]: will store the new point in the current job under the name specified in the **Starting At** field.

[**Rename All**]: will store the new point in the current job under the name specified in the **Starting At** field and perform the same action for any remaining duplicate points, storing them with the next available point name.

Starting At: is the point name assigned to the imported point when using the [**Rename**] or [**Rename All**] functions.

[**Compare Coordinates…**]: will open a screen showing the coordinates for the duplicate points to assist in making a decision of how to handle the new point.

[**Stop Importing**]: will not import the current duplicate point and will stop importing any remaining points. (All previous points will still be imported into the current job.)

Export

[**File**] [**Export**]

The Export screen allows you to export selected points from the current job to a new job or to a coordinate file in another format. This first screen is used to specify the type of file that you want to export data to.

Note: If you are exporting to a LandXML file, or to a Survey Pro version 4 .JOB/.RAW file pair, you do not select points for export as the entire contents of the current job are exported.

Survey (.survey) File: when selected, the chosen points and lines are exported to a Survey Pro version 5 format file.

Job (.JOB) File: when selected, the chosen points and lines are exported to a Survey Pro version 4 format file.

Survey Pro 4.x (.JOB / .RAW) File: when selected, the entire job is exported to a Survey Pro version 4 format .JOB/.RAW file pair.

Coordinate (.CR5) File: when selected, the chosen points are exported to a CR5 coordinate file format.

Text (.TXT) File: when selected, the chosen points are exported to an ASCII text file.

CSV (.CSV) File: when selected, the chosen points are exported to an ASCII text file that is comma delimited and the file is automatically given a *.CSV extension.

LandXML (.XML) File: when selected, all points and lines in the job are exported to a Land XML file.

JobXML (.JXL) File: when selected, all points, lines, and observation raw data in the job are exported to a JOB XML file.

[**Next >**]: opens the [Export Select Points Screen](#) unless exporting to [LandXML](#) or to [Survey Pro version 4 .JOB/.RAW file pair](#) .

Export Select Points Screen

The second [Export](#) screen will open for any file type that was selected in the previous screen except LandXML or Survey Pro version 4 .JOB/.RAW file pair. This screen is used to select the points from the current project that you want to export to the selected file type.

[**To/From…**]: allows you to specify a range of points to export.

[**Tap Points…**]: allows you to select the points to export by tapping them from a map view.

[▼]: The power button provides additional point selection options, which include selecting all control points, all non-control points and selection by description.

[**< Back**]: returns to the previous screen.

[**Next >**]: opens the next screen, which depends if the file type selected is [*.survey](#)[*.JOB](#), [*.CR5](#), [*.TXT](#), or [*.CSV](#).

Export *.survey Coordinates

When exporting to another *.survey file, the [Save As](#) screen is opened where the file name and location is entered for the new *.survey file.

Export *.JOB Coordinates

When exporting to another *.JOB file, the [Save As](#) screen is opened where the file name and location is entered for the new *.JOB file.

Export a Survey Pro version 4 .JOB/.RAW file pair

This option is used to export the Survey Pro version 5 (.survey) file contents as a Survey Pro version 4 .JOB/.RAW

file pair, which you could then import into third party software that uses the old format Survey Pro files.

If your job does not have any auto line work feature codes or any feature code attributes, the Save As screen is opened where the file name and location is entered for the .JOB/.RAW file pair.

If your job does have auto line work or feature code attributes, you will see the Job Raw Export Settings Screen where you can specify how you want your codes to be converted into the .RAW file.

Export Survey Pro version 4 .JOB/.RAW Settings

This screen is used to specify how to translate your auto linework codes into the .RAW file.

Export Codes in Foresight Format: use this option to export your codes to be parsed by Foresight office software.

Export Codes in 3rd party Format: use this option to export your codes to be parsed by common third party software.

Export: opens the Save As where the file name and location is entered.

Export *.CR5 Coordinates

The Export CR5 screen will open when exporting coordinates to a CR5 coordinate file.

CR5 File Options: specifies if the resulting file should be Sequential or Non-Sequential. (The HP 48 data collector can only use sequential coordinate files.)

[**< Back**]: returns to the previous screen.

[**Export**]: exports the selected coordinates to the new CR5 file.

Export *.TXT Coordinates

Since the coordinates in an ASCII *.TXT file can be stored in a variety of formats, two screens are used to define the format of the resulting file.

Delimiters: is the character that separates each column of text in the ASCII file.

Coordinates: is used to select if the resulting coordinates should be plane coordinates, geodetic coordinates in degrees-minutes-seconds format, or geodetic coordinates in decimal format.

Units: are the distance units that will be written to the resulting TXT file. These units are automatically set to the same units that are set for the current job.

Headers in the first row: When checked, a heading describing each column is inserted in the first row. For example, the following header could be inserted:

<center>**Name**,**Northing**,**Easting**,**Elevation**,**Description**</center>

[**< Back**]: returns to the previous screen.

[**Next >**]: opens the second screen.

Export *.TXT Coordinates – Format

Select the desired order and format for the resulting TXT file from the list of options.

[**Finish**]: exports the selected points to the TXT file.

Export *.CSV Coordinates

This routine is identical to the Export *.TXT Coordinates routine, described above with the exception that the formatting for the exported file is automatically set to comma delimited and the extension for the file name will be *.CSV.

Export LandXML (.XML) File

The LandXML export routine allows you to export points along with polylines and alignments.

Export polylines and alignments: will export the points in the current project as well as any polylines and alignments. If this is unchecked, only the points will be exported.

Export polylines on the specified layer as parcels: will export the polylines on the selected layer as parcels. (Polylines on other layers will still be exported, only not as parcels.)

Export point description as: allows you to select to export the point descriptions as LandXML descriptions or codes.

Export JobXML (.JXL) File

The JobXML export routine will export points, coordinate system, and all survey raw observation data from the job to a JobXML file.

Import Control

[**File**] [**Import Control**]

This screen is used to select a Survey Pro file (.survey / .JOB) to import control point coordinates:

[**Import**]: opens up the file browse dialog where you can select a Survey Pro version 5 (.survey) or a Survey Pro version 4 (.JOB) file to import control coordinates into the current job.

Backup / Restore Job

[**File**] [**Backup / Restore**]

The Backup / Restore wizard consists of a series of screens that are used to backup or restore all the files associated with the current job.

The routine also gives you the option of storing a snapshot of a customized map view to the archive. This can then be used to visually identify an archive.

Any number of backups can be created for a particular job. All the existing backups for the current job are listed in the main Backup / Restore screen, along with other information including the date the backup was created, the number of files stored in the archive and if the archive includes a snapshot. Archives that include a snapshot are shown with a icon, while those without a snapshot have a icon. A new (empty) archive has a icon.

All of the backups for a particular job are physically stored to a single compressed file located in the \Survey Pro Jobs directory on the data collector. This file will have the same filename as the current job, only the *.Backup extension is appended to the name. For example, the backups for a job with a filename of Smith.survey will be stored in a file called Smith.survey.Backup.

[**New Archive…**]: opens the New Archive screen where a name is entered for the new backup archive being created. Once created, an empty archive will be listed in the main Backup / Restore screen, which can then be selected to backup the current job.

[**Delete Archive…**]: opens a prompt asking if you are sure. If you select Yes at the prompt, the archive selected from the main Backup / Restore screen will be deleted.

[**Properties…**]: opens the Archive Properties screen.

Backup: when selected, tapping [**Next>**] will begin the backup routine where the data for the current job will be stored to the selected archive.

Restore: when selected, tapping [**Next>**] will begin the restore routine where the data from the selected archive will be restored, overwriting the current job.

[**Next>**]: opens the next screen.

Backup / Restore - Archive Properties

[**File**] [**Backup / Restore**] [**Properties…**]

The Archive Properties screen lists the files stored within the selected archive along with other information.

The file sizes listed in this screen are in bytes. Since all backup archives are compressed, the file sizes displayed represent the compressed files, or the amount of space actually being used by the file(s) on the data collector.

[**View Snapshot…**]: will display the snapshot from the selected archive if one was included when the archive was originally created.

Backup / Restore – Backup

When performing a backup, all the files associated with the current job are listed and will be included in the archive.

Create Snapshot: When checked, the next screen will prompt you to create a snapshot of the current job's map view,

which will then be included in the archive.

[**< Back**]: returns to the previous screen.

[**Backup**]: opens the next screen.

Backup / Restore - Create a Snapshot

The <u>Create a Snapshot</u> screen is a map view that is used to configure the map as desired and the resulting image will be saved in the archive as a snapshot along with the job files.

✅ (OK): will create the archive along with a snapshot of the map as it is configured on the screen.

❌ (Cancel): will create the backup archive without a snapshot.

Backup / Restore - Restore

When restoring the job files from an archive, the archived files will replace the existing files of the current job.

Warning: If you do not want to lose any new data that was collected after the archive being restored was created, you should first backup the current job to a new archive before restoring an older archive.

[**< Back**]: will return to the previous screen.

[**Restore**]: will restore the backed up job from the selected archive. The current job is then deleted and replaced by the backup job.

Transfer

[**File**] [**Transfer**]

The <u>Transfer</u> screen allows you to transfer files between the data collector and another device running the survey software.

Connecting to: specifies which device you are communicating with from the following options:

- HP48: if you are connecting to a Hewlett Packard HP48 calculator.
- Husky: if you are connecting to a Husky FS-series data collector.
- Survey Pro (WM/WinCE): if you are connecting to a Windows device running Survey Pro.
- Windows PC: if you are connecting to a personal computer that is running Windows CE Services.

COM Port: specifies which COM port you are using on the local machine. (COM 1 is the only available serial port on a Ranger.)

Baud Rate: specifies the communications speed. The baud rate must match in both units for successful communications.

Parity: specifies the parity. The parity must match in both units. When in doubt, select None here. All transfers are controlled from the PC when in this special mode.

[**Enter Server Mode**]: places the data collector in server mode where all file transfers are controlled from a PC running either TDS Survey Link or TDS ForeSight. Tapping [Cancel] will disconnect server mode.

[**Send File…**]: will open the <u>Open</u> screen where the file that you want to send can be selected. Once selected, the file is sent from the data collector to the specified device. A progress bar will be displayed that indicates how much of the file has been transferred. Tapping ❌ (Cancel) will stop the file transfer.

Note: The [**Send**] routine should be initiated shortly after issuing the receive command on the other device.

[**Receive File…**]: allows you to receive a file from another device. This should be tapped prior to issuing the Send command on the other device. Tapping [Cancel] will stop the file transfer.

Register Modules

[**File**] [**Register Modules**]

The <u>Register Modules</u> screen is used to upgrade the software. Refer to the User's Manual for more information on registering additional modules.

If no modules have been registered, the software will run in Demo Mode. When running in Demo Mode, users are able to test and use every routine available in the software. Although, Demo Mode limits all jobs to no more than 25 points. If a job exists on the data collector that contains more than 25 points, it cannot be opened while running in Demo Mode.

Registered: Indicates that the corresponding module has been added.

[**Enter Registration Code**]: Opens the <u>Register</u> screen where the registration number for a particular module can be entered.

About

[**File**] [**About**]

The <u>About</u> screen displays the version of the software.

[**Hardware Information**]: is a shortcut to the Windows <u>System Information</u> screen.

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Instrument Settings

[**Job**] [**Settings**]

The <u>Settings</u> screen consists of several separate screens where each individual screen accesses different types of settings.

Tap on the index card style tabs at the bottom of the screen to access different Settings screens. If the desired tab is not in view, tap the small arrow buttons to scroll through the available tabs.

The <u>Instrument Settings</u> screen is the first of multiple screens used to identify and configure the instrument(s) you are using with the software. The correct settings must be configured for successful communications between the data collector and the instrument.

The upper portion of the first <u>Instrument Settings</u> screen lists the names of all the instrument profiles on the data collector. The other columns list the COM Port, Brand, and Model of the instrument defined in each profile.

Manual Mode: A special profile that cannot be deleted. When activated, all surveying is performed without being connected to an instrument and all shot data must be entered manually.

Note: When running in leveling mode, the [**Instrument Settings…**] can be selected for Manual Mode to open the Level Method screen.

[**Instrument Settings**]: Opens the next Instrument Settings screen where the settings in the selected instrument profile can be modified.

Note: When editing an existing instrument profile, you cannot modify the instrument brand or model.

[**Create New Instrument**]: Opens the next Instrument Settings screen where you can configure the settings for a new instrument and create a new instrument profile.

[**Activate**]: Activates the selected instrument profile.

[**GeoLock**]: Opens the GeoLock Settings screen.

[**Delete**]: Deletes the selected instrument profile.

[**Import**]: Imports an instrument profile from an instrument profile file that was previously loaded on the data collector.

[**Export**]: Saves the selected instrument profile to a file, which can then be transferred to another data collector and then imported.

Instrument Settings – Screen Two

The second Instrument Settings screen opens whenever a new instrument profile is being created, or when an existing profile is being edited.

The options available on this screen will vary slightly depending on the total station model selected.

Name: The name of the instrument profile being created or changed. This is the name that appears in the list on the first Instrument Settings screen.

Brand: Specify the manufacturer of the instrument that you are using from a dropdown list.

Model: Specify the model of the instrument that you are using from a dropdown list.

Serial Port: The serial port on the data collector used for communications with the total station. (Bluetooth can also be selected on a Recon or Ranger 500X for wireless communication between the data collector and a compatible total station.)

Baud Rate: The speed at which communication occurs with the total station. This must match the baud rate configured within the total station.

Parity: The parity used for communication with the instrument. This must match the parity setting configured within the total station.

PIN: (applicable only when using Bluetooth with a Recon or Ranger 500X and a supported total station) The Personal Identification Number that was entered in the total station. These numbers must match for successful communications.

[**Bluetooth…**] (applicable only when using Bluetooth with a Recon or Ranger 500X and a supported total station):

Opens the Bluetooth configuration screen that comes with the Bluetooth driver software where you can quickly check or change the virtual COM port and favorites.

Note: See the User Manual for more information on configuring Bluetooth with a Recon or Ranger 500X and supported total station.

[**Defaults**]: Set the Serial Port, Baud Rate and Parity to their default values based on the selected total station.

[**Instrument Settings…**]: Opens the settings that are specific for the selected total station. See Notice.

[**Send to Instrument**]: (applicable only to specific total stations) Sends the selected instrument settings to the total station. This is particularly useful with robotic total stations after the total station has been reset.

NOTICE:

The settings that are available after tapping the [**Instrument Settings…**] button in non-leveling mode directly control the settings that are built into the selected total station. Since total station manufactures release new models every year, we cannot maintain the necessary set up documentation for every existing model and the models that are not yet available. The set up procedure for your particular total station is better handled by the total station manufacturer, or your instrument's dealer.

If you have specific questions on the set up of your total station you should refer to the documentation that was included with your total station.

GNSS Receiver Settings

[**Job**] [**Settings**] [**GNSS Receivers**]

Add or delete receiver profiles and change receiver profile settings. Profiles are associated with a specific receiver and use the receiver serial number as a unique identifier. From left to right the receiver profile shows:

Profile name: Name of the receiver.

Communications Settings icon: Tap to access Receiver Communications settings. The following icons may appear:
: The receiver is set for Bluetooth communications.
: The receiver is set for serial communications.

Data Modem Settings icon: Tap to access Data Modem Settings. The following icons may appear:
: Internet data modem.
: Data modem that supports both base and rover operations.
: Data modem that supports only rover operations.
: Data modem that supports only base operations.
: Unknown data modem.

General Receiver Settings icon : Tap to access Receiver Settings.

Add Receiver icon : Tap to open the Add Receiver wizard.

Tap and hold the receiver profile to show the context-sensitive menu:

Receiver Info: Select to launch the Receiver Info dialog.
Rename: Select to rename the receiver profile.
Delete: Select to delete the selected receiver profile.

Receiver Communication

This dialog appears in serial mode or Bluetooth mode, depending on the icon you tap in the Add Receiver dialog.

Serial mode

In serial mode, the Receiver Comms screen includes the following:

Port: Select the COM port required to connect to your receiver from the drop-down list.
Baud Rate: Select the baud rate required to connect to your receiver from the drop-down list.
Parity: Select the parity required to connect to your receiver from the drop-down list.
[Defaults]: Tap to return all the serial port settings to their Survey Pro defaults.
[Autodetect]: Tap to automatically detect the serial port settings for your receiver.
[Change on Receiver]: Tap to change the serial port settings on your receiver. In order for this to work, you must first have the correct serial port settings to communicate with your receiver.

Bluetooth mode

In Bluetooth mode, the Receiver Comms screen includes the following:

Bluetooth Device: Select the Bluetooth device associated with your receiver. If your receiver is not in the list, tap **[Bluetooth Settings]** to launch the Windows Bluetooth application and scan for the required Bluetooth receiver. When you return to the Communications Settings dialog, the Bluetooth device you added to Windows is automatically selected.

Add Receiver

[**Job**] [**Settings**] [**GNSS Receivers**] [**Add Receiver** ⊕]
or Connect to Receiver [**Add Receiver…**]

You can set up a receiver automatically or manually:

[Start Epoch Scan >]: Tap to open the Epoch Scan dialog. This automatically starts a scan that searches for all EPOCH receivers in the area and configures them. When the scan is complete, tap **[Save All]** to save all the receivers scanned and return to the GNSS Receivers tab, or the Connection prompt. Tap **[Rescan]** to repeat the scan.

[Start Manual Setup >]: Tap to open the Start Manual Setup dialog. You can now set up the receiver profile manually (see below). Use this option to configure any brand of receiver for serial or Bluetooth communication. When the scan is complete, tap **[Save]** to save the setup.

For manual setup, complete the screen:
Brand: The brand of this receiver.
Model: The model of this receiver.
Bluetooth / Serial: Select the communication mode for this receiver.

If you select **Bluetooth**, continue as follows:
Bluetooth Device: Select the Bluetooth receiver from the Bluetooth Device list. If your receiver is not in the list, tap

[Bluetooth Settings].
[Bluetooth Settings]: Launches the Windows Bluetooth application. Enables you to create a Bluetooth profile for your receiver.

If you select **Serial**, continue as follows:
Port: The data collector port used to communicate with the receiver.
Baud Rate: The baud rate used by the data collector for receiver communications.
Parity: The parity used by the data collector for receiver communication.

Note: If you do not know the receiver's settings, leave the default values. If the program fails to connect, it attempts to auto-detect the correct settings.

Note: If a profile already exists for a receiver scanned this way, you are prompted to modify the existing profile or discard the changes. If you choose to modify the profile, this changes the connection settings only.

[Connect]: Tap to establish a connection to the receiver and verify its capabilities. This opens the last dialog of the Add Receiver wizard.

The confirmation dialog shows:
Name: Receiver profile name. Default to receiver model name and last four digits of the receiver serial number but can be overtyped.
Capabilities: The icons show that the receiver is capable of:
$\top$: RTK rover operations.
⚲ : RTK base operations.
⊤ : Post-processing operations.

[Save]: Save the new receiver.

Data Modem Settings

The Data Modem card is used to view and configure the settings for the modem used to transmit RTK base corrections or receiver RTK rover corrections.

Modem: Select the type of modem. There will be several options here, depending on your brand and model. If the modem you are using is not in the list of known devices, select Generic Serial to set the communication parameters to work with just about any external data modem. The icon to the left of the modem selection list indicates the RTK capabilities of the data modem. The following icons indicate that the data modem:
🌐 : Supports Internet modem.
📶 : Supports both base and rover operations.
📶 : Supports only rover operations.
📶 : Supports only base operations.

The fields that appear on the screen change, depending on the modem you select:

Modems connected through a serial cable

Baudrate: Displays the baud rate the receiver uses to communicate with the modem.

Parity: Displays the parity the receiver uses to communicate with the modem.

Serial Port: Displays the serial port the receiver uses to communicate with the modem.

[**Configure**]: Opens the Modem Serial Comms. screen where you can change the settings for communication between the receiver and the data modem.

Modems where you can set the channel and configure radio settings

Serial Port fields

Baudrate: Displays the baud rate the receiver uses to communicate with the modem.

Parity: Displays the parity the receiver uses to communicate with the modem.

Serial Port: Displays the serial port the receiver uses to communicate with the modem.

[**Configure**]: Opens the Modem Serial Comms. screen where you can change the settings for communication between the receiver and the data modem.

Radio Settings fields

Channel: Displays the last radio channel when applicable.

Sensitivity: Displays the last radio sensitivity when applicable.

[**Configure**]: Establishes communication with the radio firmware and opens the Radio Settings screen where you can change the radio channel and sensitivity settings.

Modems where you cannot configure COM settings, but can configure channel settings

Channel: Displays the last radio channel when applicable.

Sensitivity: Displays the last radio sensitivity when applicable.

[**Configure**]: Establishes communication with the radio firmware and opens the Radio Settings screen where you can change the radio channel and sensitivity settings.

Cellphone modem settings

Serial Port fields

Baudrate: Displays the baud rate the receiver uses to communicate with the cellphone.

Parity: Displays the parity the receiver uses to communicate with the cellphone.

Serial Port: Displays the serial port the receiver uses to communicate with the cellphone.

[**Configure**]: Opens the Modem Serial Comms. screen where you can change the settings for communication between the receiver and the cellphone.

Select modem fields

Select Modem: Select the specific cellphone modem that applies.
[**Edit Modem**]: Edit the existing modem parameters.
[**Manage Modem**]: Manage saved GSM modems.
Base Phone #: Enter the telephone number of the RTK base receiver's cell phone.

Internet Protocol modem settings

Serial Port fields

Baudrate: Displays the baud rate the receiver uses to communicate with the cellphone.

Parity: Displays the parity the receiver uses to communicate with the cellphone.

Serial Port: Displays the serial port the receiver uses to communicate with the cellphone.

[**Configure**]: Opens the Modem Serial Comms. screen where you can change the settings for communication between the receiver and the cellphone.

Select modem fields

Select Modem: Select the required IP modem.
[**Create Modem**]: Create a new modem.
[**Edit Modem**]: Edit the existing modem parameters.
[**Delete Modem**]: Delete the existing modem parameters.

Windows networking settings

Dial-up Connection: Select the required connection from the drop-down list.

[**Manage Connections**]: Manage all existing connections.

[**Show Advanced Settings**]: Show advanced settings.

Modem Serial Comms Screen

The Modem Serial Comms. screen is used to change the settings for communication between the base or rover receiver and the data modem.

GNSS Receiver Port: Select the serial port the receiver will use to communicate with the modem.

Baudrate: Select the baud rate the receiver will use to communicate with the modem.

Parity: Select the parity the receiver will use to communicate with the modem. This setting disabled for receivers that do not support user defined parity setting.

[**Defaults**]: Automatically sets all the selectable values to their defaults based on the current receiver hardware.

[**Receiver Set**]: Sets the selected modem communication settings for the specified port on the receiver.

Note: The modem communication settings are also set in the receiver during the base and rover setup procedure. Therefore, you will not usually have to use the [**Receiver Set**] button on this page.

Radio Settings Screen

The Radio Settings screen is used to configure settings of the base or rover radio modem. All settings available are described below. However, not all radios support all of the described settings, so if you do not see one of these fields, it is because the radio type does not support it.

Channel: Select the channel the radio will use to communicate with the other radio.

Sensitivity: Select the sensitivity of the radio.

Mode: Select the transmit format used by the base radio. The rover radio must be listening for same format the base is broadcasting.

Baud: Displays the baud rate the radio is currently set to. There is no way for the software to change this value, so you must set the receiver to radio communications to match what you see here.

Parity: Displays the parity the radio is currently set to.

[**Set**]: Sends commands to the radio firmware to configure the settings selected on this screen.

Note: Some settings on the radio cannot be modified with the software. To fully program the radio modems, you need to PC software that should be supplied with the radio.

Cell Phone Settings

[**Edit Modem**]

or [**Manage Modems ...**] [**Edit**]

The Cell Phone Settings screen is used to create or modify a cell phone data modem configuration.

Auto Answer Command: Alternate Hayes AT command to use for auto answering.

Note: The default auto answer command (ATE0S0=1), default dial command (ATE0DT), and hang up command (ATH0) are entered by default on a new configuration. See IP Modem Settings.

Number to Dial: Enter the telephone number of the RTK base receiver's cell phone.

Hang Up: Alternate Hayes AT command to use for hanging up.

Dial Command: Alternate Hayes AT command to use for dialing.

IP Modem Settings

The IP Modem Settings screen is used to create or modify an IP modem configuration for a network server. (You can only configure in IP modem when RTK Rover is selected for the receiver.)

Connect Command: AT modem command to connect to the base server. Default it "ATE0&D0DT".

Disconnect Command: AT modem command to disconnect from the Internet. Default is "ATH0".

General Receiver Settings

The General tab enables you to change general settings on the receiver.

Every receiver has the option to change the elevation cutoff angle and the option to set the receiver to Off Mode. Models which have special settings available are described below.

Elevation cutoff: Keep receiver from using satellites in its position calculation that are below the given angle. The elevation angle is given in degrees above the horizon and can be anywhere from 0 degrees (use all satellites) to 90 degrees (use no satellites).

[Set Rx. to OFF Mode]: Tap to set your receiver to Off mode. This is where your receiver does not output or accept base corrections, effectively stopping RTK operations. This may be necessary in order to configure the radio.

Settings for Spectra Precision Receivers

If the current profile is for Promark 500/800 receiver, the general page also shows the following settings:

Storage Location: Select Internal Memory to store post processing data to the receiver's internal memory. Select USB Memory to store post processing data a USB storage device connected to the receiver.

NMEA Outputs: Select On to enable NMEA outputs on the receiver COM port at 9600 baud, 8 data bits, and no parity. Select Off to disable NMEA outputs.

If the current profile is for Promark 200 receiver, the general page also shows the following settings:

Storage Location: Select Internal Memory to store post processing data to the Promark device's internal memory. Select SD Card to store post processing data a SD card in the Promark device.

NMEA Outputs: Select On to enable NMEA outputs on the Promark device's COM port. Select Off to disable NMEA outputs.

If the current profile is for an Epoch 50 receiver, the general page also shows the following settings:

NMEA Outputs: Select On to enable NMEA outputs on receiver COM port 2 at 9600 baud, 8 data bits, and no parity. Select Off to disable NMEA outputs.

Note: NMEA outputs are only possible when your RTK mode is NTRIP with windows networking.

Settings for Spectra Precision Receivers

If the current profile is for an Epoch 35 receiver, the general page also shows the following settings:

SBAS Tracking: Select On to enable tracking SBAS satellites. Select Off to disable tracking SBAS satellites.

Confidence Level: Select High to have the receiver ambiguity resolution use a high confidence level. This is the desired setting for the most robust ambiguity resolution, but will result in the inability to get a fixed RTK position in challenging GNSS environments. Select Low to have the receiver ambiguity resolution use a low confidence level. This setting should only be used in challenging GNSS environments, and you should be aware of the possibility that the RTK solution may fix on incorrect ambiguities.

Settings For Trimble Receivers

If the current profile is for a Trimble receiver, the general page also shows the following settings:

Log post process data to: Select handheld or receiver memory.

Glonass tracking: Select On or Off.

Settings for Thales (Ashtech) Receivers

If the current profile is for a Thales (Ashtech) receiver, the general page also shows the following settings:

Canopy: is where you set a parameter to describe the multi-path environment. This command is relevant for ROVER mode or RVP. Choices are:

Open Sky (default)

Under Canopy (forest, urban canyon)

Confidence Level: is where you set the confidence level for ambiguity fixing. The values here are the statistical confidence level in percent. The higher the confidence level, the more certainty that the ambiguities are fixed correctly. But the longer it will take to fix them choices are:

- 99.0%
- 99.9%

Settings for Topcon (Javad) Receivers

If the current profile is for a Topcon (Javad) receiver, the general page also shows the following settings:

Co Op Tracking: Set the 'common loops' mode of the receiver. For more information on 'common loops' mode, see http://www.topcongps.com/images/coop_tracking.pdf. There are two choices:

- Off
- On

Multi Path Reduction: Set to use C/A code phase multipath and C/A carrier phase multipath reduction. This feature is only applicable if your receiver has the "_MRP" option enabled. There are two choices:

- Off
- On

Confidence Level: Set the statistical criteria to use in the RTK engine's fixed ambiguity resolution algorithm. The settings of 'Low', 'Medium', and 'High' correspond to confidence levels of %95, %99.5, and %99.9 respectively. There are three choices:

- Low
- Medium
- High

Note: It is recommended you set this value to High. This will usually mean the RTK engine may take longer to resolve a fixed position. It might even mean not being able to resolve a fixed solution in some situations. However, the consequence of a lower confidence level is that it makes it more likely to resolve an incorrect fixed ambiguity. The results of using an incorrect fix are usually much worse than the results of using a float solution.

Antenna: Set the source for antenna input. There are two choices:

- Internal
- External

Note: This setting is only available when your receiver model is Hiper .

Network Settings

[Job] [Settings] [Networks Card]

To add a new network to the list, tap the add network icon ⊕ in the Networks tab.

Name: Enter a unique name for the network server.

Address: Enter the IP address for the network server.

Port: Enter the IP port for the network server.

[Save]: Tap to save the network.

To rename a network, tap the gear icon ✿ and change the **Address** and **Port** if required.

Measure Mode Settings

[**Job**] [**Settings**] [**Measure Mode**]

The <u>Measure Mode</u> card is used to configure the RTK data collection settings.

Accept Solution Quality: Control the solution quality acceptable for storing measurements. You have two options:

- **Fixed RTK only**: Allows storage of fixed solution only.
- **Code, Float, or Fix**: Allows storage of any differential solution.

Use Acceptance Criteria: Select to apply criteria to measurement acceptance. When checked, only measurements with RMS and/or PDOP values below the threshold will be accepted. To use less than all three criteria, check this box but enter 0.0 for the criteria you do not wish to apply.

- **H RMS**: Horizontal RMS threshold for automatic acceptance or warning on point acceptance.
- **V RMS**: Vertical RMS threshold for automatic acceptance or warning on point acceptance.
- **PDOP**: PDOP threshold for automatic acceptance or warning on point acceptance.

Automatically Accept Data Collection: Select to automatically accept data collection points when the criteria is met. When checked, both the data and Offset Shots screens will automatically accept points once the measurement is better than the specified criteria. Data collection routines will always collect at least 5 seconds worth of data before automatically accepting points based on criteria.

Epoch Averaging: Set a number of epochs to average in the software. If this number is greater than one, the software will use the number of epochs specified to calculate the final position using a simple (non weighted) average.

Note: This function is not appropriate for every receiver. Some receivers, when dynamics are set to 'static', use Kalman filtering and other superior techniques to calculate an average position. In this case, the position returned from the receiver is better with each epoch and you may degrade your result by averaging with the software. You should check with your receiver manufacturer for specific recommendations on field procedure.

Post Process Settings

[**Job**] [**Settings**] [**Post Process**]

The <u>Post Process</u> card is used to configure the settings for logging post processing data, and the collecting and storing of post processing points in the software.

RTK Autonomous Points: Specify action to take when accepting autonomous points during RTK data collection. There are three options.

- **Do not store**: Select to prohibit acceptance of autonomous points in RTK data collection routines.
- **Allow in PPK Survey**: Select to allow storing of autonomous points when in an RTK survey that is also storing PPK data to a post processing file.

Session Monitor: Select to use the session monitoring thresholds when collecting data with the <u>Static / Rover Session</u> screen. To have the software display warnings during post processing data collection, check Warn me if, and specify threshold values for the number of SV, HDOP and memory.

Units Settings

The <u>Units Settings</u> card defines the units that are used within the software, sent from the total station, entered from the keypad and displayed on the screen. You can select the following settings for your project from the following dropdown lists.

Units for Distances: Defines the units used for length as Meters, International Feet, or US Survey Feet.

Display Feet/Inches: Allows you to view distances in feet and inches. Available only if the current distance is International Feet or US Feet. If selected, you can then choose the required fractions of an inch (2, 4, 8, 16, 32, 64).

Note: You can enter a distance in any distance field in units other than what is set for the job by appending the distance value with the following characters:

- **f** or **ft** or **ift** = International Feet
- **usf** or **usft** = US Survey Feet
- **i** or **in** = Inches
- **m** = Meters
- **cm** = Centimeters
- **mm** = Millimeters
- **c** or **ch** = Chains

Once the cursor leaves that field, the distance will be converted automatically. (A space between the value and the unit abbreviation is optional.)

Warning: When creating a new job, it is important that the Units for Distances field be set to the correct units. This allows you to seamlessly switch between different units in mid-job.

Problems can arise if these units are inadvertently set to the incorrect units when entering new data. For example, assume you created a control file by hand-entering a list of coordinates in a new job where the job was set to International Feet and the coordinates being entered were in US Survey Feet. Now assume you created another new job and correctly set it to US Survey Feet. If you then selected the previous job as a control file for the new job, the

display of all of the coordinates in the control file would be converted from International Feet to US Survey Feet.

Units for Angles: Defines the units used for angles as Degrees or Grads (gons).

Display Directions as: Display directions as a Bearing or Azimuth.

Azimuth type: Defines if you are using a North Azimuth or a South Azimuth.

Grid Direction: specifies if your grid coordinates are increasing positive in the North East or the South West direction.

Coord. Order: Allows you to customize the labeling and order for coordinates used throughout the software. You can select any of the following formats:

- N, E, Elev. (Northing, Easting, Elevation)
- X, Y, Z
- E, N, Elev. (Easting, Northing Elevation)
- Y, X, Z

Note: When you are doing a survey in a south west grid system, the meaning of the X/Y axes are reversed, so the south coordinate is labeled on the X axis and the west coordinate is labeled on the Y axis .

Format Settings

The Format Settings card defines the number of places beyond the decimal point that are displayed for various values in all screens, and how stations are defined. (All internal calculations are performed using full precision.)

Northings / Eastings: Allows you to display from zero to six places passed the decimal point for northing and easting values.

Elevations: Allows you to display from zero to six places passed the decimal point for elevations.

Sq feet / meters: Allows you to display from zero to four places passed the decimal point for square feet or square meter values.

Acres / Hectares: Allows you to display from zero to four places passed the decimal point for acre or hectare values.

Distances: Allows you to display from zero to six places passed the decimal point for distances.

Angles: Allows you to include from zero to two fractional seconds with angle values.

Stations: Allows you to display stations in any of the following formats:

- 12+34.123: Displays stations where the number to the left of the + advances after traveling 100 feet or meters.
- 1+234.123: Displays stations where the number to the left of the + advances after traveling 1,000 feet or meters.
- 1,234.123: Displays standard distances rather than stations.

Files Settings

The Files Settings card allows you to select a feature code definition file.

Feature Code File: Displays the selected feature code file (*.FXL) to use with the current job. FXL files can be created and customized with the Spectra Precision Feature Definition Manager.

[**Browse**]: Opens a dialog to select a feature code file to use with the current job. Tap the filename and then tap [**Open**].

[**Clear**]: Closes the currently selected file so that it is no longer used with the current job.

Descriptions Settings

[**Job**] [**Settings**] [**Descriptions**]
or ▼ (from any Description field), **Description Settings…**

The Descriptions Settings card allows you to select description code files and configure how descriptions are handled.

Use Description Code File: Mark this item to use a description file that contains codes and click the associated [**Browse**] button to navigate to and select the file.

Description code files contain one code/description pair per line where the code and description are separated by a space or a tab. (The code cannot contain spaces.)

Use Description List File: Mark this item to use a description file containing a list of descriptions without codes – one description per line and click the associated [**Browse**] button to navigate to and select the file.

Load Description List from Job File: Marking this item results in descriptions used in the current job, as well as any new descriptions entered, to be included in the description list. Add New Descriptions to Description List: Marking this item results in only new descriptions entered since marking this box to be included in the description list. (If the preceding box is marked, new descriptions are added whether or not this item is marked.)

Show Description List Automatically: Marking this item results in a drop-down list of descriptions being displayed as soon as text is entered into a **Description:** If unmarked, the list can be displayed by selecting **Show Description List** using the ▼ power button associated with a **Description** field. Double-clicking a description in the list will replace the entered text with the selected description.

Surveying Settings

The Surveying Settings card allows you to select various options that affect how data collection is performed.

Prompt for PPM during Station Setup: When checked, you will be prompted to enter the PPM correction factor as part of your conventional station setup.

Prompt for Description: When checked, a prompt for a description will appear before any new point is stored from only the routines under the Survey menu.

Note: Descriptions can be no longer than 256 characters.

Prompt for Height of Rod: When checked, a prompt for the rod height will appear before any new point is stored.

Prompt for Layer: When checked, a prompt to select a layer will appear before any new point is stored from only the

routines under the [Survey](#) menu.

Prompt for Attributes: When checked, a prompt to select feature information will appear before any new point is stored from only the routines under the [Survey](#) menu. This also requires that a feature file be selected from the [Files Settings](#) card.

Prompt for Picture: When checked, a prompt will appear before storing a point where you have the option of taking one or more pictures associated with the current point. (Only available when running on a Nomad or a Ranger 3 with a digital camera.)

Survey Map Use Enter Button for Topo: When checked, the enter key on the active survey map will take a topo shot. When unchecked, the enter button on the active survey map will take a normal shot.

Detect Duplicate Shots: When checked, a prompt will appear before attempting to store a second shot to the same location. This helps to catch when robotic total stations have lost lock while surveying. The distance tolerances set in the [Repetition Settings](#) screen are used in determining when two shots are at the same location.

Survey with True Azimuths: Automates the process of adjusting the circle on the total station when traversing so that you can survey with azimuths rather than horizontal angles.

Skip Check during Station Setup: Select this checkbox to skip the check during the station setup procedure.

Earth Curvature & Refraction: Allows you to select the earth curvature and refraction correction coefficient. Select **None** to turn Earth Curvature & Refraction correction off.

Scale Factor Settings

The <u>Scale Factor</u> card shows you the current scale factor mode for scaling ground to grid distances.

[**Setup Scale …**]: opens up the [Scale Settings](#) screen where you can select the desired method to use for scaling ground to grid distances.

Note: Scaling of ground to grid distances is usually only required when your coordinate system is set to some kind of conformal mapping plane. For a simple plane survey using a flat earth model, where ground measured distances are 1:1 to coordinate grid distances, you should leave your scale factor turned off.

Scale Settings

[**Job**] [**Settings**] [**Scale Factor**] [**Setup Scale**]

The <u>Scale Settings</u> screen is the starting point for setting up a mapping grid scale factor. Once configured, you will return to the Surveying Settings screen where you must then tap ✅ to save the scale settings.

Do not use a scale factor: Disable any mapping plane scaling that is currently enabled.

Use a single combined scale factor: Uses a single combined scale factor that is provided for you, or one can be computed with the [Calculate Scale](#) wizard.

Use a grid factor with sea level correction: Uses a mapping plane scale factor that is adjusted for elevation changes.

Use automatic map plane grid factor with sea level correction: Uses a combined scale factor that is adjusted for

elevation changes.

Use map plane ground coordinates: When selected, you can configure the job to use map plane ground coordinates.

Combined Factor: Enter a combined scale factor if already known, otherwise is the combined scale factor computed from the Calculate Scale wizard.

Grid Factor: Enter a map plane scale factor if already known, otherwise is the scale factor computed from the Calculate Scale wizard.

[**Calculate Scale**]: Opens the Calculate Scale wizard, which is used to calculate a combined scale factor or map plane scale factor.

[**Setup Map Ground Coordinates**]: First checks that a map projection is selected and if not, prompt you to select one. Next, opens a wizard where after providing an origin point and ground system offset coordinates, the entire job northing/easting database will be updated with the ground coordinate system transformation.

[**Change Map Zone**]: Opens the Select Coordinate System wizard where you can choose a mapping plane zone or calibrated site from the coordinate system database file. You can also create a new zone and datum with user-specified parameters.

Calculate Scale

[**Job**] [**Settings**] [**Scale Factor**] [**Setup Scale**] [**Calculate Scale**]

The Calculate Scale wizard is available when *Use a single combined scale factor* or *Use a grid factor with sea level correction* is selected in the Scale Settings screen and is used to compute a scale factor. If a map zone is not currently selected, you will first be required to set one up before continuing.

Projection: Displays the details about the current map zone.

Select Point: Specify a reference point.

[**Calc Scale >**]: Opens Screen Two if *Use a single combined scale factor* was selected. If *Use a grid factor with sea level correction* was selected, you will return to the Scale Settings screen and the computed grid factor will be entered for you.

- Screen Two -

Ellipsoid Height: The height of the ground above the ellipsoid surface.

[**< Back**]: Returns to the previous screen.

[**Solve >**]: Opens Screen Three.

- Screen Three -

Mapping Plane Scale Factor: Displays the scale factor that will correct for the effects of map projection distortion.

Ellipsoid Scale Factor: Displays the scale factor to correct for the geometric effect of your height above the ellipsoid surface.

Ground to Grid: Displays the combined scale factor that will be used for ground to grid calculations. Grid to Ground: displays the inverse of the combined scale factor for grid to ground calculations.

[**< Back**]: Returns to the previous screen.

[**Solve >**]: Returns to the Scale Settings screen where the combined scale factor will be entered for you.

Stakeout Settings

The Stakeout Settings card contains the setting that control how stakeout is performed. (The settings available depend on if you are running in conventional or GNSS mode.)

Stake "Corners," Not Just Even Intervals: When staking by stations, locations where a line segment changes, such as from a straight section to a curve, will also be staked when this is checked.

Stake Bisector of Non-tangent Corners: When staking an offset to a centerline that contains a corner, this option, when checked, will stake the corner point where the two offsets intersect.

Always Start Stakeout With Coarse Mode: When checked, the EDM mode toggle button found in all stakeout screens will initially be set to coarse mode (fast shot). This instructs the total station to measure distances faster, but with slightly less accuracy.

Use Manual Updating (Remote Control): When checked, a [**Shot**] button in the stakeout screens must be tapped to take a shot. When this not checked, shots are continuously taken in the stakeout screens. (This is only valid when running in remote mode, using a robotic total station.)

Design Elevation from Offset Segment: Determines where the cut/fill value is computed from in the Offset and Road Stakeout screens when the **Offset** checkbox is checked and a non-zero offset is entered. When checked, the cut/fill value is calculated from the design elevation of the node you are staking to. When unchecked, the cut/fill value is calculated from the design elevation at the specified offset location.

Note: If the specified offset extends beyond the end of the road profile, the cut/fill value is always computed from the design elevation of the node you are staking to.

View from Instrument to Rod (non-remote): When checked, the move left or right information will be presented from the rod person's point of view. When unchecked it will be presented from the total station's point of view. (This option only applies when a robotic total station is selected in the Instrument Settings.)

View from Rod to Instrument (remote): When checked, the move left or right information will be presented from the rod person's point of view. When unchecked it will be presented from the total station's point of view. (This option only applies when a non-robot total station is selected in the Instrument Settings.)

Prompt for Layer: When checked, a prompt to select a layer will appear before any new point is stored from the routines under the Stakeout menu.

Prompt for Attributes: When checked, a prompt to select feature information will appear before any new point is stored from only the routines under the Stakeout menu. This also requires that a feature file be selected from the Files Settings card, described earlier.

Note: There is no Prompt for Description checkbox as in the Surveying Settings card because you are always prompted for a description when storing a point from a stakeout routine.

Prompt for Picture: When checked, a prompt will appear before storing a point where you have the option of taking

one or more pictures associated with the current point. (Only available when running on a Nomad or Ranger 3 that has a digital camera.)

Use Perfect Stationing: When checked, staking locations will be computed at perfect stationing intervals. For example, if your starting station was 0+15 and your station interval was 100, your next stakeout location will occur at 1+00 instead of 1+15.

Use Design Point Description as Descriptor: When checked, the descriptor for a staked point that is stored will automatically be set to the same descriptor used for the design point. When unchecked, the descriptor for a stored stake point will automatically be set to the point number of the design point that you are staking.

Point Tolerance: Affects the Remote Staking routine. When performing Remote Stakeout, the final graphic screen that is displayed when you are near the stake point will occur when you are within the distance to the stake point specified here.

Line Tolerance: Affects the Stake to Line routine. When staking to a line and the prism is located at a perpendicular distance to the specified line that is within the range set here, a message will state that you are on the line.

Horizontal Distance Tolerance: Affects the GNSS staking routines. When you are within the specified distance to the location you are staking, you are considered on that location.

Turn instrument to design point: Applies only to motorized total stations. The following options are available:

- 2D (HA only): A motorized total station will turn horizontally toward the design point after tapping the Turn Instrument button in the particular stakeout screen.
- 3D (HA and ZA): A motorized total station will turn horizontally and vertically toward the design point after tapping the Turn Instrument button in the particular stakeout screen.
- Automatic 2D (HA only): A motorized total station will automatically turn horizontally toward the design point when the stakeout screen opens.
- Automatic 3D (HA and ZA): A motorized total station will automatically turn horizontally and vertically toward the design point when the stakeout screen opens.

Cut Sheet Offset stored: The cut sheet offset information can be stored to the raw data file in either of the following formats when performing any offset staking routine:

- Design Offset: When selected, a cut sheet report will list the design-offset values.
- Actual Offset: When selected, a cut sheet report will list the measured-offset values.

Display Directions As: Guides you to the GNSS stakeout location using one of the following formats:

- **Northing** / **Easting**: Suggests you Go South/Go North and Go West/Go East.
- **Distance** / **Azimuth**: Displays the necessary Azimuth and Distance to the stakeout location.
- **Forward** / **Back**: Suggests you go FORWD/BACK and Go Left/Go Right when you are within 3 meters to the location. When you are farther than 3 meters, a distance and azimuth is used.

Repetition Settings

The Repetition Settings card contains the settings that control how repetition shots are performed and acceptable tolerances.

Horizontal Tolerance: A warning message will be displayed if a horizontal angle exceeds the tolerance entered here during a repetition shot.

Zenith Tolerance: A warning message will be displayed if a vertical angle exceeds the tolerance entered here during a repetition shot.

Distance Tolerance: A warning message will be displayed if a distance exceeds the tolerance entered here during a repetition shot.

Shoot Distance To Backsight: When checked, a distance will be measured to each shot to the backsight. When unchecked, only the angles are measured.

Do Not Shoot Reverse Distances: When checked, distances are not measured during reverse shots.

Enable Automatic Repetition: When checked, all remaining shots after the first shot to the backsight and foresight will occur automatically when using a motorized instrument.

Shooting Sequence: Specifies the order that the shots are taken from the following options:

- BS > FS ^ FS > BS: Backsight, Foresight, *flop* Foresight Backsight
- BS > FS ^> BS > FS: Backsight, Foresight, *flop* Backsight, Foresight
- BS ^ BS > FS ^ FS: Backsight, *flop* Backsight, Foresight, *flop* Foresight
- FS ^ FS > BS ^ BS: Foresight, *flop* Foresight, Backsight, *flop* Backsight
- FS > BS ^ BS > FS: Foresight, Backsight, *flop* Backsight, Foresight
- FS > BS ^> FS > BS: Foresight, Backsight, *flop* Foresight, Backsight
- BS ^ BS ^ > FS ^ FS ^: Backsight, *flop*, Backsight, *flop*, Foresight, *flop*, Foresight, *flop*

Date/Time Settings

The Date/Time Settings card is used to set the date and time in the data collector.

Time: Displays the current time.

Date: Displays the current date.

Format: Select Local to display your local time, or UTC to display Coordinated Universal Time.

DUT Correction: The polar wandering correction factor, in seconds, used to convert UTC to UT1. (UT1=UTC+DUT)

Note: The date, time and UTC are computed using Window CE's Date/Time properties.

[**Set Date**]: Sets the system date with the date that is entered.

[**Set Time**]: Sets the system time with the time entered.

[**Synchronize**]: Zeros the fractional portion of the current time and advance to the nearest second so that the time can be set more accurately.

NMEA GPS Settings

The NMEA GPS card is used to configure the settings for a NMEA GPS receiver for use with the GeoLock and Navigation routines.

Turn On NMEA GPS Receiver: When checked, enables the GPS receiver.

Model: Select *Shared GPS* to use the GPS receiver settings configured in the Windows operating system (see [*Shared GPS…*] below) or select *Generic NMEA* and configure the settings from this screen.

Serial Port: The serial port on the data collector used to communicate with the GPS receiver.

Device (available only when using a Bluetooth GPS receiver and *Bluetooth* is selected for the *Serial Port*): Select the Bluetooth device that represents your GPS receiver here.

[**Bluetooth…**] (available only when using a Bluetooth GPS receiver and *Bluetooth* is selected for the *Serial Port*): Accesses the Bluetooth configuration screen where you can quickly check or change Bluetooth settings. See the User's Manual for more information on configuring Bluetooth.

Baud Rate: The speed that communication takes place. This must match the baud rate set in the GPS receiver.

Parity: This must match the parity set in the GPS receiver – usually *None*.

[**Shared GPS…**]: Shortcut to the > *Settings* > *GPS* screen. You can get more information while viewing this screen by tapping then .

Data Out settings

The Data Out Settings card is used to configure settings for exporting data to a serial port or file.

Enable Data Out: When selected, enables export of external data output to a serial port or to a file.

To Serial Port: Select to export data to the serial port on the data collector. You must enter the Serial Port, Baud Rate, and Parity. If you select Bluetooth as the serial port, you can check or change the Bluetooth settings.

To File: Select to export data to a file. You must enter the output file name.

Send Point Coordinates: Select to export point coordinates. For conventional surveys, the plane (N, E, Elev) coordinates for each stored point are exported. For GNSS surveys, the plane (N, E, Elev) and geodetic (Lat, Lng, Ht) coordinates for each stored point are exported.

Send Observations: Select to export setup and observation records. This will enable you to calculate solved coordinates from raw observations.

Serial Port: (available when the output method is 'To Serial Port') Select the serial port on the data collector for the external data output. This cannot be the same port as the current active instrument (conventional or GNSS).

Baud Rate: The baud rate for the external data output port.

Parity: The parity of the external data output port.

[**Bluetooth**]: (available when the port for external data output is set to Bluetooth) Opens the Bluetooth configuration screen where you can quickly check or change Bluetooth settings. See the User Manual for more information on configuring Bluetooth technology.

Path: (available when the output method is 'To File') Shows the location of the saved file. To select a different path, click [**Browse**].

File: (available when the output method is 'To File') Enter the file name for saving the external data output. To select a different file type, click **[Browse]**.

[Browse]: (available when the output method is 'To File') Click to open a file browse dialog where you can select the file name and path for the output file. The default file extension is .XML, but you can use any extension.

Buttons Settings

The Buttons Settings card is used to customize the function for the physical buttons located on the data collector.

The upper half of the screen lists all of the customizable button's current assignments. A particular button must be selected from this list prior to changing its settings from the lower half of the screen.

Assignment Within Survey Program: Select the function for the selected button when it is used within the software. The function of the button will switch back to its global assignment when it is used outside the software. Selecting <Global> from this field will result in the global assignment also being used from within the software.

Global Assignment: Select the function for the selected button when it is used outside the software.

[**Survey Defaults**]: Set all assignments in the *Assignment Within Survey Program* field to the software's default settings.

[**System Defaults**]: Set all assignments in the *Global Assignment* field to the system default settings and set all the assignments in the *Assignment Within Survey Program* field to <Global>.

General Settings

The General Settings card contains the following miscellaneous settings:

Auto time stamp every: When checked, a note will be entered into the .survey file consisting of the current time each time the number of minutes specified passes. This can help track when specific events occurred.

Remind to backup job every: When checked, a prompt will occur each time the specified number of hours passes reminding you to backup your job.

Use Enter Key to Move Between Fields: When checked, the [**Enter**] key will move the cursor to the next field in all screens. When unchecked, the [**Enter**] key will perform a different function depending on the field selected.

Note: The arrow keys can also be used to move the cursor between fields.

Allow Alphanumeric Point Names: When checked, numeric or alpha character can be used for point names. If unchecked, only numeric point names are valid.

Beep When Storing Points: When checked, a beep will sound whenever a new point is stored.

Beep On Control Activation: When checked, a beep occurs when any button, checkbox, or other control is tapped.

Prompt for Description: When checked, a prompt for a description will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus.

Prompt for Layer: When checked, a prompt to select a layer will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus.

Prompt for Attributes: When checked, a prompt to select feature information will appear before any new point is stored from any routine other than those included in the Survey and Stakeout menus. This also requires that a feature file be selected from the Files Settings card, described earlier.

Prompt for Picture: When checked, a prompt will appear before storing a point where you have the option of taking one or more pictures associated with the current point. (Only available when running on a Nomad or a Ranger 3 with a digital camera.)

Prompt to Backup When Closing Job: When checked, you will be reminded to backup the current job prior to closing it.

Prompt for Elevation of 2D Cogo Points: When checked, a majority of the COGO routines will prompt you for an elevation before storing a 2D point. When unchecked, 2D points will be stored without the prompt.

Always Use ALL CAPS in Edit Fields: When checked, characters will always be entered using capital letters in edit fields, regardless of the keyboard setting.

Log Serial Port Traffic: When checked, all serial port traffic will be logged to a text file called TDS-Log.txt for troubleshooting purposes and is stored in the Jobs folder. The file is automatically overwritten when logging traffic on a date that is different from the previous date.

Use Smart Soft Input Panel Activation: When checked, the SIP will automatically open when the cursor is inside an input field and close when the cursor is moved outside an input field. (Not available on Ranger data collectors.)

Edit Points

[**Job**] [**Edit Points**]

The Edit Points screen allows you to add, edit, and delete any points in the current job.

[**Edit…**]: If only a single point is selected, this will open the point in the Edit Point Screen where the details of the point can be modified. If more than one point is selected, the Edit Points Screen will open where the description, layer, and elevation for the selected points can be modified simultaneously.

Note: Multiple points can be selected by tapping the first point in a range, then tap the shift key from a soft input panel, and lastly tap the last point in the point range. Individual points in a point range can be selected/unselected by tapping the control key from a soft input panel and then tapping the desired points.

Note: Double tapping on a point will open that point in the editor.

[**Insert…**]: Opens a screen where a new point can be added.

[**Delete…**]: Delete the selected point.

[**Find…**]: Search for a point by its description.

[**Find Next**]: Find the next point that contains the description entered when using the [Find…] button.

[**Go To…**]: Opens a dialog box where any point can be quickly located by the entered point name.

Edit Points - (multiple point editing)

[**Job**] [**Edit Points**] [**Edit…**]
(When more than one point is selected.)

This screen is accessed after tapping **[Edit…]** when more than one point is selected. The change made in this screen will be applied to all the selected points.

Description: When checked, allows you to change all the selected point's descriptions to the Description entered in the description edit field.

Layer: When checked, allows you to move the selected points to the layer selected in the layer edit control.

Note: Only user entered points (key in or imported) can be placed on the Control layer. If any of the points in the selection are derived from measurements, then the control layer will not be an option in the layer edit box.

Elevation: When checked, allows you to move the selected points to the elevation entered into the elevation edit field.

Note: You can only change the elevation of multiple points if all of the points in the selection are derived from user input (key in or imported). If any of the points in the selection are derived from observations, the Location card will not be displayed.

Edit Point

[**Job**] [**Edit Points**] [**Edit…**]

The Edit Point screen is used to modify point properties.

There are three cards on the Edit Point screen:

- **General** Edit Point - General Card
- **Location** Edit Point - Location Card
- **Feature** Edit Point - Feature Card

Edit Point - General

[**Job**] [**Edit Points**] [**Edit…**] [**General**]

The General card of the Edit Point screen is used to modify the description, layer and picture information for the selected point.

Point Name: Displays the selected point's name.

Description: The description for the selected point.

Layer: The layer for the selected point.

Note:; Only user entered points (key in or imported) can be assigned as control points. If the point selected for editing is derived from a measurement, then you will not see the Control layer in the layer edit box.

Picture: Displays a list of pictures associated with a point. You can click the drop-down list to see the pictures associated with the job. Use the Power button to view or delete any of the pictures associated with a point. Use the camera button to open the camera application and take additional pictures for a point.

Note: When you delete a picture using the menu item, the picture is disassociated from this point in the job, but the picture file is not removed from the disk. To get rid of the actual picture file, you must use the file explorer to delete the file.

Note: The camera button is only available on a Nomad or Ranger 3 data collector that has an integrated digital camera.

Edit Point - Location

[**Job**] [**Edit Points**] [**Edit…**] [**Location**]

The Location card is used to modify the coordinate of a user entered point, or to show the point detail information for any point derived from a survey measurement.

If the selected point was entered by the user (or imported from an external file), you can edit the coordinate values:

Coordinate Type is used to select what kind of coordinate is entered for this point:

- **Grid** enter a northing, easting, elevation coordinate for this point.
- **WGS84 LLH** enter a latitude, longitude, height coordinate in the global geodetic datum for this point.
- **Local LLH** enter a latitude, longitude, height coordinate in the local datum for this point.

If the point was derived from a survey measurement, then this card shows point details for the selected point

[**GNSS Control Point**]: Opens up the GNSS Control Point Pair Screen.

GNSS Control Point Pair

[**Job**] [**Edit Points**] [**Edit…**] [**Location**] [**GNSS Control Point**]

The GNSS Control Point Pair screen is used to associate a pair of points together to form a GNSS control point. One of the points must be a local grid point, and one point must be a GNSS point.

[**Use as Calibration Control Point**]: check this box if you wish to use the selected point as a GNSS calibration control point.

[**GNSS Point / Grid Point**]: choose a point to pair with the selected point to form a calibration point pair.

[**Use for Horizontal Calibration**]: check this box if the calibration point pair is suitable to use for horizontal calibration.

[**Use for Vertical Calibration**]: check this box if the calibration point pair is suitable to use for vertical calibration.

Edit Point - Feature

[**Job**] [**Edit Points**] [**Edit…**] [**Feature**]

The <u>Feature</u> card is used to modify the feature code and line work control code associated with the point.

Any feature codes for the selected point are shown in the list of codes. Each line of the list of codes shows:

- **Code Icon**: Icon for the code. If you are using a FXL feature file, this icon will show whether the code is for a point feature or a line feature. If you are not using a FXL feature file, or if this code is not defined in the FXL file, the icon will be blank showing that it is a user entered feature.
- **Code Name**: The abbreviated code string for this code.
- **Line work Icon**: An icon representing the state of the auto line work for the point with this code.
- **Attribute**: If this code also has feature attributes defined for it, the attribute icon will show if the attributes have been entered.
- **Delete**: Tap the x to remove this code from the point.

[+]: opens up the <u>Pick a Feature Screen</u> where you can key in any code you wish or select one from a list of codes defined in the Feature File (.FXL).

Pick a Feature

The <u>Pick a Feature</u> screen is used to enter a feature code string. You can pick a feature code from the list of codes, or you can enter the string directly into the edit field. If you are using a Feature Code File (.FXL), you can pick from the list of codes defined in the file, or you can enter any other code string to define a new feature. If you are not using a Feature Code File, you can simply enter any string you wish to define the feature code for a point.

Filtered By: shows the current selection filter. You can tap on the filter icon to change the view filter.

[**Feature Code**]: enter the text string for a code, or double tap on the list to select the code string for an existing code.

Note: You can enter a code and the line work control code separated by a space in the [**Feature Code**] edit field, or you can enter just the feature code and then assign the line work code with by tapping the line work icon next for that feature code in the list of codes for this point.

Edit Polylines

[**Job**] [**Edit Polylines**]

The <u>Edit Polylines</u> screen is used to add, edit, and delete polylines in the current job.

The first screen will display a list of all the polylines that are stored in the current job. Selecting any of the polylines listed will display a horizontal (overhead) and vertical (side) view of that polyline.

[**Edit…**]: Open the selected polyline in the <u>New Polyline</u> screen, described below.

[**Delete…**]: Delete the selected polyline.

[**New…**]: Open the <u>Polyline Editor</u> where a new polyline can be created.

Import PL5: Import polylines. Available on the Power menu button item. Tap the down arrow to open this menu from the Edit Polylines screen.

Export PL5: Export polylines. Available on the Power menu button item. Tap the down arrow to open this menu from the Edit Polylines screen.

New Polyline

The second screen is used to define all of the points that are used in the polyline. Any curve information will be entered later, but the end points must still be selected at this point.

The current polyline is shown on color displays with bold red lines and all other polylines are shown using thin black lines. Only the current polyline data can be edited.

[**Tap Points…**]: Opens a map view where the points in your polyline can be tapped. They must be tapped in the order that they occur in the polyline.

[**To/From…**]: Allows you to define a range of points to define a polyline.

[**Edit…**]: Opens the third screen, described next, where the current polyline can be modified.

[**Clear**]: Removes the current polyline.

[**Properties**]: Allows you to enter a **Description** and select a **Layer** for the Polyline. If you have a feature code loaded, you can also add **[Attributes].**

Polyline Editor

Once the initial points are selected for the current polyline, the third screen allows you to modify the polyline and define any curve and grade information for the polyline sections.

Selecting any point in the left column of the screen will select that point and the line segment that follows it up to the next point. The selected section is then highlighted in the map portion of the screen. Any edits will occur on the selected section.

[**Remove**]: Remove the selected point and the line segment that follows it. The previous line segment will be automatically joined to the following point. The change will only be saved if you then tap ✅. Tapping ❌ will return to the previous screen without saving the changes.

[**Clear All**]: Completely removes the current polyline. The change will only be saved if you then tap ✅. Tapping ❌ will return to the previous screen without saving the changes.

[**Curves…**]: Opens the fourth screen, described below, where a horizontal, vertical, or spiral curve can be added to the selected polyline segment.

Horizontal / Vertical: Toggles between showing the map in a Horizontal (overhead) view or a Vertical (side) view.

[**<- Insert**]: Insert a point, or a group of points in front of the selected point. The change will only be saved if you then

tap ✅. Tapping ❌ will return to the previous screen without saving the changes.

Note: if <End> is selected in the list, the [**<-Insert**] button will change to an [**<-Append**] button to indicate that additional points will be appended to the end of the list.

Add/Edit Curve

The fourth screen is used to modify a selected polyline segment that occurs between two points. A horizontal, vertical, and/or spiral curve can be applied to the polyline segment.

Adding a Horizontal Curve Tap the [**Arc / Spiral**] tab.

Curve: Set to Arc to enter a horizontal curve.

[**Radius**] | [**Delta**] | [**Degree Arc**] | [**Degree Chord**]: Allows you to specify the radius of the curve using a variety of methods.

[**Turn**]: Specifies if the curve turns toward the Right or Left as you occupy the initial point and face the end point.

[**Arc**]: Specifies if the arc of the curve is Small (less than 180°) or Large (greater than 180°).

Adding a Spiral: Tap the [**Arc / Spiral**] tab.

Curve: Set to Spiral to enter a spiral curve.

Radius: The radius of the spiral curve. (The same radius of the circular curve adjacent to the spiral.)

Length: The length of the spiral, measured along the curve from the TS to the SC.

Turn: Specifies if the spiral curve turns to the Right or Left as you occupy the initial point and face the end point.

Direction: Specifies if the curve runs from where the tangent intersects with the spiral toward where the spiral intersects with the curve (TS->SC) or if the curve runs from where the curve intersects with the spiral toward where the spiral intersects with the tangent (CS->ST).

Adding a Vertical Curve: Tap the [**Parabolic Curve**] tab.

Apply Curve: Checked to enter a vertical at curve.

Grade at EVC / BVC is the known grade at either the end of vertical curve or beginning of vertical curve. The grade entered here is determined by the selection made in the Auto-Compute field.

Auto-Compute: Automatically compute the grade at the selected point and display it on the screen. The grade at the point that is not checked here must be specified in the field defined above.

Edit Alignments

The Edit Alignments screen is used to create and edit alignments, which can then be used with routines such as Offset Staking, Offset Points, Offset Lines and Road Layout.

Alignments are used to describe all of the horizontal and vertical details of a road's centerline. An alignment does not

use existing points to define any particular locations on the alignment, although a point can be used to anchor the starting location, which is the same location for both the horizontal and vertical parts of the alignment. Any location on an alignment where a change occurs is called a *node*.

An alignment can contain straight sections, grades, horizontal, vertical, and spiral curves. The horizontal and vertical portions of an alignment are defined separately and independently, but they are both combined within the software to create a single alignment with horizontal and vertical characteristics.

Add / Edit Alignments

[**Job**] [**Edit Alignments**] or [**Roads**] [**Edit Alignments**]

The Add / Edit Alignments screen displays a list of all the existing alignments in the current job. The right portion of the screen shows a graphic of the horizontal and vertical portion of the selected alignment.

[**New…**]: Opens the Edit Alignment screen where a new alignment can be created from scratch.

[**Edit…**]: Opens the Edit Alignment screen where the details of the selected alignment can be edited.

[**Delete…**]: Used to delete the selected alignment.

[▼]: The power button opens the following routines:

- **Create Points**: Opens the Create Points screen where points can be stored that coincide with the selected alignment.
- **Import .RD5 File**: Opens the Open screen and lists all the *.RD5 alignment files in the Jobs directory. Select the desired file and tap ✅.
- **Export .RD5 File**: Opens the Save As screen where the current alignment can be saved to a *.RD5 file.

Edit Alignment

[**Job**] [**Edit Alignments**] [**Edit…**]
or [**Job**] [**Edit Alignments**] [**New…**]

The Edit Alignment screen is used to edit an existing alignment or create a new one.

Edit Alignment Screen – HAL Tab

The HAL (**H**orizontal **AL**ignment) tab in the Edit Alignment screen is used to enter or modify only the horizontal details of an alignment.

[**Insert…**]: Opens the Edit Segment screen where a new horizontal alignment segment can be inserted prior to the selected segment.

[**Edit…**]: Opens the Edit Segment screen where the selected horizontal segment can be modified.

[**Remove**]: Removes the selected segment and automatically joins the next segment with the previous segment.

Note: The station and azimuth at the beginning of the selected horizontal segment are displayed at the bottom of the screen.

Edit Alignment Screen – VAL Tab

The VAL (**V**ertical **AL**ignment) tab in the Edit Alignment screen is used to enter or modify only the vertical details of an alignment.

Note: The total horizontal length of the VAL must be equal to or greater than the total horizontal length of the HAL when the alignment is used for road layout.

[**Insert…**]: Opens the Edit Segment screen where a new vertical segment can be inserted prior to the selected segment.

[**Edit…**]: Opens the Edit Segment screen where the selected vertical segment can be modified.

[**Remove**]: Removes the selected segment and automatically joins the next segment with the previous segment.

Note: The station and elevation at the beginning of the selected vertical segment are displayed at the bottom of the screen.

Edit Alignment Screen – POB Tab

The POB (**P**oint **O**f **B**eginning) tab in the Edit Alignment screen is used to define the starting location of the alignment. The first horizontal and vertical segment will always begin at this location.

[**Location**]: Starting location for the horizontal and vertical alignments will be at the specified North, East and Elev coordinates.

[**Point**]: Starting location for the horizontal and vertical alignments will be at the specified Point.

Start Station: The station on the alignment that corresponds with the starting location or point.

Edit Alignment Screen – General Tab

The General tab in the Edit Alignment screen is used to describe the alignment and select the layer where it is located.

Description: The description of the alignment.

Layer: The layer where the alignment will be located.

[**Attributes**]: Opens the Point Feature Attributes screen where the feature attributes for the alignment can be selected.

Edit Segment

The Edit Segment screen is accessed anytime an existing horizontal or vertical segment is added or edited. A variety of segment editing screens are possible depending on the type of segment being edited or created. Each segment editor is discussed below.

Edit Segment - Line Card

The Line card is used to add a straight horizontal line segment in the alignment.

Length: The horizontal length of the line.

Make this segment tangent to previous: When checked, the specified line will be tangent to the ending tangent of the previous segment.

Note: When making a new horizontal segment tangent to the previous segment, the new segment will appear in the Edit Alignment screen tagged with a (P). This means that if the previous horizontal segment is edited or deleted, where the orientation changes, all subsequent horizontal segments that have the (P) tag will also be adjusted so they will remain tangent to the previous segments. This does not hold true for vertical alignment segments. Vertical segments will always begin with the specified starting grade unless they are manually modified.

[**Azimuth**] / [**Bearing**]: Used to enter a known azimuth or bearing of the line.

: Adds the line to the current horizontal alignment.

Edit Segment - Arc (Horizontal Curve) Card

The Arc card is used to add a horizontal curve to the alignment.

The curve can be defined by two of the following:

- [**Radius**]: The distance from the radius point to the curve
- [**Delta**]: The internal angle from center to tangent points.
- [**Degree Arc**]: The internal angle equivalent to a 100-ft arc length.
- [**Degree Chord**]: The internal angle equivalent to a 100-ft chord length.
- [**Length**]: The arc length.
- [**Chord**]: The chord length.
- [**Tangent**]: The distance from the PC or PT to the PI.
- [**Mid Ord**]: The distance between the curve and the chord at the center of the curve's length.
- [**External**]: The minimum distance between the PI and the curve.

Turn: Specifies if the curve turns to the Left or Right as you face the curve from the beginning.

Make this segment tangent to previous: When checked, the start of the specified curve will be tangent to the ending tangent of the previous segment.

[**Azimuth**] / [**Bearing**]: Used to enter a known azimuth or bearing at the start of the curve.

: Adds the curve to the current horizontal alignment.

Edit Segment - Spiral Card

The Spiral card is used to add a spiral curve to the alignment.

Radius: The radius of the spiral. (This equals the radius of the horizontal curve tangent to the spiral.)

Length: The length of the spiral.

Turn: Specifies if the curve turns to the ⊙ Left or ⊙ Right as you face the curve from the beginning.

Dir: Specifies if the curve runs from TS to SC (Tangent to Spiral, to Spiral to Curve) or CS to ST (Curve to Spiral, to Spiral to Tangent).

Make this segment tangent to previous: When checked, will automatically turn the spiral so the beginning is tangent to the end of the previous segment.

[**Azimuth**] / [**Bearing**]: Used to specify a known azimuth or bearing of the start of the spiral.

Edit Segment - Vertical Grade Card

The Vertical Grade card is used to enter a segment with any grade.

Length: The horizontal length of the segment.

Grade: The grade (slope) of the segment.

Get Previous Grade: Automatically enter a grade equal to the grade at the end of the previous segment.

Edit Segment - Vertical Curve

The Vertical Curve card is used to enter a parabolic vertical curve to the alignment. **Length**: is the horizontal length of the vertical curve.

Start Grade: The starting grade of the vertical curve.

End Grade: The ending grade of the vertical curve.

[**Get Previous Grade**]: Automatically enter a Start Grade equal to the grade at the end of the previous segment.

Auto Linework

[**Job**] [**Auto Linework**]

The Auto Linework screen is used to display the current state of active feature coded auto linework. The list of current lines shows:

- [**Code**]: The code string defining the linework.
- [**Status**]: The status of the line, indicating the current and pending linework control state.
- [**Points**]: A list of the points currently used for this line.

[**View**]: Opens up the View Polyline screen where you can view all of the segments making up the selected line.

View Raw Data

[**Job**] [**View Raw Data**]

The View Raw Data screen displays the raw observation data of the current job. You can use this screen to attach a note to the job, or to any specific record. You can also edit certain raw records and reprocess the job coordinates.

The raw data is displayed in a tree view, with the root nodes of the tree showing a record of each survey action taken in the current job. You can expand a tree node by tapping on the [+] next to the node or double tapping on the node. This will show you the individual fields of the selected record.

You can navigate through the raw data view using the navigation buttons:

- [**Up**]: Navigate to the beginning of the records.
- [**Down**]: Navigate to the end of the records.
- [**Left**]: Navigate to the previous record in your navigation history.
- [**Right**]: Navigate to the next record in your navigation history.
- [**Find Point**]: Opens up the Find Point screen where you can enter the name of a point to search for in the records
- [**Find Next Point**]: Searches for the next reference to the point name selected by the Find Point screen.

You can tap and hold on selected records to open up a screen to edit that specific record. The following records can be edited:

- [**Conventional Setup**]: Opens up the Edit Station Setup screen.
- [**Conventional Target**]: Opens up the Edit Target screen.
- [**GNSS Base Setup**]: Opens up the Edit GNSS Base screen.
- [**GNSS Antenna**]: Opens up the Edit GNSS Antenna screen.

You can tap and hold on any record to attach a note to this specific record. You can also append a note to the end of the file by tapping the [**Note...**] button.

[**Note…**]: Opens the Raw Data Note screen.

[**Time**]: Appends the current date and time in the form of a note to the end of the raw data records.

Raw Data Find Point

[**Job**] [**View Raw Data**] [**Find Point**]

The Raw Data Find Point screen allows you to enter an existing point name to search for in the raw data records.

[**Point**]: Enter the name of the point to search for.

Raw Data Edit Station

[**Job**] [**View Raw Data**] [**Edit Station**]

The Raw Data Edit Station screen allows you to edit the conventional station setup.

[**Occupy Point**]: Enter the occupy point for this station setup.

Note: If you wish to change the station setup point, you can only choose a user entered point (key in or imported) as the new station point for this setup. If you wish to use a point derived from a survey measurement, you must first go to the Edit Points screen and insert a copy of that point.

[**HI**]: Enter the height of instrument for this setup.

[**Backsight**]: Enter the backsight azimuth or backsight point name for this setup.

Note: If you wish to change the backsight point, you can only choose a user entered point (key in or imported). If you wish to use a point derived from a survey measurement, you must first go to the Edit Points screen and insert a copy of that point.

[**Apply PPM**]: Check this box if you wish to apply a PPM correction to measured slope distances. Enter the PPM correction factor in the edit box.

[**Calculate**]: (Survey Pro On Board only) Opens up the Calculate PPM screen.

[**Earth Curvature and Refraction**]: Set the earth curvature and refraction correction coefficient. Select [**None**] to turn earth curvature and refraction correction off for all observations from this station setup.

Raw Data Edit Calculate PPM

[**Job**] [**View Raw Data**] [**Edit Station**] [**Calculate**]

(Survey Pro On Board only)

The Calculate PPM screen allows you to calculate the PPM correction factor from the given temperature and pressure inputs.

[**Pressure**]: Enter the atmospheric pressure, and set the units for pressure.

[**Temperature**]: Enter the temperature, and set the units for temperature.

[**PPM**]: The calculated PPM value.

[**Calculate**]: triggers the instrument to calculate the PPM correction factor from the given pressure and temperature inputs.

Raw Data Edit Target

[**Job**] [**View Raw Data**] [**Edit Target**]

The Raw Data Edit Target screen allows you to edit the conventional target and height of rod.

[**HR**]: Enter the height of rod.

[**Add Offset**]: Enter any vertical offset for the height of rod.

[**Prism Constant**]: Enter the prism constant, in millimeters.

[**Select Observations**]: Select the survey observations that you wish to apply this edit to.

[**Select All**]: Select all of the observations currently using this target record.

[**Unselect All**]: Clears the selection of observations.

Note: If you selected the target record to edit from the root of the record tree, by default all observations that use that target will be updated with the new target. If you selected the target record to edit from an individual observation, by default only that observation's target will be updated.

Raw Data Edit GNSS Base

[**Job**] [**View Raw Data**] [**Edit GNSS Base**]

The Raw Data Edit GNSS Base screen allows you to edit the GNSS base setup.

[**Base Point**]: Enter the base point for this setup.

Note: If you wish to change the base setup point, you can only choose a user entered point (key in or imported). If you wish to use a point derived from a survey measurement, you must first go to the Edit Points screen and insert a copy of that point.

Note: To edit the antenna height for the base setup, tap and hold on the antenna record under the GNSS base record and choose Edit GNSS Antenna.

Raw Data Edit GNSS Antenna

[**Job**] [**View Raw Data**] [**Edit GNSS Antenna**]

The Raw Data Edit GNSS Antenna screen allows you to edit the GNSS antenna height for the base or rover setup.

[**Antenna**]: Displays the antenna type for this antenna record.

[**Measured**]: Enter the measured antenna height.

[**To**]: Enter the measure to mark for this antenna measurement.

[**Serial #**]: Enter the antenna serial number for record keeping purposes.

[**Select Observations**]: Select the survey observations that you wish to apply this edit to.

[**Select All**]: Select all of the observations currently using this GNSS antenna record.

[**Unselect All**]: Clears the selection of observations.

Note: If you selected the GNSS antenna record to edit from the root of the record tree, by default all observations that use that antenna will be updated with the new antenna. If you selected the GNSS antenna record to edit from an individual observation, by default only that observation's antenna will be updated.

Raw Data Note

[**Job**] [**View Raw Data**] [**Note...**]

The Raw Data Note screen is used to append a note to an individual raw data record or to the end of the raw data records in the job. The note can consist of any string of text.

The buttons in the lower portion of the screen can be tapped to quickly enter any of ten default Foresight linework commands. These buttons can also be customized, or new buttons can be created.

[**Write Now!**]: Appends the text in the upper portion of the screen to selected record or to the end of the raw data records in the job.

Code Page

The Code page lists the default line work command code buttons and/or customized buttons. Tapping any button will enter the text associated with that button to the upper portion of the screen.

[**Customize**]: Toggles the page between normal mode and customize mode. When in customize mode, any of the default line work command buttons can be customized or new buttons created.

[**Default**] (only available after tapping [**Customize**]): Restores the default contents of the Code page. Any customized buttons will be lost.

History Page

The History page provides a quick way to enter a note that was used earlier. The page lists up to the last 30 notes used.

Notes that were entered from the buttons on the Code page are excluded from this list to reduce clutter since those notes are already easily accessible.

Sort: Allows you to sort the list of previous notes using a variety of methods.

Select: Copies the note currently selected from the list into the upper portion of the screen where it can then be appended to the raw data file using the [**Write Now!**] button.

: Removes the selected note from the list.

Code Edit

[**Job**] [**View Raw Data**] [**Note...**] [**Code**] [**Customize**] *click a button*

Tapping any of the 16 available buttons while in customize mode will open the contents of that button in the Code Edit screen where it can be modified as desired.

Button Label: This is the text that will appear on the selected button. A maximum of 5 characters can be entered here.

Actual Text: This is the text that will be entered in the upper portion of the Raw Data Note screen when the selected button is tapped. A maximum of 127 characters can be entered here.

: Saves the changes and returns to the previous screen.

: Cancels any changes made and returns to the previous screen.

Note: Custom code buttons remain intact even when switching or creating new jobs because the details of these buttons are stored to a text file in the program's folder called NoteCode.ini. If you want to copy custom code buttons to another data collector, you must copy this file to the same folder on the other data collector.

View DTM

[**Job**] [**View DTM**]

Before viewing a DTM, the <u>Setup DTM 3D</u> screen will open where the DTM layers must be defined. This screen is also used to define other parameters for the DTM.

[**Layers**]: Opens the <u>Layers for Staking DTM</u> screen where the DTM layers are selected.

[**Boundary**]: Opens the <u>Choose Polyline</u> screen where a polyline can be selected that defines the boundary of the DTM.

Exclude points…: Move any points that exist outside the selected boundary to the Auxiliary layer. If a point is later stored outside the boundary, they will also be moved to the Auxiliary layer.

Discard the boundary…: Initially moves any points that exist outside the boundary to the Auxiliary layer. If a point is later stored outside the boundary, the selected boundary is automatically unselected.

[**Clear**]: Unselect the selected boundary and move it to the Auxiliary layer.

[**Breaklines…**]: Open the <u>Add/Edit Break lines</u> screen where DTM break lines can be added or edited.

[**Points…**]: Open the <u>Points on DTM Layer</u> screen where the points on the DTM layer can be viewed, new points can be imported, and existing points can be deleted (moved to the Auxiliary layer).

[**3D View…**]: Open the 3D View screen where the DTM can be viewed from any angle.

Layers for Staking DTM

[**Job**] [**View DTM**] [**Layers…**]

The <u>Layers for Staking DTM</u> screen is used to select the non-reference DTM layer and an optional layer where invalid objects are stored.

Select DTM Layer: The non-reference DTM layer used for stake points that are stored and other objects that exist on the surface you are staking. These points will be used to generate a DTM surface to compare to the reference DTM surface.

Select Auxiliary Layer: If this is checked and a point is stored that is located outside the selected DTM boundary, the point is automatically stored on the Auxiliary layer. If left unchecked, a prompt will appear when storing a point outside the boundary where you must specify the layer to store the new point.

Layer (Auxiliary): The layer that all points will be stored to if they cannot be stored to the DTM layer.

Choose Polyline

[**Job**] [**View DTM**] [**Boundary…**]

The <u>Choose Polyline</u> screen is used to select an existing polyline that defines a boundary for your non-reference DTM surface.

All the polylines in the current job are displayed. Select the appropriate polyline and tap ✅.

Add/Edit Break-lines

[**Job**] [**View DTM**] [**Breaklines…**]

The Add/Edit Break-lines screen is used to select, edit, create, or delete the break lines that will be used when computing the DTM. The break lines that will be used when computing the DTM are listed in this screen.

[**Edit…**]: Opens the Edit Polyline screen where the selected polyline can be modified or a new polyline can be created.

[**Delete…**]: Move the selected polyline to the Auxiliary layer.

[**Add Existing…**]: Displays all the polylines in the current job. Selecting a polyline and tapping ✅ will move the selected polyline to the DTM layer.

Note: If a boundary is defined, only polylines that fall within the boundary can be added.

[**New…**]: Opens the New Polyline screen, which is identical to the Edit Polyline screen and is used to create a new polyline.

Edit Polyline

[**Job**] [**View DTM**] [**Break-lines**] [**Edit…**] or [**Job**] [**View DTM**] [**Break-lines**] [**New…**]

The Edit Polyline screen is used to perform some preliminary editing to a polyline prior to accessing the polyline editor with the [**Edit…**] key.

[**Tap Points…**]: Allows you to tap points to define a new polyline. If a polyline was already selected prior to accessing this screen, it will be replaced by the polyline being created.

[**To / From…**]: Allows you to define a range of points that define a polyline. If a polyline was already selected prior to accessing this screen, it will be replaced by the polyline being created.

[**Edit…**]: Opens the Polyline Editor where the polyline can be further edited.

[**Clear**]: Permanently removes the selected polyline from the job.

[**Properties…**]: Opens the New Line screen where the description, layer and feature attributes can be modified.

🖩: Opens the Map Display Options screen to select what is displayed on the screen.

Points on DTM Layer

[**Job**] [**View DTM**] [**Points…**]

The Points on DTM Layer screen displays all the points on the DTM layer and allows you to add points from another layer or delete (move) points to a different layer.

[**Delete**]: Move the selected point(s) to the Auxiliary layer. If the Auxiliary layer is not specified, you will be prompted to select the layer to move the points to.

Note: Points on a boundary or break line cannot be deleted.

[**GoTo**]: Quickly find and select the specified point.

[**Add From To**]: Opens the Select Point(s) screen where a point range can be entered. The points will then be moved to the DTM layer.

[**Del From To**]: Opens the Select Point(s) screen where a point range can be entered. The points will then be moved to the Auxiliary layer.

3D View

[**Job**] [**View DTM**] [**3D View…**]

The 3D View screen is used to view the DTM from any angle.

[**Settings**]: Opens the 3D View Settings screen, described below, where the information displayed in the 3D view can be configured.

[**Volume**]: Displays the total cut and fill volume between the area that has been staked and a reference datum, whose elevation is specified in the 3D View Settings screen; or the total cut and fill between the area that has been staked and the selected DTM.

Datum: Displays the datum elevation set in the 3D View Settings screen.

: Toggles to display or hide the point names and descriptions.

: When this button is activated, dragging within the 3D View will result in the image being rotated to any angle.

: When the button is activated, dragging within the 3D View will pan the image.

3D View Settings

[**Job**] [**View DTM**] [**3D View…**] [**Settings**]

The 3D View Settings screen is used to configure the information displayed in the 3D View screen.

Height Exaggerated to the Maximum: When checked, the height exaggeration is automatically set to a high value. When unchecked, the height exaggeration can be set manually in the next field.

Height Exaggeration Ratio: The value that the height is multiplied by in the 3D view. Higher values mean more exaggeration; a value of 1.0 would result in no exaggeration.

Hidden-line Removal: When checked, will hide all the lines that occur behind other surfaces in the 3D View. The image shown here is identical to the image shown on except the hidden lines are not removed.

Display the Difference: This applies only to DTM stakeout. When checked, the vertical portion (z-axis) of the <u>3D View</u> screen is computed by the elevation differences between the non-reference DTM surface and the reference DTM surface. This will result in any objects that occur above or below the reference DTM to clearly stand out as hills and valleys and the volume information provided in the <u>3D View</u> screen will be between the staked points and the reference DTM.

When unchecked, the Datum field can be set to a reference elevation. Cut and fill volumes in the <u>3D View</u> screen will then be based on the difference of a horizontal plane at the elevation specified here and the non-reference DTM surface.

Datum: When the Display the Difference checkbox is unchecked, cut and fill volumes will be computed in the <u>3D View</u> screen based on the difference of a horizontal plane at the elevation specified here and the staked points.

View Direction (from view point to the center): Allows you to specify the exact horizontal and vertical angle in which to view the DTM.

Manage Layers

[**Job**] [**Manage Layers**]

The <u>Manage Layers</u> screen is used to manage the layers for the current job. All existing layers are displayed along with which layers are visible and how many objects are on each layer.

[**Set Active**]: Set the selected layer as the active layer. The active layer is marked with a ⊕ symbol.

[**New…**]: Opens the <u>New Layer</u> screen where a new layer can be added. You are prompted for a name and if the new layer should be visible.

[**Edit…**]: Opens the <u>Edit Layer</u> screen where the selected layer can be edited. The layer name and visibility can be changed.

Note: You can toggle layer visibility by tapping on the [**Visible**] column of the layer list.

[**Delete**]: Delete the selected layer.

Note: Only layers that contain no objects can be deleted. Layer 0 is required and cannot be deleted or renamed.

Tip: To move several points from one layer to another, select the desired points in the <u>Edit Points</u> screen and tap [**Edit**]. Select the layer you want to move them to and tap ✅.

Job Information

[**Job**] [**Job Info**]

The <u>Job Information</u> screen displays details of the current job and allows you to remove wasted space in the current

job file.

Filename: Displays the current job file name.

Feature Code File: Displays the feature code filename used in the current job.

Folder: Displays the directory where the current job file is located.

Size: Displays the size of the current job.

Created: Displays the date that the current job was created.

Points: Displays the first and last point names and if alphanumeric point names are being used.

Lines: Displays the number of polylines and alignments that are in the current job.

Roads: Displays the number of roads in the current job and the filenames associated with them.

Basemaps: Displays the number of basemaps in the current job and the filenames associated with them.

Attributes Collected: Displays the number of point and line attributes used in the current project.

Pictures: Displays the number of pictures used in the current project.

Total Storage: Displays the total amount of memory that is installed on the data collector.

Available Storage: Displays the amount of free memory that is available to use for jobs.

Wasted Space: Displays the amount of empty space that is being used by the current job. This space can be recovered as described below.

[**Recover Wasted Space Now**]: As you add and remove points and lines in a job, empty gaps can result within the job file. These gaps use storage space. This button will remove any gaps in the job file, thus recovering the wasted space.

Note: The software checks for low memory situations every minute. When the available system memory falls below 256K of RAM, a warning is displayed.

Calculator

[**Job**] [**Calculator**] or ▼, Calculator (where applicable)

The Calculator screen behaves exactly like any other RPN-format calculator. It consists of a stack that can contain any number of values and buttons that perform various operations. When a value is being entered from the keypad, it is displayed in a special area called the active area. This value is then place in Level 1 of the stack after tapping the Enter key.

Tapping a button on the display performs the corresponding operation on either the last value in the display, or the last two values, depending on the operation. Each button is explained below where the value in Level 1 is x and the value in Level 2 is y.

+: Adds x and y.

÷: Divides y by x.

-: Subtracts y from x.

×: Multiplies x and y.

[**Enter**]: Moves the active value to Level 1 of the stack, or duplicates Level 1 if there is no active value.

Swap: Swaps positions of x and y in the stack.

Drop: Drops (removes) x from the stack.

Edit: Moves the value in Level 1 to the active area where it can be edited.

±: Changes the sign of x.

1/x: Inverse of x.

pi: Enters 3.141592654 to the stack.

Clr: Clears the stack.

√‾x: Square root of x.

Sin^{-1}: Arc sine of x.

Cos^{-1}: Arc cosine of x.

Tan^{-1}: Arc tangent of x.

°>dms: Converts x in decimal degrees to degrees.minutes-seconds.

x^n: Raises x to the power of n.

x^2: Squares x.

Sin: Sine of x.

Cos: Cosine of x.

Tan: Tangent of x.

dms>°: Converts x, in degrees.minutes-seconds to decimal degrees.

Ln: Natural logarithm (base e) of x.

Log: Common logarithm (base 10) of x.

°>R: Converts x, in decimal degrees to radians.

G>R: Converts x, in Grads to radians.

P>R: Converts the polar coordinates (y,x) to rectangular coordinates.

dms -: Subtracts x in degrees.minutes-seconds from y in degrees.minutes-seconds.

x

e : Raises 2.718281828 to the power of *x*.

10^x: Raises 10 to the power of *x*.

R>°: Converts *x*, in radians to decimal degrees.

R>G: Converts *x*, in radians to Grads.

R>P: Converts the rectangular coordinates (*y*,*x*) to polar coordinates.

dms +: Adds *x* in degrees.minutes-seconds and *y* in degrees.minutes-seconds.

Manage Pictures

[**Job**] [**Manage Pictures**]

The Manage Pictures screen is used to manage pictures that are associated with the current job.

The list of pictures is sorted by the picture names by default, but they can also be sorted by point association, date, or file size by tapping the desired column's heading. For example, tap [**Date**] to sort all the pictures by date. Tapping [**Date**] again will reverse the sort order.

Various icons are used to indicate the type of point the corresponding pictures is associated with.

[**View**]: Opens the selected picture in the Windows Mobile® Pictures & Video application. Tap [ok] to return to the software. Additional options are available from the [**Send**] and [**Menu**] buttons, but are not related to the software and are not covered in this manual.

[**Del**]: Deletes the selected picture.

Take Pictures

[**Job**] [**Take Picture**]

The Take Picture routine is only available on a Nomad or Ranger 3 with a built-in camera. The routine is used to take a new picture and optionally associate it with an existing point.

Align the shot in the first Take Still Picture screen and when ready, press **[Enter]** on the data collector to take the picture. The picture will be displayed on the second screen automatically. The first two screens of the routine are part of the Windows Mobile® Pictures & Video application.

The second screen is used to preview the picture. You must tap **[ok]** or press **[Enter]** on the data collector button to continue to the final screen. If the picture is unacceptable, you can cancel from the third screen and start over.

Note: The options available from the bottom of this screen are part of the Windows Mobile® Pictures & Video application and are not supported in the software.

The third screen is used to name and describe the picture.

New Picture File Name: Enter the picture name here. The previous name entered will initially be entered in this field for you, except the number will be advanced by one.

Point Associated with Picture: You can specify an existing point in this field to associate the picture with the specified point. Raw Data Note: Any text entered here will be stored to the job as a note along with the picture details.

❌: can be used to cancel out of the routine without saving the picture.

✅: Saves the picture and closes the routine.

Survey Menu

The Survey Menu contains the routines used for collecting data with a conventional or robotic total station.

Station Setup
Check Setup
Traverse/Sideshot Index
Repetition Shots
Multiple Sideshots
Radial Sideshots
Distance Offsets
Horizontal Angle Offset
Vertical Angle Offset
Auto Collect
Quick Codes
Corner & 2 Lines
Corner & Angle
Corner & Offset
Corner & Plane
Surface Scan
Shoot From Two Ends
Record Mode
Remote Elevation
Check Point
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Remote Control

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On-board builds of the Survey Pro software have enhanced features to take advantage of the platform.

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Station Setup

[**Survey**] [**Station Setup**]
The Station Setup wizard is used to set the occupy point and orient the instrument.

PPM Correction: If you have Prompt for PPM set on the [Survey Settings](#) card, then you start your station setup on the [PPM Correction](#) screen.

Setup Type: Select the type of setup to do with this wizard. You can choose from: [Known Point](#), [Unknown Point (Resection)](#), and [Use Last Setup](#).

Station Setup PPM Correction

The following screens are used to setup PPM correction parameters for the station setup.

Apply PPM [**In Instrument**] : Use this option if you set the instrument to apply the PPM correction. In this case, the distances returned to Survey Pro by the instrument have already been corrected for PPM.

[**Record PPM values to file ...**]: Opens up the PPM Booking screen where you can record the temperature and pressure values entered into the instrument for book keeping purposes.

Apply PPM [**In Survey Pro**] : Use this option if you set the instrument to 0 PPM correction, and you want to have Survey Pro correct measured slope distances for PPM.

[**Pressure**]: Enter the atmospheric pressure and pressure units.

[**Temperature**]: Enter the temperature and temperature units.

[**PPM**]: Enter the parts per million correction factor for measured slope distances.

Certain instruments use the Survey Pro application to control PPM correction, if you are connected to an instrument of this type, the PPM correction page will show the following controls:

[**PPM Off**] : Use this option to disable PPM correction of measured slope distances.

[**PPM On**] : Use this option to enable PPM correction of measured slope distances.

[**Pressure**]: Enter the atmospheric pressure and pressure units.

[**Get Pressure**]: (if available) Gets the atmospheric pressure from the barometer built into the instrument.

[**Temperature**]: Enter the temperature and temperature units.

[**Get Temperature**]: (if available) Gets the temperature from the thermometer built into the instrument.

[**Calculate**]: Triggers the instrument to calculate the PPM correction factor from the input values.

[**PPM**]: Enter the parts per million correction factor for measured slope distances.

Station Setup PPM Correction

The PPM Booking screen is used to record the temperature, pressure, and PPM values that were set on the instrument for the case where the instrument is applying the PPM correction.

Note: The PPM correction values entered on this page are for book keeping purposes only. When PPM is being applied in the instrument, the instrument will correct measured slope distances for PPM and the corrected distance is returned to Survey Pro.

[**Pressure**]: Enter the atmospheric pressure and pressure units.

[**Temperature**]: Enter the temperature and temperature units.

[**PPM**]: Enter the parts per million correction factor for measured slope distances.

Station Setup Known Point

The following screens are used when the setup type is set to Known Point.

Station Setup Known Point – Enter Occupy Point

+ Occupy Point: Select a point to setup on. You can enter a point name, select from a list or from the map. If you enter a new point name here, you will have to enter known coordinates for that point and store it before proceeding with the wizard.

2D Survey: Check this box to conduct a 2D survey. This option will allow you to select a 2D point for the occupy point, and will disable the height of instrument and rod controls in setup and measurement taking user interface.

Information: Shows the location (N, E, Elev) and description of the selected occupy point.

HI: Enter the height of instrument if you are doing a 3D survey.

[Remote Elevation]: This button is available when using 3D survey Mode. Tap this button to open the Remote Elevation screen where you can calculate the height of the instrument from a shot on the rod on a different point.

[Check Setup]: This button is only available when there is already a station setup in place. Tap **Check Setup** to open the Station Check screen.

[Next >]: Advances to the Orient Instrument page.

Station Setup Known Point – Orient Instrument

New Point/BS Point/BS Azimuth: Select the type of backsight used to orient the instrument. You can choose between: New Point, BS Point, BS Azimuth

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Station Setup Known Point – Orient Instrument – New Point

BS Azimuth / BS Bearing: Enter the azimuth or bearing to the new backsight point.

Backsight Circle: Enter the circle reading you would like to set on the backsight line.

[Read Circle]: Tap to read the circle from the instrument

[Send Circle]: Sends the entered Backsight Circle to the instrument.

Fixed Target / Roving Target: Select the target type at the backsight point. Choose fixed target if you will use a dedicated target at the backsight. Choose Roving Target if you will use the same target at the backsight as you will for foresight points.

HR: Enter the height of the backsight target.

[Measure Backsight]: Triggers a measurement from the total station, and stores the new backsight point.

[**Finish**]: Records the setup and exits the wizard.

Station Setup Known Point – Orient Instrument – BS Point

BS Point: Enter the point name to use for the backsight point.

BS Azimuth: Displays the grid direction to the backsight point.

Fixed Target / Roving Target: Select the target type at the backsight point. Choose fixed target if you will use a dedicated target at the backsight. Choose Roving Target if you will use the same target at the backsight as you will for foresight points.

HR: Enter the height of the backsight target.

[Read Circle]: Tap to read the circle from the instrument

[Send Circle]: Sends the entered Backsight Circle to the instrument.

[**Next >**]: Advances to the Check Setup page. This button shows up when you are using check backsight as part of the station setup work flow.

[**Finish**]: Records the setup and exits the wizard. This button only shows up when you have Skip Check during Station Setup checked on the Surveying card of the Job Settings pages.

Station Setup Known Point – Orient Instrument – BS Azimuth:

BS Azimuth: Enter the azimuth to the known azimuth reference mark.

[Read Circle]: Tap to read the circle from the instrument

[Send Circle]: Sends the entered Backsight Circle to the instrument.

[**Next >**]: Advances to the Check Setup page. This button shows up when you are using check backsight as part of the station setup work flow.

[**Finish**]: Records the setup and exits the wizard. This button only shows up when you have Skip Check during Station Setup checked on the Surveying card of the Job Settings pages.

Station Setup Resection

The following screens are used when the setup type is set to Unknown Point / Resection.

Station Setup Resection – Enter Store Point

Store Pt: Enter the name for the new point to be stored as a result of the resection.

Description: Enter the description of the new point to be stored as a result of the resection.

HI: Enter the height of instrument if you are doing a 3D survey.

2D Survey Check this box to conduct a 2D survey. This option will allow you to select a 2D point for the occupy point, and will disable the height of instrument and rod controls in setup and measurement taking user interface.

Shots per Resect Point: Enter the number of repetition sets you will collect for each point.

Sequence: Select the mode to shoot each set of the resection measurements. You can choose between: Direct and Reverse, or Direct Only.

[Check Setup]: This button is only available when there is already a station setup in place. Tap Check Setup to open the Station Check screen.

Station Setup Resection – Observations

Resect Point: Enter the name of the known point to observe next in the resection.

Option: Select the measurement option. You can choose between: Distance and Angle, and Angle Only.

HR: Enter the height of rod for each observation.

Observe: Triggers the instrument to take an observation, and adds the results

Point List: Shows the points observed so far, and the residuals of those points in the current resection solution if it is solved. You can tap on the check box to the left of each point name to enable or disable the use of that point in the resection solution. The solution is automatically resolved each time you change the resection point assignments.

[**Next >**]: Advances the wizard to the resection Results screen. You must have enough observations to solve the resection before you can advance.

Station Setup Resection – Results

Occupy Point: Displays the name of the point to be stored at the occupy location as a result of the resection.

Description: Displays the description of the point to be stored at the occupy location as a result of the resection.

North / East / Elevation: Displays the coordinate to be stored for the occupy point.

Solution Angular RMS: Displays the root mean squared of the angular measurements used in the resection.

Solution Distance RMS: Displays the root mean squared error of the distance measurements used in the resection.

[**Store >**]: Stores the point, and advances to the Station Setup wizard in BS Point mode, where you can complete the station setup for the newly stored occupy point.

Station Setup Use Last

The following screens are used when the setup type is set to Use Last.

Station Setup Use Last – Enter HI

HI: Enter the height of instrument if you are doing a 3D survey.

[Check Setup]: This button is only available when there is already a station setup in place. Tap Check Setup to open the Station Check screen.

[**Next >**]: Advances to the Station Setup Use Last – Send Circle Page.

Station Setup Use Last – Send Circle

Fixed Target / Roving Target: Select the target type at the backsight point. Choose fixed target if you will use a dedicated target at the backsight. Choose Roving Target if you will use the same target at the backsight as you will for foresight points.

HR: Enter the height of the backsight target.

[Send Circle]: Sends the Backsight Circle for this setup to the instrument.

[**Next >**]: Advances to the <u>Check Setup</u>. This button shows up when you are using check backsight as part of the station setup work flow.

[**Finish**]: Records the setup and exits the wizard. This button only shows up when you have Skip Check during Station Setup checked on the <u>Surveying card</u> of the <u>Job Settings</u> pages.

Check Setup

This screen is used to verify the backsight by measuring the distance between the occupy point and the backsight point, or taking a measurement to a third point.

Check Type: Select the method to check the backsight. You can choose between: By Angle, By Distance, and By Point.

By Angle: Use this method to check the current backsight circle compared to the set backsight circle.

By Distance: Use this method to check the distance between the occupy point and the backsight point, plus the current backsight circle compared to the set backsight circle.

By Point: Use this method to measure to a third point and check the closure to that point.

[Check]: Triggers the instrument to take a measurement appropriate for the check type you are performing.

Traverse / Sideshot

[**Survey**] [**Traverse / Sideshot**]

The <u>Traverse / Sideshot</u> screen is the main screen used for data collection.

Foresight: The point name that will be used for the next stored point.

Description: The description for the next stored point.

HR: The height of the rod.

🔷 🔽 : Opens the <u>Smart Target</u> options.

[**Side Shot**]: Opens the <u>Traverse Now</u> screen where you can choose to observe a new point to traverse to, or select a point you have previously occupied from this setup.

[**Traverse**]: Triggers the total station to take a shot to the prism. The new point is stored as a traverse shot in the data collector and a The <u>Traverse Now</u> screen will open. If you choose to traverse now, the occupy point will automatically

change to the previous foresight point and the backsight point will automatically change to the previous occupy point.

Note: Prior to storing a point, you may then be prompted for description, rod height, layer, and/or feature information depending on the selections made in the <u>Surveying Settings</u> screen.

[**Backsight…**]: Opens the <u>Station Setup</u> screen where you can set and check your station occupy point and backsight.

📋: A shortcut to the <u>Surveying Settings</u> screen.

Traverse Results

Angle Right: The horizontal angle right around the Occupy Point from the Backsight to the Foresight Point.

Azimuth: The azimuth from the Occupy Point to the Foresight Point.

Zenith: The zenith angle measured by the total station to the prism.

Slope Dist: The slope distance measured by the total station to the prism.

Horz Dist: The horizontal distance from the Occupy Point to the Foresight Point.

Vert Dist: The vertical distance from the Occupy Point to the Foresight Point.

Point: The name of the stored point.

Desc: The description of the stored point.

Location N: The Y-coordinate of the stored point.

Location E: The X-coordinate of the stored point.

Location Z: The elevation of the stored point.

Traverse Now

Before taking a shot with the [**Traverse**] button, the <u>Traverse Now</u> screen will open where you can choose to take a new observation as your traverse point, or you can choose among any of the observations already taken from this station setup as your traverse point.

[**Measure and Traverse Now**]: This option will trigger the instrument to take a new observation, and then open the <u>Traverse Wizard</u> to guide you through moving the station setup to the forward point.

[**Traverse to an Existing Point**]: Shows a list of points already observed from this station setup. Select any point from the list and then tap:

[**Pick a point and Traverse To...**] opens the <u>Traverse Wizard</u> to guide you through moving the station setup to the forward point.

Traverse Wizard

[Survey] [Traverse / Sideshot] [Traverse] [Traverse Now]
This wizard is used to setup the occupy point and backsight after a traverse observation.

Note: If you have Prompt for PPM turned on in the <u>Survey Settings</u>, the the Traverse Wizard will start with the <u>PPM Setup</u> screen.

HI: Enter the height of the instrument at the new setup point.

New Occupy Point: Displays the name of the traverse to point. This would be the name of the point you shot with the Traverse button.

New Backsight Point: Displays the name of the new backsight point. This would be the point you were just occupying.

Fixed Target / Roving Target: Select the target type at the backsight point. Choose fixed target if you will use a dedicated target at the backsight. Choose Roving Target if you will use the same target at the backsight as you will for foresight points.

HR: Enter the height of the backsight target.

[Send Circle]: Sends the entered Backsight Circle to the instrument.

[**Next >**]: Advances to the <u>Check Setup</u> page. This button shows up when you are using check backsight as part of the station setup work flow.

[**Finish**]: Records the setup and exits the wizard. This button only shows up when you have Skip Check during Station Setup checked on the <u>Surveying card</u> of the <u>Job Settings</u> pages.

Point Exists Screen

[**Survey**] [**Traverse / Sideshot**] [**Traverse**] or [**Side Shot**]

When performing a traverse or side shot and the foresight point name already exists, the <u>Point Exists</u> screen will open where you select how to handle the new point.

[**Overwrite Existing**]: Overwrite the existing point with the new coordinates.

[**Store Observation**]: Stores the observation data, but does not update the point coordinate. The observation results will show you the differences between the observed coordinate and the existing coordinate.

[**Compute Average**]: Computes an average coordinate using this new observation and all other observations (conventional and GNSS). You will see a prompt showing you the agreement between this observation and the previous coordinate for the point. If you accept the prompt, the point will be updated with the new averaged coordinate.

[**Use Next Available**]: Store the coordinates using the next available point name.

Note: Certain points are protected and cannot be changed. If you are taking an observation to a protected point, the option to overwrite or compute average will not be available.

Remote Shot Screen (Remote Mode)

[**Survey**] [**Traverse / Sideshot**] [**Traverse**] or [**Side Shot**]

When running in remote mode, tapping the [**Traverse**] or [**Side Shot**] button from the <u>Traverse / Sideshot</u> screen will open the <u>Remote Shot</u> screen.

The <u>Remote Shot</u> screen is identical to the <u>Remote Control</u> screen with the addition of a [**Take Shot**] button that allows you to trigger the total station to take a shot.

[**Take Shot**]: After the total station is properly aiming toward the prism, this will trigger the total station to take a shot. If you are performing a side shot, you will remain in the <u>Remote Shot</u> screen once the shot is completed. If you are performing a traverse shot, you will return to the <u>Traverse / Sideshot</u> screen when the shot is completed.

Repetition Shots

[**Survey**] [**Repetition Shots**]

The <u>Repetition Shots</u> screen is used to perform side shots or traverse shots using any number of repetitions.

Note: The sequence that the repetition shots are performed is selected in the Repetition <u>Settings</u> screen.

Foresight: The name of the point that will be stored.

Number of Sets: The desired number of sets to shoot to the backsight and foresight.

Note: One set is equivalent to two shots to the backsight and foresight point.

HR: The rod height.

: Opens the <u>Smart Target</u> options.

Average (of): Shows the average angle or distance to the foresight from all the shots taken. The value in parenthesis is the total number of repetitions performed.

Worst Residual: Displays the worst residual calculated from all the sets of the selected measurement type.

Description: The description for the point that is being stored. This field appears prior to storing the new point.

Note: A residual is the difference between a single measurement and the average of all the measurements.

Note: If a residual exceeds the tolerances set in the <u>Repetition Settings</u> screen, that value is displayed in **bold** text.

[**HA**], [**ZA**], [**SD**]: Allows you to replace the current repetition data for the corresponding button with new data. Once tapped, the repetition data for the tapped button will be deleted. You will then need to perform all sets defined in the Number of Sets field again, where the new data will replace the corresponding deleted data.

[**All**]: Open a screen that asks if you want to add an additional set to those already done or start over.

[**Toss**]: Delete the corresponding set that has the worst residual.

Note: A set can only be "tossed" when three or more sets have been collected.

[**Side Shot**]: Use the repetition data gathered to create a new side shot point. The foresight point will automatically advance to the next available point.

[**Traverse**]: Use the repetition data gathered to create a new traverse point. The occupy point will automatically update to the previous foresight point and the backsight point will automatically update to the previous occupy point.

[**Backsight…**]: Opens the Station Setup screen where the current backsight can be modified.

: A shortcut to the Surveying and Repetition Settings screens.

Multiple Sideshots

[**Survey**] [**Multiple Sideshots**]

The Multiple Sideshots screen is used to perform multiple side shots using any number of repetitions to each foresight without the need to re-shoot the backsight.

Foresight: The point name that will be stored.

Description: The description for the next stored point.

HR: The length of the rod.

: Opens the Smart Target options.

Number of Sets: The desired number of sets to shoot to the backsight or foresight.

[**Shoot Backsight**]: Used to shoot the backsight. You will be required to shoot the number of sets to the backsight entered in the Number of Sets field.

Note: The backsight can be re-shot at any time, but it must be shot before the first side shot can be shot.

[**Side Shot**]: Used to shoot a side shot. Once the final set is complete, the new point is stored and the foresight point will automatically advance to the next available point.

[**Backsight…**]: Opens the Station Setup screen. where the current backsight can be modified.

: A shortcut to the Surveying and Repetition Settings screens.

Radial Sideshots

[**Survey**] [**Radial Sideshots**]

The Radial Sideshots routine combines the functionality of the Multiple Sideshots routine with the accuracy of the Repetition Shots routine. It is used to perform repetition shots to a backsight and any number of foresights (side shots)

from the same occupy point.

: Accesses the Surveying Settings screen and Radial Sideshot Settings screen, which is identical to the Repetition Settings screen with the exception of the choices for the **Shooting Sequence**. Select **B>F1>..>Fn^F1>..>Fn>B** to shoot all Face 2 side shots in the same order as the Face 1 side shots, or **B>F1>..>Fn^Fn>..>F1>B** to shoot the Face 2 side shots in reverse order.

Option: When shooting the first set, measuring a distance and angle for each shot is required, but when starting all subsequent sets, **Angle Only** can also be selected for this field.

Number of Sets: Where the desired number of sets is specified.

[**Done with SS >**]: Used when you are finished shooting side shots. This is only available while taking Face 1 side shots for the first set.

[**Shoot**] / [**Shoot BS**]: Used to shoot the current point. If the shot was already performed, the [**Next >**] button will be enabled. Tapping [**Shoot**] again will throw out the results of the last shot and re-shoot it.

[**Next >**]: Used to take the next required shot in the routine. The button label will contain additional information to help indicate which shot is required next.

Distance Offset

[**Survey**] [**Distance Offset**]

The Distance Offset screen is used to store a new point that is a known distance away from the rod location. This screen is useful when the rod cannot occupy the new point's location.

Foresight: The point name that will be stored.

Desc.: The description for the offset shot that is stored.

HR: The length of the rod.

: Opens the Smart Target options.

Offset: The offset distance that is to the left (when ◉ L is selected) or right (when ◉ R is selected) of the prism from the total station's point of view.

Horz Dist Offset: The offset distance that is beyond the prism (positive value) or in front of the prism (negative value) from the total station's point of view.

Elevation Offset: The offset distance that is below the prism (negative value) or above the prism (positive value).

Note: Multiple offsets can be applied simultaneously.

[**Shoot**]: Take a shot to the prism, apply the offset(s) entered, and then store the new point.

[**Backsight…**]: Opens the Station Setup screen. where the current backsight can be modified.

: A shortcut to the Surveying Settings screen.

Horizontal Angle Offset

[**Survey**] [**Horizontal Angle Offset**]

The Horizontal Angle Offset screen allows you to compute and store the location of a new point that cannot be occupied, such as at the center of large tree.

The routine shoots a prism positioned at the side of the new point and then reads the horizontal angle when aiming toward the center of the new point to compute the new point's location.

Foresight: The point name that will be used when storing the new point.

Description: The description for the offset shot that is stored.

[**Backsight…**]: Opens the Station Setup screen..

[**Aim Center**]: Record the horizontal angle from the total station, which should be facing the center of the new point.

[**Shoot Prism**]: Take a shot to the prism, which is located at the side of the new point.

: A shortcut to the Surveying Settings screen.

Note: The new point will have the same elevation as the point occupied by the prism.

Note: The prism only needs to occupy the location at the side of the new point. A prism is not necessary when shooting the location directly in front of the new point.

Vertical Angle Offset

[**Survey**] [**Vertical Angle Offset**]

The Vertical Angle Offset screen allows you to compute and store the location of a new point that exists directly above or below the rod location, but cannot be occupied, such as the top of a utility pole.

The new point will have the same coordinates as the rod location, but with a different elevation.

Foresight: The point name that will be used when storing the new point.

Description: The description for the offset shot that is stored.

[**Shoot Prism**]: Take a shot to the prism.

[**Aim Zenith**]: Read the vertical angle measured by the total station, which should be facing the new point's location.

[**Backsight…**]: Opens the Station Setup screen..

: A shortcut to the Surveying Settings screen.

Auto Collect

[**Survey**] [**Auto Collect**]

The Auto Collect screen allows users with robotic total stations to automatically collect points either at a specified time interval or after the rod has moved a specified horizontal distance.

Note: This routine only works when used with a robotic total station in remote control mode.

Foresight: The point name that will be used when storing the first new point. Each successive point name will automatically be incremented by the next available point number.

Description: The description that will be assigned to all the points that are stored from this routine.

⦿ **Time**: When this radio button is selected, a point will automatically be stored after each time specified in the corresponding field passes.

⦿ **Distance**: When this radio button is selected, a point will automatically be stored each time the prism is moved from the last stored point by the horizontal distance specified in the corresponding field.

Note: The accuracy that a point will be stored when auto collecting by Distance will vary depending on how frequently the total station measures a distance and how fast the prism is traveling.

: A shortcut to the [Surveying Settings](#) screen.

[**Backsight…**]: Opens the [Station Setup](#) screen..

[**Next >**]: Opens the next [Auto Collect](#) screen.

Auto Collect- Screen 2

The second Auto Collect screen displays information related to the points that have been stored and when the next point will be stored.

The box in the upper-left corner displays the direction and distance the total station is aiming relative to the backsight.

The upper-right corner displays the next store point number and when the next point will be stored in either seconds or distance.

The lower-left corner is a graphic that shows the current total station position, the current prism position, and when collecting by distance, the approximate location of the next store point (represented by an X) based on the speed and direction the prism is moving from the previous store point. Previous stored points are also displayed as dots in this part of the screen.

The lower-right corner of the screen displays the number of points that have been stored and the speed and direction the prism is traveling.

[**Store Now**]: Stores a point at the current prism location, even if the time / distance criteria are not yet met.

[**< Back**]: Returns to the previous [Auto Collect](#) screen.

[**Start / Stop**]: Toggles between starting or stopping the Auto Collect routine.

Quick Codes

[Survey] [Quick Codes]

The Quick Codes screen is used to rapidly take shots with different description codes.

Foresight: Is where you enter the foresight point name.

Note: If you specify an existing point in the Foresight field, you are prompted to overwrite or use the next available point. You will not have the option to store an observation.

HR: The height of the rod.

⬛ 🔽: Opens the Smart Target options.

[Backsight]: Opens the Station Setup screen where you can set and check your station occupy point and backsight.

Tap any of the buttons to take a shot and store the point with the description of the button label. This shot is taken using the current smart target and all relevant settings. The point is stored with the description labeled on the button, for example, **[Ditch]** or **[TOPO]**. You can also tap **[Enter]** to take a shot with the last used button.

Note: Storing points in this routine does not change the last user-specified description used in any survey routine.

Note: To enter a new description, or edit an existing button description in the Quick Codes screen, tap and hold the button. The Quick Code button labels are saved in the \Program Files\Survey Pro\QuickCodes.ini file. You can copy these files from one data collector to another to preload the list.

Corner & 2 Lines

[**Survey**] [**Corner & 2 Lines**]

The Corner and 2 Lines screen is used to store a point at the corner of a structure using a reflectorless total station where a direct measurement to the point is not possible, but two points on two intersecting lines can be shot.

Foresight: The name of the point that will be stored.

Description: The description for the point that will be stored.

HR: 0.000: Shows that no rod height will be used with this routine since all shots are direct reflectorless.

[**Shoot Line 1**]: Prompts you to take two shots on Line 1, which intersects with Line 2 at the point you want to store.

Note: Each shot for a line can be in any location on the same line. (Shot 1 can be to the left or the right of Shot 2.)

[**Shoot Line 2**]: Prompts you to take two shots on Line 2, which intersects with Line 1 at the point you want to store.

Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap 🟢 to accept the computed elevation.

[**Backsight**]: Opens the Station Setup screen you can set and check your station occupy point and backsight.

Corner & Angle

[**Survey**] [**Corner & Angle**]

The Corner and Angle screen is used to store a point that cannot be shot on a reference line using a reflectorless total station where two other points on the same line can be shot.

Foresight: The name of the point that will be stored.

Description: The description for the point that will be stored.

HR: 0.000: Shows that no rod height will be used with this routine since all shots are direct reflectorless.

[**Shoot Line**]: Prompts you to take two shots on a line that intersects with the point you want to store.

Note: Each shot can be in any location on the line. (Shot 1 can be to the left or the right of Shot 2.)

[**Aim at Corner**]: Prompts you to aim at the corner (the point that you want to store). Although no shot is taken, the angles to the point will be used to compute its location.

Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap to accept the computed elevation.

[**Backsight**]: Opens the Station Setup screen where you can set and check your station occupy point and backsight.

Corner & Offset

[**Survey**] [**Corner & Offset**]

The Corner and Offset screen is used to store a point using a reflectorless total station for a point that cannot be shot directly, but the offset(s) to the point can be measured from a reference line that can be shot.

Foresight: The name of the point that will be stored.

Description: The description for the point that will be stored.

HR: 0.000: Shows that no rod height will be used with this routine since all shots are direct reflectorless.

Horiz Offset: The horizontal distance on the line from Shot 1 to the new point. Select ⊙ L if the new point falls to the left of Shot 1, or select ⊙ R if it falls to the right.

Perpendicular Offset: The horizontal distance, perpendicular to the reference line, from the line to the new point (see diagram). A positive value extends away from the total station where a negative value is closer to the total station.

Elevation Offset: The vertical offset from the line to the new point. (See diagram.) A positive value will result in a new point above the reference line and a negative value results in a new point below the reference line.

[**Shoot Line**]: Prompts you to take two shots on the horizontal reference line.

Note: Each shot can be in any location on the reference line (Shot 1 can be to the left or the right of Shot 2), but the

Horiz Offset is always measured from Shot 1.

[**Backsight**]: Opens the Station Setup screen where you can set and check your station occupy point and backsight.

Note: After each shot is complete, the computed elevation is displayed for the new point. You can either enter a different elevation or tap ✅ to accept the computed elevation.

Corner & Plane

[**Survey**] [**Corner & Plane**]

The Corner and Plane screen is used to store a point using a reflectorless total station for a point that cannot be shot, but three points on the same plane can be shot.

Foresight: The name of the point that will be stored.

Description: The description for the point that will be stored.

HR: 0.000: Shows that no rod height will be used with this routine since all shots are direct reflectorless.

[**Shoot Plane**]: Prompts you to take three shots on the same flat surface that the new point is located.

Note: Each shot can be in any location on the same plane, but they must not form a straight line and they should not be grouped close together.

[**Aim at Corner**]: Prompts you to aim at the corner (the point that you want to store). Although no shot is taken, the angles to the point will be used to compute its location.

Note: After all shots are done, the computed elevation is displayed for the new point. You can either enter a different elevation or tap ✅ to accept the computed elevation.

[**Backsight**]: Opens the Station Setup screen you can set and check your station occupy point and backsight.

Shoot From Two Ends

[**Survey**] [**Shoot From 2 Ends**]

The Shoot From 2 Ends screen is used observe a traverse leg from both ends to eliminate the effects of curvature and refraction. The routine requires that a foresight point is shot, but it is not stored until after it is occupied and another shot is taken to the previous occupy point. The coordinates for the foresight point are computed from an average of data gathered at each occupy point.

Note: Because the shoot from two ends procedure eliminates the effects of earth curvature and refraction, the individual observations from each end are not reduced with the curvature and refraction parameter set on the Surveying Settings card. Instead, curvature and refraction are eliminated by averaging the observations from both ends of the traverse leg.

Foresight: The name given to the next stored point.

Description: The description given to the next stored point.

HR: The length of the rod.

⊞ ▼: Opens the [Smart Target](#) options.

Number of Sets: The desired number of sets required when shooting each foresight. You must select at least one set.

[**Traverse**]: Prompts you to shoot the Foresight point. After each set is performed, the <u>Move To Other End</u> dialog box will open and prompt you to set up on the new point and enter a new instrument and rod height. The [Traverse Wizard](#) screen will then open to guide you through the setup on the forward point.

[**BS Setup…**]: Opens the [Station Setup](#) screen where the current backsight can be modified.

⊞: A shortcut to the [Surveying Settings](#) and [Repetition Settings](#) screens.

Record Mode

[**Survey**] [**Record Mode**]

When running in Record Mode, all control of the total station is performed from the total station's keypad. The data collector will simply log each shot that is taken from the total station.

This routine is typically used for topo work, where the total station remains over a single occupy point during all shots.

Note: Not all total stations support record mode.

Foresight: The point name that will be used when storing the next point. Once a point is stored, it will be incremented to the next available point.

Description: The description for all the shots that are stored.

HR: The length of the rod.

⊞ ▼: Opens the [Smart Target](#) options.

Start Recording]: Starts recording all shots performed from the total station.

[**Stop**]: Stops record mode.

[**Backsight…**]: Opens the [Station Setup](#) screen. where the current backsight can be modified.

⊞: A shortcut to the [Surveying Settings](#) screen.

Remote Elevation

[**Survey**] [**Remote Elevation**]

The <u>Remote Elevation</u> screen will compute the elevation for the occupy point by shooting a foresight with a known elevation, or it will compute the elevation for a foresight when the occupy elevation is known.

Known Elevation Is…: Where you specify if the Occupy point or the Foresight point has a known elevation.

Elevation: The known elevation for the selected point.

Shoot: Defines if you want to perform a Direct shot only, or Direct & Reverse shots to the foresight.

HR: The length of the rod.

: Opens the Smart Target options.

Store Pt: When checked, the elevation of the point specified here will be replaced with the computed elevation.

[**Take Shot…**]: Computes the elevation for the point that had an unknown elevation and optionally writes that elevation to the specified Store Pt.

Results

OCC Elevation: Displays the elevation for the occupy point.

FS Elevation: Displays the elevation for the foresight point.

Check Point

[**Survey**] [**Check Point**]

The Check Point screen compares the rod location with an existing point in the project. This routine is similar to the Check Setup routine and is used to verify that the rod and/or the total station is over the correct point. This routine does not store a new point.

Point: The point from the project that will be compared to the observed point (rod location).

Height of Rod: The length of the rod.

[**Backsight…**]: Opens the Station Setup screen..

[**Take Shot**]: Takes a shot and displays the deltas between the observed point and the selected point. High delta values can indicate either the rod and/or total station is over the wrong point. The deltas can also be viewed in the Results screen and Map screen.

: A shortcut to the Surveying Settings screen.

Solar Observation

[**Survey**] [**Solar Observation**]

The Solar Observation screen is used to compute the azimuth to an arbitrary backsight based on the position of a celestial body; typically the sun.

Input Card WARNING! Direct viewing of the sun without a proper filter will cause serious eye damage.
Pointing a total station directly toward the sun without a solar filter can also damage the EDM components.

[image]: A shortcut to the [Date/Time Settings](#) screen.

Lat. / Long.: The latitude and longitude of the total station. These values can be scaled from a map, such as a U.S.G.S. 7.5-minute quadrangle sheet or collected with a handheld GPS unit.

Aim: Selects the portion of the celestial body that where you intend to aim. You can select *Left Edge of Center*, *Center*, or *Right Edge of Center*.

Note: Typically *Left Edge of Center* is selected when performing a sun shot in the northern hemisphere and *Center* is selected for star shots.

[**Corrections**]: Displays which corrections are currently selected with an *N* for no, or a *Y* for yes. When tapped, the Corrections screen opens where the following corrections are configured.

- **Non-linear Declination Correction**: Applies a correction for the linear interpolation of the declination of the sun for the time that an observation is taken. This error is usually negligible, but is removed when this is checked. (This should only be checked when performing sun shots.)
- **Correct to State Grid**: When selected, the computed azimuth is referenced from the local State Plane grid rather than true north.
- **Center Meridian / Zone Constant**: These values are used to adjust the computed azimuth to the local State Plane grid. Appendix A lists these values for the United States.

GHA0: The Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the current date.

Decl0: The declination of the sun at zero hour on the current date.

GHA24: The Greenwich Hour Angle of the sun at zero hour Universal Time, Greenwich, on the following day (24-hours later).

Decl24: The declination of the sun at zero hour on the following day.

Solar Semi-Diameter: The semi-diameter of the sun, expressed in minutes and seconds.

Shots Card

Number of sets: The number of sets that will be taken to the celestial object.

Reverse Shots: When checked, reverse shots will be required with each set. When unchecked, only direct shots are required.

[**Shoot**]: Opens the Enter Shot Data screen, described below, where the shot data is entered for the selected observation.

[**Toss**] / [**Incl**]: Toggle the selected observation so that it will be hidden or un-hidden, respectively. When an observation is hidden, it will not be used when calculating the final azimuth.

Note: The [**Toss**] / [**Incl**] buttons perform the same function as checking / un-checking the checkbox in front of each observation.

Note: A backsight observation cannot be tossed.

[**Del**]: Permanently deletes the most current observation if it is selected allowing you to shoot that shot again.

[**Reset**]: Permanently deletes all observations. A warning prompt will appear before the observations are deleted.

The Enter Shot Data Screen

Horizontal Angle: Displays the horizontal angle measured by the total station. This value is updated with the [**Take Shot**] button, described below.

Current Date / Time: Displays the current date, time, and DUT. These settings can be changed from the Date/Time Settings screen.

Date: If incorrect, the current date should be entered here.

Time: Where the precise time that the observation occurred is entered.

Hrs to GMT: The number of hours that the time at the current location differs from Greenwich Mean Time.

Take Shot: Records the horizontal angle from the total station.

[**Get Local Time**]: Fills in the Time field with the current time that is set in the data collector. This function is not available when shooting the backsight.

Sun Shot Procedure Summary

- Point the telescope ahead of the path of the sun and lock the horizontal movement of the total station.
- Immediately record the horizontal angle from the total station using the [**Take Shot**] button.
- When the target becomes properly aligned with the cross-hairs, record the current time as accurately as possible. The time can be automatically read from the data collector using the [**Get Local Time**] button, or measured from an external time piece and manually entered in the appropriate fields.
- When finished, tap the ✅ button to complete the current observation.

When all observations are complete, the Results page displays the computed azimuth to the backsight.

Results Card

BS D/R: The horizontal angle recorded to the backsight for the particular direct/reverse observation.

Azi D/R: The computed azimuth to the backsight for the particular direct/reverse observation.

Avg: The computed average azimuth of the backsight, relative to true north.

Grid Avg: The computed average azimuth of the backsight, relative to the local State Plane grid.

This field is only displayed when a state grid correction is applied.

Note: See the User Manual for more information on the usage of the Solar Observation routine.

Remote Control

[**Survey**] [**Remote Control**]

Remote control mode is a special mode that makes it easier for users to control fully robotic total stations from a remote data collector.

Note: The remote control functions are available only after a supported robotic total station is selected and enabled in the <u>Instrument Settings</u> screen.

The <u>Remote Control</u> screen allows you to turn the total station in any direction using the arrow buttons on the keypad and control the tacking functions.

The arrow keys are typically used to get the total station to aim in the general vicinity of the prism prior to initiating a search. The total station will continue to turn in the direction of the button as long as the button remains pressed.

[**^**]: Aims the scope upward.

[**v**]: Aims the scope downward.

[**>**]: Turns the scope to the right (as you face the total station from the data collector).

[**<**]: Turns the scope to the left.

[**GeoLock**]: This button is available when GeoLock is enabled and when a supported total station has lost lock on the prism. Tapping it will turn the total station to the area of the prism computed by the GPS solution, followed by a prism search. (See the User's Manual for more information on using GeoLock.)

[**Search**]: Starts the search routine where the total station searches in a specific pattern until it "sees" the prism and then stops.

[**Lock**]: Puts the total station in track mode where it will track the movements of the prism.

[**Stop**]: Stops the total station from tracking or searching.

[**Turn To**]: Opens the <u>Turn To</u> screen where the total station can be turned to a specified direction or quickly flipped between face one and face two.

EDM Mode: Allows you to select from various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

[**Results**]: Displays the <u>Results</u> card.

[**Map**]: Displays the <u>Map</u> card.

[**Aim**]: Displays the <u>Aim</u> card.

[**Foresight**]: Displays the <u>Foresight</u> card.

The satellite icon in the Command Bar indicates the status of the satellite connection when using GeoLock. Tapping this icon will display a pop-up list with the following items:

- **Sky Plot**: Opens the <u>Sky Plot</u> screen.
- **Settings**: Opens the <u>GeoLock Settings</u> screen.
- **Reset**: Resets the GPS localization solution.
- **Sats**: An output-only field that will display one of the following messages, which will change along with the color of the satellite icon:

GREEN: On - Ready: GeoLock is active and a localization solution exists.
YELLOW: On - Collecting Data: GeoLock is active but a localization solution does not yet exist.
RED: No GPS Data or GeoLock requires Backsight set: No NMEA data is available or the backsight has not yet been

set.

GRAY: Off: GeoLock is not enabled.

Results Card

[**Survey**] [**Remote Control**] [**Results**]

The <u>Results</u> card displays live angle data from the total station and live distance data is displayed depending on the current EDM mode.

[**HD/VD**] / [**ZA/SD**]: Toggles the data displayed from the total station between HA, HD and VD, or HA, ZA and SD.

Map Card

[**Survey**] [**Remote Control**] [**Map**]

The <u>Map</u> card displays a live map showing the total station position relative to the current foresight and backsight.

Aim Card

[**Survey**] [**Remote Control**] [**Aim**]

The <u>Aim</u> card is used to precisely aim the instrument. Tapping around the total station graphic will turn the instrument to the location corresponding to the horizontal and vertical scale bars.

[**> By Angle**] / [**> By Distance**]: Toggles between turning by angles or by distances, respectively. The scales in the scale bars will also switch between angles or distances. The scales in the scale bars are calculated using the last distance that was measured.

Foresight Card

[**Survey**] [**Remote Control**] [**Foresight**]

The <u>Foresight</u> card is available only if the backsight is solved. It displays live coordinates for the current foresight.

Turn To

[**Survey**] [**Remote Control**] [**Turn To**]

The <u>Turn To</u> screen is used to turn a robotic total station to a specified horizontal and zenith angle, or to a specified point.

Horizontal Angle: The horizontal angle that the total station will turn to.

Zenith Angle: The zenith angle that the total station will turn to.

[**Turn to Angles**]: Turns the total station to the specified horizontal and zenith angles.

Existing Point: The point from the current job that the total station will turn to.

[**Turn to Point**]: Turns the total station to the specified point.

[**Turn to Backsight**]: Turns the total station to the backsight point.

[**Flip**]: Quickly rotates the total station from face one to face two, or vice versa.

Sky Plot

[**Survey**] [**Remote Control**] [🟢] [**Sky Plot**]

The Sky Plot screen displays the relative location of the visible satellites in the sky, as well as if they are being used to calculate a position.

Satellites with a usable signal are shown with red flashing indicators.

The Elevation Mask is the minimum angle above the horizon where locked satellites are used for a solution. This area is indicated on the screen by the inner circle.

GeoLock Settings

[**Survey**] [**Remote Control**] [🟢] [**Settings**]
or [**Job**] [**Settings**] [**Instrument**] [**GeoLock**]

The GeoLock Settings screen is used to enable/disable GeoLock and displays the current setting of the NMEA GPS receiver. (The GPS receiver settings are configured on the *Job > Settings > NMEA GPS* page.)

Enable GeoLock: When checked, enables the GeoLock feature.

Use 3D GeoLock…: When checked, the GPS elevation will also be used to compute your location and adjust the vertical angle of the total station accordingly. GPS is generally less precise vertically than horizontally so unless you are using GeoLock while in very steep terrain, this item should remain unchecked.

Surface Scan

[**Survey**] [**Surface Scan**]

The Surface Scan screen takes advantage of a robotic, reflectorless total station to automatically take a sequence of shots of a surface. PC software can then use the data to generate a 3-D raster image of the surface or a DTM surface to compute volume information. Consult the User's Manual for more information on performing a surface scan.

Select Type of Surface Scan: Select the type of surface scan to perform here. The option selected will determine how you will define your perimeter and distance intervals.

Distance Grid:
[**Point 1**], [**Point 2**], [**Point 3**]: Are the point names that will be used when storing the upper-left, upper-right and lower points that define the surface perimeter.

Note: If any points defining your perimeter already exist, the point names can be entered in these fields without re-shooting them.

[**Shoot 1**] , [**Shoot 2**], [**Shoot 3**]: Shoots and stores the corresponding point.

Horizontal Distance Interval: The horizontal distance between each shot taken during the surface scan.

Vertical Distance Interval: The vertical distance between each shot taken during the surface scan.

Angle Grid:
[**> HA/ZA**] / [**> Point**]: Allows you to define the corners of your perimeter by taking a shot to measure the horizontal and zenith angles to each corner (or enter them in by hand), or by selecting existing points from the current job, respectively.

Horizontal Angle Interval: The horizontal angle that will be turned between each shot taken during the surface scan.

Vertical Angle Interval: The vertical angle that will be turned between each shot taken during the surface scan.

HR: The rod height, which should typically be set to zero since all shots taken are reflectorless (no rod).

[**Show Outline**]: This will cause the total station to scan the perimeter of the defined surface. This is useful to visually check the perimeter of your surface when the laser pointer is activated on the total station.

[**Show Unit**]: This will cause the total station to scan a single horizontal/vertical interval. This is useful to visually check your interval settings when the laser pointer is activated on the total station.

[**Next >**]: Opens Surface Scan Statistics screen.

Surface Scan Statistics

[**Survey**] [**Surface Scan**] [**Next >**]

The Surface Scan Statistics screen displays details about the surface that was just defined.

Store Pts: This box should be checked to store the points that are shot during the surface scan. Enter the starting point number in the corresponding field.

[**Back**]: Returns to the previous screen.

[**Go >**]: Opens the Surface Scan Results screen

Surface Scan Results

[**Survey**] [**Surface Scan**] [**Next >**] [**Go >**]

The Surface Scan Results screen contains two cards that detail the progress of the surface scan. The Map card shows the points that were shot in green, points that have not yet been shot in gray and rejected points in red.

[**Stop**] (Results card): Will stop the surface scan.

[> **X,Y View**] / [> **X,Z View**] (Map card): Changes the orientation of the current view.

Quick Shot routine

Opens when you start the software, or when you press the STAR key from anywhere in the application.

This includes the following:

- No Job mode
- Job mode
- Quick Shot Settings
- Shell to external mode

No Job mode

On starting Survey Pro On board, the <u>No Job Mode</u> screen appears. You can:

- Take measurements, but not store points.
- Change instrument settings.
- Allow for the setting of circle.

HA: Horizontal angle.
ZA: Vertical angle.
SD (or HD/VD): Bold for current shot for 3 seconds to show the shot is new; then normal to show the data is old.

Note: SD (or HD/VD) from a shot initiated by the MSR2 key is prefaced with "*".

The icons on the screen are used as follow:
Circle: Select one of the following:

- **Circle 0**: The horizontal angle is set to 0. You are prompted to accept.
- **Circle Az**: You are prompted for the new horizontal angle reading. The instrument is set to this reading.

Turn to: Appears if the instrument supports motorized turning. There are two options:

- **Turn To**: Launch the Turn To screen.
- **Flip**: Change the face of the instrument.

Search: Appears if the instrument supports auto lock. There are three options:

- **Search**: Find a prism and lock onto it.
- **LockNGo**: Lock onto a prism and follow it.
- **Stop**: Stop tracking prism.

Open/New: Opens the Open/New Job screen.
Laser Pointer/**Tracklight**: Toggle between using the laser pointer or tracklight.
Lock: Toggle the prism lock state.
Close: Tap to exit the application.

Job mode

Once you have opened a job, you can:

- Perform station setup.
- Go to stakeout mode.
- Store sideshot or traverse shots or angle offset shots.

HA: Horizontal angle.
ZA: Vertical angle.
SD (or HD/VD): Current shot is bold until it is stored as a point. Non-bold values cannot be stored and the user is prompted to take a new shot.

Note: SD (or HD/VD) from a shot initiated by the MSR2 key is prefaced with "*".

The icons on the screen are used as follow:
Station setup: There are three options:

- **Stakeout**: Launches the Quick Stake dialog.
- **Station Setup**: Launches the Station Setup wizard.
- **Check Station**: Launches the Check Setup dialog.

Turn to: Appears if the instrument supports motorized turning. There are two options:

- **Turn To**: Launch the Turn To dialog.
- **Flip**: Change the face of the instrument.

Search: Appears if the instrument supports auto lock. There are three options:

- **Search**: Find a prism and lock onto it.
- **LockNGo**: Lock onto a prism and follow it.
- **Stop**: Stop tracking prism.

Store Sideshot: There are two options:

- **Sideshot**: Store the currently displayed data as a sideshot, and invalidate the distance.
- **Traverse**: Store the currently displayed data as a traverse shot, and invalidate the distance.

Laser Pointer/**Tracklight**: Toggle between using the laser pointer or tracklight.
Lock: Toggle the prism lock state.
Close button: Tap to go to the Survey Pro main menu.

Note: Taking a shot can be a two-step process, depending on the setting for the MSR key. First, initiate a measurement with the MSR key. Once the shot has returned data, it appears on the dialog. You can then store the displayed values as a sideshot or a traverse shot.

Quick Shot dialog settings

To open the dialog, tap the settings icon in the title bar.

Display: Options are HA,ZA,SD or HA,HD,VD. Controls the values that appear in the Quick Shot screen.
MSR Key: There are two options:

- **Measure Only**: When the MSR key is pressed, a measurement is initiated but no shot is stored.
- **Measure and Store**: When the MSR key is pressed, a measurement is initiated and a sideshot is stored if a JOB is open.

Note: The MSR2 key always operates in **Measure and Store** mode.

Shell to External Mode

Tap the Data Collector icon to open the Data Collection mode screen. This enables you to use an external data collector.

[Exit and Go Robotic…]: Tap to change the radio channel and ID before the software is set to the internal radio and exits the software.
[Exit and Go RS232 / USB]: Exits the application.

Quick Stake Routines

Quick Stake enables you to quickly and simply stake out and store a point and will work for both motorized instruments with AutoLock capability and conventional mechanical total stations:

- Quick Stake States
- Operating Quick Stake
- Stakeout settings

Note: For a description of common controls, see Quick Shot.

Quick Stake States

Blank: When no valid design point has been entered when it first started.
ANGLE TO TURN TO, DISTANCE: Once a valid point has been entered and an angle reading is received from the instrument, Angle to Turn To appears with an arrow icon and the angle itself is in the current angle unit. When the instrument is turned to the left by hand, the instrument operator sees the angle count down to 0 and past 0 and the angle increases while the left arrow icon changes to a right arrow icon .

Note: If the instrument has servo motors, tap the turn icon so that the instrument can turn to 0 by itself.

COME/GO, LEFT/RIGHT, CUT/FILL: Tap the MSR button to shoot the target. If a slope distance is available, it

goes into the third state and shows stakeout information of Come/Go, Left/Right, and Cut/Fill.

The icons on the screen are used as follow:
Survey: There are two options:

- **Survey**: Return to Quick Shot quickly.
- **Check Station**: Launches the Check Setup dialog.

Turn to: Appears if the instrument supports motorized turning. There are two options:

- **Turn To Line**: Turn the instrument to turn point 2D.
- **Turn to**: Starts the Turn To dialog.

Search: Appears if the instrument supports AutoLock. There are three options:

- **Search**: Find a prism and lock onto it.
- **LockNGo**: Lock onto a prism and follow it.
- **Stop**: Stop tracking prism.

Store: There are two options:

- **Store**: Store the staked point with a description.
- **Store Sideshot**: Store the point just shot as a sideshot point with sideshot raw data records, but not as a staked point.

Note: The Design point name will be incremented by 1, to allow convenient staking of the next point.

The following icons may appear:
(Green arrow, left) GO LEFT within Point Tolerance you specified in Stakeout Settings.
(Green arrow, right) GO RIGHT within Point Tolerance you specified in Stakeout Settings.
(Yellow arrow, left) GO LEFT, larger than Point Tolerance; less than 0.3 meters (1 foot) in horizontal distance.
(Yellow arrow, right) GO RIGHT, larger than Point Tolerance; less than 0.3 meters (or 1 foot) in horizontal distance.
(Red arrow, left) GO LEFT, larger than than 0.3 meters (or 1 foot) in horizontal distance.
(Red arrow, right) GO RIGHT, larger than than 0.3 meters (or 1 foot) in horizontal distance.
(Green arrow, down) COME, within Point Tolerance you specified in Stakeout Settings.
(Green arrow, up) GO, within Point Tolerance you specified in Stakeout Settings.
(Yellow arrow, down) COME , larger than Point Tolerance; less than 0.3 meters (1 foot) in horizontal distance.
(Yellow arrow, up) GO, larger than Point Tolerance; less than 0.3 meters (or 1 foot) in horizontal distance.
(Red arrow, down) COME, larger than 0.3 meters (or 1 foot) in horizontal distance.
(Red arrow, up) GO, larger than 0.3 meters (or 1 foot) in horizontal distance.
(Brown triangle, plus sign) FILL, that is, the point shot is below the Design point.
(Blue triangle, minus sign) CUT, that is, the point shot is above the Design point.

Operating Quick Stake

Prerequisites: Open a job. Make sure that backsight and occupying have been solved.

1. *Pick a design point*: Enter the point, tap the map button to pick it from a map, or select the map from the drop-down list.
2. *Turn to the design point*: Turn the instrument to the angle as its reading counts down to zero degree. If the instrument has servo motors built-in, tap the Turn To Line icon.

3. ***Tap the MSR key to measure to the rod***: Quick Stake goes into COME/GO, LEFT/RIGHT mode and shows a CUT/FILL.
4. ***Store the staked point***: Tap Enter or the stake icon. You are prompted to store the point as a new point. A description defaults, based on one of the following selections:
   - Design point's description.
   - PT and the design point name.
5. ***Stake Next, exit***: When you have stored the point, a new design point is already entered into the Design Point field and ready to be staked. The dialog has already been changed from "COME/GO, LEFT/RIGHT, CUT/FILL" to "ANGLE TO TURN TO, DISTANCE".

Stakeout settings

To change the stakeout settings, tap the Settings icon.

Live update fields

This option enables you to update fields automatically with live data from the instrument. A **[Start / Stop]** button allows you to toggle the field between live mode and data entry mode. When a field is in live mode, it is updated constantly and cannot be edited.

Only one field can be live at a time.

Hotkeying to a new dialog and starting a live field, will stop any live fields on the previous dialog.

Angle/Direction fields: Populated with angle and direction information.

Distance fields: Populated when new shot data comes in (either from a continuous measurement, or a single measurement initiated by the user). The fields are populated with the HD or VD converted from the returned SD (adjusted for earth curve, PPM, and prism constant). HI and HT are ***not*** taken into account.

Location/Elevation fields: Only show Start/Stop once a Backsight setup is completed. After a Backsight setup is completed, the fields populate when shot data comes in (either from a continuous measurement, or a single measurement initiated by the user). These fields do take HI and HT into account.

MSR/MSR2 Key Support

The following table lists the routines that support MSR/MSR2 keys to take shots:

- The MSR key takes a shot with the currently selected SmartTarget.
- The MSR2 key takes a reflectorless shot with a 0.0 prism constant and a 0.0 height of rod. It also stores the shot as a Sideshot (if able) when used in the [Traverse/Sideshot](#) and [Quick Shot](#) routines.

Note: For Spectra Precision Focus 30 Stakeout functions, if you want to use the MSR key to update shot data, you must set **Use Manual Updating (Remote Control)** option for MSR key support in the [Stakeout Settings](#).

Routine	MSR Supported	MSR2 Supported

Live Fields	Yes	Yes
Quick Shot	Yes	Yes
Quick Stake	Yes	No
Repetition Shots (Shot Prompt)	Yes	No
Remote Shot	Yes	No
Survey\Traverse/Sideshot	Yes	Yes
Stakeout\Stake Points	Yes	No
Stakeout\Stake List of Points	Yes	No
Stakeout\Stake To Line	Yes	No
Stakeout\Offset Staking	Yes	No
Stakeout\Slope Staking	Yes	No
Stakeout\Point Slope Staking	Yes	No
Stakeout\Line and Offset	Yes	No
Stakeout\Curve and Offset	Yes	No
Stakeout\Spiral and Offset	Yes	No
Stakeout\Show Station	Yes	No
Stakeout\Stake DTM	Yes	No
Stakeout\Station Staking	Yes	No
Roads\Road Stakeout	Yes	No
Roads\Slope Staking	Yes	No
Roads\Show Station	Yes	No

The items available in the Survey Menu with the GNSS module depend the current state of the setup. There are four states:

- No RTK survey is setup.
- Base is set up, but the rest of the RTK survey is not set up.
- Base and rover are setup, but the required calibration is not yet solved.
- Setup complete (base, rover, and calibration).

The Survey Menu contents are listed below for each of the four states.

Survey Menu
RTK GNSS Mode
(Survey not in Session)

GNSS Status Index
Start Survey Index
Start Base Index
Projection Index
Import GNSS Control
Receiver Information
Projection Calculator Index
File Management

Survey Menu
RTK GNSS Mode
(Base Set Up, but Survey not in Session)

GNSS Status Index
Start Survey Index
Base Info
End Survey
Projection Index
Import GNSS Control
Receiver Information
Projection Calculator Index
File Management

Survey Menu
RTK GNSS Mode
(Base and Rover Set Up, but required calibration not yet solved)

GNSS Status Index
Solve Calibration Index
Base Info
End Survey
Projection Index

[Import GNSS Control](#)
[Receiver Information](#)
[Projection Calculator Index](#)
[File Management](#)

Survey Menu
RTK GNSS Mode
(Survey in Session)

[GNSS Status Index](#)
[Traverse Base](#)
[Data Collection Index](#)
[Resume Survey](#)
[End Survey](#)
[Control Points Index](#)
[Quick Codes](#)
[Base Info](#)
[Projection Index](#)
[Remote Elevation](#)
[Import GNSS Control](#)
[Receiver Information](#)
[Projection Calculator Index](#)
[File Management](#)

[Main Index](#)

Survey Menu
Post Processing Mode

[GNSS Status Index](#)
[Start Static](#)
[Occupy (Static)](#)
[Start Stop/Go](#)
[Occupy (Stop/Go)](#)
[End Recording](#)
[Receiver Information](#)
[File Management](#)

[Main Index](#)

Start Survey at Base Index

[Start Survey at Base](#)
[Connect to Base](#)
[Projection Prompt](#)
[Set Base Receiver](#)

Receiver Antenna
Select Base Point

Connect to Rover
Set Rover Receiver
GNSS Resection / Backsight
Occupy Control Set Up
Occupy Control Point
Check GNSS Resection/Backsight
Occupy Check Setup
Occupy Check Point
Solve Calibration Results

Start Survey Index

Start Survey at Rover
Connect to Rover
Projection Prompt
Set Rover Receiver
Select Base Point at Rover
GNSS Resection / Backsight
Occupy Control Set Up
Occupy Control Point
Check GNSS Resection/Backsight
Occupy Check Setup
Occupy Check Point
Solve Calibration Results

Start Survey Solve Calibration Index

GNSS Resection / Backsight
Occupy Control Set Up
Occupy Control Point
Check GNSS Resection/Backsight
Occupy Check Setup
Occupy Check Point
Solve Calibration Results

GNSS Status Contents

GNSS Status
Receiver Card
Data Link Card
Cell / IP Modem Card
Post Process Card
Sky View Card
Sat Info Card
Position Card

GNSS Data Collection Contents

Control Points Contents

Projection Contents

Projection Calculator Contents

GNSS Status

[**Survey**] [**GNSS Status**]

The GNSS Status screen contains several index card-format screens providing real time status of the active receiver.

Receiver

The Receiver card displays information about the receiver mode and GNSS solution quality.

Mode: Displays if the receiver is set to Off, Base, Rover, or Post Processing mode.

Memory: Displays the amount of memory remaining in the receiver's internal storage card.

Battery: Displays the remaining battery charge in the receiver.

Satellites: Displays the number of satellites:

- **Used**: By the receiver for the current GPS solution.
- **Locked**: (Tracked) by the receiver.

[**Reset Ambiguities**]: Used to reinitialize the receiver's RTK engine.

Solution: Displays the type and quality of solution. It will be one of the following values:

- **No Communication**: Not receiving a response to commands.
- **No Data**: Receiving an unknown or a bad response to commands.
- **No RTK Solution**: Receiving a response, but the receiver is not computing a solution.
- **Autonomous**: Receiving a stand-alone solution (accuracy is about 100 meters).
- **Code**: The receiver is calculating a code differential solution (precision is about 1 to 10 meters).
- **Float**: The receiver is calculating a carrier phase differential solution with float ambiguities (precision is typically within 0.1 m to 0.5 m).
- **Network Float**: The receiver is calculating a carrier phase differential solution using NTRIP network corrections with float ambiguities (precision is typically within 0.1 m to 0.5 m).
- **Fixed**: The receiver is calculating a carrier phase differential solution with fixed ambiguities (precision is typically within 15 mm).
- **Network Fixed**: The receiver is calculating a carrier phase differential solution using NTRIP network corrections with fixed ambiguities (precision is typically within 15 mm).

Vector Length: Displays the length of the vector from base to rover when the solution type is RTK fixed or float. If the solution is not a network RTK solution, then the PPM value of the vector length is also displayed.

H Precision: Displays the root mean squared (RMS) error of the horizontal solution reported by the receiver. It is displayed in project units.

V Precision: Displays the RMS error of the vertical solution reported by the receiver. It is displayed in project units.

Note: This value is supplied by the receiver, and the software displays the receiver's value without modification. Most manufactures report this value at the 2 or 3 sigma level. However, since different manufacturers use different statistical methodology, it is not necessarily valid to compare the RMS values between brands, or even between models with different firmware.

HDOP: Displays the Horizontal Dilution of Precision. It is a measure of the geometrical quality of the solution. DOP has no units and lower numbers indicate better solution geometry.

VDOP: Displays the Vertical Dilution of Precision. It is a measure of the geometrical quality of the solution.

PDOP: Displays the Position Dilution of Precision. It is a combination of HDOP, VDOP and Time Dilution of Precision. It will always be larger than HDOP and VDOP.

Data Link

The <u>Data Link</u> card displays information about the base to rover communications when the modem is a radio.

Receiver mode: See the [Receiver](#) card.

Modem Reception: Displays two values indicating the data modem signal quality. This information is only displayed if the receiver is in rover mode.

Signal Latency: Displays the age of the differential correction used in the current GNSS solution.   This value should be one second or less for good RTK solutions. If this value is consistently greater than one second, check the data modem link.

Reception: Displays the receiver's estimation of the percent quality of the radio link.

Modem Settings: Displays the current modem settings

Channel: The radio modem channel.

Sensitivity: Displays the modem sensitivity (squelch).

Configure Modem...: Opens the [Radio Settings](#) screen where you can change the radio channel and sensitivity settings.

Cell/IP Modem

The <u>Cell/IP Modem</u> card displays information about the base to rover communications when the modem is a cell phone or internet modem.

Receiver mode: See the [Receiver](#) card.

Modem Reception: Displays two values indicating the data modem signal quality. This information is only displayed if the receiver is in rover mode.

Signal Latency: Displays the age of the differential correction used in the current GNSS solution.   This value should be one second or less for good RTK solutions. If this value is consistently greater than one second, check the data modem link.

Reception: Displays the receiver's estimation of the percent quality of the radio link.

[**Dial**]: Dials the cell phone or IP modem using the configuration set in the [Cell Phone Settings](#) or [IP Modem Settings](#) screen, respectively.

[**Hang up**]: Disconnects the cell phone or IP modem connection.

Post Process

The <u>Post Process</u> card displays information about GNSS raw data logging for post processing.

Note: Some GNSS receivers monitor post processing session status while others simply record event markers in the log file. If your receiver does not monitor sessions, some fields are not displayed.

Status: displays information about the recording. It will be one of four values

- **No Communication**: Not receiving a response to commands.
- **No Data**: Receiving an unknown or a bad response to commands.
- **Recording**: A file on the receiver or in the data collector is open and recording GNSS raw data. If this receiver monitors sessions, this field will display: session in progress when a session is ongoing.
- **Not Recording**: No file is open and there is no raw data recording.

Last Site ID: Displays the Site ID of the current session if a session is in progress. If your receiver does not monitor sessions, the Site ID is the last Site ID used by the software.

Interval: Displays the current recording interval set in the receiver.

Remaining: Displays the time remaining in the current session if a session is in progress. This field only shows when your receiver times sessions counting down.

Elapsed: Displays the time elapsed since this receiver was put into static mode, if a session is in progress. This field only shows when your receiver times sessions counting up.

Free Memory: Displays the amount of memory remaining on the disk where post processing data is stored. This will usually be the receiver's built in memory or the receiver's removable memory card. For some brands and models, this may be disk space on the data collector.

HDOP: / **VDOP**: / **Satellites Used**: / **Satellites Locked**: See the [Receiver](#) card.

Sky View

The Sky View card displays a plot of the satellites tracked and the elevation mask boundary.

SV Used: **/** **SV Lock**: See the [Receiver](#) card.

Elev Mask: Displays the elevation mask for satellite tracking currently set on the General card of the Receiver Settings screen.

Reset Mask:

Elev Mask: Displays the elevation mask currently set on the General card of the Receiver Settings screen. For receivers that support changing the elevation mask outside of receiver setup, you can enter a new value here and tap [**Reset Mask**].

Reset Mask: Changes the current elevation mask to the value entered in the **Elev Mask** field.

Note: If the receiver setup has not yet been performed, the elevation mask will not be displayed. Also, if you have changed the elevation mask setting, and have not yet reconfigured this receiver, the value you see on this display will be the value from the settings, and not the value the receiver is currently using.

Sat Info

The Sat Info card displays signal quality information for the satellites used by the receiver, and allows you to disable tracking specific satellites, which is useful if the receiver is tracking a 'noisy' satellite.

SNR Plot tab: This tab lists all the satellites that are in view and shows a bar graph that indicates the signal-to-noise ratio. A longer bar indicates more noise, and a lower-quality signal.

USI: The universal identifier number of the satellite that you wish to disable or re-enable. For GPS satellites, this will be the Pseudo Random Noise (PRN) number and will be between 1 and 37. For GLONASS satellites, this will be the Frequency Channel Number (FCN) + 45, and will be between 45 and 70.

[**Disable**]: Disables the USI entered above. This satellite will then no longer be used in any solution until it is re-enabled.

[**Enable**]: Re-enables the USI entered above.

[**Enable All**]: Enables all the satellites that were disabled.

The following buttons appear only if the connected instrument supports GLONASS:

[**GLO On**]: Enables all GLONASS satellites.

[**GLO Off**]: Disables all GLONASS satellites.

Note: Depending on the receiver brand and model, the behavior of **[GLO On] [GLO Off]** and **[Disable] [Enable]** varies. For example, with some receivers you can enable a single GLONASS satellite using **[Enable]** after you have previously turned all GLONASS off, while with other receives, **[Enable]** will not affect GLONASS numbers if you have turned GLONASS off.

SV List tab: This tab lists signal quality information for each satellite being used, which is reported by the receiver. The columns available depend on the receiver being used. Consult your receiver's documentation for more information.

Position

The Position card displays your current position as well as your course and speed information if you are moving. The Position card will display one of three coordinates: WGS84 latitude, longitude, height; Local latitude, longitude, height; or Grid north, east, elevation.

Solution: See the Receiver card.

Latitude/Longitude/Height: or North/ East/ Elevation: displays the location of the receiver.

Heading: Displays your course over ground if you are moving. If your coordinate display is geodetic, this heading is with respect to geodetic north. If your coordinate display is grid, then this heading is with respect to grid north.

Speed: Displays your horizontal speed over ground if you are moving.

WGS84: Set the position display to show WGS84 latitude, longitude, and height. This option is always available.

Local LLh: Set the position display to show Local latitude, longitude, and height. This option is only available when you have a coordinate system selected and solved.

Note: Local LLh numbers make sense when in mapping plane mode. When using Ground – Default Ground Calibration mode, you should not use Local LLh display.

Grid: Set the position display to show Grid north, east, and elevation. This option is only available when you have a coordinate system selected and solved.

Starting a Survey

Start Survey at Base

[Survey] [Start Base]
When you are starting a survey at your own RTK base, select the **Start Base** menu item. You will first be prompted to select a receiver with the <u>Connect to Base</u> screen.

Connect to Base

The <u>Connect to Base</u> screen is used to select a base receiver to connect to, and to pick the format for base corrections. The display of the receivers to select list is identical to the <u>Receiver Settings</u> screen. Below the list of receivers, the modem type of the selected receiver is displayed. Depending on the modem type, additional settings may be displayed.

For Broadcasting Radio Modems
Correction Format: Is where you select the correction format of the base receiver broadcast. The formats available will depend on your brand and model.
Use CMR Station Index: Set a CMR station index, if you are using a CMR type correction format.

For Internet Modems
Select Network: Is where you select the network to use. When you select a network, the address, port, and correction format used by the network will be displayed.

[Connect>]: Connects to the selected receiver and advanced to the <u>Set Base Receiver screen</u>.

Note: If you have not already selected your projection mode, you will be prompted to do so with the <u>Projection Prompt</u> before the <u>Set Base Receiver</u> screen opens.

Projection Prompt

The <u>Projection Prompt</u> screen is used to select the projection mode to use for this survey.

Note: If you have previously checked the Don't Ask Me Again check box, this screen is skipped.

[Use Ground Calibration>]: Tap to launch the Start Survey wizard in default ground calibration mode. The Start Survey workflow (set base / rover, collect control, and solve calibration) will define the projection. In this mode, the next step will be to select to use a geoid model with the <u>Select Geoid screen</u>.
[Select a Mapping Plane>]: Tap to launch the <u>Select Coordinate System</u> screen. You must select a mapping plane zone to continue. Once you have selected a coordinate system, the Start Survey wizard advances to the next screen
Don't Ask Me Again: Check to start the survey with the method selected above, and subsequent instances of the start survey workflow will skip this prompt and start with the chosen method.

Note: To reset all optional messages, tap **[Reset Optional Messages]** on the <u>General Settings</u> screen.

Select Geoid

[**Start Survey Survey**] | **Projection Prompt**, or

[**Survey**] [**Projection**] [**Select Geoid…**]

The Select Geoid screen is used to choose a geoid model to use with the default ground calibration coordinate system.

[**Use a geoid model**]: Is where you select if you want to use a geoid. Leave this box unchecked if you want to use ellipsoid heights for the vertical coordinate.
[**Geoid Model**]: Select the geoid model from the list of available geoids.
[**File Name**]: Shows the geoid file descriptive name.
[**File**]: Shows the name of the file on the disk that matches the selected geoid record. If there are multiple files that match the selected geoid, then you may choose which file to use.

Set Base Receiver

The Set Base Receiver screen is used to enter the base receiver antenna and setup the base receiver hardware.
Base Receiver: Displays information about the status of the GNSS receiver.
Base Antenna: Displays information about the base antenna.
Antenna Type: Select the antenna type to use.
[**Setup**]: Tap to change the antenna for the base receiver. See Receiver Antenna.
Measure To: Specify the location on the antenna or receiver where the antenna height should be measured to.
Measured: Enter the distance from the ground to the *Measured To* location.
Post Processing Recording Interval: Sets the period for logging GNSS raw data for RTK + post processing. Set it to *Off* to disable post processing data collection.
[**Next >**]: Tap to open the Select Base Point screen.

Receiver Antenna

The Receiver Antenna screen is used to select the type of antenna used with the receiver, and to enter optional parameters for the antenna setup. This screen may be opened for the Base Receiver Antenna, Rover Receiver Antenna, or the Post Processing Antenna screen.
Antenna Type: Select the antenna type to use.
Measure To: Specify the location on the antenna or receiver where the antenna height should be measured to.
Measured: Enter the distance from the ground to the *Measured To* location
Radius: Shows the radius of the antenna from the measure to mark if the measure to mark is not for a true vertical height.
Offset: Shows the offset from the measure to mark to the L1 phase center of the antenna. The L1 phase center is the location that RTK fixed positions are measured to.

Note: If your antenna type is Manual, then the Radius and Offset fields will allow you to enter values, otherwise, they display the known values for the chosen antenna.

Serial#: Enter the serial number for the antenna. This information is optional, and is written to the raw data.
Notch: Enter the number of the notch you are measuring to for slant measure marks that have multiple notch points.

Note: When the measure to mark is true vertical; the Radius and Notch fields will not be available.

[**Set**]: Updates the receiver antenna settings with the values selected on this screen.

Note: When this screen is used by the RTK rover for updates of antenna height during a survey, the Set button will send the new antenna parameters to the receiver as well as updating the software's settings.

Select Base Point

The Select Base Point screen is used to choose the point in the job file where the base is located, or to store a new point for the base receiver setup location. When this screen is first opened, Survey Pro searches the job file database for a location matching the base receiver's current position. This screen will then open in one of three states:

- No matching base point
- One matching base point
- Multiple matching points

No Matching Base Point

This screen appears when the base receiver's location matches a single point in the job file.
Base is set on a new job point: Select this if the base is set up on a point that is not already stored in the job.
Base is set on an existing job point: Select this when the base is set up on a point stored in the job.
Base Point: Specifies the name of the base point. This is a new point name when the base is set on a new point or an existing point name when the base is set on an existing job point.

One Matching Base Point

This screen appears when the base receiver's location matches a single point that matches the base receiver position.
Base Point: Shows the name of the point matching the base receiver's location.
[**Change >**]: Changes this screen to the No Matching Base Point display described above where you can override the point selected to match the base receiver's location.

More Than One Matching Base Point

This screen appears when the base receiver's location may match more than one point in the job file.
Select a Base Point: Allows you to select a point from the dropdown list that contains all the matching points found in the job.
[**Change >**]: Changes this screen to the No Matching Base Point display described above where you can override the point selected to match the base receiver's location.

[**< Back**]: Return to the previous screen.
[**Next >**]: Sets the base receiver to broadcast corrections in the chosen format at the specified base point location, then opens the Connect to Rover screen.

Connect to Rover

The Connect to Rover screen is used to select a rover receiver to connect to. The display of the receivers to select list is identical to the Receiver Settings screen. Below the list of receivers, the modem type and correction format are displayed for radio modems. The Network and server type are displayed for internet modems.

[Connect>]: Connects to the selected receiver and advanced to the Set Rover Receiver screen.

Set Rover Receiver

The Set Rover Receiver screen is used to enter the rover receiver antenna and setup the rover receiver hardware.
Rover Receiver: Displays information about the status of the receiver.
Antenna Type: Select the antenna type to use.
[Setup]: Tap to change the antenna for the base receiver. See Receiver Antenna.
Measure To: Specify the location on the antenna or receiver where the antenna height should be measured to.
Measured: Enter the distance from the ground to the *Measured To* location.
Post Processing Recording Interval: Sets the period for logging GNSS raw data for RTK + post processing. Set it to *Off* to disable post processing data collection.
[**Finish**]: Tap to open the Data Collection screen. You can finish on this screen if the coordinate system and any required calibration are already solved.
[**Next >**]: Tap to advance to the GNSS Resection / Backsight screen if a calibration solution is required before data collection can begin.

GNSS Resection / Backsight

The GNSS Resection / Backsight screen is used to collect control points required to setup and solve the coordinate system before you can collect data with valid local coordinates.

GNSS Resection
This screen is called GNSS Resection when you have set the base on a new point. The number of control points required to solve the calibration is displayed.
[**Occupy Control >**]: Opens the Occupy Control Setup screen. When you have occupied enough control to solve the calibration, the Check GNSS Resection/Backsight screen opens.
[**Start Now**]: Solves a temporary calibration, which allows you to collect data before the calibration is fully solved, then opens the Data Collection screen. You must collect the required number of control at some point in order to get valid local coordinates for your GNSS data collected points.

GNSS Backsight
This screen is called GNSS Backsight when you have set the base on an existing point. The number of control points required to solve the calibration is displayed.
[**Occupy Control >**]: Opens the Occupy Control Setup screen. When you have occupied enough control to solve the calibration, the Check GNSS Resection/Backsight screen opens.
Use base as vertical benchmark: Check this box if the base is set up on a job point with an accurate elevation to include it for vertical control during calibration.
[**Start Now**]: Solves a temporary calibration, which allows you to collect data before the calibration is fully solved, then opens the Data Collection screen. You must collect the required number of control at some point in order to get valid local coordinates for your GNSS data collected points.

[**One Point**]: This will solve a valid calibration using the base point as the horizontal and vertical control point, then open the Data Collection screen.

Note: The **[One Point]** button appears in place of the **[Start Now>]** button when the conditions for One Point setup are met:

- You must be in Default Ground Calibration projection mode.
- You have started a new job with only one point, and that point was selected as the base point location.
- You cannot yet have a coordinate system initialized or solved.

Occupy Control Setup

The Occupy Control Setup screen is used to specify which job point with accurate NEE coordinates you are occupying and if you want to use the point for horizontal and/or vertical control in the calibration. The assignment of H and/or V can be modified later.

Point: Select the existing job point you are occupying.

H: Select this option if the point has good horizontal coordinates to use for horizontal control when localizing.

V: Select this option if the point has a good elevation to use for vertical control when localizing.

[Set HR]: Opens the Receiver Antenna screen where you can change the antenna setup and update the receiver.

[Start Control Point Occupy]: Opens the Occupy Control Point screen.

Note: A GNSS Control point is made up of a pair of job points which are linked together. One of the job points must be a grid point. The grid point can be derived from a key in or imported grid coordinate, or from a conventional measurement. The other job point must be a GNSS point. The GNSS point can be derived from a key in or imported geodetic coordinate, or from a GNSS measurement.

Check GNSS Resection / Backsight

The Check GNSS Resection / Backsight screen is used to occupy a check point in order to verify the quality of the calibration solution.

GNSS Resection / Backsight: The points used for the Resection (base setup on a new point) or the Backsight (base setup on an existing point) are shown in the display.

[**Occupy Check >**]: Opens the Occupy Check Setup screen to select an existing job file point and initiate an occupation to check the calibration. When you have occupied a check point for horizontal and vertical solutions, the Solve Calibration screen will open.

[**Start Now**]: Solves the calibration with the current control points, and opens the Data Collection screen. This calibration solution will use the minimum number of points required, so there will be no redundancy of the solution, and therefore no way to verify the results. You should occupy a check point at some time during the survey to check the quality of your solution.

[**One Point**]: Solves a valid calibration using the one control point collected, then open the Data Collection screen.

Note: The **[One Point]** button appears in place of the **[Start Now>]** button when the conditions for One Point setup are met:

- You must be in Default Ground Calibration projection mode.
- You can have only two points in the job file. One point must be the control you just collected, and the other is a new point you chose as your initial base setup location.

- You cannot yet have a coordinate system initialized or solved.

[**<Back**]: Tap to return to the previous screen.

Occupy Check Setup

The Occupy Check Setup screen is similar to the Occupy Control Setup screen.
 [**Start Check Point Occupy**]: Opens the Occupy Check Point screen.

Solve Calibration - Results

The Solve Calibration Results screen is used to display the results of the GNSS Resection / Backsight, as well as make any changes to the horizontal and/or vertical control point assignments. You can also use this screen to access the Calibration Settings screen to input the calibration parameters manually.
 Before the Solve Calibration screen opens, the calibration is computed using all the assigned control points, and then the automatic blunder detection routine runs to detect obvious blunders in the solution. If blunders are detected, then you are prompted if you want to automatically remove the assigned points from the solution and resolve. If you tap [**Yes**], the dimensions (H and/or V) of the points detected as blunders will be unassigned and the calibration will be resolved. If you tap [**No**], then the results will open with all points still assigned with their original dimension in the solution.

GNSS Resection / Backsight: Displays the current status of the solution:
Green Light: If the calibration is solved and no blunders were detected, you will see a green light and the status line will show the root mean squared (RMS) error of the horizontal and vertical solution.
Yellow Warning Triangle: If the calibration is solved and no blunders were detected, but some of the points used have a large residual error, you will see a yellow triangle and the status line will show the point with the largest horizontal and/or vertical residual.
Red Stop Sign: If the calibration is solved, and blunders were detected that could not be clearly identified, or if you were prompted to remove blunders and you said no, then you will see a red stop sign and the status line will indicate there are possible blunders in the solution.
Yellow Arrow: If the calibration is solved, but the control points are not spaced far enough apart to run the automatic blunder detection, then you will see a yellow arrow, and the status line will indicate the poor geometry of the control points, or if the calibration fails to solve, you will see a yellow arrow and the status the status line will indicate the failure to solve the calibration.'

The list of GNSS control points is shown in the box, along with the horizontal and/or vertical assignment of each point. You can tap on the H and/or V column for each point to change the dimension assigned to use in the solution. You can double tap on any point to see details about that point. When the calibration is solved, you will see horizontal and vertical residuals (errors) in the columns for each point used for that dimension.
[**Add Point...**]: Tap to open the Occupy Check Setup screen where you can select additional points to add as control for the calibration solution.
[**Details ...**]: Tap to open the Projection Details screen and shows the exact numeric parameters of the pending calibration solution.
[**Resolve**]: Tap to recalculate the solution. This button appears if you change the horizontal or vertical control point assignments
[**Finish**]: Tap to apply the calibration solution and open the Data Collection screen.

Note: The calibration blunder detection routine will attempt to determine if there are any blunders in the GNSS control points used. This detection is done independently of the residuals of the least squares solution. The blunder detection routine is limited to a maximum of 15 GNSS control points. If you have more than 15 GNSS control points, the

blunder detection cannot run and you will see the yellow warning for your calibration solution status. You must evaluate the quality of the solution manually if this is the case.

Start Survey at Rover

[Survey] [Start Survey]
When you are starting a survey at the RTK rover, either because the RTK base is already set, or because you are using an NTRIP network for base corrections, select the **Start Survey** menu item. You will first be prompted to select a receiver with the [Connect to Rover](#) screen.

Connect to Rover

The <u>Connect to Rover</u> screen is used to select a rover receiver to connect to, and to pick the format for base radio corrections, or to pick the Network for internet corrections. The display of the receivers to select list is identical to the [Receiver Settings](#) screen. Below the list of receivers, the modem type of the selected receiver, and settings for that modem type are displayed.

For Broadcasting Radio Modems
Correction Format: Select the correction format of the base receiver broadcast. The formats available will depend on your brand and model. **Use CMR Station Index:** Set a CMR station index, if you are using a CMR type correction format.

For Internet Modems
Select Network: Is where you select the network to use. When you select a network, the address, port, and correction format used by the network will be displayed.

Note: If you have already set the correction format or Network, either by setting the base with this instance of the Start Survey workflow, or if you are reconnecting to the rover to resume a survey, then the Correction Format field displays the format currently in use.

[Connect>]: Connects to the selected receiver and advanced to the [Set Rover Receiver](#) screen.

Note: If you have not already selected your projection mode, you will be prompted to do so with the [Projection Prompt](#) before the <u>Set Rover Receiver</u> screen opens.

Set Rover Receiver

The <u>Set Rover Receiver</u> screen is used to enter the rover receiver antenna and setup the rover receiver hardware.
Rover Receiver: Displays information about the status of the receiver.
Antenna Type: Select the antenna type to use.
[Setup]: Tap to change the antenna for the base receiver. See [Receiver Antenna](#).
Measure To: Specify the location on the antenna or receiver where the antenna height should be measured to.
Measured: Enter the distance from the ground to the *Measured To* location.
Post Processing Recording Interval: Sets the period for logging GNSS raw data for RTK + post processing. Set it to *Off* to disable post processing data collection.

[**Next >**]: Tap to advance to the Select Base Point at Rover screen.

Select Base Point At Rover

The Select Base Point at Rover screen is used to choose the point in the job file where the base is located, or to store a new point for the base receiver setup location. This screen is similar to the Select Base Point screen described in the Start Survey at Base section.
Base Antenna: Displays information about the base antenna received at the rover from the broadcast stream.

Note: If your receiver brand is capable of getting the base antenna information from the data link, then the received height will be initialized here.

Antenna Brand: Select the brand of the base receiver antenna.

Note: If we do not know the base antenna brand, then this field will display 'Unknown', and the Antenna Type below will be 'Unknown External' with the height given to the base antenna phase center. If your base corrections are from a receiver of the same brand, or for most NTRIP networks, it is acceptable to leave this field as 'Unknown'. However, if you are doing base to rover RTK, and your base is of a different brand than the rover, or if your NTRIP network does not use a NULL antenna, then it is important to set the base antenna brand to avoid a vertical bias.

Antenna Type: Select the antenna type to use.
[**Setup**]: Tap to change the antenna for the base receiver. See Receiver Antenna.
Measure To: Specify the location on the antenna or receiver where the antenna height should be measured to.
Measured: Enter the distance from the ground to the *Measured To* location.
[**Finish**]: Tap to open the Data Collection screen. You can finish on this screen if the coordinate system and any required calibration are already solved.
[**Next >**]: Tap to advance to the GNSS Resection / Backsight screen if a calibration solution is required before data collection can begin.

Data Collection

The Data Collection screen is used to collect GNSS measurements and store new points in the job.
GNSS Status (at top of screen): Displays the current solution type, the data modem reception quality, the number of satellites used and the horizontal precision computed by the receiver. When this area is tapped, the GNSS Status screen will open.
Point: Enter the point name for the next point to be stored.
Desc: Enter the description for the next point to be stored.
[**Set HR**]: Displays the current antenna measurement and measure to setting. You can change the antenna measurement by entering a new value in the edit box. This new antenna height will be sent to the receiver with your next data collection point. You can change both the antenna measurement and measure to setting by tapping on Set HR to open the Receiver Antenna screen.
[**Traverse**]: Opens the Traverse Base screen.
[**Control**]: Opens the Control Points screen.
[**Topo SS**]: Stores a point with a single epoch of data. The current position is checked against the criteria, and if acceptable, the point is stored.

Note: The Topo SS function never puts the receiver in static mode, so the precision of the rapid side shot will be less

than a point occupied in static mode.

[**Feature**]: Opens the <u>Feature Collection</u> screen where various automatic and manual data collection options are available.
[**Offset**]: Opens the <u>Offset Shots</u> screen where a point can be collected and stored at a specified offset.
[**Point**]: Opens the <u>Occupy Data Points</u> screen used to occupy and store a new point.

Traverse Base

The Traverse Base routine provides an easy method to collect a point and then move your base to that point, or to move your base to any existing point in the current job.
[**Traverse Base >**]: Prompts you to move your base to another existing job point and then starts the <u>Start Survey at Base</u> wizard.
[**Occupy then Traverse >**]: Opens the <u>Occupy Data Points</u> screen and allows you to first occupy and store a new point. You will then be prompted to connect to your base and the <u>Start Survey at Base</u> workflow will open

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Feature Collection

[**Survey**] [**Data Collection**] [**Feature**]

The <u>Feature Collection</u> screen is used when you wish to set up automated continuous data collection.

Points to be Stored: Displays the starting point name and description of the group of points to be stored.

Method: Select the method of continuous data collection. The available methods are described below:

- **Time Interval**: After accepting the first point, additional points will automatically be stored after the specified time interval (in seconds) has elapsed. Each successive point name is incremented to the next available name.
- **Distance Interval 2D / 3D**: After accepting the first point, additional points will automatically be stored after traveling the specified horizontal or 3D distance. Each successive point name is incremented to the next available name.
- **Hold Still For**: After accepting the first point, additional points are automatically stored when the pole is held in the same spot for the specified interval of time (in seconds).
- **Manual: prompt once**: Stores points in the same way as tapping [**Topo SS**] from the <u>Data Collection</u> screen, incrementing the point name after each stored point.
- **Manual: prompt every point**: Performs the same function as the Manual Prompt Once routine, above, except you are prompted for a new description, layer, and feature code with each point stored.

Interval: Enter the interval criteria used for continuous collection modes. The Interval field is not available if either of the manual methods is selected.

Update Rate: Set the receiver to 1 Hz or 5 Hz mode. When 5 Hz is selected, the receiver will compute positions five times a second so the display will update in near real time and measurement latency will be minimized.

[**Start**]: Opens the <u>Occupy Data Points</u> screen where data can be collected.

Note: If you hotkey to another screen while using the <u>Feature Collection</u> routine, the <u>Feature Collection</u> screen will be suspended until you return to it.

Offset Shots

[**Survey**] [**Data Collection**] [**Offset**]

The <u>Offset Shots</u> screen is used to collect a point you cannot physically occupy with GPS. You can occupy a nearby point with the GNSS rover and then measure the offset distance and direction with tape and compass, or take a shoot with a laser range finder.

Offset Point: The point name of the offset point to be stored.

Description: The description of the offset point to be stored.

[**>Azimuth**] / [**>Bearing**]: The direction or bearing from the occupied point to the offset point.

[**Direction from Two Points**]: Used to compute the azimuth or bearing from the reference point to the offset point by occupying a second reference point on line with the offset point. Once tapped, a prompt opens for the name to store the reference point followed by the <u>Occupy Data Points</u> screen. After measuring the coordinate at the on line point, you will return to the <u>Offset Shots</u> screen where you will be prompted to pick the direction to the offset point.

[**>Zenith**] / [**>Vertical Dist**]: Enter the zenith angle or vertical distance from the occupied point to the offset point.

Slope Dist / **Horizontal Dist**: Enter the slope distance or horizontal distance from the occupied point to the offset point.

[**Occupy GPS**]: Occupy the GNSS reference point. A prompt for the name of the GPS reference point is followed by the <u>Occupy Data Points</u> screen. After measuring the coordinate at the occupied point, you will return to the <u>Offset Shots</u> screen where new points can be stored with a direction and distance from the occupied point.

[**Shoot Laser**]: Triggers the selected active conventional instrument to take a shot to the offset. You can select from a number of laser range finders available on the <u>Job</u> | <u>Settings</u> | <u>Instrument</u> screen when in conventional mode. The active instrument will always return a zenith and slope distance. The active instrument may return a horizontal angle, which will be treated as an azimuth.

Note: If your laser range finder has a compass, azimuth returned will be magnetic. Use the Instrument Settings screen for your laser range finder to set magnetic declination to apply to the angle. If you are using magnetic declination, the laser range finder magnetic bearing will be corrected to geodetic using magnetic declination, and then to grid using meridian convergence.

[**Store**]: Prompts you for a description, layer, and feature code (depending on your survey settings) for the new offset point, and stores the point for the current location.

Occupy Data Points

The <u>Occupy Data Points</u> screen is used to collect measurements to new points. This screen is used to occupy a point, occupy an offset reference point, and for feature collection.

Local Coordinates: Displays the local coordinates computed from the current geodetic measurement.

Solution Quality: Displays the quality of the current measurement: the solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. These values are explained with the <u>GNSS Status</u> screen.

Session Time: Displays the total occupation time so far for this measurement.

Count Status: Displays Measuring when you have current coordinates from the receiver and the screen is updating with the latest measurement. If you are using Epoch Averaging, Averaging is displayed after you tap [**Topo SS**] while the number of epochs is averaged in the software. Suspended is displayed if you are not receiving valid data from the receiver.

[**Topo SS**]: Prompts for description, layer, and feature code (depending on your Survey settings) for the new point, then returns to the previous screen.

[**GNSS Status**]: Opens the GNSS Status screen.

Control Points

[**Survey**] [**Control Points**] or

Data Collection [**Control**]

The Control Points screen is used to measure GNSS control points to use in the calibration adjustment, or to check the location of exiting points against GPS measurements and the latest coordinate system.

GNSS Status: Displays the current solution type, radio signal quality, number of satellites used, and the receiver's estimate of the horizontal precision of the current point. If this area is tapped, the GNSS Status screen will open.

[**Set HR**]: Displays the current antenna measurement and measure to setting. You can change the antenna measurement by entering a new value in the edit box. This new antenna height will be sent to the receiver with your next control or check point collection. You can change both the antenna measurement and measure to setting by tapping on [**Set HR**] to open the Receiver Antenna screen.

[**Projection**]: Opens the Projection screen.

[**View Points**]: Opens the View Coordinates File screen, where the project points can be examined.

[**Post Process**]: Opens the Receiver Session screen where you can occupy a point for a post processing only session. This allows you log a session in the post processing file using an existing point name without changing that point record in the job file.

[**Check**]: Opens the Check Control Point screen, where the local coordinate computed from the measurement is compared to the local coordinate's known value.

[**Control**]: Opens the Occupy Control Point screen, where geodetic coordinates are measured at a point with local coordinates and added to that point record in the job file.

Note: A GNSS Control point is made up of a pair of job points which are linked together. One of the job points must be a grid point. The grid point can be derived from a key in or imported grid coordinate, or from a conventional measurement. The other job point must be a GNSS point. The GNSS point can be derived from a key in or imported geodetic coordinate, or from a GNSS measurement.

Check Control Point

[**Survey**] [**Control Points**] [**Check Point**] or

Data Collection [**Control**] [**Check Point**]

The Check Control Point screen is used to check a control point. This is done when you want to verify the quality of the coordinate system solution.

Coordinates: Displays the local coordinates computed using the current measurement and the latest projection solution.

Solution Quality: Displays the quality of the current measurement: the solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. These values are explained with the GNSS Status screen.

Errors: Displays the differences between the computed local coordinates and the known coordinates for the control point.

Note: If the Errors are larger than the measurement precision of the instrument, you probably have a problem with your projection solution.

Session Time: Displays the total occupation time so far for this measurement.

Count Status: Displays Measuring when you have current coordinates from the receiver and the screen is updating with the latest measurement. If you are using Epoch Averaging, Averaging is displayed after you tap [**Accept**] while the number of epochs is averaged in the software. Suspended is displayed if you are not receiving valid data from the receiver.

[**GNSS Status**]: Opens the GNSS Status screen.

[**Accept**]: Writes the results to raw data and returns you to the Control Points screen.

Occupy Control Point

The Occupy Control Point screen is used to add geodetic coordinates to a known project point. The most common use of this screen is to measure control points for the calibration solution. This screen is also used by the Calibration Calculator routine for one point calibration setup.

Geodetic Coordinates: Displays the geodetic coordinates measured at the current local point.

Solution Quality: Displays the quality of the current measurement: the solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. These values are explained with the GNSS Status screen.

Control Point: Select if the current point is to be used for Horizontal control and/or Vertical control by tapping the appropriate checkboxes.

Session Time: Displays the total occupation time so far for this measurement.

Count Status: Displays Measuring when you have current coordinates from the receiver and the screen is updating with the latest measurement. If you are using Epoch Averaging, Averaging is displayed after you tap [**Accept**] while the number of epochs is averaged in the software. Suspended is displayed if you are not receiving valid data from the receiver.

[**GNSS Status**]: Opens the GNSS Status screen.

[**Accept**]: Adds the measured GNSS coordinates to the point record in the job file, and returns to the Control Points screen.

Resume Survey

[**Survey**] [**Resume Survey**]
(Available only when in RTK GNSS mode and a survey is in session.)

The Resume Survey routine is used to continue with a survey that has been interrupted.

[**Resume Survey**]: Tap to open the Connect to Rover screen, where you must select your RTK rover to connect to. Once the connection to the RTK rover is confirmed, you will be prompted if you want to:
[**Reset Rover**]: Opens the Start Survey at Rover workflow where you can restart the rover receiver.
[**Data Collection**]: Opens the Data Collection screen where you can continue to collect data.

End GNSS Survey

[**Survey**] [**End GNSS Survey**]

The End GNSS Survey screen is used to stop an active post processing Stop & Go recording session, or stop an RTK survey by hanging up an NTRIP connection, if applicable, and invalidating the rover setup. The initial screen lists all the activities that will occur if you choose to continue, which varies depending on the type of survey being ended.

If you choose to end a post processing session, the session is closed and if using a receiver that supports file downloads, a prompt will also occur asking if you want to download the file. If you choose to download the file, the File Management screen will open where you can download and manage existing files.

Quick Codes

[**Survey**] [**Quick Codes**]

The Quick Codes screen is used to rapidly take shots with different description codes.
GNSS Status (at top of screen): Displays the current solution type, the data modem reception quality, the number of satellites used and the horizontal precision computed by the receiver. Tap this area to open the GNSS Status screen.
Point: Enter the point name for the next point to be stored.

Note: If you specify an existing point in the Point field, you are prompted to overwrite or use the next available point. You will not have the option to store an observation.

[**Set HR**]: Displays the current antenna measurement and measure to setting. You can change the antenna measurement by entering a new value in the edit box. This new antenna height will be sent to the receiver with your next data quick code point. You can change both the antenna measurement and measure to setting by tapping **[Set HR]** to open the Receiver Antenna screen.

Tapping any of the buttons will store a point with the description of the button label. If the Occupy Point in Quick Codes box is checked on the Job | Settings | Surveying card, the receiver is put into static mode and the Occupy Data Points screen opens. If the box is not checked, the point will be stored with a single epoch of data from the receiver,

without going into static occupation mode. The point is stored with the description labeled on the button, for example, **[Ditch]** or **[TOPO]**. You can also tap **[Enter]** to store a point with the last used description.

Note: Storing points in this routine does not change the last user specified description used in any survey routine.

Note: To enter a new description, or edit an existing button description in the <u>Quick Codes</u> screen, tap and hold the button. The Quick Code button labels are saved in the \Program Files\Survey Pro\QuickCodes.ini file. You can copy these files from one data collector to another to preload the list.

Base Info

[**Survey**] [**Base Info**]

The <u>Base Info</u> screen is used to display the details about the currently set RTK base receiver. This menu item is not available when the base receiver is not yet set.
Base Point: Displays the current base point name..
Latitude: Displays the current latitude of the base point set in the software.
Longitude: Displays the current longitude of the base point set in the software.
Height: Displays the current height of the base point set in the software.
Antenna: Displays the details about the base receiver antenna.

Projection

[**Survey**] [**Projection**]

The <u>Projection Information</u> screen is used to select and solve the horizontal and vertical projections, which are used to transform GNSS measured WGS84 coordinates (latitude, longitude, height) into local coordinates (North,East,Elevation). The upper portion of the screen displays the status and details on the current projection mode.

The screen is also used to switch between <u>Mapping Plane Mode</u> and <u>Default Ground Calibration mode</u>. The buttons available will vary depending on the current projection mode.

Projection – Default Ground Calibration Mode

The <u>Projection</u> screen is described here for when the horizontal projection mode is set to **Default Ground Calibration**.

Use this setting when you want ground level coordinates, and there is no projection and no datum to define a geodetic coordinate transformation. In this mode, a default map projection is created with the first GNSS control point collected. You collect GNSS measurement on points with known local coordinates, and solve a calibration adjustment. The calibration adjustment will translate, rotate, and scale the default map projection's (y,x) into your local coordinates (N,E).

[**Show Details…**]: Opens the <u>Projection Details</u> screen, where the complete details of the calibration solution, reference map projection, and Geoid model are displayed.

[**Reset Origin…**]: Opens the <u>Calibration Set Zone</u> screen, where you can enter the parameters of the intermediate mapping plane to be used for the calibration adjustment.

Note: This step is usually not necessary, since the intermediate mapping plane is automatically set up by default using the location of the first GNSS control point collected in this job. However, if the first GNSS control point is far away (more than 10km), or it is considerably higher or lower (+/- 200m) you may wish to enter the parameters of the intermediate mapping plane.

[**Select Geoid…**]: Opens the Select Geoid screen, where you can select the geoid model to use with the default ground calibration. This button is active only when the intermediate mapping plane is not yet set up. To change the geoid once the default mapping plane is setup, use the [Reset Origin] button.

[**Solve Calibration…**]: Opens the Solve Calibration screen, where control points can be selected and the horizontal and vertical calibration are solved. This button is active only when the intermediate mapping plane is already set up.

[**Switch to Mapping Plane…**]: Switches the horizontal projection mode from Ground – Default Ground Calibration to Mapping Plane.

Projection Details

[**Survey**] [**Projection**] [**Show Details…**]

The Projection Details screen is used to view the numeric parameters of the current coordinate system solution. You can also choose to save the coordinate system to the data base from this screen.

[**Save System To Database**]: Saves the current projection record to a coordinate system database file. First, the current database file is checked for a matching record, and if found you will be prompted that you need not save the current coordinate system. If no matching record is found, then the current coordinate system will be saved as a new record. If a different record with the same name is found, you will be prompted to rename the current record before you can save.

Calibration Set Zone

[**Survey**] [**Projection**] [**Reset Origin…**]

The Calibration Set Zone screen is used to manually configure the parameters of the calibration reference stereographic projection. It is also used to select the geoid model to use with calibration coordinate systems.

Projection Origin: Set the origin coordinate for the default projection.

Latitude: Enter the origin latitude of the reference stereographic mapping plane. This is usually set at the latitude of the first GNSS control point.

Longitude: Enter the origin longitude of the reference stereographic mapping plane. This is usually set at the longitude of the first GNSS control point.

North: Enter the north coordinate at the origin of the reference stereographic mapping plane. This is usually the grid northing of the first GNSS control point.

East: Enter the east coordinate at the origin of the reference stereographic mapping plane. This is usually the grid easting of the first GNSS control point.

[**Origin Height**] / [**Origin Scale**]: Enter either the height or the scale factor used to reference the calibration system to

ground level.

[**Same as Base**]: Updates the values with the coordinate of the GNSS base station.

Use Geoid: Choose to use a geoid model with this zone. When this box is checked, you can select a geoid model from the dropdown list to use with the coordinate system. When this box is unchecked, no geoid will be used with the coordinate system. You can pick a geoid model from the database using the drop down box.

[**Database**]: Opens the Select Coordinate System screen where you can pick a reference stereographic map projection zone or a solved calibration site from the coordinate system data base file (.csd).

[**Reset**]: initializes a new calibration reference stereographic map projection with the input parameters.

Select Database

[**Survey**] [**Projection**] [**Reset Origin…**] [**Pick from Database**] [**Select Database…**]
or [**Survey**] [**Projection**] [**Select Zone**] [**Select Database…**]

The Select Database screen is used to select the coordinate system database to use. This screen will list all of the coordinate system database files (*.csd) you have in the program's directory. Highlight the .csd file you wish to use and tap ✅ to load the selected coordinate system database file.

Solve Calibration

The Solve Calibration screen is used to calculate a calibration solution using the currently assigned horizontal and vertical control points. This is the same screen as the Solve Calibration Results screen described in the start survey sections.

You can also use this screen to open the Calibration Settings screen, where you can modify the way a calibration is solved from control points, or manually input calibration parameters. To open the Calibration Settings screen, tap on the settings icon when the Solve Calibration screen is open.

Calibration Settings

The Calibration Settings screen is used to modify the default settings for solving a calibration from control points, or to manually enter calibration parameters from values.

Method: Select the desired state. The options are:

- Solve from control points. Use this state to select the settings to be used when solving the calibration from the GNSS control points.
- Key in parameters. Use this state to open interface that allows you to key in parameters for a calibration solution.
- Calibration calculator. Use this state to setup a Default Ground Calibration coordinate system that is parallel to a selected mapping plane grid, using a single GNSS control point to determine the translation between the two systems. This state is only available when your projection mode is set to Default Ground Calibration.

Solve H: Check this box to apply only the horizontal solution. The current vertical solution is maintained.
Solve V: Check this box to apply only the vertical solution. The current horizontal solution is maintained.

Solve from Control Points

Calibration scale

[Calculate scale from control points]: Select this option to calculate the best-fit scale parameter from the horizontal control points. This is the default setting
[Fix scale to 1.0]: Select this option to calculate a fixed scale calibration, where the rotation and translation are calculated from control points, but the scale is fixed to 1.0.

Note: When you are using Default Ground Calibration mode, a scale of 1.0 will give ground distance at the default origin height, which is usually the height of the first control point. You can modify the default calibration zone using the Calibration Set Zone screen. When you are using Mapping Plane mode, a scale of 1.0 will give you exact grid distances on the mapping plane.

Calibration origin

[Origin at centroid of control points]: Select this option to solve the origin parameter at the centroid of the horizontal control points. This is the default setting.
 [Select a point for calibration origin]: Select this option if you wish to override the default behavior of using the centroid of the control coordinates as the origin. You will need to assign an origin point below.
 [Origin Point]: Enter a point for the calibration origin. This point must be one of the active horizontal control points.

Key in parameters

The Key in parameters screen is used to input calibration horizontal and vertical parameters by hand. This can be done to copy a calibration solution between data collectors in the field, or to recreate a calibration solution from a raw data printout.

Horizontal Card

The Horizontal card is used to manually enter the six parameters of the horizontal calibration solution.

Scale: Enter the scale factor.

Rotation: Enter the rotation angle.

Translation (N,E): Enter the horizontal shift (N,E) from the intermediate map projection to the local coordinate system.

Origin N/E: Enter the origin location, in intermediate mapping plane coordinates, of the scale and rotation point.

Vertical Card

The Vertical card is used to manually enter the five parameters of the vertical calibration solution.

Slope N: Enter the slope of the inclined plane along the local north grid axis in parts per million.

Slope E: Enter the slope of the inclined plane along the local east grid axis in parts per million.

Separation: Enter the separation between the inclined plane and the local elevation.

Origin N / E: Enter the local origin (north,east) of the inclined plane.

[**Solve >**]: Updates the calibration solution using the values entered on the <u>Horizontal</u> and/or <u>Vertical</u> cards.

Calibration calculator

The <u>Calibration Calculator</u> screen is used to setup a calibration parallel to a selected mapping plane zone, or some arbitrary rotation, from a single control point.

Rotation: Enter the rotation angle used for the calibration. This angle should be the negative of the meridian convergence from your desired grid origin the default ground calibration zone. You can use the [Calc Rotation] function to set the calibration to be parallel to a mapping plane zone. Alternatively, if you have some other origin for the grid directions, such as a sun shot or the central meridian of a township, you can enter the convergence between that location and the origin of the default ground calibration zone.

[**Calc Rotation**]: Opens the <u>Projection Calculator</u> screen in calculate rotation mode. The results are filled into the Rotation field when you complete the calculation.

Base Station Local Coordinate: Enter the local plane coordinates of the base. If you set up on a new base point, these fields are blank and you need to occupy one control point to calculate the base station local coordinates.

[**Occupy Control**]: Opens the <u>Control Points</u> screen where you select a control point to occupy. When you are done, the base local coordinate is calculated using your entered rotation.

Projection – Mapping Plane Mode

The <u>Projection</u> screen is described here for when the horizontal projection mode is set to Mapping Plane. Use this setting when you want your coordinate system to be a conformal map projection chosen from the coordinate system database file.

Status Line: The text at the top of the screen describes the status of the horizontal projection solution.

[**Show Details…**]: Opens the <u>Projection Details</u> screen, where the complete details of the calibration solution, reference map projection, and Geoid model are displayed.

[**Select Zone…**]: Opens the <u>Select Coordinate System</u> screen where you can choose a zone or site from the data base, key in a custom zone, and delete zones or sites from the database.

[**Mapping Plane Ground…**]: Opens the <u>Ground Coordinates</u> screen where the grid to ground conversion parameters can be calculated and applied.

[**Solve Calibration…**]: Opens the <u>Solve Calibration</u> screen where control points can be selected and the horizontal and vertical calibration are solved.

[**Switch to Default Ground Calibration…**]: Switches the horizontal projection mode from Mapping Plane mode to <u>Ground Default Ground Calibration mode</u>.

Select Coordinate System

The <u>Select Coordinate System</u> screen is used to choose a mapping plane zone or localized site from the coordinate system database file. You can also open the <u>Key In Zone</u> wizard to create a new zone and datum with user specified

parameters.

Database: Select what type of coordinate system record to choose. You can:

- **Use Database Zone**: Displays controls to pick a map projection from the regions and zones in the database.
- **Use Database Site**: Displays controls to pick a localized zone based site from the Site region in the database.

Region: Select the region of the map projection zone.

Zone: Select the specific map projection zone.

Datum: View or select the horizontal datum for this zone.

Note: Some zones in the database may not have a default datum attached. In this case, the datum control is a list box and you must select from the data base datums before you can set the zone.

Use Geoid: Select to use a geoid model with this zone. You can pick a geoid model from the database using the drop down box.

[**Delete Zone**]: Deletes the currently selected site or zone.

Note: This delete function cannot be undone. Also, you cannot delete system database records. If you select a protected record, you will be prompted that the record cannot be deleted.

[**Key In Zone >**]: Tap to open the Key In Zone screen where you can create a custom map projection zone, ellipsoid and datum.

[**Finish**]: Accepts the currently selected zone and readjusts the job coordinates to the latest projection.

Key In Zone

[**Survey**] [**Projection**] [**Select Zone**] [**Key In Zone >**]

The Key In Zone wizard is used to generate a custom mapping plane zone.

Key In Zone - Setup

The Key In Zone Setup screen is used to pick the zone and datum type for the new zone, as well as set the azimuth orientation and grid direction for the new zone.

Zone Type: Select what kind of map projection to use for the new zone. The options are:

- Transverse Mercator.
- Lambert 1 Parallel
- Lambert 2 Parallel
- Stereographic / Oblique Stereographic
- Oblique Mercator Angle

Datum Type: Select what kind of datum to use for the new zone. The options are:

- **Pick from database**: Choose this option to add a data base datum and ellipsoid to the new zone

- **Custom Molodensky**: Choose this option to use a custom 3-parameter datum transformation, with either a custom ellipsoid or a data base ellipsoid.
- **Custom Similarity**: Choose this option to use a 7-parameter datum transformation, with either a custom ellipsoid or a data base ellipsoid.

Grid and Azimuth Parameters: is where you select the grid azimuth and the positive coordinate direction. The options are:

- **North Azimuth**: Set a north azimuth for your new zone.
- **South Azimuth**: Set a south azimuth for your new zone.
- **North/East Grid**: Set the coordinates increasing positive in the north, east direction
- **South/West Grid**: Set the coordinates increasing positive in the south, west direction.

Key In Zone - Mapping Plane Parameters

The Key In Zone Mapping Plane Parameters screen is used to enter the values for the map projection zone.

The parameters required depend on the zone type. They will include:

- **Central Longitude / Latitude**: Enter the geodetic origin of the map projection.
- **False Northing / Easting**: Enter the coordinate offsets at the origin of the map projection.
- **Scale factor**: Enter the scale factor of the map projection.
- **N / S Parallel**: Enter the north and south standard parallels of the map projection.
- **Azimuth**: Enter azimuth of the central line of the map projection.

Key In Zone – Oblique Mercator Settings

The Key In Zone Oblique Mercator screen is sued to set extra parameters when the Zone Type is set to Oblique Mercator Angle.

Azimuth At: Enter the convention for projection azimuth. The options are:

- Equator
- Center of Projection

Origin At: Enter the convention for projection azimuth. The options are:

- Equator
- Center of Projection

Rectify Coordinates: Set if the coordinates are rectified. Coordinates are 'rectified' if the local plane is rotated by the azimuth angle of the central meridian of the projection so that grid North lines up with geodetic north at the origin.

Key In Zone - Ellipse

The Key In Zone Ellipse screen is used to set or create an ellipse for a new datum. This screen is only displayed when Datum Type is Molodensky or Similarity.

Choose an ellipse for the new zone.

Ellipse from Data Base: Choose this option to use the selected data base ellipsoid.

Key in Ellipse: Choose this option to enter the values for the custom ellipsoid.

Values: Enter the values for the custom ellipse if you are not using Ellipse from List:

Ellipse a: Enter the semi major axis of the new ellipsoid.

Other Parameter: Select the other ellipse parameter to enter. You can use one of: Semi minor axis; Flattening; Reciprocal flattening; First eccentricity; First eccentricity squared; Second eccentricity; Second eccentricity squared.

Key In Zone - Datum Translation

The <u>Key In Zone</u> Datum Translation screen is used to enter translations when the Datum Type is Molodensky or Similarity.

Datum Translate From WGS84 To Local: Enter the three translations from WGS84 to the local datum.

Note: The sign convention for the datum translations is from WGS84 to the local datum. If your datum transformation is defined for local to WGS84, be sure to inverse values before entering in the software.

Key In Zone - Datum Rotation and Scale

The <u>Key In Zone</u> Datum Rotation and Scale screen is used to enter translations when the Datum Type is or Similarity.

Datum Rotations From WGS84 To Local: Enter the three rotations from WGS84 to the local datum.

Scale Factor (ppm): Enter the scale of the datum transformation from WGS84 to the local datum. The scale factor is entered in parts per million.

Note: The sign convention for the datum rotations and scale factor is from WGS84 to the local datum. If your datum transformation is defined for local to WGS84, be sure to inverse the values before entering in the software.

Key In Zone - Datum from Database

The <u>Key In Zone</u> Datum from Database screen is used to select a database datum when the Datum Type is Pick from Data Base.

Datum: Select the data base datum to use for the new zone.

Key In Zone - Results

The <u>Key In Zone</u> Results screen is used to review the values you input for the zone to be created.

[**Store**]: Opens a prompt to enter the region and zone of the new map projection zone, stores the named zone in the data base and sets the zone as the current projection record.

Ground Coordinates

[**Survey**] [**Projection**] [**Setup Ground Coordinates**]

The <u>Ground Coordinates</u> wizard is used to apply a switch between mapping plane grid and ground coordinates. This feature is only used when the horizontal projection mode is Mapping Plane.

Ground Coordinates - Setup

The <u>Ground Coordinates</u> Setup screen is used to toggle between grid and ground coordinates, and to select how to define the origin of the ground coordinate system.

Projection Definition: Choose how to represent the mapping plane coordinates. There are two options:

- **Use Grid Coordinates**: WGS84 geodetic coordinates will be transformed into mapping plane zone coordinates. Horizontal distances on the ground are usually scaled to the grid.
- **Use Ground Coordinates**: WGS84 geodetic coordinates will be transformed into ground scaled coordinates translated to a local origin. Horizontal distances on the ground are 1:1 on the grid, because the grid is scaled to the ground.

Ground Coordinates Origin: Select what point to use as the origin of the ground coordinate system relative to the origin of the mapping plane zone. The options are:

- **Origin at mapping plane origin**: Ground coordinate scale factor will be applied from the origin of the mapping plane zone.
- **Pick point to define origin**: Ground coordinate scale factor will be applied from a point selected from the job.
- **Key in coordinates to define origin**: Ground coordinate scale factor will be applied from a location entered by the user.

Ground Coordinates - Key In Origin

The <u>Ground Coordinates</u> Key In Origin screen is used to input the location of the ground coordinates origin. This screen is used when you select Key in coordinates to define origin on the Setup screen.

Project Location: Enter the local point from which the ground coordinate scale factor is to be applied.

Coordinate Type: Select the type of coordinates to enter. You can use WGS84 geodetic, local geodetic, or grid coordinates. This choice will affect the fields displayed below.

North/Latitude: Enter the northing / latitude of the local origin.

East/Longitude: Enter the easting / longitude of the local origin.

Elevation/Height: Enter the vertical coordinate of the local origin.

Ground Coordinates - Scale

The <u>Ground Coordinates</u> Scale screen is used to compute the scale factor to convert grid to ground coordinates for the reference height. This screen is used when you select either Key in coordinates to define origin or Pick point to define origin on the first page.

Reference Point Location (Local): Displays the local Latitude, Longitude, and Height of the ground origin point.

Scale Factor: Displays the inverse combined scale factor for this ground setup. This scale factor is automatically calculated based on the local ground origin.

Override scale factor: Where you can over ride the scale factor. Check this control to enable the scale factor edit field and enter any other scale factor.

Ground Coordinates - Location

The Ground Coordinates Location screen is used to define the local ground coordinate of the origin point. This coordinate will be used to calculate an offset from the mapping plane grid coordinates so that you can separate the grid and ground coordinates to make them recognizable. This screen is used when you select either Key in coordinates to define origin or Pick point to define origin on the first page.

Reference Point Location (Grid): Displays the local northing and easting of the ground origin.

Desired Local Ground Coordinate: Desired local northing and easting coordinate of the ground origin.

Ground Coordinates - Results

The Ground Coordinates Results screen is used to preview the values to be used for the ground coordinate system. This screen displays the parameters for the ground coordinate system. If the origin was set to use either Key in coordinates to define origin or Pick point to define origin on the first page, the values on this page are calculated from the parameters entered in the wizard. If the origin was set at the Mapping plane origin, then you need to enter the scale and offsets in the edit fields on this page.

Ground Offsets: Displays the shift applied to the mapping plane coordinates to get the desired local ground coordinate at the selected origin.

Scale: Displays the ground scale factor.

Remote Elevation

[**Survey**] [**Remote Elevation**]

The Remote Elevation screen is used to compute and store a new base point elevation and vertical site by occupying a known vertical benchmark at the rover.

Note: The Remote Elevation screen is only available when a geoid model is used for the vertical projection, the horizontal projection is already solved and the base and rover are set.

Base Point: Displays the current base point number and elevation details.

[**Info**]: Opens detailed information about the base point.

Add Benchmark Elevation: When selected, a new point will be created in the job file with the entered elevation. We will calculate (N,E) from the GNSS measurement(lat,lng) and store the new point with the entered Elevation.

Elevation: When Add Benchmark Elevation is selected, this is the elevation of the new point.

Select Point / **New Point**: Existing or new benchmark point name that you will occupy.

[**Set HR**]: Displays the current antenna measurement and measure to setting. You can change the antenna measurement by entering a new value in the edit box. This new antenna height will be sent to the receiver with your next data collection point. You can change both the antenna measurement and measure to setting by tapping on [**Set HR**] to open the Receiver Antenna screen.

[**Accept**]: Updates the projection with the vertical solution calculated from the control point observation and adjusts the job coordinates to the latest projection.

[**Occupy Benchmark**]: Opens the Occupy Control Point screen where the measurement is taken by the rover on the

remote benchmark. The New Elevation field of the <u>Remote Elevation</u> screen will then display the calculated elevation for the base point to be set on tapping [Accept].

Import GNSS Control

[**Survey**] [**Import GNSS Control**]

The <u>Import GNSS Control</u> wizard is used to merge an accurate NEE location (control point source) with a GNSS collected point in the job file. This point will then be designated as a GNSS control point and can be used to solve a calibration adjustment. Solving the calibration adjustment can be done automatically at the end of this wizard, manually after the end of this wizard, or at a later time. There are three methods to import the control point source:

- Import from an XML format 'OPUS Solution Report'
- Import from a text format 'NGS Datasheet' file
- Key in a coordinate in NEE, LLH WGS84, or LLH local

Select Points and Import Source

The first screen is used to select the job points you want to merge with accurate NEE coordinates to convert to GNSS control and select how you will enter the control point source to get the accurate NEE.

[**To/From…**]: Opens the <u>Select Point(s)</u> screen where you can select points by specifying a point range.

[**Tap Points…**]: Opens a map view where you can select points by tapping them on the screen.

Select a method…: Used to select from the following sources for accurate coordinates.

- OPUS Solution Results .xml file
- NGS Data Sheet .txt file
- Key In Coordinate

[**Next >**]: Opens one of two possible screens depending on the choice made for the *Select a Method...* field in the first screen.

Enter Control Coordinate – OPUS or NGS Data Sheet

The purpose of this screen is to pick a data sheet point or OPUS solution file to use as the control point source. This is the second screen that appears when either *OPUS Solution* or *NGS Data Sheet* was selected in the first screen.

Point: Displays the name of the selected job point that the control point source will be merged into.

Search this directory…: Displays the path to look for OPUS .xml or NGS .txt files

[**Browse**]: Opens a new screen where you can select a different path to search for OPUS .xml or NGS .txt files. On , all .txt files in the specified directory are read and any valid data sheet points that are within 100 meters are then put into the drop-down list below.

Select the RINEX file, or NGS data sheet point…: Allows you to select any valid data sheet point found from the drop-down list.

[**Details**]: Opens a screen that lists the selected OPUS Solution Report or NGS data sheet point details.

[**Next >**]: Opens the final screen.

Enter Control Coordinate – Key In

The purpose of this screen is to manually input the control point coordinates. This is the second screen that appears when *Key In Coordinate* was selected in the first screen.

Point (n / x): Displays the name of the selected job point that the control point source will be merged into. A counter is included where n is the number of points set so far, including the one you are working on, and x is the number of total points to set in this sequence.

Coordinate Type: Select the type of coordinates being entered (*Grid*, *Local LLH*, or *WGS84 LLH*). The selection made here determines the format for the following three fields.

Latitude / **North**: The Latitude / Northing of the control point source.

Longitude / **East**: The Longitude / Easting of the control point source.

Height / **Elevation**: The Height / Elevation of the control point source.

[**Next >**]: Restarts the wizard if more control points need to be set, or opens the final screen if all control points are set.

Review Results and Finish

The final screen of the wizard shows a preview of the control point coordinates to be created. If there is only one point selected, the <u>Single Point Results</u> screen will open. If there are multiple points selected, the <u>Multiple Points Results</u> screen will be open.

Single Point Results

This page displays the values to be used to create the new GNSS control point.

New GNSS Control Point to be Created: This shows the new NEE location for the selected point, the existing LLH location, the existing NEE location, and the deltas between the new and old locations. This will also include data sheet details if the control point source comes from an NGS data sheet or an OPUS Solution Report file.

Tap [Finish] to…: Determines what will occur after tapping Finish from the following options:

- Automatically solve calibration / calibration
- Open the solve calibration/calibration wizard
- Solve the calibration/calibration later

[**< Back**]: Opens a prompt asking if you want to reenter the control source for the selected point. If [Yes], the control point source is cleared for the point and the previous screen is open. If [No], we leave the control point source and go back to the selection screen.

[**Finish**]: See the section on *Finish* below.

Multiple Point Results

This screen displays the values to be used to create the new GNSS control points.

New GNSS Control Points to be Created: For all of the selected points, this list box shows the new NEE location, the existing LLH location, and the existing NEE location.

[**Show Details**]: Shows the same details for the selected point as the <u>Single Point Results</u> screen shows, described above.

[**Re-Enter**]: Clears the control point source for the selected point in the list box and returns to the previous screen.

[**< Back**]: Returns to the selection screen.

[**Finish**]: See *Finish,* below.

Finish

The finish behavior will be one of three cases:

1. Create the control points, solve the calibration with all job file control points, launch the projection readjust wizard and apply the updated calibration to the map projection zone.
2. Create the control points and open the solve calibration wizard.
3. Create the GNSS control points and exit the wizard.

Receiver Info

Access by tapping and holding the receiver in the <u>GNSS Receivers</u> screen
or select Receiver Info from the Survey menu.

The <u>Receiver Info</u> screen shows the following:

Name: Name of the receiver that is currently connected.
Model: Receiver model.
Capabilities: Icons show what the receiver is capable of:
⊤ : RTK rover operations.
⋏: RTK base operations.
⊤: Post-processing operations.
Serial Number: Receiver serial number.
Firmware Ver: The firmware version the receiver is currently running.
Additional Information: Depending on your brand and model, additional information about the receiver may be displayed here.

Projection Calculator

[**Survey**] [**Projection Calc**]

The <u>Projection Calculator</u> wizard is used to calculate scale factor or convergence (rotation) for any point on the selected mapping plane. You can use the computed values for calculations from the, Past Results power button option.

Projection: Displays the current mapping plane settings.

Select Point: Enter the name of the reference point where the rotation or scale is to be computed.

[**Calc Rotation >**]: Opens the <u>Projection Calculator</u> screen where the rotation is computed.

[**Calc Scale >**]: Opens the <u>Projection Calculator</u> screen where the scale is computed.

Projection Calculator – Rotation

Convergence: Displays the computed rotation from grid north to geodetic north.

Rotation: Displays the computed rotation from geodetic north to grid north.

[**< Back**]: Returns you to the first Projection Calculator screen.

[**Accept**]: Copies the two computed values to past results and returns you to the first Projection Calculator screen.

Projection Calculator – Scale – Height Correction

Ellipsoid Height: Enter the WGS84 ellipsoid height for your current location. This value will be used to calculate the height above the terrain component of the scale factor. This is sometimes referred to as the sea level correction.

[**< Back**]: Returns you to the first Projection Calculator screen.

[**Solve >**]: Takes you to the final screen.

Projection Calculator – Scale

Mapping Plane Scale Factor: Displays the computed mapping plane scale factor on the selected mapping plane at the reference point.

Ellipsoid Scale Factor: Displays the computed ellipsoid scale factor at the reference point.

Combined Scale Factor: Displays the Mapping Plane Scale Factor multiplied by the Ellipsoid Scale Factor. This is the ground to grid scale factor.

Inverse Combined Factor: Displays the inverse of the Combined Scale Factor. This is the grid to ground scale factor and is the value used in the calibration solution.

[**< Back**]: Returns you to the previous Projection Calculator screen.

[**Accept**]: Copies the two computed values to past results and returns you to the Main Menu.

File Management

[**Survey**] [**File Management**]

The File Management routine is used to manage post processing files on a supported GNSS receiver. The routine can delete post processing files from the receiver or recover files that were recently deleted. Post processing files can also be copied or moved from the receiver to the data collector for more convenient transfers to a PC.

Active Files tab: The Active Files tab lists the details of all the files that are currently on the connection target:

- If connected to the receiver, the files on the receiver's internal memory are listed.
- If connected to the SD card, it shows all SP1 files in the SD card slots.

Files can be selected from this list to delete or copy/move to the data collector.

Connected To: The drop-down list shows the current connection mode. The states are Receiver and SD Card:

- If you change from SD Card to Receiver, the system attempts to connect to the active receiver. If this fails, or if the active receiver is not a Trimble receiver or the Spectra Precision Epoch 25 receiver, a message appears, and the setting reverts to SD Card.
- If the change is successful the file list is repopulated with the appropriate files.

[Download Selected]: Tap to downloads the selected files to \Survey Pro Jobs.

Delete After Download: Select to delete the files after they are successfully downloaded to \Survey Pro Jobs.

Note: If your connection is to the SD card, or a Trimble receiver with firmware greater than version 3.8, a message appears to warn you that it is not possible to reverse the deletion.

[**Delete Selected**]: Deletes the selected files from the receiver. If your connection is to the SD card, or a Trimble receiver with firmware >= 3.8, then you see a message warning you that there is no undelete.

Recoverable Files tab: Lists the details of all the files on the receiver that were recently deleted. Files can be selected from this list and recovered.

Recover Selected File(s): Restores the selected files on the receiver.

Start Static

[**Survey**] [**Start Static**]

When you are starting a static post processing survey you will first be prompted to select a receiver with the [Connect to Post Process Receiver](#) screen.

Connect to Post Process

The Connect to Post Process screen is used to select a receiver capable of post process data logging. The function and interface of the list of receivers is described in the [Receiver Settings](#) screen.
 [Connect >]: Connects to the selected receiver and checks the post processing session status for that receiver. If the receiver is not currently logging data, the [Post Processing Start](#) screen opens. If the receiver is currently logging data, the [End Recording](#) prompt will appear.

Post Processing Start

The [Post Processing Start](#) screen is used to select the recording interval and begin logging on the receiver.
Recording Interval: Select the recording interval for post processing data collection.
Start Static: Start a post processing log file in Static mode, where the receiver will remain over a single point for the duration of the session. Once the file is begun, the [Static Receiver Session](#) screen opens.
Start Stop/Go: Start a post processing log file in Stop and Go mode, where the receiver will move between points,

and stay stationary on points of interest for periods of time during the survey. Once the file is begun, the Stop and Go Receiver Session screen opens.

Note: The location of the file is usually on the receiver's built in memory. However, some models support collection of post processing data to a file on the data collector. For those receivers that support it, the location of the log file is specified on the Receiver General Settings screen.

Note: The Post Processing screen is used to start a post processing only survey. If you wish to record post processing data simultaneous with RTK, then you should set the recording interval on the Set Base Receiver screen and/or the Set Rover Receiver screen when starting a RTK survey

Static Receiver Session

[**Survey**] [**Post Processing**] [**Start ... >**]
or [**Survey**] [**Occupy**]
The Static Receiver Session is used to enter the station name and antenna height for a static post processing occupation. This screen opens up after you have started a static session with the Post Processing Start screen, or if you tap **[Survey] [Occupy]** and you are connected to a receiver that is already logging static data.
Point : Enter the station name for the static session.
Description: Enter the description for the static session.
Antenna: Displays antenna setup for this receiver.
[**Set HR**]: Opens up the Receiver Antenna screen, where you can modify the antenna type and measurement for this receiver
[**Apply**]: Sends the current station and antenna information to the receiver.

Note: Some receivers cannot change the station name and antenna height of a session once it is started, therefore, this button may be disabled depending on your brand and model, and the state of the current post processing survey.

[**End Survey**]: Ends the static point occupation, and closes the file.

Start Stop/Go

[**Survey**] [**Start Stop/Go**]
When you are starting a stop and go post processing survey you will first be prompted to select a receiver with the Connect to Post Process Receiver screen.

Stop/Go Receiver Session

[**Survey**] [**Post Processing**] [**Start ... >**]
or [**Survey**] [**Occupy**]
or (in GNSS mode) [**Survey**] [**Control Points**] [**Post Process**]

The Stop/Go Receiver Session screen is used to mark the beginning and end of static segments during the stop and go post processing log file. You can enter the point name and descriptions of the static segments, as well as change the antenna height for occupations. This screen is also used in GNSS mode if you want to record an extra occupation to log file when logging post processing simultaneous with RTK.

Point : Enter the station name for the stop and go point.
Description: Enter the description for the stop and go point.
Session Duration: Allows you to specify how long you want each static occupation during the stop and go file to last.
Log Until Stop: Check this control to have the static occupation continue until you tap **[Stop]**. If this is unchecked, the static occupation will last as many minutes and seconds that you have set in the duration edit fields.
[**Start**]: Marks the beginning of a static point occupation with the entered *Site ID* and *Description*.

[**Apply**]: Updates the static occupation with any changes of the Site ID, Description, or antenna height. This button only appears after you have tapped [Start] to begin a static occupation, and only for brands and models that support this function.

[**Stop**]: Marks the end of the static occupation.

End Recording

[**Post Process**] [**End Recording**]
The End Recording menu is used to stop recording. When you tap **[End Recording]**, you are first prompted to select a receiver with the Connect to Post Process Receiver screen. If the selected receiver is logging data, you will be prompted to end logging with the End Survey screen.

Stakeout Menu

The <u>Stakeout Menu</u> contains a variety of stakeout routines, including offset staking.

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Note: The stakeout routines behave differently when running in remote control mode. For a description of this special mode, see the [Remote Control](#) section of the User's Manual.

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Stake Points

[**Stakeout**] [**Stake Points**]

The Stake Points screen allows you to stake a single point or a series of points.

Design Point: is the name of the first point that you want to stake.

Increment: when advancing to the next point, the point number is incremented by the value entered here. (A negative integer can be entered to have point numbers advance in descending order.)

[**Next Point >**]: advances the current Design Point by the Increment value. If that point does not exist and the Increment value =1, the Design Point is advanced to the next existing point.

Height of Rod: is the length of the rod.

[**Backsight…**]: opens the [Station Setup](#) screen.

[**Solve >**]: takes you to the second Stake Points screen where the distance and direction to the design point is displayed, see below.

📷: opens the Stakeout Settings screen.

Stake Points - Screen 2

Design point: displays the name of the design point that was entered in the first screen.

Description: displays the description assigned to the design point.

Angle Right: is the horizontal angle to turn to face the design point.

Horz. distance: is the horizontal distance from the occupy point to the design point.

Vert Distance: is the vertical distance from the occupy point to the design point.

ZE to Rod: is the zenith angle required to face the prism over the design point.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.
4. The first time [**Circle Zero**] is used during a stakeout session, a dialog will appear to warn that the original backsight reference will be lost.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the first screen.

[**Stake >**]: opens the third and final Stake Points screen where the shots to the stake point are performed.

Stake Points - Screen 3

Height of Rod: is the length of the rod.

Design Elev: displays the current design elevation, which can be modified with the [**Change…**] button.

FORWARD/BACK: indicates if the rod must move forward (toward the total station) or backward (away from the total station).

Go RIGHT/Go LEFT: indicates if the rod must move to the right or left from the total station's point of view.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

CUT/FILL: displays the required amount of cut or fill to bring the stake point to the design point's elevation.

Rod Elev: displays the elevation at the rod's location computed from the last shot.

[**Change…**]: is used to modify the current design elevation, which will also modify the associated CUT/FILL value for the current station being staked.

[**Shot**]: takes a shot to the prism and computes come/go, cut/fill information.

Shot data: displays the measurements from the last shot.

[**Store…**]: stores the stake point.

[**Store/Tape…**]: opens the Stake Out Point (Tape Offset) screen where the staked point can be stored that includes a specified offset. The default value is the appropriate distance correction to the design point.

[**Topo SS…**]: stores a side shot using the data from the last shot taken. (This will not take a new shot.)

[**Turn Instrument**]: (available with robotic total station) turns the total station toward the design point.

[**< Back**]: returns to the second screen.

[**Stake Next >**]: returns you to the previous Stake Points screen where the Design point is advanced by the Increment value.

Instrument Stakeout

Instrument Stakeout is a special stakeout option only available when using a Nikon DTM or NPL series total station while the Send Stakeout Data to Instrument option is checked in the Instrument Settings screen.

When using Instrument Stakeout, a new stakeout screen will appear after you tap [**Stake >**] from the Stake Points - Screen 2. The stakeout data is then sent to the total station where the controls on the total station are used to stake the point.

Once you are satisfied with the stake location, tap [**Take Final Shot >**] to shoot the final stakeout location and proceed to the Stake Points – Screen 3.

If you tap [**Shot**] from Screen 3 to take another shot, you will return to the Instrument Stakeout screen, where you can once again use the controls on the total station to stake the point.

HR: is the rod height.

[**Update HR on Instrument**]: If a new rod height is entered in the HR field, or if a new Smart Target is selected, this button sends the new HR information to the total station.

[**Take Final Shot >**]: Once you are satisfied with the stake location, this button will take a final shot before proceeding to the next Stake Point screen (Screen 3).

Remote Staking

[**Stakeout**] [**Stake Points**] [**Solve >**] [**Stake >**]

Performing stake out in remote mode is different from running in a non-remote mode because the feedback is continuous and provided in the rod's point of view instead of the total station's point of view.

When staking in remote mode, the first four shots taken in a row where no distance is returned will result in a beep to warn that the instrument has possibly lost track of the prism.

[**Done**]: when you are satisfied with the location of the prism, this button will open the final Stake Points screen where the staked point can be stored.

Stake List of Points Screen

[**Stakeout**] [**Stake List of Points**]

The Stake List of Points screen is used to stake points from a specified list of points. Points can also be selected by description or polyline.

[**To/From…**]: opens a window where a range of points can be defined. The points within the specified range can then be staked.

[**Tap Points…**]: displays a map of the current job. Simply tap the points that you want to stake and then tap 🟢.

🔽: Allows you to select points using a variety of other methods including: select all points; all control points; all non-control points; by description; or by polyline.

Design Point: displays the point to be staked. The initial Design Point is the first point of the selected polyline or point range.

[**Change Design Point…**]: opens the Edit Point List screen where the current point list can be edited.

Increment: is the number of points to advance from the Design Point after tapping [**Next Point >**]. (A negative integer can be entered to have point numbers advance in descending order.)

[**Next Point >**]: Advances the Design Point by the Increment and automatically solves to open the Stake List of Points screen where you can begin staking the point. The points are advanced in the same order that they were defined when the polyline was created or when the point range was defined.

Height of Rod: is the length of the rod.

[**Backsight…**]: opens the Station Setup screen.

[**Solve >**]: opens the next Stake List of Points screen where the current Design Point can be staked.

Note: The screens available after tapping [**Solve >**] or [**Next Point >**] are identical to Screens Two and Three in the Stake Points routine.

📇: opens the Stakeout Settings screen.

Edit Point List

[**Stakeout**] [**Stake List of Points**] [**Change Design Point…**] or

[**Stakeout**] [**Stake List of Points**] ▼ **Edit List**

The Edit Point List screen is used to modify the existing point list.

[**Remove**]: removes the selected point from the point list.

[**Clear All**]: removes all the points from the point list.

[**To Closest**]: is available only when the screen is accessed with the [**Change Design Point…**] button. This will automatically select the point in the point list that is nearest to the previously staked point, which is the selected point when the screen if first accessed.

[**<- Insert**] / [**<-Append**]: will insert the point specified in the corresponding field above the point selected in the point list. When <End> is selected, the point is appended to the end of the list.

[**Change to**]: is available only when the screen is accessed with the [**Change Design Point…**] button. This is used to stake the point currently selected in the point list.

Stake to Line

[**Stakeout**] [**Stake to Line**]

The Stake to Line screen allows you to locate any location in relation to a predefined line. The line can be defined by two points, a point and direction, a polyline or the centerline of an alignment. Distance, direction and cut/fill information is provided so the rod can locate the line by traveling the shortest possible distance (a perpendicular offset to the line).

[**> Define Line**] / [**> Polyline**]: When set to [**Define Line**] (shown here), a line can be defined by two points or a point and a direction. When set to [**Polyline**], (shown below) the line is defined by an existing polyline.

Start Point: defines the first point of the line to be staked.

[**> Point**] / [**> Direction**]: defines the second point on the line, or the direction of the line to be staked, respectively.

Begin Station: defines the station associated with the Start Point.

[**Tap Line…**]: displays a map of all the polylines and alignments in the current job. Simply tap the line that you want to stake to and then tap ✅.

[**To/From…**]: opens a window where a line can be defined by a range of points.

[**Backsight…**]: opens the Station Setup screen.

[**Stake>**]: takes you to the second Stake to Line screen.

Stake to Line- Screen 2

The second screen is where the staking is performed. The graphic display of this screen will change depending on how close the rod is to the specified line. The initial screen, that is displayed before a shot is performed, shows the position of the total station, the line of the backsight and the specified line to stake. Each type of graphic is displayed below.

HR: is the rod length.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

BACK / **FORWARD**: is the distance that the rod must travel BACK (away from the total station) or FORWARD (toward the total station) in order to occupy the specified line.

LEFT of Line / **RIGHT of Line** / **ON LINE**: is displayed if the rod is to the left or right side of the line, or is on the line. The LEFT and RIGHT side is determined as if occupying the Start Point and facing the Foresight Point or Direction of the line, specified in Screen 1. ON LINE is determined if you are within the Line Tolerance specified in the Stakeout Settings screen.

Offset Dist.: is the perpendicular offset from the specified line to the rod. This is the minimum distance that the rod must travel to occupy the line.

Station: is the station on the specified line where the offset occurs, relative to the Start Point.

Shot Data: displays the information measured by the total station during the previous shot.

Cut / Fill: displays the required amount of cut or fill to bring the stake point to the elevation of the reference line at the nearest perpendicular.

Note: If staking beyond the end points of the reference line, or if the reference line is defined by a 2D point, no vertical data is computed.

[**Meas**]: contains the information measured by the total station during the previous shot.

[**Shot**]: takes a shot to the prism.

[**< Back**]: returns to Screen 1.

[**Store**]: opens the Store Point screen so you can store the last point that was shot.

Remote Stake to Line

The contents of the Stake to Line screen when running in remote mode is nearly identical to running in non-remote mode except the graphic portion of the screen looks and behaves differently. Point the data collector toward the total station for proper orientation and the graphic tells you the direction to travel to reach the line in the shortest distance.

If the **Use Manual Updating (Remote Control)** field is checked in the Stakeout Settings screen, a [**Shot**] button will be available, which allows you to manually control when shots are taken.

Offset Staking

[**Stakeout**] [**Offset Staking**]

The Offset Staking screen is used to stake the center of a road, the road edge, the curb/ditch edge, or any offset at fixed intervals. An existing polyline, alignment, or a specified point range can define the centerline of the road.

The first Offset Staking screen is used to define the centerline of the road that you want to offset stake.

[**Tap Line…**]: displays a map of all the polylines and alignments in the current job. Simply tap the line that you want to offset stake and then tap ✅.

[**To/From…**]: opens a window where a range of points can be defined. The points within the specified range will define the centerline of the road to be offset staked.

Begin Station: is the station assigned to the first point of the selected polyline or point range.

[**Backsight…**]: opens the Station Setup screen.

[**Next>**]: takes you to the second Offset Staking screen.

Offset Staking - Screen 2

The second Offset Staking screen is used to define the cross section of the road that you want to offset stake.

**1/2 Road Width**: is the **L**eft and **R**ight width of the road, respectively, from the centerline to the edge of payment. (See diagram below.)

X-Slope (%): is the **L**eft and **R**ight slope of the road, respectively, from the centerline to the edge of payment.

Note: A negative slope will result in water running from the centerline toward the edge of payment.

Stake Curb / Ditch: When checked, a curb or ditch and an offset can be defined beyond the edge of the pavement.

[**Shape 1**]: ⟩⋯⟨ / [**…2**]: ⊐⋯⊏ / [**…3**]: ⊢⋯⊣ : when staking a curb / ditch, this button allows you to select the shape of the curb, ditch, or slope beyond the edge of pavement so cut / fill information can be computed on this surface if a random offset is specified. The selected shape is displayed by an icon next to the button, as well as with a bold line in the road's cross-sectional profile at the bottom of the screen.

Note: The selected Shape is irrelevant if a random offset is not specified since the nodes are always in the same place for each shape that uses the same Height and Offset values.

Height: is the height of the curb, ditch, or slope in feet or meters. A positive value is considered a curb and a negative value a ditch.

Offset From Edge of Road: is the distance that the curb or ditch extends from the edge of pavement.

Note: The specified curb or ditch height and offset will be applied to both sides of the road.

[**< Back**]: returns to the previous screen.

[**Next >**]: opens the next screen.

Offset Staking - Screen 3

The third Offset Staking screen is used to select the station and section of the road to be staked and to specify an offset distance from the design point.

Station to Stake: is the station to be staked.

Station Interval: specifies how far to advance from the current station to the next station.

[**Next Sta**]: advances the current station by the Station Interval.

Note: When advancing, if you want to also stake the locations where the alignment of the road changes, be sure to check the Stake "Corners", Not Just Even Intervals option in the Stakeout Settings card. Tapping the 🖼 button will access the Stakeout Settings.

[<<] / [>>]: These buttons are used to select the section of the road that you want to stake.

Offset: When checked, is the offset distance that will be applied to the selected design point. A positive offset extends from the design point away from the centerline. A negative offset extends towards the centerline.

Subgrade: When checked, allows you to specify a vertical offset from the actual node locations. Positive values result in the stake location occurring below the selected node. Negative values result in the stake location occurring above the selected node.

X-Slope (%): is the slope of the selected road section.

1/2 Road Width: displays the width of the selected road section defined in the previous screen. This value can quickly be edited from this field.

HR: is the rod height.

[**Backsight…**]: opens the Station Setup screen.

[**< Back**]: returns to the previous screen.

[**Solve >**]: opens the next screen.

Offset Staking - Screen 4

The fourth Offset Staking screen displays the information needed to aim the total station toward the selected design point.

Station: displays the current station and section of the roadway being staked and the current line segment type from the polyline that describes the centerline. If staking the center and an offset was specified, (To L) or (To R) is also displayed to indicate if the offset is to the left or right of the centerline, respectively.

Offset: displays the offset that is applied to the design point.

Slope: displays the slope of the road at the section being staked.

From Instrument to Design Point: displays the angle and distance information from the total station to the design point (plus offset if specified).

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the Stakeout dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the previous screen.

[**Stake >**]: opens the next screen.

Offset Staking – Screen 5

Height of Rod: is the length of the rod.

Design Elev: displays the current design elevation, which can be modified with the [**Change…**] button.

FORWARD / **BACK**: indicates if the rod must move forward (toward the total station) or backward (away from the total station).

Go RIGHT / **Go LEFT**: indicates if the rod must move to the right or left from the total station's point of view.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

CUT / **FILL**: displays the required amount of cut or fill to bring the stake point to the design point's elevation.

Rod Elev: displays the elevation at the rod's location computed from the last shot.

[**Change…**]: is used to modify the current design elevation, which will also modify the associated CUT/FILL value for the current station being staked.

[**Shot**]: takes a shot to the prism and computes come/go, cut/fill information.

Shot data: displays the measurements from the last shot.

[**Store…**]: opens the next screen.

[**Store/Tape…**]: opens the Stake Out Point (Tape Offset) screen where the staked point can be stored that includes a specified offset. The default value is the appropriate distance correction to the design point.

[**Topo SS…**]: stores a side shot using the data from the last shot taken. (This will not take a new shot.)

[**Turn Instrument**]: (available with robotic total station) turns the total station toward the design point.

[**< Back**]: returns to the previous screen.

[**Stake Next >**]: returns you to the second Offset Staking screen, without storing a stake point, where the Design point is advanced by the Increment value.

Offset Staking – Screen 6

This screen is used to describe the stake point before it is stored and select if the [Results](#) screen should be displayed.

Point: is the point name for the stake point being stored.

Description: is the description for the stake point being stored. The default description is the station, side, and distance from the centerline for the design point.

Show Results on OK: When this checkbox is checked, a [Results](#) screen will open after tapping ✅ from this screen.

Note: This screen will not appear if the *Write Cut Sheet Data Only (No Store Point)* checkbox is checked in the [Stakeout Settings](#) screen, although the [Results](#) screen will still appear if the *Show Results on OK* checkbox was never unchecked from this screen. (It is checked by default.)

Offset Staking – Stakeout Results

This screen shows detailed cut/fill values, which may be needed when marking a road or offset stake.

❌ (Close): returns you to the second [Offset Staking](#) screen where the *Design Point* is advanced by the *Increment* value.

Slope Staking

[**Stakeout**] [**Slope Staking**]

The Slope Staking screen is used to locate the catch points for a roadway in any terrain.

The first screen is used to define or select the line that describes the centerline of the road to be slope staked. An existing polyline or alignment can be selected, or a series of existing points can be entered to define the centerline.

[**Tap Line…**]: allows you to tap an existing polyline or alignment that defines the centerline of the road.

[**To/From…**]: allows you to enter a range of points to define the centerline of the road.

Begin Station: defines the station at the beginning of the centerline.

[**Backsight…**]: opens the [Station Setup](#) screen.

[**Next>**]: opens the [next screen](#).

Slope Staking - Screen 2

The second screen is used to describe the profile of the road.

1/2 Road Width: is the horizontal width of **L**eft and **R**ight sides of the road, respectively, from the centerline to the nearest edge of the curb or ditch.

X-Slope: is the cross slope of the **L**eft and **R**ight sides of the road, respectively. The slope is computed from (rise/run)x100. (A negative slope will cause water to run from the centerline toward the edge.)

Stake Curb / Ditch: When checked, this allows you to include a curb or ditch in the road profile.

Height: defines the height of the curb, or depth of the ditch. (A negative value would be used to define the depth of a ditch.)

Offset From Edge of Road: defines the width of the curb or ditch.

[**< Back**]: returns to the previous screen.

[**Next >**]: opens the next screen.

Slope Staking- Screen 3

Station to Stake: is the station that will be staked next.

Station Interval: is the value that is added to the Station to Stake after the [**Next Station**] button is pressed.

[**Next Station**]: advances the Station to Stake by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the [**Next Station**] button will also stop at any horizontal or vertical alignment node that falls within the interval.

Fill Slope: is the desired slope, calculated from run over rise, between the hinge point and catch point when the area requires a fill.

Cut Slope: is the desired slope, calculated from run over rise, between the hinge point and catch point when the area requires a cut.

Segment # (Fill HP): when the terrain requires a fill, you have the option to compute the hinge point from either side of the second segment. The option to use segment # 1 can simplify the situation where a ditch meets an area requiring a fill, which would otherwise result in an area with two similar or identical negative slopes.

[**< Back**]: returns to the previous screen.

[**Stake CP >**]: opens the next screen.

Slope Staking- Screen 4

The fourth screen is used to perform the actual slope staking shots.

Left / **Right**: displays if a Cut or Fill slope is being computed and if it is on the Left or Right side of the road, respectively.

Rod Elev: is the current elevation at the rod location.

Des. Slope: is the design cut or fill slope.

Obs. Slope: is the computed (observed) cut or fill slope based on the last shot and the corresponding hinge point.

Cut / Fill: is the cut or fill required for the current rod location to be positioned on the design slope.

Toward CL / Away CL: is the computed horizontal distance that the rod must move either toward the centerline or away from it, respectively, before it is positioned at the catch point.

Note: The computed horizontal distance is based on the observed terrain computed from the last two shots. If only one shot has been taken, it is assumed that the terrain is level when computing this value.

On Station / **Back Sta** / **Ahead Sta**: informs you if the rod is on the station being staked, or the distance it must move (parallel to the centerline) back or ahead to be on the correct station.

HD to HP: is the horizontal distance from the rod to the hinge point.

VD to HP: is the vertical distance from the rod to the hinge point.

HD to CL: is the horizontal distance from the rod to the centerline.

VD to CL: is the vertical distance from the rod to the centerline.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

[**Results**]: This will display the following additional cut, fill, and location information:

- Type of slope (e.g. left/right, cut/fill)
- Design and observed slope ratios (run over rise)
- Design and actual stations
- HD and Cut/Fill to Hinge Point
- HD and Cut/Fill to Center Line
- If applicable, HD and Cut/Fill to Edge of Pavement and Edge of Curb
- Name of segment and HD and Cut/Fill to that segment extremity (Road Slope Stake only)

Note: The [**Results**] button is only available from the <u>Store Catch Point</u> screen (Screen 5, below) when using GNSS or Remote mode, which is accessed after tapping [**Store >**].

The button described below selects which information is displayed on the screen from the following options:

- [**Vertical Map**]: displays a cross-sectional view at the current station.

Note: When you tap a map view, an expanded view of the same map will fill the screen.

Note: The Vertical Map will show an X at the location of each previous shot. This can be useful in determining if the current terrain will never intersect the slope (no catch point).

- [**Horizontal Map**]: displays an overhead view of the job.
- [**Shot Data**]: displays the shot data for the latest shot.

The button described below selects the type of slope that will be used between the catch point and hinge point from the following options:

- [**Automatic Slope**]: selects the slope that is nearest to the current rod position.

- [**Force CUT Slope**]: forces all computations to be based on a cut slope.
- [**Force FILL Slope**]: forces all computations to be based on a fill slope.

[**Topo SS…**]: will store the last shot taken as a side shot.

HR: is the rod height.

[**< Back**]: returns to the previous screen.

[**Store >**]: opens the next screen.

Slope Staking – Screen 5

The fifth screen is used to store a point for the last shot taken from the previous screen, which should be located at the catch point.

Point Name: is the name assigned to the stored point.

Description: is the description assigned to the stored point.

[**Results**]: This will display the following additional cut, fill, and location information:

- Type of slope (e.g. left/right, cut/fill)
- Design and observed slope ratios (run over rise)
- Design and actual stations
- HD and Cut/Fill to Hinge Point
- HD and Cut/Fill to Center Line
- If applicable, HD and Cut/Fill to Edge of Pavement and Edge of Curb
- Name of segment and HD and Cut/Fill to that segment extremity (Road Slope Stake only)

[**Store CP**]: stores the point.

Offset from CP: This field is used if you want to stake another location that is at the specified horizontal distance from the catch point away from the road.

[**Solve >**]: opens a new screen used to stake the point at the offset specified above.

[**< Back**]: returns to the previous screen.

[**Next CP >**]: returns to the third slope staking screen where the station to stake can be advanced and the next catch point can be located.

Slope Staking Offset Stake

The following screen is only accessed if you choose to stake a point at a specified offset away from the catch point.

Station: displays the current station being slope staked.

Offset from CP: is the offset from the catch point specified in the previous screen.

From Instrument to Design Point: displays the angle and distance information from the total station to the design point.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the <u>Stakeout</u> dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the <u>previous screen</u>.

[**Stake >**]: opens the next screen, which is identical to the third <u>Stake Points</u> screen.

Point Slope Staking

[**Stakeout**] [**Point Slope Staking**]

The <u>Point Slope Staking</u> routine is a simplified version of the <u>Slope Staking</u> routine.

The <u>Point Slope Staking</u> routine determines the location of the catch point from a known hinge point and a specified horizontal direction from the hinge point, whereas the <u>Slope Staking</u> routine determines the location of the catch point from a perpendicular offset to a known centerline at a specified station.

The first screen is used to specify the hinge point and horizontal direction from the hinge point to the catch point.

[**From Point**]: is the hinge point.

[**> Point**] / [**> Direction**]: is either another point that lies in the same vertical plane as the hinge point and catch point, or the azimuth from the hinge point to the catch point, respectively.

Fill Slope: is the desired slope, calculated from run over rise, between the hinge point and catch point when the area requires a fill.

Cut Slope: is the desired slope, calculated from run over rise, between the hinge point and catch point when the area requires a cut.

Height of Rod: is the rod height.

[**Backsight…**]: opens the <u>Station Setup</u> screen.

[**Stake CP >**]: opens the <u>next screen</u>.

Point Slope Staking – Screen 2

The second screen is used to perform the actual point slope staking shots.

Rod Elev: is the current elevation at the rod location.

Des. Slope: is the design cut or fill slope.

Obs. Slope: is the computed (observed) cut or fill slope based on the last shot and the corresponding hinge point.

HD to HP: is the horizontal distance from the rod to the hinge point.

Cut to HP / Fill to HP: is the cut or fill required to bring the current rod location level with the hinge point.

To Slope Offset: is the perpendicular offset between the rod location and the horizontal line from the hinge point to the catch point.

Direction (**CW** or **CCW**): is the horizontal angle (clockwise or counterclockwise, respectively) that the rod must turn around the hinge point for it to be over the line from the hinge point to the catch point.

Below DS / Above DS: is the vertical distance that the rod is located below or above the design slope. If the [**Automatic Slope**] option is selected, this will be the distance to the nearest slope, otherwise it will be the distance to the selected (cut or fill) slope.

Toward HP / **Away HP**: is the estimated horizontal distance the rod must move toward or away from the hinge point before it is over the catch point.

Note: The computed horizontal distance is based on the observed terrain computed from the last two shots. If only one shot has been taken, this value will be blank.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

[**Results**]: This will open the Slope Staking Results screen, listing detailed information for the current setup and last shot.

Note: The [**Results**] button is only available from the Store Catch Point screen when using GNSS or Remote mode, which is accessed after tapping [**Store >**].

The button described below selects which information is displayed in the screen from the following options:

- [**Vertical Map**]: displays a cross-sectional view at the current station.

Note: When you tap a map view, an expanded view of the same map will fill the screen.

Note: The Vertical Map will show an X at the location of each previous shot. This can be useful in determining if the current terrain will never intersect the slope (no catch point).

[**Horizontal Map**]: displays an overhead view of the job.

- [**Shot Data**]: displays the shot data for the last shot.

The button described below selects the type of slope that will be used from hinge point to the catch point from the following options:

- [**Automatic Slope**]: selects the slope that is nearest to the current rod position.
- [**Force CUT Slope**]: forces all computations to be based on a cut slope.
- [**Force FILL Slope**]: forces all computations to be based on a fill slope.

HR: is the rod height.

[**Topo SS…**]: will store the last shot taken as a side shot.

[**Shot**]: takes a shot.

[**< Back**]: returns to the previous screen.

[**Store >**]: opens the next screen.

Point Slope Staking – Screen 3

The third Point Slope Staking screen is identical to the fifth Slope Staking screen.

Stake Line and Offset

[**Stakeout**] [**Line and Offset**]

The Stake Line and Offset screen is used to stake stations on a line, or at an offset to it, at fixed intervals.

Start Point: defines the first point of the line to be staked.

[**End Point**] / [**Direction**]: defines the second point of the line, or the direction of the line to be staked, respectively.

Begin Station: defines the station associated with the Start Point.

[**Backsight…**]: opens the Station Setup screen.

[**Next>**]: opens the next screen.

: opens the Stakeout Settings screen.

Stake Line and Offset – Screen 2

Station to Stake: is the desired station that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the [**Next Sta**] button is pressed.

[**Next Sta**]: advances the Station to Stake by the Station Interval.

Offset: defines the offset distance and if the offset occurs to the right of the line, when R is selected, or left, when L is selected. The right or left side is referenced while viewing the line from the Start Point.

[**Vertical Offset**]: is the offset distance that is below the design location (when D is selected) or above the design location (when U is selected).

[**> Grade**]: specifies a slope from the specified line to the parallel line that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the design elevations as the Offset value increases.

Height of rod: is the length of the rod.

[**Backsight…**]: opens the [Station Setup](#) screen.

[**< Back**]: returns to the [previous screen](#).

[**Solve>**]: opens the third [Stake Line and Offset](#) screen, described next.

Note: A motorized total station will automatically turn toward the design point after pressing [**Solve>**] depending on the configuration of the [Stakeout Settings](#) screen.

Stake Line and Offset – Screen 3

Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the line being staked from the specified line and if it is on the Right or Left side of the specified line.

From Instrument to Design Point: displays the direction and distance that the total station must aim toward so that it is facing the current station.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing the current target, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data.
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the current target location.
3. To prevent errors if this button is used, the backsight set up is invalidated when exiting the Stakeout dialog. A circle zeroed on a design point is meaningless once the design point has been staked.

Note: The **Circle Zero** button is not available when using a robotic total station.

[**< Back**]: returns to the [previous screen](#).

[**Stake >**]: opens the fourth Stake Line and Offset screen, which is identical to the third [Stake Points](#) screen.

Note: Tap the graphic portion of the screen for an expanded view.

[Click here](#) to view a summary of the Stake Line and Offset screens.

Screen Summary

[Screen 1](#) is used to define the primary line used to determine the location of the line to be staked and the station associated with the Start Point.

[Screen 2](#) is used to define the offset distance and location, the station to be staked and the station interval.

[Screen 3](#) provides the distance and direction information to the current station to be staked.

Screen 4 is used to stake the current station.

Stake Curve and Offset

[**Stakeout**] [**Curve and offset**]

The Stake Curve and Offset screen is used to stake stations on a curve or at an offset to it at fixed station intervals.

PC Point: is the starting point of the curve (point of curvature).

[**PC Tangent Azm**] / [**PC Tangent Brg**]: defines the azimuth or bearing, respectively, of the tangent at the PC Point.

[**Radius**] / [**Degree Arc**] / [**Degree Chord**]: defines the radius, degree, arc, or degree chord of the curve, respectively.

Turn: defines if the curve turns to the Left or Right from the point of view of the PC.

Begin Station: is the station assigned to the PC Point.

[**Backsight…**]: opens the Station Setup screen.

[**Next>**]: takes you to the second Stake Curve and Offset screen, described below.

📋: opens the Stakeout Settings screen.

Curve and Offset – Screen 2

Station to Stake: is the desired station on the curve that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the [**Next Sta**] button is pressed.

[**Next Sta**]: advances the Station to Stake by the Station Interval.

Offset: is the horizontal distance of the offset from the specified curve. The offset occurs on the left (while viewing the curve from the PC) when the L is selected or on the right when the R is selected.

Note: An offset of zero would result in the specified curve being staked.

[**V. Offset**]: will result in the elevations for the design points to be adjusted by the value entered here and will change the cut / fill values accordingly. Design elevations will be lower when D is selected, and higher when U is selected.

[**Grade**]: specifies a slope from the specified curve to the curve that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the corresponding design elevations on the specified curve as the Offset value increases.

Height of Rod: is the length of the rod.

[**< Back**]: returns to the previous screen.

[**Solve>**]: opens the third Stake Curve and Offset screen.

Note: A motorized total station will automatically turn toward the design point after tapping [**Solve>**], depending on the configuration of the Stakeout Settings screen.

Curve and Offset – Screen 3

Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the curve being staked from the specified curve and if it is on the Right or Left side of the specified curve.

Angle Right: is the horizontal angle that the total station must aim toward so that it is facing the current station.

Horz. distance: is the horizontal distance from the occupy point to the current station.

Vert Distance: is the vertical distance from the occupy point to the current station.

ZE to Rod: is the zenith angle that the total station must aim toward so that it is facing the current station.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data.
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the previous screen.

[**Stake >**]: opens the next screen, which is identical to the third Stake Points screen.

Click here to view a summary of all the Stake Curve and Offset screens.

Screen Summary

Screen 1 is used to define the primary curve used to determine the location of the curve to be staked and the station associated with the PC Point.

Screen 2 is used to define the offset distance and location, the station to be staked and the station interval.

Screen 3 provides the distance and direction information to the current station to be staked from the occupy point.

Screen 4 is used to stake the current station.

Stake Out Point (Store/Tape) Screen

The Stake Out Point (Store/Tape) screen allows you to store a point at a specified offset from the stake point, resulting in a point that is either closer to, or further away from the total station.

Point: is the name assigned to the new offset point.

Description: is the description assigned to the new offset point.

Tape Out/Tape In: is the specified offset from the stake point. A positive value will result in a new point that is further away from the total station. The default value is the appropriate distance correction to the design point.

: stores the new offset point.

Stake Spiral and Offset

[**Stakeout**] [**Spiral and Offset**]

The **Stake Spiral and Offset** screen allows you to stake stations at fixed intervals on a spiral curve, or at an offset to it.

Start Point: is the point associated with the beginning of the spiral curve. This can either be the TS or the CS, which is specified later in this screen (see below).

[**Tangent Azm**] | [**Tangent Bearing**]: defines the tangent azimuth or bearing at the entrance to the spiral.

[**Radius**] | [**Degree Arc**] | [**Degree Chord**]: defines the radius, degree arc, or degree chord of the curve, respectively.

Length: is the length of the spiral curve.

Begin Station: is the station associated with the Start Point.

Turn: defines if the curve turns toward the Left or Right from the point of view of the Start Point.

Spiral: defines the direction of the spiral curve by the following options:

- **TS to SC**: the spiral begins at the tangent (Tangent to Spiral) and ends at the circular curve (Spiral to Curve).
- **CS to ST**: the spiral begins at the circular curve (Curve to Spiral) and ends at the tangent (Spiral to Tangent).

Stake Spiral and Offset - Screen 2

Station to Stake: is the desired station on the spiral curve that you want to stake.

Station Interval: is the value that is added to the Station to Stake after the [**Next Sta**] button is pressed.

[**Next Sta**]: advances the Station to Stake by the Station Interval.

Offset: is the horizontal distance of the offset from the spiral curve. The offset occurs on the left (while viewing the spiral from the Start Point) when the ⦿ L is selected or on the right when ⦿ R is selected.

Note: An offset of zero would result in the spiral curve itself being staked.

[**V. Offset**]: will result in the elevations for the design points to be adjusted by the value entered here and will change

the cut / fill values accordingly. Design elevations will be lower when is selected, and higher when U is selected.

[**Grade**]: specifies a slope from the spiral curve to the curve that is being staked. When this is a non-zero value, the elevation for the staked points will increasingly differ from the corresponding design elevations on the spiral curve as the Offset value increases.

Height of rod: is the length of the rod.

[**Backsight…**]: opens the Station Setup screen.

[**< Back**]: returns to the previous screen.

[**Solve>**]: opens the third screen, described next.

Note: A motorized total station will automatically turn toward the design point after pressing [**Solve>**] depending on the configuration of the Stakeout Settings screen.

Stake Spiral and Offset - Screen 3

Station: displays the current station that is being staked.

H. Offset: displays the offset distance of the spiral curve being staked from the specified spiral curve and if it is on the Right or Left side of the specified spiral curve.

Angle Right: is the horizontal angle that the total station must aim toward so that it is facing the current station.

Horz Dist: is the horizontal distance from the occupy point to the current station.

Vert Dist: is the vertical distance from the occupy point to the current station.

ZE to Rod: is the zenith angle that the total station must aim toward so that it is facing the current station.
[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the previous screen.

[**Stake >**]: opens the next screen, which is identical to the third Stake Points screen.

Stake Spiral and Offset - Screen Summary

Screen 1 is used to define the primary spiral curve used to determine the location of the curve to be staked and the

station associated with the Start Point.

Screen 2 is used to define the offset distance and location, the station to be staked and the station interval.

Screen 3 provides the distance and direction information to the current station to be staked from the occupy point.

Screen 4 is used to stake the current station.

Show Station and Offset

[**Stakeout**] [**Show Station**]

The Show Station and Offset routine allows you to take a shot to a prism that is positioned anywhere near a polyline, a range of points that define a line, or an alignment to see where the prism is located in relation to the line.

[**Tap Line…**]: allows you to tap an existing polyline or alignment that the station and offset will be computed from.

[**To/From…**]: allows you to enter a range of points that define the line where the station and offset will be computed from.

Begin Station: is the station assigned to the beginning of the line.

[**Backsight…**]: opens the Station Setup screen.

[**Next >**]: takes you to the next Show Station and Offset screen where the slope staking parameters are set up.

Show Station and Offset- Screen 2

The second Show Station and Offset screen is used to take a shot to the prism and view the data.

Height of Rod: is the length of the rod.

EDM: This button can be toggled to various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

Station: displays the station at the rod position.

Offset Dist: displays the perpendicular offset from the centerline to the rod position.

Elev: displays the elevation at the rod position.

Offset: displays if the rod position is to the right of the line, left of the line, or on the line.

Segment: displays the name of the template's segment at the rod position.

Shot Data: displays the angles and distance measured by the total station from the last shot.

[**Shot**]: takes a shot to the prism.

[**< Back**]: returns to the previous screen.

[**Store…**]: stores the stake point.

Store Offset Points

[**Stakeout**] [**Store Offset Points**]

The Store Offset Points screen is used to store points in the current job at a specified offset from an existing polyline or alignment at a specified interval.

[**Tap Line…**]: allows you to tap an existing polyline or alignment that the station and offset will be computed from.

[**To/From…**]: allows you to enter a range of points that define the line where the station and offset will be computed from.

Begin Station: is the station assigned to the beginning of the line.

[**Next >**]: takes you to the next Store Offset Points screen where the slope staking parameters are set up.

Store Offset Points - Screen 2

The second Store Offset Points screen is used to define the road profile, or offset distances that will be used to compute the offset point coordinates.

1/2 Road Width: is the Left and Right width of the road, respectively, from the centerline to the edge of payment.

X-Slope (%): is the Left and Right slope of the road, respectively, from the centerline to the edge of payment calculated from (rise/run)x100.

Note: A negative slope will result in water running from the centerline toward the edge of payment.

Stake Curb / Ditch: When checked, a curb or ditch and an offset can be defined beyond the edge of the pavement.

Height: is the height of the curb or ditch in feet or meters. A positive value is considered a curb and a negative value a ditch.

Offset From Edge of Road: is the distance that the curb or ditch extends from the edge of pavement.

Note: The specified curb or ditch height and offset will be applied to both sides of the road.

[**< Back**]: returns to the previous screen.

[**Next >**]: opens the next screen.

Store Offset Points - Screen 3

The third Store Offset Points screen is used to define which offset points will be stored.

From Station: is the station where the stored offset points will begin.

To Station: is the station where the stored offset points will end.

Station Interval: is the distance between the stations where offset points are stored.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, offset points will also be stored where ever the horizontal or vertical section of the road changes.

Start Point: is the point number that will be assigned to the first offset point that is stored. Each stored point that follows will be assigned the next available point number.

Description: is the description that will be assigned to all the offset points that are stored.

Center Line: offset points will be stored at locations on the centerline when checked.

Edge of Pavement: offset points will be stored at the end of the first segment (the edge of the roadbed) on the left and/or right side when checked.

Curb: offset point will be stored at the end of the second segment (the end of the curb or ditch) on the left and/or right side when checked.

[**Unselect All**]: quickly unchecks all the checkboxes.

[**< Back**]: returns to the previous screen.

[**Store**]: stores all the offset points based on the information provided.

Stake DTM

[**Stakeout**] [**Stake DTM**]

The Stake DTM routine allows you to stake an area and get cut/fill information between the point being staked and a reference DTM surface at the same horizontal coordinates. You can also obtain volume information between the surface being staked and a specified reference elevation or the reference DTM surface.

The reference DTM surface can be defined by a layer in the current job or a file loaded on the data collector. Either a DXF file containing a triangulated irregular network (TIN) or a digital terrain model (DTM) file can be used.

Consult the User's manual for more information.

Note: The speed performance of the Stake DTM routine is enhanced when using a DTM file as opposed to a DXF file.

DTM Source: is where you select your reference DTM surface. If using a layer, toggle the button to [**> Layer**] and then select the layer from the dropdown list. If using a DTM or DXF file, toggle the button to [**> File**] and then tap the ▼ power button and Browse then select the appropriate file.

Warning: If importing a DXF or DTM file where the distance units in the source file are different than the distance units for the current job, the imported coordinates will be converted to the current job's distance units when they are imported. This is normally the desired result, but it can cause a problem if the distance units for the imported data or the current job were set incorrectly. This situation can most commonly occur when working with International Feet and US Survey Feet, where the conversion from one to the other is not always obvious.

Usually the difference between International Feet and US Survey Feet is negligible (2 parts per million), but when

dealing with State Plane or UTM mapping plane coordinates, which are often very large in magnitude, the difference can be considerable if the coordinates are converted from one format to the other.

If importing coordinates from a source where you are not sure if the units are in International Feet or US Survey Feet into a job that is set to International Feet or US Survey Feet, you will usually just want to import them without any conversion being performed. To do this, be sure to select the same distance units for the source file as those set for the current job.

Store Point: is the starting point number if points are stored during the staking process. Future points are stored with the next available point names.

HR: is the rod height.

[icon][icon]: opens the Smart Target options.

With Centerline: When checked, offset and stationing information from the selected centerline to the stake point is also provided in the DTM Shot screen.

[**Choose a Centerline…**]: will open the Select Line screen where an existing polyline or alignment can be selected that describes a centerline.

Generate DTM with Staked Points: will add any staked points to the non-reference DTM layer and generate a DTM surface for all the objects on this layer. This DTM surface will be updated when a new point is stored to it. You can also view this surface with live cut/fill volumes at any time from the 3D View screen.

Note: Viewing the DTM during DTM Stakeout is a useful quality assurance technique to determine where additional points are needed.

[**Setup / View DTM**]: opens the Setup DTM 3D screen where the non-reference DTM layers are configured and optionally viewed from the 3D View screen.

[**Backsight…**]: opens the Station Setup screen.

[**Next >**]: opens the next screen.

Choose a Centerline

[**Stakeout**] [**Stake DTM**] [**Choose a Centerline…**]

The Select Line screen is used to select a particular polyline or alignment that defines a centerline. Separate overhead and side views are displayed for the selected polyline.

Simply select the desired line and tap [icon].

Stake DTM – Screen 2

[**Stakeout**] [**Stake DTM**] [**Next >**]

The second Stake DTM screen displays all relevant information for the current rod position and a graphic that shows

the reference DTM surface and its corners. Once a shot is taken, the rod location and the occupied TIN triangle are displayed.

Data: shows the angle and distance information from the previous shot.

Result: shows the current northing, easting, and elevation of the rod as well as the computed elevation of the reference DTM at the current location and the cut or fill necessary to bring the elevation at the current location to the elevation of the reference DTM at the current location.

Note: If the DTM and Cut or Fill fields are blank after taking a shot, it indicates the rod is outside the reference DTM boundary.

Centerline: shows the current station and offset information for the rod location relative to the centerline selected from the previous screen. The type of line segment in the polyline or alignment at the current station is also displayed. (This card is only available if the With Centerline checkbox was checked in the first Stake DTM screen.)

Note: Tapping anywhere within the map view will open a larger map view with zoom controls.

Point: is the point name that will be assigned to the next stored stake point.

Desc: is the description that will be assigned to the next stored stake point.

HR: is the height of the rod.

EDM: This button can be toggled to shoot in various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

[**Take Shot…**]: triggers the total station to take a shot to the prism.

[**View…**]: opens the 3D View screen where a 3D view of the non-reference DTM surface can be viewed from any angle as well as cut/fill volume information between two selected surfaces.

Note: The [**View…**] button is only available when *Generate DTM with Staked Points* is checked in the first Stake DTM screen and at least three stake points have been stored that do not lie on a straight line.

[**< Back**]: returns to the first Stake DTM screen.

[**Store**]: will store a stake point for the last point that was shot using the point name shown in the Point field and the description in the Desc field. (A new shot is not taken from this button.) The Point field is then advanced to the next available point name.

Station Staking

[**Stakeout**] [**Station Staking**]

The Station Staking routine allows you to stake the stations, offsets, and surfaces built into a LandXML file.

The first Station Staking screen is used to load a LandXML file and view the details of that file.

The box on the left displays the horizontal view of the centerline include within the LandXML file and the box on the

right shows the vertical view.

[**Set Center Line…**]: allows you to select any polyline or alignment in the current job to use as a centerline. This will replace any centerline loaded from the LandXML file.

[**View Cross-Sections…**]: opens the Cross-Section View screen, described below, where you can view the station, surface, and offset details of the loaded LandXML file.

[**Load From LandXML…**]: opens the Open screen where you can select which LandXML file to load.

[**Backsight…**]: opens the Station Setup screen where you can set your backsight.

[**Next >**]: opens the next Station Staking screen.

Cross-Section View

[**Stakeout**] [**Station Staking**] [**View Cross-Sections**]

The Cross-Section View screen is used to view the station, surface, and offset details of the loaded LandXML file.

The upper portion of the screen lists the Station, Northing, Easting, and Elevation at the selected node.

The larger graphic area displays the cross-sectional view of the selected surface. The smaller graphic area displays the horizontal view of the centerline.

Zoom Extents: will zoom so the entire cross section will fit inside the frame.

Zoom In Button: will zoom the current screen in by approximately 25%.

Zoom Out Button: will zoom the current screen out by approximately 25%.

: expands a list where you can select to zoom to a window, zoom up vertically, or zoom down vertically.

Stations: allows you to scroll through and view all the stations in the LandXML file.

Surfaces: allows you to scroll through and view all the surfaces in the LandXML file.

Offset: allows you to scroll through and view the details of the node at the selected offset.

Tap ⊗ (Close) to exit from this screen.

Station Staking – Screen 2

[**Stakeout**] [**Station Staking**] [**Next >**]

The second Station Staking screen is used to configure which Station, Surface, and Offset you want to stake.

Use the corresponding << and >> buttons to scroll the available Station, Surface, and Offset that you want to stake.

Height of Rod: is the rod height.

[**Backsight…**]: opens the <u>Station Setup</u> screen where you can set your backsight.

[**< Back**]: returns to the <u>previous screen</u>.

[**Solve >**]: opens the next <u>Station Staking</u> screen.

Station Staking – Screen 3

[**Stakeout**] [**Station Staking**] [**Next >**] [**Solve >**]

The third <u>Station Staking</u> screen shows the direction and distance information from the instrument to the selected stake point.

The Station, Surface, and Offset information is displayed at the top of the screen.

From Instrument to Design Point: lists the direction and distance information used to aim the total station toward the stake point.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the <u>Stakeout</u> dialog if this button has been used. A circle zeroed on a design point is meaningless once the design point has been staked.
4. The first time **Circle Zero** is used during a stakeout session, a dialog will appear to warn that the original backsight reference will be lost.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the <u>previous screen</u>.

[**Stake >**]: opens the final <u>Station Staking</u> screen used to perform the shots to stakeout the point. This is identical to the third <u>Stake Points</u> screen.

Define a Location

[**Stakeout**] [**Define a Location**]

The <u>Define a Location</u> screen is used to manually enter the distance and direction to a new point from any existing reference point and then stakeout the new point.

From Point: is the reference point that the specified angle and distance information is applied to for locating the new point.

[**Azimuth**] / [**Bearing**]: is the direction from the reference point to the new point.

+/- Angle: is the angle to be added to the specified azimuth or bearing, thus modifying the direction to the new point.

Note: To subtract an angle from the specified azimuth or bearing, enter a negative +/- Angle value.

Horiz. Dist: is the horizontal distance from the reference point to the new point.

Vert. Dist: is the vertical distance from the reference point to the new point.

Store point: When this is checked, the computed point will be stored with the name specified here.

[**Solve**]: will compute the location for the new point and access the next screen.

Define a Location- Screen 2

The second <u>Define a Location</u> screen displays the direction and distance information from the occupy point to the new point.

Ref. Point: is the reference point specified in the From Point field in the previous screen.

Description: is the description for the reference point.

From Instrument to Location: displays the angle and distance information from the total station to the new point. Users would aim their non-robotic total station the direction specified here.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the <u>Stakeout</u> dialog if this button has been used. A Circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the previous screen.

[**Stake >**]: opens the third <u>Define a Location</u> screen where the new point can be staked out.

Note: The third <u>Define a Location</u> screen is identical to the third <u>Stake Points</u> screen.

Where is Next Point

[**Stakeout**] [**Where Is Next Point**]

The <u>Where is Next Point</u> screen is used to assist the rod person in locating another point, given the current rod point, a reference point, and the point to locate.

Current Rod Pt: is the current rod point.

Next FS Point: is the point that the rod person wants to locate.

Increment: is added to the Next FS Point value after pressing the [**Next Point >**] button. (A negative integer can be entered to have point numbers advance in descending order.)

[**Next Point >**]: advances the Next FS Point value by the specified Increment, replaces the current rod point by the previous FS point, and accesses Screen 2.

Note: If the Next FS Point does not exist and the Increment value=1, pressing the [**Next Point**] button will access the next existing point. If the Increment is greater than one and the next point does not exist, a warning is displayed.

[**> Reference Pnt**] / [**> Reference Azm**]: is the reference point / azimuth used to determine the direction to the Next FS Point.

[**Solve >**]: computes the direction and distance to the Next FS Point and opens the next screen.

Where is Next Point - Screen 2

This screen shows two graphics that indicate the direction and distance that the rod person must travel to reach the Next FS Point.

The clock-style graphic shows the current rod location at the center, a line in the 12 o'clock position indicates the direction to the Reference, and an arrow shows the direction to the Next FS Point. There is also a text indicator that explains the direction to travel in a clock format.

The second graphic is a map view that shows the Current Rod Point, the Reference and the Next FS Point. It also shows the Occupy Point if the backsight has been set.

The lower left portion of the screen displays the azimuth from the rod to the Next FS Point and the horizontal distance between them.

[**< Back**]: returns you to the first screen.

[**Done**]: closes the screen.

Navigation

The Navigation routine allows you to navigate to existing points using autonomous positions from a GPS receiver that outputs a NMEA signal. (Most inexpensive consumer handheld GPS receivers will output the required signal.) The routine also allows you to store course-precision GPS points.

[**Target…**]: opens a screen where you can select the target point to navigate to.

[**Store WP…**]: opens the Store GNSS Sideshot screen where you can store a new autonomous GPS point.

[**Best Fit**]: opens the Best Fit screen (below) used to add control points to the best fit solution.

Map Page
The Map Page of the Navigation screen displays a map of the points in the current job and your current position.

When stationary, your position is marked with a flashing green circle. When moving, a green triangle is displayed that represents your current position and direction of travel and a blue arrow indicates your velocity. When navigating, a red arrow points from your current position to the target.

Zoom Extents Button: will change the scale of the screen so that all the points in the current job will fit on the screen.

Zoom In Button: will zoom the current screen in by approximately 25%.

Zoom Out Button: will zoom the current screen out by approximately 25%.

Zoom Window Button: allows you to drag a box across the screen. When your finger or stylus leaves the screen, the map will zoom to the box that was drawn.

Zoom to Point Button: prompts you for a point name and then the map view will be centered to the specified point with the point label displayed in red.

: expands a list where you can select additional map options.

Target Page
The Target Page is used to direct you to the current target. When you are close to the target, the graphic will change to help you more accurately locate the point.

Show N/E: When selected, the directions to travel are displayed are displayed in a Northing/Easting format.

Show Azi/Dist: When selected, the directions to travel are shown as an azimuth and distance.

Position Page
The Position Page is used to view the coordinates for your current position.

View GPS Position: Displays your current position in geodetic coordinates when selected.

View Local Position: Displays your current position in ground coordinates. This can only be selected after a Best Fit solution is computed, or if a coordinate system projection is solved.

[**Status…**]: opens the Sky Plot screen to view the GPS satellite constellation.

Navigation – Best Fit Screen

[**Stakeout**] [**Navigation**] [**Best Fit**]

The Best Fit screen is used to compute the rotation and scale necessary to align the geodetic coordinate system from the GPS receiver with the ground coordinate system used in the current job. A minimum of two points must be recorded to compute a Best Fit solution.

Note: The **Best Fit** button is not available when a coordinate system projection is solved.

Point: is the point in the job that you are occupying and want to add to the Best Fit solution.

[**Add Control and Re-Solve**]: Tap this while remaining stationary over the point. The position will be measured and added to the Best Fit solution. You will then return to the Navigation screen.

Points Currently Used in Best Fit: lists the points that are used in the Best Fit solution. This section is hidden when no best points have been collected. You can toggle the points used in the best fit solution by tapping on the **Use for H**

Control column of the point list. If you toggle the best fit point assignments, you can then tap the [**Resolve with Existing Points**] button to update the best fit solution.

Stakeout Menu for GPS

Stake Points (GNSS Staking)

[**Stakeout**] [**Stake Points**]

The GPS Staking screen is used to navigate to a design point with the receiver in roving mode. Once the design point has been staked, this screen is also used to control static occupations for the most precise measurement to the as built point.

The first two screens of this routine are similar to the conventional method, except that the [**Backsight**] button on the first screen and the [**Circle Zero**] button on the second screen are replaced with a [**Setup HR**] button to configure rover antenna. The backsight information is replaced with rover antenna height information. See the conventional Stake Points for comparison.

There are two navigation methods available when staking a point and you can switch between them by tapping the [+] / [^] button in the top right corner of the navigation graphic.

When using the [^] method, a large red arrow indicates the direction of travel and always appears at the top of the graphic. This arrow will dim when at a standstill or when near the design point. A north and south indicator are displayed on the graphic and will rotate depending on your direction of travel along with a blue line that indicates the direction to your reference point or azimuth. When you are near the design point, the graphic will change and the **N**/**S** indicator will stop updating to assist you in more precisely locating the design point.

When using the [+] method, your reference point or azimuth will always appear at the top of the screen and that is the direction you should be facing while navigating. Like with the other navigation method, the graphic will change as you get closer to the design point.

GNSS Status: displays the current solution type, the number of satellites used, and the horizontal and vertical

precision computed by the receiver. When this area of the screen is tapped, the epoch count stops and the GNSS Status screen opens.

Go SOUTH / **NORTH**: displays the distance the rover must move in a south or north direction to reach the design point.

Go EAST / **WEST**: displays the distance the rover must move in an east or west direction to reach the design point.

Note: The **Display Directions As field** in the Stakeout Settings screen configures the format for the text that directs you to the design point.

CUT / **FILL**: displays the required cut or fill between the current elevation and the design point.

[**Ref: 0°00'00"…**]: opens a screen where you can select a reference azimuth or point, which will then be displayed on the navigation graphic as a blue line to assist in orienting yourself. When **Auto Snap to Reference When Close** is checked in this screen and when using the [^] navigation method, the navigation method will automatically switch to the [+] method when you are within 3 meters of the design point. (Checking this box while in using the [+] navigation method has no effect.)

[**>OCCUPYING**] / [**>ROVING**]: switches from ROVING to OCCUPYING mode. When ROVING, the receiver is in dynamic mode and will calculate your position as you move to the point. When OCCUPYING, the receiver is switched to static mode and will calculate the most precise position for the staked point.

[**Topo SS**]: allows you to store a side shot measurement during stake out. This button behaves like the Topo SS button on the data collection page. The RMS and type of the current solution is checked against the criteria, and if acceptable, you are prompted

[**Accepts**]: opens the third and final Stake Points screen where the current stake point can be staked and optionally stored. When post-processing and in Occupying mode, this button will be labeled [Store] and will signal the end of the occupation and store the point.

Stake to Line

[**Stakeout**] [**Stake to Line**]

The Stake to Line screen allows you to locate points on a continuous predefined line. Direction information is provided to locate the line by traveling the shortest possible distance (a perpendicular offset to the line) between the rover and the line.

The first screen of this routine is similar to the conventional method, except that the [**Backsight**] button is replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional method for details.

Stake to Line – Screen 2

The second screen is where measurements take place and the staking directions are displayed. The graphic and display direct you to points on line via the shortest route, a perpendicular offset from the rover to the line.

The graphic display will change depending on how close you are to the specified line.

Note: Tap the graphic portion of the screen for an expanded view.

GNSS Status: displays the current solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. If this area of the screen is tapped, the epoch count stops and the GNSS Status screen opens.

Go SOUTH / NORTH: displays the distance the rover must move in a south or north direction to reach the closest point on the line.

Go EAST / WEST: displays the distance the rover must move in an east or west direction to reach the closest point on the line.

[**>OCCUPYING**] / [**>ROVING**]: switches from ROVING to OCCUPYING mode. When ROVING, the receiver is in dynamic mode and will calculate your position as you move to the point. When OCCUPYING, the receiver is switched to static mode and will calculate the most precise position for the staked point.

Results / **Current Location**: displays either the directions to the closest point on the line or the current local coordinate.

LEFT of Line / **RIGHT of Line** / **ON LINE**: displays the position of the rover with respect to the line. Left and right are relative to north. ON LINE is displayed when you are within the Line Tolerance specified in the Stakeout Settings screen.

Offset Dist.: displays the perpendicular offset distance from the line to the rover.

Station: displays the station on the line associated with the offset location. It is relative to the **Start Point** defined in the first screen.

[**>Results**] / [**>(N,E,Z)**]: toggles the display between Results and Current Location.

[**Store**]: prompts you for a point name and description and stores a point for the current location.

Slope Staking

[**Stakeout**] [**Slope Staking**]

The Slope Staking screen is used to locate the catch points for a roadway in any terrain.

The first three and the last screens of this routine are similar to the conventional method except that the [**Backsight**] and [**Circle Zero**] buttons are replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional method for details.

Once the centerline of the road is selected and the road profile is defined, the fourth Slope Staking screen is used to locate the stake point at the current station.

Slope Staking – Screen 4

The graphic portion of the Horizontal Map and Vertical Map is updated continuously. This allows the user at the rover position to watch the movement of the rover in relation to the slope and easily position the rod over the catch point.

Note: You can tap in the graphic portion of the screen to open the graphic in a larger window.

Although the graphic portion of the screen is continuously updated, the numeric values are not updated until the [**Shot**] button is tapped. The correct procedure for slope staking in GNSS mode is to use the graphic portion of the screen to locate the catch point as closely as possible and press [**Shot**]. Once the position is satisfactory, you can determine if the rover needs to be moved again.

GNSS Status: displays the current solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. Tap on this button to open the detailed GNSS Status screen.

The first button selects the type of slope that will be used between the catch point and hinge point from the following options:

- [>**Automatic Slope**]: selects the slope based on the current rover position. If the rover is above the hinge point, a cut slope is computed. If the rover is below the hinge point, a fill slope is computed.
- [>**Force CUT Slope**]: forces all computations to be based on a cut slope.
- [>**Force FILL Slope**]: forces all computations to be based on a fill slope.

The second button selects which information is displayed in the lower corner of the screen from the following options:

- [>**V Map**]: displays a cross-sectional view at the current station.

Note: When you tap a map view, an expanded view of the same map will fill the screen.

Note: The Vertical Map will show an X at the location of each previous shot. This can be useful in determining if the current terrain will never intersect the slope (no catch point).

- [>**H Map**]: displays an overhead view of the job.
- [>**N,E,Z**]: displays the coordinates computed from the last shot.

[**Occupy…**]:opens the Occupy Data Points screen where data can be collected for the current point.

[**Side Shot**]: allows you to store a side shot measurement during stake out. This button opens a prompt for the side shot point name and opens the GNSS Occupy Data Points screen. After you store the new point (or cancel) you will resume with the Slope Staking screen.

Results: displays the results computed from the last [**Shot**].

Obs. Slope: is the computed (observed) cut or fill slope based on the last shot and the corresponding hinge point.

Des. Slope: is the design cut or fill slope.

Cut / Fill: is the cut or fill required for the current rover location to be positioned on the design slope.

Toward CL / Away CL: is the computed horizontal distance that the rod must move either toward the centerline or away from it, respectively, before it is positioned at the catch point.

Note: The computed horizontal distance is based on the observed terrain computed from the last two shots. If only one shot has been taken, it is assumed that the terrain is level when computing this value.

On Station / **Back Sta** / **Ahead Sta**: informs you if the rod is on the station being staked, or the distance it must move (parallel to the centerline) back or ahead to be on the correct station.

HD to HP: is the horizontal distance from the rod to the hinge point.

VD to HP: is the vertical distance from the rod to the hinge point.

HD to CL: is the horizontal distance from the rod to the centerline.

VD to CL: is the vertical distance from the rod to the centerline.

Line and Offset

[**Stakeout**] [**Line and Offset**]

The instructions for the Line and Offset routine for GNSS similar to the conventional method, except that the [**Backsight**] and [**Circle Zero**] buttons are replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Curve and Offset

[**Stakeout**] [**Curve and Offset**]

The instructions for the Curve and Offset routine for GNSS are similar to the conventional method, except that the [**Backsight**] and [**Circle Zero**] buttons are replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Spiral and Offset

[**Stakeout**] [**Spiral and Offset**]

The instructions for the Spiral and Offset routine for GNSS are similar to the conventional method, except that the [**Backsight**] and [**Circle Zero**] buttons are replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Show Station and Offset

[**Stakeout**] [**Show Station**]

The Show Station and Offset routine allows you to position the rover anywhere near a polyline, a range of points that define a line, or an alignment to see where the rod is located in relation to the selected line.

The first screen of this routine is similar to the conventional method, except that the [**Backsight**] button is replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Show Station – Screen 2

Once the line is selected, the second screen is opened where information is displayed about the rod position and the selected line.

GNSS Status: displays the current solution type, the number of satellites used, and the horizontal and vertical precision computed by the receiver. Tap on this button to open the detailed GNSS Status screen.

[**>OCCUPYING**] / [**>ROVING**]: switches from ROVING to OCCUPYING mode. When ROVING, the receiver is in dynamic mode and will calculate your position as you move to the point. When OCCUPYING, the receiver is switched to static mode and will calculate the most precise position for the staked point.

[**>Results**] / [**>N,E,Z**]: displays either the results, or plane coordinates in the lower corner of the screen.

Station: is the station at the current rod position.

Offset Dist: is the perpendicular distance from the line to the rod.

Elev: is the elevation at the rod position.

Offset: displays if the rod is on the Left or Right of the line.

Segment: displays the type of line segment at the current station.

[**< Back**]: returns to the previous screen.

[**Store**]: stores a point for the current rod location.

Store Offset Points

[**Stakeout**] [**Store Offset Points**]

The instructions for the Store Offset Points routine for GNSS are similar to the conventional method, except that the [**Backsight**] button is replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Stake DTM

[**Stakeout**] [**Stake DTM**]

The Stake DTM routine allows you to stake an area and get cut / fill and volume information based on a reference DTM or specified elevation datum.

The first screen of this routine is similar to the conventional method, except that the [**Backsight**] button is replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional reference manual for details.

DTM GNSS Shot

[**Stakeout**] [**Stake DTM**] [**Solve**]

The <u>DTM GPS Shot</u> screen displays all relevant information on the current rover position and a graphic that shows the rover location, the occupied TIN triangle, and the rectangular DTM corners of the DTM boundary.

Note: the DTM boundary corners and TIN triangle may not be visible depending on the current scale of the screen.

[**>OCCUPYING**] **/** [**>ROVING**]: switches from ROVING to OCCUPYING mode. When ROVING, the receiver is in dynamic mode and will calculate your position as you move to the point. When OCCUPYING, the receiver is switched to static mode and will calculate the most precise position for the staked point.

Note: You must be within the boundary of the DTM before any cut / fill information is provided.

[**3D View…**]: opens the <u>3D View</u> screen (consult the conventional surveying Reference manual) where a 3D view of the DTM can be viewed from any angle as well as cut / fill information for the current location.

Note: The [**3D View…**] button is only available when Generate TIN w\Staked Points is checked in the previous screen and at least three stake points have been stored.

[**Store**]: stores a point at the current rover location with the point name shown in the St Pt field and the description in the Desc field. Also advances the St Pt to the next available point name.

St Pt: is the point name that will be assigned to the next stored point.

Desc: is the description that will be assigned to the next stored point.

HR: is the height of the rod.

Data: shows the northing, easting, and elevation of the current rover location.

Result: shows the computed elevation of the DTM at the current location and the cut or fill necessary to bring the elevation at the current location to the elevation of the DTM at the current location.

C.L.: shows the current station and offset information for the rover location relative to the selected centerline. The type of line segment in the polyline at the current station is also displayed. (This card is only available if the With C.L. checkbox was checked in the previous screen.)

Note: Tapping anywhere within the map view will open a larger map view, which provides zoom controls.

Where is Next Point

[**Stakeout**] [**Where is Next Point**]

The instructions for the <u>Where is Next Point</u> routine for GNSS are similar to the conventional method, except that the [**Backsight**] button is replaced with a [**Setup HR**] button to configure rover antenna and the backsight information is replaced with rover antenna height information. See the conventional Reference Manual for details.

Inverse Menu

The Inverse Menu contains routines that compute the direction and distance between two objects. The following screens are available from the Inverse Menu:

Inverse Point to Point
Inverse Point to Line
Inverse Point to Polyline
Inverse Point to Multiple Points
Inverse Point to Location / Point

Main Index

Inverse Point to Point

[**Inverse**] [**Point to Point**]

The Inverse Point to Point screen will calculate the distance and direction between two existing points.

Begin Point: is the reference point used to compute the distance and direction to the End Point.

End Point: is the point whose relationship to the Begin Point is computed.

[**Select from Map…**]: allows you to quickly select both the Begin Point and End Point from a map view. The first point tapped is entered as the Begin Point and the second as the End Point.

[**Solve**]: will compute the distance and direction from the Begin Point to the End Point.

Results

Azimuth: is the azimuth from the Begin Point to the End Point.

Horz Dist: is the horizontal distance from the Begin Point to the End Point.

Vert Dist: is the vertical distance from the Begin Point to the End Point.

Slope Dist: is the slope distance from the Begin Point to the End Point.

North: is the change in the Y-coordinate from the Begin Point to the End Point.

East: is the change in the X-coordinate from the Begin Point to the End Point.

Elevation: is the change in elevation from the Begin Point to the End Point.

Grade: is the slope from the Begin Point to the End Point.

Inverse Point to Line

[**Inverse**] [**Point to Line**]

The Inverse Point to Line screen computes the perpendicular offset distance and direction from a known point to a continuous line defined by two points or one point and a direction.

Inverse Point: is the known point that the offset information to a specified line is computed.

Begin Station: is the beginning station value that corresponds with the Start of Line, which is used to compute the inverse station in the results.

Start of Line: is the first point that defines the line from which the offset is computed.

[**Point**] / [**Direction**]: is the second point or known direction that defines the line from which the offset is computed.

Store Point: When checked, will store the coordinates for the point located on the specified line, tangent to the offset.

[**Solve**]: will compute the distance and direction of the offset from the known point perpendicular to the specified line.

Results

Inv. Station: is the station on the specified line where the perpendicular offset occurs, starting from the Begin Station.

Offset: is the horizontal distance of the perpendicular offset between the Inverse point and specified line.

Offset is: indicates if the Inverse point is located to the Right, Left, or on the specified line as you occupy Point 1 and face the second point or direction of the line.

Azimuth (pt to line): is the azimuth of the offset from the Inverse point toward the specified line.

North: is the Y-coordinate on the specified line, tangent to the perpendicular offset.

East: is the X-coordinate on the specified line, tangent to the perpendicular offset.

Elevation: is the elevation on the specified line, tangent to the perpendicular offset.

Inverse Point to Polyline

[**Inverse**] [**Point to Polyline**]

The Inverse Point to Polyline screen computes the offset distance from a known point perpendicular to a polyline.

Inverse Point: is the known point that the offset to a polyline segment is computed.

Begin Station: is the starting station assigned to the beginning of the polyline, which is used to compute the Station in the results.

[**Tap Polyline**]: allows you to tap an existing polyline from a map view.

[**Editor**]: opens the Polyline Editor where a new polyline can be created or an existing polyline can be modified.

[**Tap Points**]: provides a map view where you can tap any existing points to create a temporary polyline.

[**To/From**]: provides point selection by entering point names.

Store Point: When checked, will store the first solution where a perpendicular offset intersects with a polyline using the specified point name. If additional solutions are found, the following solutions will be stored using consecutive

point names.

[**Solve**]: will compute the distance and direction of the offset from the known point perpendicular to the polyline.

Note: There is no solution if a perpendicular offset does not occur within the extents of any selected polyline segments.

Results

Station: is the station along the polyline where the offset occurs, starting from the Begin station.

Offset: is the horizontal distance of the offset.

Offset is: indicates if the Inverse Point is located to the right, left, or on the specified line as you occupy the beginning of the polyline and face the end.

Segment Type: shows if the segment is a line, arc, or spiral.

Beg. Pt: if applicable, this is the first point selected that defines a line.

End Pt: if applicable, this is the second point selected that defines a line.

Inverse Point to Multiple Points

[**Inverse**] [**Multiple Points**]

The Inverse Point to Multiple Points screen will calculate the distance and direction from an existing point to one or more other points.

Inverse point: is the reference point used to compute the distance and direction to the other points.

[**Tap Points**]: provides a map view where you can tap multiple points.

[**To/From**]: provides selection of points by point name.

[**Solve**]: will compute the distance and direction from the Inverse point to all selected points.

Results

Azimuth: is the azimuth from the Inverse Point to the selected point.

Horz Dist: is the horizontal distance from the Inverse Point to the selected point.

Vert Dist: is the vertical distance from the Inverse Point to the selected point.

Slope Dist: is the slope distance from the Inverse Point to the selected point.

North: is the change in the Y-coordinate from the Inverse Point to the selected point.

East: is the change in the X-coordinate from the Inverse Point to the selected point.

Inverse Point to Location / Point

[**Inverse**] [**Location / Point**]

The Inverse Point to Location / Point screen will calculate the distance and direction from any point or location to another point or location.

Begin: is the reference point or location used to compute the distance and direction to another point or location.

End: is the other point or location whose correlation to the Begin point or location is computed. Each location is defined by one of the following methods:

- [**Location:**]: when selected, the coordinates for any location can be entered in the appropriate fields.
- [**Point:**]: when selected, any existing point name can be entered in the appropriate field or selected from a map view
- **Store Pt.**: When checked, will store a point for the location(s) entered.
- [**Solve**]: will compute the distance and direction from the Begin point or location to the End point or location.

Cogo Menu

The Cogo Menu contains all of the coordinate geometry routines used to perform computations from the existing job data. The following screens are available from the Cogo Menu:

Point in Direction
Intersection
Offset Line
Offset Points
Station Offset
Corner Angle
Compute Area
Surface Area
Triangle Solutions
Map Check Index
Subdivide Area
HD/VD to SD/ZA
SD/ZA to HD/VD
Architectural Units Conversion
Average Points

Main Index

Map Check Index

Map Check
Add/Edit Line
Add/Edit Curve
Add to Map

Cogo Menu Index
Main Index

Point in Direction

[**Cogo**] [**Point in Direction**]

The Point in Direction screen will calculate and store the position of a new point after providing a distance and direction from a known point.

From point: is the point name of the reference point used for locating the new point.

[**Azimuth] / [Bearing**]: is the direction from the reference point to the new point.

+/- Angle: is the angle added to the Azimuth / Bearing to modify the direction to the new point.

Note: To subtract an angle from the specified azimuth or bearing, enter a negative +/- Angle value.

Horiz. Dist: is the horizontal distance from the reference point to the new point.

Vert. Dist: is the vertical distance from the reference point to the new point.

Store point: When this is checked, the computed point will be stored with the name specified here.

[**Solve**]: will compute the location for, and optionally store the new point.

Intersection

[**Cogo**] [**Intersection**]

The Intersection screen computes, and optionally stores, the coordinates for the intersection of two lines, where the lines are tangent to existing points. Each line is independently defined by a known direction or a known length.

Point 1: is an existing point that is tangent to the first line.

Point 2: is an existing point that is tangent to the second line.

[**Distance**] / [**Azm or Brg**]: is the length or direction of the specific line tangent to the specified point.

Store I-Sect 1/2: These items are only available after solving the screen. Once solved, the computed intersections can be viewed from the Map card where you can decide which intersecting point(s) to store in the Input card.

[**Store**]: Stores the intersecting points checked above, which were computed after solving.

[**Solve**]: will compute the intersecting point(s) and open the Results card.

Offset Line

[**Cogo**] [**Offset Line**]

The Offset Line screen is used to store points or an alignment that is parallel to an existing set of points, a polyline, or an alignment, at a specified perpendicular offset.

Note: When storing points, the number of new points stored will equal the number of points in the selected polyline or point range. If the offset is from an alignment, the number of points stored will equal the number of nodes that occur in the horizontal portion of the alignment.

[**Tap Line…**]: allows you to tap an existing polyline or alignment that the offset will be computed from.

[**To/From…**]: allows you to enter a range of points that define the line where the offset will be computed from.

Offset: defines the offset distance and which side the offset occurs. The right or left side is referenced from the first point that defines the specified line.

Save to job as an alignment: when checked, the computed offset line will be saved as a new alignment under the name specified in the Description field.

Note: Spiral curves cannot be generated in a new offset alignment. If the original centerline contains any spiral curves,

they will be treated as straight sections in the offset alignment that is created. The Offset Staking or Offset Points routine should be used to stake offsets from a spiral curve.

Store Pts: When checked, is the first point name that will be used when storing the computed offset points. Additional points will automatically be assigned with the next consecutive point name, such as 8, 9, 10… or Offset, Offset2, Offset3…

Description: is the description that will be assigned to the new points that are generated or to the new alignment.

[**Solve**]: computes and stores the new offset points and polyline.

Offset Points

[**Cogo**] [**Offset Points**]

The Offset Points screen is used to store points at a specified perpendicular offset to an existing polyline, alignment, or point range. Points can be stored that correspond with the nodes of an alignment, points of a polyline, and/or at a specified station interval.

[**Tap Line…**]: allows you to tap an existing polyline or alignment that the offset points will be computed from.

[**To/From…**]: allows you to enter a range of points that define the line where the offset will be computed from.

Offset: defines the offset distance and which side the offset occurs. The right or left side is referenced from the first point that defines the selected line.

Store Pts: When checked, will store the offset points that are computed based on the selected line and which of the two following checkboxes are checked.

Note: Leaving the Store Pts field unchecked and solving the screen will result in a map screen that displays the points that would be stored, but without actually storing anything to the job. This is useful for testing the routine before storing information.

Store Nodes: When checked, computes offset points that correspond to each node in the selected alignment (points where the horizontal or vertical alignment change), or that correspond to the existing points in a selected line or point range.

Sta. Intervals: When checked, computes offset points from the beginning of the selected line or point range, and at each specified station interval along the line or point range.

Description: is the description that will be assigned to all points that are stored.

[**Solve**]: computes the offset points, and stores them if the Store Pts checkbox is checked.

Station Offset

[**Cogo**] [**Station Offset**]

The Station Offset screen will compute and optionally store a point at a specified station and offset to an existing polyline or alignment. The elevation for the stored point will always be set to the elevation of the first node of the

polyline, or alignment.

Start Station: is the station for the first node of the selected line.

Station: is the station on the line where you want to compute an offset point from.

Offset: is the offset distance that is to the left (when ⊙ L is selected) or right (when ⊙ R is selected) from the selected line.

Store Pts: When checked, will store the computed offset point with the name specified in the corresponding field.

[**Tap Line…**]: opens a window where any polyline or alignment in the current job can be selected.

[**To/From…**]: opens a window where a new line can be defined by entering a range of points.

[**Solve**]: computes the location of the offset point and optionally stores the point.

Corner Angle

[**Cogo**] [**Corner Angle**]

The Corner Angle screen provides information on the horizontal angle created from three known points.

Backsight: is an end point of the angle to be solved.

Middle Point: is the corner point of the angle to be solved.

Foresight Point: is the other end point of the angle to be solved.

[**Select from Map…**]: Allows you to quickly select all of the above points from a map view. The first point tapped is entered in the Backsight field, the second in the Middle Point field and the third point tapped is entered in the End Point field.

[**Solve**]: will compute the following results that describe the angle defined by the three points provided.

Results

Angle left: is the horizontal angle created as you occupy the Middle Point, face the Backsight, and turn counterclockwise to the Foresight Point.

Angle right: is the horizontal angle created as you occupy the Middle Point, face the Backsight, and turn clockwise to the Foresight Point.

180 - right: is the angle that results from subtracting the angle right value from 180°.

HD to Beg.: is the horizontal distance between the Backsight and the Middle Point.

HD to End: is the horizontal distance between the Foresight Point and the Middle Point.

Compute Area

[**Cogo**] [**Compute Area**]

The <u>Compute Area</u> routine computes the area of a flat horizontal plane encompassed by a selected boundary.

[**Tap Line…**]: allows you to tap an existing polyline defining a boundary from a map view.

[**To/From…**]: provides selection of individual points to define a boundary.

[**Solve**]: will compute the details for the horizontal area of the selected boundary and display them in the <u>Results</u> screen.

Results

Area: is the area that the boundary encloses. If the boundary is not closed, the area is computed as if a line joined the two ends.

Length: is the length of the selected boundary.

Perimeter: is the length of the selected boundary, plus any additional length between the two ends of an open boundary.

Surface Area

[**Cogo**] [**Surface Area**]

The <u>Surface Area</u> routine computes the surface area of a best-fit flat plane within a selected boundary positioned at any incline. You can also optionally compute a volume when a thickness of the surface is provided.

Note: Boundaries containing curves are not supported.

[**Tap Line…**]: allows you to tap an existing polyline from a map view that defines the boundary of the surface.

[**To/From…**]: provides selection of individual points to define the boundary of the surface. The points must be selected in sequence around the boundary so no side of the boundary crosses another.

[**Solve**]: computes the area details within the selected boundary and displays them in the <u>Results</u> screen.

Results

Surface Area: is the area of the best-fit plane encompassed by the selected boundary. If the boundary is not closed, the area is computed as if a straight line joined the two ends.

Thickness: is the thickness entered on the previous screen used for calculating a volume.

Volume: is the computed volume (area of plane x thickness).

Perimeter: is the perimeter length of the selected boundary, plus any additional length between the two ends of an open boundary.

Angle of Plane: is the angle from the horizontal ground to the best-fit plane.

Residuals: Shows how well each point in the boundary fit within the computed best-fit plane. (A value of zero represents a perfect fit.)

Triangle Solutions

[**Cogo**] [**Triangle Solutions**]

The <u>Triangle Solutions</u> screen will solve for the unknown parts of a triangle after providing three known parts.

Triangle Solution: is where you select the parts of the triangle that are known. You can select any of the following from the dropdown list:

- **Side-Side-Side**: The lengths of all three sides are known.
- **Angle-Side-Angle**: Two angles and the side between them are known.
- **Side-Angle-Angle**: Two angles and one side (that does not lie between those angles) are known.
- **Side-Angle-Side**: Two sides and the angle between them are known.
- **Side-Side-Angle**: Two sides and one angle (that is not between those sides) are known.

[**Solve…**] will solve for the unknown parts of the triangle.

Results

Side a / b / c: displays the length of each side.

Angle A / B / C: displays the corresponding angle.

Area: displays the area of the triangle in square feet and acres, or in square meters and hectares.

Map Check

[**Cogo**] [**Map Check**]

The <u>Map Check</u> screen is used to manually enter boundaries from a map to check for closure and other information related to the boundary.

[**Edit…**]: opens the appropriate editor screen where you can edit the selected line or curve from the list.

[**Delete**]: deletes the selected line segment.

[**Clear**]: clears all line entries.

[**Closure**]: opens the Results page.

[**Add Line…**]: opens the Add/Edit Line screen where a new line can be added prior to the select segment.

[**Add Arc…**]: opens the Add/Edit Curve screen where a new curve can be added prior to the selected segment.

[**Add to Map…**]: opens the [Add to Map](Add to Map) screen where the map data entered in the list can be added to the current job as a polyline.

Results

Area: is the area that the boundary encloses. If the start and end points are in different locations, the area is computed as if a line joined these two points.

Length: is the length of the boundary from the first point to the last point.

Perimeter: is the length of the boundary from the first point to the last point, plus any additional length between the last point and the first point.

Error dist.: is the distance between the last point and the first point.

Error azm: is the direction from the last point to the first point.

Precision: is the ratio between the Error distance and Perimeter.

Add / Edit Line

[**Cogo**] [**Map Check**] [**Add Line…**]

The <u>Add / Edit Line</u> screen is used to enter a new line to the list prior to the selected line segment.

[**Azimuth**] / [**Bearing**]: is the direction of the line.

Length: is the length of the line, in feet or meters.

⬤: enters the line to the list.

❌ : closes the screen without entering any new line data.

Add / Edit Curve

[**Cogo**] [**Map Check**] [**Add Arc…**]

The <u>Add / Edit Curve</u> screen is used to enter a new curve to the list prior to the selected line segment.

[**Radius**]: The distance from the radius point to the curve.

[**Delta**]: The internal angle from center to tangent points.

[**Degree Arc**]: The internal angle equivalent to a 100-ft arc length.

[**Degree Chord**]: The internal angle equivalent to a 100-ft chord length.

[**Length**]: The arc length.

[**Chord**]: The chord length.

[**Tangent**]: The distance from the PC or PT to the PI.

[**Mid Ordinate**]: The distance between the curve and the chord at the center of the curve's length.

[**External**]: The minimum distance between the PI and the curve.

[**Azimuth**] / [**Bearing**]: defines the direction of the curve, tangent at the PC.

Turn: defines if the curve turns to the Left or Right while viewing the curve from the PC Point.

⬤ : appends the curve to the list.

Add to Map

[**Cogo**] [**Map Check**] [**Add to Map…**]

The <u>Add to Map</u> screen is used to add the existing line and curve data to the current job as a polyline.

Description: is the name that will be assigned to the new polyline that will be added to the project.

[**Location**]: can be used to manually enter the coordinates for the first point of the polyline.

[**Point**]: can be used to define the starting location of the first point of the polyline by an existing point.

Store Points: is the first point name that will be used for the new points that are needed to add the figure to the current job. All additional points will be incremented from this point.

✅ : adds the figure to the job at the specified location.

❌ : closes the screen without adding any new data to the job.

Subdivide Area

[**Cogo**] [**Subdivide Area**]

The <u>Subdivide Area</u> routine will take a boundary with one open side and compute the location of a line that will enclose the boundary with a specified area using the Hinge Method or the Parallel Method.

The Hinge Method computes the location of the side of a boundary that can pivot on a fixed point.

The Parallel Method computes the location of one side of a four-sided boundary where the computed side is parallel to a stationary side of the boundary.

The top-left field is used to enter the desired area of the specified boundary. In the next field, select the units entered from the dropdown list.

Hinge: solves the boundary using the Hinge Method when selected.

Parallel: solves the boundary using the Parallel Method when selected.

[**Tap Polyline…**]: allows you to tap an existing polyline from a map view to define the fixed sides of the boundary.

Note: a boundary has two fixed sides and one side defined by a direction when using the Hinge Method. It has one fixed side and two sides defined by a direction when using the Parallel Method.

[**Editor…**]: opens the <u>Polyline Editor</u> where a new polyline can be created or an existing polyline can be modified.

[**Tap Points…**]: provides a map view where you can tap any existing points to define the fixed sides of the boundary.

[**To/From…**]: provides point selection by entering point names.

Store Pt 1 / 2: When checked, will store a point at the location of the end point(s) of the computed boundary line.

[**Azimuth**] / [**Bearing**]: defines the direction of the boundary sides with lengths that are not yet known.

Results

Point 1 / 2: Displays the coordinate of the end points of the computed boundary line.

Total Area: is the total area of the boundary.

Plot Area: is the area enclosed by the pre-defined fixed boundary lines.

Difference: is the difference between the Total Area and the Plot Area.

HD/VD to SD/ZA

[**Cogo**] [**HD/VD to SD/ZA**]

The HD/VD to SD/ZA screen will convert a vertical and horizontal distance to an equivalent slope distance and zenith angle.

Horz Dist: is the horizontal distance from the occupy point to the foresight point.

Vert Dist: is the vertical distance from the occupy point to the foresight point.

HI: is the distance that the total station is above the ground.

HR: is the length of the rod.

[**Earth Curvature and Refraction**]: Set the earth curvature and refraction correction coefficient. Select [**None**] to turn earth curvature and refraction correction off for all observations from this station setup.

[**Solve**]: computes the equivalent slope distance and zenith angle from the data entered.

Results

Zenith: is the computed zenith angle from the occupy point to the foresight point.

Slope Dist: is the computed slope distance from the occupy point to the foresight point.

SD/ZA to HD/VD

[**Cogo**] [**SD/ZA to HD/VD**]

The SD/ZA to HD/VD screen will convert a slope distance and zenith angle to an equivalent horizontal distance and vertical distance.

Slope Dist: is the slope distance to be converted.

Zenith: is the zenith angle to be converted.

HI: is the distance that the total station is above the ground.

HR: is the length of the rod.

[**Earth Curvature and Refraction**]: Set the earth curvature and refraction correction coefficient. Select [**None**] to turn earth curvature and refraction correction off for all observations from this station setup.

AU Conversion

[**Cogo**] [**AU Conversion**]

The AU Conversion (Architectural Units Conversion) screen will convert distances with fractional inches to decimal distances.

If the job is configured for International Feet or US Survey Feet, it is assumed that the distance entered in this screen is in the same units as the job. If the job is configured for meters, it is assumed that the distance entered in this screen is in International Feet. See Input Shortcuts in the User's Manual for more information on entering architectural units.

[**Convert**] / [**Use**]: will perform the conversion. If this screen is accessed from the Quick Pick list when the cursor was in a distance field, this button will be labeled [**Use**] and will copy the converted distance to the corresponding distance field.

Average Points

[**Cogo**] [**Average Points**]

The Average Points routine will compute the average location from any number of existing points.

Note: This routine will compute an average coordinate from the selected individual points. If you wish to compute an average coordinate from multiple observations, you should select [**Compute Average**] when prompted by the Point Exists Screen.

The first screen is used to select the points you want to use for computing the average.

[**To/From**]: opens the Select Points screen where you can specify the points you want to include.

[**Tap Points**]: opens a map view where you can tap on the points you want to include.

[▼]: The power button opens a list of alternative methods to select the points to average, or view a list of points already selected.

The *Select by distance* option opens a screen where you can select multiple points by first selecting any point as the *Radius Point* and then specifying a *Distance* from that point. The radius point and any other points within the specified distance to it will be included in the average computation.

[**Next >**]: opens the next screen.

Average Points – Screen 2

The second screen is used to view the coordinates of the average point, optionally adjust the data used to compute the average and optionally save the point.

The lower portion of the screen displays all the selected points that are being used to compute the average location. If any points' residual values exceed your tolerances, you can uncheck that point and a new average is computed that

excludes that point.

Result: Displays the average coordinates of all the selected points. These coordinates are automatically updated when changes are made in the lower portion of the screen (without the need to tap [*Solve*]).

Use Elevation from Point: When checked, and if storing the point, the elevation for the computed point will be the elevation of the point selected here. When unchecked, the average elevation of all the selected points will be displayed and used if storing the average point.

Store Point: When checked, the average location computed will be saved to the point specified in the associated field after solving. If unchecked, nothing is saved when solving.

[**< Back**]: Returns to the previous screen.

[**Solve**]: If the *Store Point* box is checked, this will save a new point with the computed average coordinates, otherwise this simply closes the screen.

Curve Menu

The Curve Menu contains routines that will compute all aspects of a horizontal curve and assist in curve layout.

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Curve Solution

[**Curve**] [**Curve Solution**]

The Curve Solution screen provides detailed information on a curve when two parts of the curve are known.

The first known part of the curve is defined by one of the following:

- **Radius**: is the distance from the radius point to the curve.
- **Delta**: is the deflection angle.
- **Degree Arc**: is the deflection angle that results in a 100-ft. arc length.
- **Degree Chord**: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- **Delta**: is the deflection angle.
- **Length**: is the arc length.
- **Chord**: is the chord length.
- **Tangent**: is the distance from the PC or PT to the PI.
- **Mid Ordinate**: is the distance between the curve and the chord at the center of the curve's length.
- **External**: The minimum distance between the PI and the curve.

[**Solve**]: Computes the details for the horizontal curve.

[**Layout…**]: opens the Horizontal Curve Layout screen. where points can be created so the curve can be staked in the field.

[**Traverse…**]: opens the Traverse on Curve screen.

Results: Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

External: is the minimum distance between the PI and the curve.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: (not shown) The minimum distance between the PI and the curve.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Known PI and Tangents

[**Curve**] [**PI and Tangents**]

The PI and Tangents screen is used to compute and store the PC, PT, a nd radius points when the PI point and the direction of both tangents are known, along with one other curve attribute.

PI Point: is the PI point.

[**Azm PI->PC**] / [**Brg PI->PC**]: is the direction of the tangent from the PI to the PC.

[**Azm PI->PT**] / [**Brg PI->PT**]: is the direction of the tangent from the PI to the PT.

The remaining curve attribute can be defined with one of the following selections:

- **Radius**: is the distance from the radius point to the curve.
- **Delta**: is the deflection angle.
- **Degree Arc**: is the deflection angle that results in a 100-ft. arc length.
- **Degree Chord**: is the deflection angle that results in a 100-ft. chord length.

Store PC: When checked, will store the computed PC point with the specified point name.

Store RP: When checked, will store the computed radius point with the specified point name.

Store PT: When checked, will store the computed PT point with the specified point name.

Results

Radius: is the distance from the radius point to the curve.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Three Point Curve

[**Curve**] [**3 Point Curve**]

The Three Point Curve screen will compute the details of a curve when three points of the curve are specified; the PC, PT and any other point on the curve; or the PC, PT and radius point.

First point: is the first point from the current job that defines the curve. The specified point can be either the PC or the Radius Point by selecting the appropriate radio button.

Note: The selection made for the first point determines the available choices in the remaining fields.

Pt. on Curve: is any point that lies on the curve between the PC and PT.

PC: is the point that defines the beginning of the curve (Point of Curvature).

PT: is the point that defines the end of the curve (Point of Tangency).

Store RP: When checked, the radius point will be computed and stored with the name specified here.

[**Solve**]: will compute the curve based on the selected points.

[**Traverse**]: opens the Traverse on Curve, where the curve can be included in a traverse.

[**Layout**]: opens the Curve Layout
screen, where the location of points on a curve can be computed at any station interval.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Compute Radius Point

[**Curve**] [**Radius Point**]

The <u>Compute Radius Point</u> screen is used to compute and optionally store the radius point for a curve when certain parts of the curve are known.

PC Point: is the point that defines the beginning of the curve (Point of Curvature).

PT Point: is the point that defines the end of the curve (Point of Tangency).

Turn: specifies if the curve turns to the Left or Right as you face the curve from the PC.

Arc: specifies if the arc is Small (less than 180°) or Large (greater than 180°).

The final part of the curve is defined by one of the following choices:

- Radius: is the distance from the radius point to the curve.
- Delta: is the deflection angle.
- Degree Arc: is the deflection angle that results in a 100-ft. arc length.
- Degree Chord: is the deflection angle that results in a 100-ft. chord length.

Store RP: When checked, the computed radius point will be stored with the name specified here.

[**Solve**]: computes the location of the radius point.

[**Layout…**]: opens the <u>Curve Layout</u> screen.

[**Traverse…**]: opens the <u>Traverse on Curve</u> screen.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

External: is the minimum distance between the PI and the curve.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Line Tangent to Circles

[**Curve**] [**Tangent to Circle**]

Will compute the location of a line that is tangent to the specified sides of two specified circles.

Tangent Line: determines which sides of the circles the computed line will be tangent to as you occupy the 1st Radius Point and face the 2nd Radius Point.

1st / 2nd Radius Pt: defines the points around which the circles are computed.

Radius: defines the radius of the circles that are used to compute the Tangent Line.

Store Tan Pt: When checked, will store the computed tangent points.

[**Solve**]: computes the location of the tangent line and optionally stores the two tangent points.

Results

TP 1: displays the coordinates for the first tangent point.

TP 2: displays the coordinates for the second tangent point.

Azimuth: is the azimuth of the tangent line from the first tangent point to the second.

Distance: is the length of the tangent line.

Horizontal Curve Layout

[**Curve**] [**Curve Layout**]

The <u>Curve Layout</u> screen is used to assist in the layout of a horizontal curve by computing the direction and distance to points on the curve using a variety of methods.

Method : The method determines how the points on the curve are laid out. Each method is described below.

PC Deflection: provides deflection angles and distances to each station on the curve as if occupying the PC and backsighting the PI. The results are given in the following format:

- **Station**: is the current station on the curve.
- **Deflection**: is the angle to turn to the current station.
- **Long chord**: is the distance from the PC to the current station.
- **Short chord**: is the distance from the previous station to the current station.

PI Deflection: provides deflection angles and distances to each station on the curve as if occupying the PI and backsight the PC. The results are given in the following format:

- **Station**: is the current station on the curve.

- **Deflection**: is the angle to turn to the current station.
- **PI to Station**: is the distance from the PI to the current station.

Tangent Offset: provides perpendicular offset information from the tangent (the line from the PC to the PI) for each station on the curve. The results are given in the following format:

- **Station**: is the current station on the curve
- **Tan dist (TD)**: is the distance on the tangent, from the PC to the PI, or the PI to the PT, where the perpendicular offset occurs.
- **Tan offset**: is the distance, perpendicular to the tangent, to the curve at the particular station.
- **Tan**: is the length of the tangent (the distance from the PC to the PI).
- **Tan - TD**: is the distance on the tangent, from the PI to the PC, or the PI to the PT, where the offset occurs

Chord Offset: provides perpendicular offset information from the chord (the line from the PC to the PT) for each station on the curve. PC deflection information is also provided. The results are given in the following format:

Station: is the current station on the curve.

- **Chord dist.**: is the distance on the long chord from the PC (toward the PT) where the perpendicular offset occurs.
- **Chord offset**: is the distance to the current station on the curve, perpendicular to the long chord.
- **PC Deflection**: is the angle to turn to the current station, as if occupying the PC and backsighting the PI.
- **Chord Length**: is the distance from the PC to the current station on the curve.

The first known part of the curve is defined by one of the following:

- [**Radius**]: is the distance from the radius point to the curve.
- [**Delta**]: is the deflection angle.
- [**Degree Arc**]: is the deflection angle that results in a 100-ft. arc length.
- [**Degree Chord**]: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- [**Delta**]: is the deflection angle.
- [**Length**]: is the arc length.
- [**Chord**]: is the chord length.
- [**Tangent**]: is the distance from the PC or PT to the PI.
- [**Mid Ordinate**]: is the distance between the curve and the chord at the center of the curve's length.
- [**External**]: is the minimum distance between the PI and the curve.

PC Station: is the starting station assigned to the PC.

Interval: When checked, all necessary information for each station at the specified interval on the curve will be computed.

Start station: when not computing by interval (above), only the information for the particular station entered here is computed.

[**Solve**]: will solve and display all the details of the specified curve, without the layout information.

[**Sta -**]: decreases the current station by the station interval.

[**Sta +**]: increases the current station by the station interval.

[**Layout**]: will solve and display the layout information for all the stations of the specified curve.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Traverse on Curve

[**Curve**] [**Trav. on Curve**]

The Traverse on Curve screen will compute the PT and radius point for a curve when the tangent azimuth at a PC point is known.

The first known part of the curve is defined by one of the following:

- [**Radius**]: is the distance from the radius point to the curve.
- [**Delta**]: is the deflection angle.
- [**Degree Arc**]: is the deflection angle that results in a 100-ft. arc length.
- [**Degree Chord**]: is the deflection angle that results in a 100-ft. chord length.

The second known part of the curve is defined by one of the following:

- [**Delta**]: is the deflection angle.
- [**Length**]: is the arc length.
- [**Chord**]: is the chord length.
- [**Tangent**]: is the distance from the PC or PT to the PI.
- [**Mid Ordinate**]: is the distance between the curve and the chord at the center of the curve's length.
- [**External**]: is the minimum distance between the PI and the curve.

[**PC Point**]: is the point that defines the beginning of the curve (Point of Curvature).

[**Azimuth**] / [**Bearing**]: is the direction of the tangent at the beginning of the curve.

[**Turn**]: specifies if the curve turns to the Left or Right as you face the curve from the PC.

Store PT: When checked, will store the computed PT point with the specified point name.

[**Store RP**]: When checked, the computed radius point will be stored with the name specified here.

[**Solve**]: will compute and store the PT, and if desired, the radius point.

Results

Radius: is the distance from the radius point to the curve.

Length: is the arc length.

Chord: is the chord length.

Delta: is the deflection angle.

Tangent: is the distance from the PC or PT to the PI.

Mid Ord.: is the distance between the curve and the chord at the center of the curve's length.

External: is the minimum distance between the PI and the curve.

Deg. Arc: is the deflection angle that results in a 100-ft. arc length.

Deg. Chord: is the deflection angle that results in a 100-ft. chord length.

Segment: is the area between the arc length and the chord.

Sector: is the area between the arc length and the two edge radii.

Fillet: is the area between the arc length and the tangents.

Parabolic Curve

[**Curve**] [**Parabolic Curve**]

The Parabolic Curve screen provides detailed information on a vertical parabolic curve when certain parts of the curve are known.

Known: The PVC or PVI radio button is selected to define which point on the curve is known.

One of the following options must be selected from the dropdown list:

- **Curve Length**: is selected when the length of the curve is known. When selected the following must also be specified:
- **Point On Curve**: is selected when the location of another point on the curve is known. When selected, the following must also be specified.
- **Hi/Lo Elevation**: is selected when the high or low point for the curve is known. When selected, the following must also be specified.

Note: When the begin and end grades are both positive or both negative, the high / low elevation will not be located between the PVC and PVT.

PVC / PVI Station: is the station for the specified point.

PVC / PVI Elevation: is the elevation for the specified point.

Begin Grade: is the grade at the tangent of the PVC.

End Grade: is the grade at the tangent of the PVT.

Curve length: is the length of the vertical curve (the horizontal distance between the PVC and PVT).

Hi/Lo Elevation: is the elevation of the curve at the location where the tangent is zero (the crest of the curve).

Station: is the station where the other point is located on the curve.

Elevation: is the elevation of the other point.

[**Solve**]: computes the details for the vertical curve.

[**Layout**]: opens the Parabolic Layout screen where you can solve for an elevation at a specified station, or solve for a station at a specified elevation.

Results

PVC sta.: is the station at the PVC.

PVI sta.: is the station at the PVI.

PVT sta.: is the station at the PVT.

Hi/Lo sta.: is the station where the vertical curve has a tangent equal to zero (the crest of the curve).

Elev.: is the elevation for the respective point.

Parabolic Layout

[**Curve**] [**Parabolic Layout**]

The Parabolic Layout screen allows you to compute an elevation at a specified station, or a station at a specified elevation.

Beg. Grade: is the percent grade at the PVC.

End Grade: is the percent grade at the PVT.

Curve Length: is the horizontal distance between the PVC and PVT.

PVC Station: is the starting station at the PVC.

PVC Elevation: is the elevation at the PVC.

Solve for: is where you select to solve for an unknown Elevation, or an unknown Station. The selection made here determines which of the following choices will be available.

Interval: When checked, the Current station can be incremented by the specified interval by using the Sta - and Sta +

buttons and then re-computed with the Layout button.

Current station: is the station that will be solved for with the Layout button.

Elevation: is the known elevation for the location(s) on the parabolic curve where you want to compute the station(s).

[**Solve**]: computes the details of the vertical curve.

[**Sta -**]: decreases the Current station by the Interval.

[**Sta +**]: increases the Current station by the Interval.

[**Layout**]: computes either the elevation at the specified Current station or the station(s) at the specified Elevation.

Results

PVC sta.: is the station at the PVC.

PVI sta.: is the station at the PVI.

PVT sta.: is the station at the PVT.

Elev.: is the elevation for the respective point.

Hi/Lo sta.: is the station where the vertical curve has a tangent equal to zero (the crest of the curve).

Straight Grade

[**Curve**] [**Straight Grade**]

The Straight Grade screen will solve for the elevation at a specified station or a station at a specified elevation on a straight grade.

Begin Station: is the station where the straight grade begins.

Begin Elev: is the elevation at the Begin station.

Grade: is the percent slope.

Solve for: is where you select to solve for an Elevation or a Station. The choice made here determines which of the following selections are available.

End station: is the station where you want to compute the elevation.

Interval: When checked, the End station can be incremented by the specified interval by using the [**Station-**] and [**Station+**] buttons and then re-computed with the [**Layout**] button.

End Elevation: is the elevation at the point where you want to compute the station.

[**Layout**]: performs the computation and displays the results.

Results

Station: is the current station.

Elevation: is the elevation for the current station.

Spiral

[**Curve**] [**Spiral]**

The Spiral screen will compute the details of a spiral curve, given the spiral length and radius.

Spiral length: is the length of the spiral curve.

Radius: is the circular curve radius.

[**Solve**]: computes the details of the spiral curve.

[**Layout…**]: opens the Spiral Layout screen where the location of stations on the spiral curve can be computed.

[**Traverse…**]: opens the Traverse on Spiral screen.

Results

X of Throw: is the distance along the tangent where a perpendicular line intersects with the radius point.

Y of Throw: is the minimum distance between the tangent and the extended circular curve.

X: is the distance from the TS to the SC along the tangent.

Y: is distance from the SC to the tangent.

Delta: is the angle between the tangent, and the line between the PI and SC.

Spiral Layout

[**Curve**] [**Spiral**]

The Spiral Layout screen is used to compute station locations on a spiral curve.

Radius: is the radius of the circular curve.

Spiral Length: is the length along the spiral curve from TS to SC.

TS station: is the station at the TS point.

Interval: When checked, is the spiral arc distance that is added or subtracted from the Current Station using the [**Sta +**] and [**Sta -**] buttons.

Current Station: is the station on the curve that is computed.

[**Solve**]: solves and displays the details for the specified spiral curve.

[**Sta -**]: decreases the Current Station by the specified Interval.

[**Sta +**]: increases the Current Station by the specified Interval.

[**Layout**]: computes the location of the Current Station.

Results

Station: is the current station.

Deflection: is the horizontal angle to the current station as if occupying the TS and backsighting the Spiral PI.

Long crd.: is the chord length from the TS to the current station.

Short crd.: is the chord length from the previous station to the current station.

Traverse on Spiral

[**Curve**] [**Spiral**]

The Traverse on Spiral screen is used to compute the location of, and optionally store the SC, or ST and spiral PI points.

Radius: is the radius of the circular curve.

Length: is the length along the spiral curve from TS to SC.

TS / CS Point: is the existing point associated with the TS or CS point.

[**Azimuth**] **/** [**Bearing**]: is the tangent direction at the TS or CS point.

TS->SC: specifies that the curve starts at the tangent to spiral and ends at the spiral to curve.

CS->ST: specifies that the curve starts at the curve to spiral and ends at the spiral to tangent.

Right / Left: specifies is the curve turns toward the right or left as you face the spiral from the TS or CS.

Store SC / ST: When checked, saves a point for the computed SC point.

Store PI: When checked, saves a point for the computed spiral PI.

Results

Tangent: the tangent direction entering the spiral at the TS or CS.

Tangent Out: the tangent direction exiting the spiral at the SC or ST.

X of Throw: is the distance along the tangent where a perpendicular line intersects with the radius point.

Y of Throw: is the minimum distance between the tangent and the extended circular curve.

X: is the distance from the TS to the SC along the tangent.

Y: is distance from the SC to the tangent.

Delta: is the angle between the tangent, and the line between the PI and SC.

Roads Menu

The Roads Menu contains the routines used to perform road layout.

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Add/Edit Templates

[**Roads**] [**Edit Templates**]

The Add/Edit Templates screen is used to edit an existing template or create a new template.

Templates describe the cross-sectional profile of a roadway. They can contain information such as the road width, its slope, a curb, and/or a ditch. Each separate portion of a template is called a *segment*. All templates must have at least one segment and all templates of a particular road must have the same number of segments.

Any template can describe either the left or right side of the road's cross-section (they're reversible). If a road's left and right side are identical, only one template needs to be created; the other side can use the same template, or be "mirrored" later when the road is defined.

All of the saved templates are listed displayed in this screen including each template's name, number of segment, cut slope, and fill slope. An image of the selected segment is also displayed in this screen.

[**New…**]: opens the New Template screen where a new template can be created. This screen is identical to the Edit Template screen except most the buttons are initially deactivated.

[**Edit…**]: opens the Edit Template screen where the selected template can be edited.

[**Copy…**]: opens the Save As screen where a copy of the selected template can be saved with a different name.

[**Delete…**]: deletes the selected template.

[**Import…**]: opens the Open screen where a template can be copied from one folder to the current folder and imported into the job.

Edit Template

[**Roads**] [**Edit Templates**] [**Edit…**]

or [**Roads**] [**Edit Templates**] [**New…**]

The Edit Template screen is identical to the New Template screen and is used to create a new template or edit an existing one.

All of the segments of the current template are listed in the screen. The list shows the name of each segment, the horizontal and vertical offsets (lengths), and the slope.

Note: The length of the first segment must be greater than zero.

Cut Slope: is the slope that will be used when locating the catch point in a situation where the existing terrain is above the level of the hinge point.

Fill Slope: is the slope that will be used when locating the catch point in a situation where the existing terrain is below the level of the hinge point.

[**Insert…**]: opens the Edit Segment screen where a new segment will be added prior to (above) the segment selected in the Edit Template screen.

Note: To add a segment to the end of all existing segments (furthest away from the centerline), be sure <End> is selected from the Edit Template screen prior to tapping [**Insert…**].

[**Edit…**]: opens the Edit Segment screen where the details of the selected segment can be edited.

Note: The selected segment is shown with a thicker line in the map view in the lower portion of the Edit Template screen.

[**Remove**]: removes the selected segment and automatically joins the previous segments to the following segments.

Note: When a segment is removed the existing segments toward the centerline will not change. Only those on the side of the removed segment away from the centerline are adjusted.

Edit Segment

[**Roads**] [**Edit Templates**] [**Edit…**] [**Insert…**]
or [**Roads**] [**Edit Templates**] [**Edit…**] [**Edit…**]
or [**Roads**] [**Edit Templates**] [**New…**] [**Insert…**]

The Edit Segment screen is identical to the New Template screen and is used to create a new template or edit an existing one.

Segment Name: is the name for the segment. A name is required, but it does not have to be unique.

Horizontal Dist: is the horizontal length of the offset

Slope / V Offset: is the slope of the segment, or the vertical length, respectively. When defining a vertical offset, select the ⊙ D if the segment travels downward, or select ⊙ U if the segment travels upward from the point of view of the centerline.

Note: A segment with a negative slope will result in water that flows from the centerline toward the road edge.

Edit Alignments

[**Roads**] [**Edit Alignments**] or [**Jobs**] [**Edit Alignments**]

The Edit Alignments screen is used to create an alignment that defines the centerline of a road containing both horizontal and vertical elements. Editing alignments is fully described [here](#).

Add/Edit Roads

[**Roads**] [**Edit Roads**]

The Add/Edit Roads screen is used to define your road. This is where the templates are added to the alignment and any widenings and super elevations are defined.

All existing roads are listed in this screen. If an existing road is selected, the overhead and profile view of that road are also displayed.

[**New…**]: Opens the New Road screen where a new road can be defined.

[**Edit…**]: Opens the Edit Road screen where the selected road can be edited. The Edit Road screen is identical to the New Road screen.

[**Delete…**]: Opens the following prompts to delete the selected road(s).

- **Are you sure you want to delete the selected Roads?**: Answering **Yes** to this prompt will disassociate the selected road(s) from the current job so they are no longer displayed in the Add/Edit Roads screen. In this case, the road can still be re-associated with the [**Import…**] routine. Answering **No** to this prompt will return you to the Add/Edit Roads screen without making any changes.
- **Delete alignment** *alignment name***?:** Answering **Yes** to this prompt will delete the selected alignment(s) from the current job so they are no longer displayed in the Edit Alignments screen. In this case, the alignment can be re-associated with the [**Import…**] routine from the definition in the RD5 file. Answering **No** to this prompt will open the next prompt without deleting the selected alignment(s) from the current job.
- **Delete** *Roadname***.RD5 file?:** Answering **Yes** to this prompt will permanently delete the selected alignments and road (RD5) files from the data collector.

[**Import…**]: Opens the Import Road screen where a road file can be imported into the existing job. You can import two types of road file into the job:

- Survey Pro road files (RD5) can be imported into the current job. These road files will be added to the job file and can be edited and modified using the Edit Roads functions.
- Land XML files (XML) can be loaded in the current job. Land XML files with roads will be loaded into Survey Pro and can be used in any road staking routine. However, Land XML roads cannot be edited with the Edit Roads functions, nor will they be saved in the job file, so you will have to reload the road if you close and reopen the job.

Note: There are some limitations on the Land XML road elements that are supported in Survey Pro.

- Only one *CrossSectSurf* element is allowed to be defined at each template.
- Only clothoid spirals are supported
- Curve-Spiral-Curve is support for road alignments only, other alignments will turn the spiral into a straight line segment.
- Only *PVI*, *ParaCurve*, and *UnsymParaCurve* elements are supported along the vertical alignment definition.

Note: Some changes may be required to make the Land XML road compatible with Survey Pro. If necessary, the following changes will be made to the road elements imported into Survey Pro:

- The horizontal alignment will have extra line segments pre-pended or appended to match the length of the vertical alignment.
- The vertical alignment will have extra flat line segments pre-pended or appended to match the length of the horizontal alignment.
- *UnsymParaCurve* elements will be converted into two parabolic curves on the vertical alignment.
- If the first *CrossSectSurf* element in the file starts after the defined start station of the horizontal alignment, a copy of the *CorssSectSurf* element will be added at the start station.
- If the center-line elevation defined in the *CrossSectSurf* element differs from the actual center-line elevation, as defined by the vertical alignment, the left and right templates will have a zero-width starting segment added at the inner-most node, called "Subgrade Adjustment" to account for the difference.
- Once all *CrossSectSurf* elements have been loaded and converted to templates, each template will be padded on the outer-most node with additional zero-width segments to ensure each station has the same number of defined segments.

All of these changes will be noted in the results dialog after importing the Land XML road for review by the user. You can save this report to a file by tapping and holding on the results dialog.

New Road Screen / Edit Road

[**Roads**] [**Edit Roads**] [**New…**] or [**Edit…**]

The New Road screen is identical to the Edit Road screen and is used to assemble the parts of a road or edit an existing road. This screen consists of five separate index card style tabs. Each tab accesses a different card that is used to define a particular part of the road.

The Road Card

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Road**]

The Road card of the New Road screen is used to select the alignment to use for the road.

Road Name: is the name assigned to the road. The name must not be the same as any existing road name.

Alignment Description: displays the name of the selected alignment.

[**Choose Alignment**]: opens the Choose Alignment screen where an existing alignment can be selected.

[**Check**]: checks the road for errors and displays the results in the Roads Report screen.

[**View Profiles**]: opens the Road Profiles screen where you can see information about the cross-sectional profile of the road at any station.

[**Set POB…**]: opens the Road Alignment Properties screen where information about the current alignment can be changed.

Roads Report Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Road**] [**Check…**]

The Roads Report screen displays a list of any errors after performing the following tests:

- Confirm that the alignment contains both a HAL and a VAL.
- Confirm that the horizontal length of the VAL is greater than or equal to the HAL.
- Confirm there is at least one template for each side of the road.
- Confirm the first template coincides with the starting station.
- Confirm that all template segments have a name. (The names do not have to be unique.)
- Confirm that the same number of segments exist on each side of the alignment.
- Confirm that each widening start station is less than the corresponding widening's end station.
- Confirm that one widening does not overlap with another widening.
- Confirm that the start station for each super elevation is less than the end station.
- Confirm that no two super elevations overlap.
- Confirm that the start and end of each super elevation either both hinge on the centerline or both hinge on the edge.
- Confirms all templates, widening and super elevations are on the alignment.
- Confirms no more than one template exists at any particular station on the same side of the road.
- Confirms the first segment of all templates is greater than 0.
- Checks for empty templates.
- Checks for widenings with zero width.
- Checks for overlapping parabolic transitions.
- Checks for template-widening width matching.
- Checks for template-super elevation slope matching.

Road Profiles Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Road**] [**View Profiles…**]

The Road Profiles screen allows you to see information about the cross-sectional profile of the road at any station after at least one template has been added to each side of the road.

[<<], [>>] : these buttons move a circle icon that starts at the centerline to each node of the template at the current station. Information for the selected segment is displayed in the right portion of the screen. The name for the selected segment is shown between these buttons.

[**Go…**]: opens a screen where a specific station can be entered. Once ✅ is tapped, the profile at the entered location is shown in the Road Profiles screen.

[**Prof…**]: opens the Details screen and lists several details about the road's cross-sectional profile at the current station.

[**Seg…**]: opens the <u>Details</u> screen and lists information related to the selected segment at the current station.

Road Alignment Properties Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Road**] [**Set POB…**]

The <u>Road Alignment Properties</u> screen is used to change information about the current alignment.

Description: is the name of the current alignment. A new name can be assigned to the alignment from this field.

[**Point**] / [**Location**]: depending how this button is toggled, you can change the POB of the alignment by entering a new point number or new coordinates.

Start Station: replaces the existing starting station of the alignment with the starting station entered here.

The Templates Card

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Templates**]

The <u>Templates</u> card of the <u>New Road</u> screen is used to add existing templates to the road.

The screen displays a list of left and right templates that are currently assigned to the road. When a particular template is selected, a cross-sectional profile view of the selected template is displayed and an overhead view shows where the selected template occurs on the alignment.

[**Add…**]: when a template or <End> is selected from the L or R columns in the <u>Templates</u> card, this button opens the <u>Add Template</u> screen, which allows you to add a new template to the same side of the road that was selected.

[**Edit**]: allows you to edit the selected template in the <u>Edit Template</u> screen, which is identical to the <u>Add Template</u> screen.

[**Remove**]: removes the selected template from the list.

[**Check…**]: checks the road for errors and displays the results in the <u>Roads Report</u> screen, described above.

Add / Edit Template Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Templates**] ([**Add…**] or [**Edit…**])

The <u>Add / Edit Template</u> screen allows you to add a template to the road or edit an existing template.

Template: The Template column lists all the templates that can be added to the road. Selecting a template will display an image of that template in the lower corner of the screen. Once the first template is added, this box will only list templates with the same number of segments as the first.

Start Sta: is the location of the template on the alignment.

[**Check…**]: opens the <u>Roads Report</u> screen and displays any errors.

[**New…**]: opens the <u>New Template</u> screen, which is identical to the <u>Edit Template</u> screen, where a new template can

be created.

[**Edit…**]: opens the <u>Edit Template</u> screen where the selected template can be modified, although accessing the templates editor from here will not allow inserting or removing of segments.

The Widenings Card

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Widenings**]

The <u>Widenings</u> card of the <u>New Road</u> screen is used to add or edit widenings.

A widening is a section of a road that changes in width, but does not necessarily require any new templates. The road width is adjusted by changing only the width of the first segment of the template that leads into the beginning of the widening. Any additional segments, like those that may describe a sidewalk or ditch, are not adjusted.

The following rules must be considered when adding a widening to a road:

- A widening must have a starting station and an ending station or a length.
- Left and right widenings are separate and independent of each other.
- The start and end stations must occur within the boundaries of the alignment.
- The starting station must occur before the ending station.
- The beginning of a widening must match the width of the previous widening or template.
- The end of a widening must match the next template or widening unless it is the last element in the road.
- The beginning or ending of a widening cannot occur within the boundaries of another widening, but the beginning of one widening can occur at the same station as the end of a previous widening.
- Widenings are always positioned by their start station.

[**Add…**]: when a widening or <End> is selected from the L or R columns in the <u>Widenings</u> card, this button opens the <u>Add Widening</u> screen, which allows you to add a widening to the same side of the road that was selected.

[**Edit**]: allows you to edit the selected widening in the <u>Edit Widening</u> screen, which is identical to the <u>Add Widening</u> screen.

[**Remove**]: removes the selected widening from the list.

[**Check…**]: checks the road for errors and displays the results in the <u>Roads Report</u> screen.

Add / Edit Widening Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Widenings**] ([**Add…**] or [**Edit…**])

The <u>Add / Edit Widening</u> screen allows you to add a widening to the road or edit an existing widening.

Start Station: is the location of the beginning of the widening on the alignment.

[**Length**] / [**End Station**]: is the length of the widening measured from the Start Station, or it is the end station, depending on how the button is toggled.

Starting Width: is the starting width of the widening. This must match the width of the previous template, or widening.

Ending Width: is the ending width of the widening.

[**Check…**]: opens the Roads Report screen and displays any errors.

[**New…**]: opens the New Widening screen, which is identical to the Edit Widening screen, where a new widening can be created.

[**Edit…**]: opens the Edit Widening Screen screen where the selected widening can be modified.

Mirror to Right / Left: duplicates the widening to the other side of the road when checked.

Super Elevations Card

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Super Elevations**]

The Super Elevations card of the New Road screen is used to add or edit super elevations.

A super elevation changes the cross slope of the first segment of a template in order to bank a curve - the slope of any remaining segments will remain unadjusted. One super elevation defines a begin point and an end point where the slope change begins and where it finishes the transition for one side of a road. Therefore, to bank a two-lane road, four super elevations would be required - one at the beginning and one at the end of the curve for each side of the road.

A super elevation can either hinge at the outer edge of the first segment, or at the centerline. Hinging at the center results in the elevation of the outer segments to change. Hinging at the edge results in the elevation of the centerline changing. Because of this, the software will only allow you to hinge on edge for one side of a road. If the other side is also super elevated, you will be forced to hinge that side at the center so that an abrupt change in elevation does not occur at the centerline.

[**Add…**]: when a super elevation or <End> is selected from the L or R columns in the Super Elevations card, this button opens the Add Super Elevation screen, which allows you to add a super elevation to the same side of the road that was selected. (Widenings and super elevations are always sorted in this list by their specified start stations.)

[**Edit**]: allows you to edit the selected super elevation in the Edit Super Elevation screen, which is identical to the Add Super Elevation screen.

[**Remove**]: removes the selected super elevation from the list.

[**Check…**]: checks the road for errors and displays the results in the Roads Report screen.

Add / Edit Super Elevation Screen

[**Roads**] [**Edit Roads**] ([**New…**] or [**Edit…**]) [**Super Elevations**] ([**Add…**] or [**Edit…**])

The Add / Edit Super Elevation screen allows you to add a super elevation to the road or edit an existing super elevation.

Start Station: is the location of the beginning of the super elevation on the alignment.

[**Length] / [End Station**]: is the length of the super elevation measured from the Start Station, or it is the end station, depending on how the button is toggled.

Note: Keep in mind that the slope at the end of a super elevation will continue down the road unless another super

elevation is entered to change the slope back again. For example, a curve will typically require two super elevations for each side of the road: one at the beginning of the curve and one at the end.

Slope 1 / 2: is the starting and ending slopes of the road, respectively. The starting slope must match the current slope of the road at that station.

Parabolic Transition 1 / 2: is the length of the vertical curve that will lead in and out of the super elevation, respectively. Parabolic transitions are optional parts of a super elevation and result in a smoother change going into and coming out of a super elevation, similar to how a spiral curve is used with a horizontal curve.

Note: One half of the parabolic transition length will extend before and after the starting point and/or the ending point of the super elevation. This should be considered when using parabolic transitions near the end of an alignment since this length cannot extend beyond the limits of the road.

Hinge on [Center] / [Edge]: determines if the super elevation is computed by rotating the road around the centerline or the road's edge.

Note: When hinging on edge, the road is actually rotated around the end of the first segment of the template that leads into the super elevation. Only the first segment is adjusted with a super elevation. The length and slope of any segments beyond the first will not be adjusted from a super elevation.

[**Check…**]: checks the road for errors and displays the results in the Roads Report screen.

Road Stakeout

[**Roads**] [**Road Stakeout**]

The Stake Road screen is used to stake any segment of a road profile at any station.

Use Station Equation: When checked, the current station equation will be applied to the road.

[**Equation Settings**] : opens the Station Equation screen where a station equation can be configured.

[**Tap Road…**]: opens the Tap on a Road screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

Begin Station: displays the station assigned to the beginning of the road.

End Station: displays the final station in the road.

[**Backsight…**]: Opens the Station Setup screen..

[**Next >**]: takes you to the next Stake Road screen where a specific point on the road can be selected to stake.

Stake Road - Screen 2

The second Stake Road screen displays a cross-sectional profile view of the road at the current station. Any particular point on this view can be selected and staked.

Station Interval: is the value that is added to the Station to Stake after the [**Next Station**] button is pressed.

[**Next Station**]: advances the Station to Stake by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the [**Next Station**] button will also stop at any horizontal or vertical alignment node, and the beginning and end of any widening and super elevation that falls within the interval.

[<<] , [>>] : These buttons are used to select the particular node, or an offset to it, from your road profile that you wish to stake. The segment name at the selected node is also displayed. If staking the centerline with an offset, the side of the road that the offset occurs is also displayed.

Offset: When checked, allows you to specify an offset distance to stake as opposed to staking the actual node locations.

Note: A *positive* value offset is applied at the specified distance from each node *away* from the centerline. A *negative* value offset is applied at the specified distance from each node *toward* the centerline.

Note: If an offset occurs past the edge of the road, no vertical or cut / fill information will be computed for that point.

Subgrade: When checked, allows you to specify a vertical offset from the actual node locations. Positive values result in the stake location occurring below the selected node. Negative values result in the stake location occurring above the selected node.

[**Backsight…**]: Opens the Station Setup screen..

[**< Back**]: returns to the previous screen.

[**Next >**]: takes you to the next Stake Road screen where the direction and distance information to the stake point is displayed.

Stake Road - Screen 3

The third Stake Road screen displays distance, direction, and other information about the point to be staked.

Station: displays the station where the stake point occurs and the type of line segment it falls on in the alignment.

Segment: displays the name of the segment tangent to the point to be staked; if the point is on the Left or Right side of the road; and the specified offset, if any.

Angle Right: is the horizontal angle from the backsight to the stake point.

Horz Dist: is the horizontal distance from the total station to the stake point.

Vert Dist: is the vertical distance from the total station to the stake point.

ZE to Rod: is the zenith angle from the total station to the stake point.

[**Circle Zero**]: is used to modify the circle on the total station so that the angle right reading will be zero when it is facing toward the design point, which can sometimes be easier than turning to an obscure angle value. When this

button is tapped, the following actions will occur:

1. A new backsight circle value is computed, sent to the instrument and stored in the raw data
2. The Angle Right value is changed to zero to reflect the change. The instrument now needs to be turned horizontally to zero to face the design point.
3. To prevent errors, the backsight set up is invalidated when exiting the Stakeout dialog if this button has been used. A Circle zeroed on a design point is meaningless once the design point has been staked.

Note: The [**Circle Zero**] button is not available when using a robotic total station.

[**< Back**]: returns to the previous screen.

[**Stake >**]: opens the final Stake Road screen where the shots to the stake point are performed.

Stake Road - Screen 4

The fourth and final Stake Road screen is used to perform the shots necessary to locate the design point. This screen is identical to the final Stake Points screen.

Road Slope Staking

[**Roads**] [**Slope Staking**]

The Road Slope Staking screen is used to locate the catch point of the road at any station.

[**Tap Road…**]: opens the Tap on a Road screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

Begin Station: displays the station assigned to the beginning of the road.

End Station: displays the final station in the road.

Use Station Equation: When checked, the current station equation will be applied to the road.

[**Equation Settings**] : opens the Station Equation screen where a station equation can be configured.

[**Backsight…**]: Opens the Station Setup screen..

[**Next >**]: takes you to the next Road Slope Staking screen where the slope staking parameters are set up.

Road Slope Staking - Screen 2

The second Road Slope Staking screen is used to set up some slope stake parameters prior to slope staking the road.

Station: is the station to be slope staked.

Station Interval: specifies how far to advance from the current station to the next station.

[**Next Station**]: advances the current station by the Station Interval.

Note: If the Stake Corners option is selected in the Stakeout Settings screen, the [**Next Station**] button will also stop at any horizontal or vertical alignment node, and the beginning and end of any widening and super elevation that falls within the interval.

[**Backsight…**]: Opens the Station Setup screen..

[**< Back**]: returns to the previous screen.

H. Map Card

The H. Map card displays information about the horizontal details of the road at the current station.

Segment Type: displays the type of horizontal section at the current station.

Left / Right: is the description of the left and right templates that are being used at the current station.

V. Map Card

The V. Map card displays a graphic of the cross-sectional profile of the road at the current station. The hinge points and slopes are also displayed.

Slopes Card

The Slopes card is used to specify the cut and fill slopes that will be used when computing the location of the catch point. The default values are the slopes stored in the template for the section being staked. To override a default slope, check the appropriate box and key in the new slope. The new slope entered will always be used regardless of the values stored in the templates. Changes to slopes will be reflected in the V. Map card graphic.

Cut Slope: is the left and right slope, respectively, used when the terrain requires a cut (the hinge point is located below the terrain's surface).

Fill Slope: is the left and right slope, respectively, used when the terrain requires a fill (the hinge point is located above the terrain's surface).

Cut/Fill Hinge Points Cards: The Fill Hinge Points tab and the Cut Hinge Points tab are used to select the segment where you want the hinge point location to be computed from in situations requiring a fill or a cut respectively. (The hinge point will occur at the node of the selected segment furthest from the centerline.) The hinge point can also be defined at different segments for the left and right sides of the road.

Left / Right: is the specified left and right segment, respectively, to compute the hinge point from in a situation that requires a fill. Changes to these fields will be reflected in the V. Map card graphic.

[**Stake CP >**]: opens the next slope staking screen. The following slope staking screens are identical to non-road layout slope staking screens and are described starting here.

Road Station and Offset

[**Roads**] [**Show Station**]

The Road Station and Offset routine allows you to take a shot to a prism that is positioned anywhere on the road and compute the details of where that point is located in relation to the road. This information can then be compared to the

data from a grade sheet.

[**Tap Road…**]: opens the <u>Tap on a Road</u> screen where you can tap on any road in the job to select it.

Name: displays the name of the selected road.

Begin Station: displays the station assigned to the beginning of the road.

End Station: displays the final station in the road.

Use Station Equation: When checked, the current station equation will be applied to the road.

[**Equation Settings**] : opens the <u>Station Equation</u> screen where a station equation can be configured.

[**Backsight…**]: Opens the <u>Station Setup</u> screen..

[**Next >**]: takes you to the next <u>Road Station and Offset</u> screen where the slope staking parameters are set up.

Road Station and Offset - Screen 2

The second <u>Road Station and Offset</u> screen is used to take a shot to the prism and view the data from various cards.

Height of Rod: is the length of the rod.

EDM: This button can be toggled to various EDM modes. The options available depend on the total station being used. Consult the total station's documentation for more information on the EDM modes that it supports.

[**Shot**]: takes a shot to the prism.

[**< Back**]: returns to the previous screen.

[**Store…**]: stores the stake point.

Alignment Card

Station: displays the station at the rod position.

Template: displays the name of the template that is used at the rod position.

Segment: displays the name of the template's segment at the rod position.

Elev: displays the elevation at the rod position.

Offset Dist: displays the perpendicular offset from the centerline to the rod position.

Right of Line / Left of Line / On Line: displays if the rod position is to the right of the centerline, left of the centerline, or on the centerline, respectively.

Cross-Section Card

Station: displays the station at the rod position.

Template: displays the name of the template that is used at the rod position.

Segment: displays the name of the template's segment at the rod position.

Cut / Fill: is the necessary cut or fill that will bring the rod position even with the road's surface.

Cut / Fill to CL: is the necessary cut or fill that will bring the rod position to the same elevation as the centerline at the current station.

Cut / Fill to Edge: is the necessary cut or fill that will bring the rod position to the same elevation as the outer edge of the last segment at the current station.

Shot Data Card: Displays the angles and distance measured by the total station from the last shot.

Station Equation

[**Roads**] [**Road Stakeout**] [**Equation Settings**]
or [**Roads**] [**Slope Staking**] [**Equation Settings**]
or [**Roads**] [**Show Station**] [**Equation Settings**]

The Station Equation screen is used to configure the stationing for an alignment with stationing that changes at a specific location. This situation might occur where the road you are staking merges with another road and once you stake past the point where the roads merge, you want to use the stationing assigned to the other road.

Once you pass the location where the stationing changes, all ahead stations are displayed with a **(2)** after it to differentiate between a back and ahead station, such as **11+00 (2)**. Likewise, when keying in an ahead station, you must append it with a **(2)** to indicate it is an ahead station.

Road Name: Displays the name of the current alignment.

Back: Defines the stationing on the back alignment where the stationing change occurs.

Ahead: Defines what the new stationing is for the same location defined in the **Back** field.

Increase: indicates the stationing should increase as you move forward past the location where the stationing changes.

Decrease: indicates the stationing should decrease as you move forward past the location where the stationing changes.

Note: When **Stake "Corners", Not Just Even Intervals** is checked in Stakeout Settings, the location where the stationing change occurs is considered a corner and will be included as you advance.

Adjust Menu

The Adjust Menu contains routines to perform a variety of adjustments.

[Scale](#)
[Translate](#)
[Rotate](#)
[Traverse Adjust Index](#)

[Main Index](#)

Traverse Adjust Index

[Traverse Adjust](#)
[Traverse Adjust- Angle Adjustment](#)
[Traverse Adjust- Compass Rule](#)
[Traverse Adjust- Results](#)

[Adjust Menu Index](#)
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Scale

[**Adjust**] [**Scale**]

The <u>Scale</u> screen will scale the distances of a range of points relative to a specified base point. This is useful to correct a survey where a scale factor was inadvertently applied during data collection.

[**Tap Points…**]: allows you to select points by tapping them from a map view.

[**To/From…**]: allows you to select points by typing in a point range.

Base point: The distances to all the selected points will be scaled relative to this point. (The coordinates for the base point will not change.)

Scale factor: is the scale factor that is applied to the distances from the base point to the selected points.

Include Elevation in Adjustment: When checked, the elevations to the selected points will also be adjusted by the scale factor relative to the Base point.

[**Solve**]: will perform the adjustment on the selected points and change the coordinates accordingly.

Translate

[**Adjust**] [**Translate**]

The <u>Translate</u> screen will move a group a points horizontally and vertically by a specified distance and direction.

[**Tap Points…**]: allows you to select points by tapping them from a map view.

[**To/From…**]: allows you to select points by typing in a point range.

Translate by Coordinates: When checked, all of the selected points will be adjusted in the same direction and distance as between a specified From point or location and a To point or location. When unchecked, the selected points will be adjusted by the specified direction and distance. The choice made here determines the options available below.

Note: The choice made above determines which fields will be available below.

[**Azimuth**] / [**Bearing**]: is the direction to move the selected points.

Horizontal Distance: is the horizontal distance that the selected points are moved.

Vertical Distance: is the vertical distance that the selected points are moved.

From: is where the first point or location is defined that is used to compute the direction and distance that the selected points are adjusted.

To: is where the last point or location is defined that is used to compute the direction and distance that the selected points are adjusted.

[**Point**] / [**Location**]: allows you to enter either a point name or location coordinates.

[**Solve**]: adjusts the selected points in the same direction or distance as defined from the *From* point to the *To* point, or by the direction and distance entered.

Rotate

[**Adjust**] [**Rotate**]

The Rotate screen will rotate selected points around a specified point. This is useful to correct a survey where an incorrect backsight was used during data collection.

[**Tap Points…**]: allows you to select points by tapping them from a map view.

[**To/From…**]: allows you to select points by typing in a point range.

Rotation Point: The selected points will be rotated around the point specified here. (The coordinates for the rotation point will not change.)

Simple Angle: when selected, this allows you to enter the deflection angle to rotate the selected points.

Old and New Azimuths: when selected, this allows you to enter an old and new azimuth, which is used to compute the angle to rotate the selected points.

Note: The choice made from the two options above determines which fields will be available below.

Rotate: is the angle to rotate the selected points around the Rotation point.

[**Old Azimuth**] / [**Old Bearing**]: is a known direction between any two points in the current job before they are

rotated.

[**New Azimuth] / [New Bearing**]: is the direction between the same two points specified above after the rotation.

[**Solve**]: will perform the rotation on the selected points and change the coordinates accordingly.

Traverse Adjust

[**Adjust**] [**Traverse Adjust**]

The Traverse Adjust wizard is a series of screens that allow you to adjust a closed traverse for angular error and/or perform a compass rule adjustment on a closed or open traverse.

Choose Your Traverse: is used to select a traverse to adjust from the following options:

- [**Tap Polyline…**]: is used to tap an existing polyline from a map view.
- [**To/From…**]: provides selection of points by point name.

Angle Adjust: When checked, will perform an angle adjustment to the closed traverse. An angle adjustment will apply the angular error equally among all of the angles of the closed traverse and adjust the coordinates for all but the first two traverse points. (The first leg of the traverse is not adjusted.)

Compass Rule: When checked, will perform a compass rule adjustment on the selected traverse.

Adjust elevation: when selected, the elevations for the traverse points are also adjusted from the compass rule adjustment. [**Next >**]: opens the next screen of the adjustment wizard.

Traverse Adjust - Angle Adjustment

If an angle adjustment is being performed, this screen will appear next.

Closing Angle: is the closing angle for the traverse, which must be represented as an angle-right as shown below.

[**Next >**]: opens the next screen of the adjustment wizard.
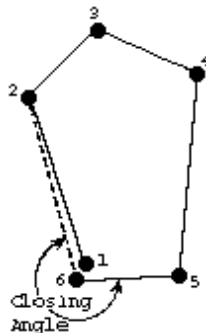
Traverse Adjust - Compass Rule

If a compass rule adjustment is being performed, this screen will appear next.

Closed Traverse: select this option if you are adjusting a closed traverse.

Close to Known Location: select this option if you are adjusting an open traverse and closing to a known point or location.

Note: if a closing location is not specified, it is automatically assumed that the first point of the traverse will be the closing location.

[**Location**]: allows you to enter coordinates to define the closing location.

- **North**: is the Y-coordinate for the closing location.
- **East**: is the X-coordinate for the closing location.
- **Elev**: is the elevation for the closing location.

[**Point**]: allows you to select an existing point to define the closing location.

- **Point**: is the name of the existing point at the closing location.

[**Next**]: opens the next screen of the adjustment wizard.

Traverse Adjust - Results

This screen displays the changes that will be made by the adjustment, where they can be previewed before the actual adjustment is made.

The screen lists the adjustment details in three main sections: the angle adjustment details; the compass rule adjustment details, and the point details where the before-and-after coordinates for each point are listed.

Error dist: is the horizontal distance between the starting point and closing point.

Error azm: is the direction from the closing point to the starting point.

Precision: is the ratio of the error distance to the length.

Angular error: is the difference between $(N-2) \cdot 180$ and the actual sum of the internal angles, where N is the number of sides in the traverse.

Length: is the sum of all the sides of the boundary.

Perimeter: is the length plus the error distance.

[**Adjust**]: if the results in the preview are acceptable tap this button to perform the adjustment.

Miscellaneous Screens Menu

The following screens are only available via a Quick Pick or a power button. They are not available directly from any menu item.

Past Results
Create Points
Edit Description List
Trimble Slant HR -> HR
Convert Slant HI -> HI
Quick Pick Editor
Select Points
Map View
Active Map
Survey Map
Map Display Options
Manage Basemaps
Edit Basemaps
Smart Targets
Manage Smart Targets
Edit Smart Targets

Main Index

Past Results

[▼], **Past Results** (where applicable)

When the Past Results option is used to enter a value in a specific field that was computed previously within the software.

Select the line that contains the value that you want to use and tap ✅.

The selected value will then be entered in the field associated with that power button.

Create Points Screen

[**Job**] [**Edit Alignments**] [▼] Create Point

The Create Points screen is used to store points that coincide with specific locations on an alignment.

Alignment Nodes: When checked, will store points at locations where a change occurs on an alignment, for example where a straight section and a curved section meet.

Sta. Intervals: When checked, will store a point at the specified station interval along an alignment.

Start Point Name: is the name for the first point that will be stored from this screen.

Description: is the description that will be given to all the points that are stored from this screen.

Start Location: is the location for the first point, which is the reference location used to compute the locations of the remaining points. The default location is the POB defined from the Edit Alignment screen.

Edit Description List

 (From any **Description** field), **Edit Description List...**

The Edit Description List screen is used to modify the contents of the drop-down description list, which is optionally displayed next to any **Description** field. You can also save the list to a file.

[**Edit**]: Opens the selected description in a screen where you can modify it.

[**Insert**]: Opens a screen where you can add a new description.

[**Delete**]: Deletes the selected description.

[**Clear**]: Deletes all the descriptions in the list.

[**Save**]: Saves the list to the current description text file. This is only available when the list only contains the descriptions in the current non-code description file.

[**Save As…**]: Saves the contents of the list to a new description text file.

Trimble Slant HR -> HR

 (From any **HR** field), **Trimble Slant HR -> HR**

This option only applies when using a Trimble Traverse Kit that allows the measurement of a Slant HR instead of the usual HR.

When this option is selected, it will convert a Slant HR entered in an HR field to a standard HR. This must be performed each time a new Slant HR is entered in the HR field.

Consult the documentation that came with the Trimble Traverse Kit for more information on correctly measuring a Slant HR.

Convert Slant HI -> HI

 (From any HI field), **Convert Slant HI to HI**

This option is only available when using a Trimble total station that supports a Slant HI instead of the usual HI, such as a Trimble S6.

When this option is selected, it will convert a Slant HI entered in an HI field to a standard HI. This must be performed each time a new Slant HI is entered in an HI field.

Consult the documentation that came with the Trimble Total Station from more information on correctly measuring a Slant HI.

Quick Pick Editor

⭐, **Edit Quick Pick** (located at bottom of list)

The Quick Pick Editor is used to customize the list of routines available from the ⭐ Quick Pick button.

Menu Items: Is a dropdown list containing the menu items you would normally see in the Main Menu. Selecting a menu item from this list will display all of the routines from that menu item that can be included in the Quick Pick list. Routines listed in bold are already in the Quick Pick list.

[**Add -->**]: will add the routine selected in the left column to the bottom of the Quick Pick list, which can then be moved elsewhere in the list.

[**Defaults**]: will revert the Quick Pick list back to the defaults. A prompt will first ask you if you are sure before the changes occur.

Quick Picks: is the list of routines available from the current Quick Pick list.

[**Move Up**]: will move the routine selected in the right column up one level toward the top of the list.

[**<-- Remove**]: will remove the selected routine from the current Quick Pick list.

[**Move Down**]: will move the routine selected in the right column down one level (toward the bottom of the list).

Select Points

From any screen that contains a [**To/From...**] button.

The Select Point(s) screen is used to define a simple list of points or a list of points that define a line that can include curves depending on where the screen is accessed from.

Examples of how to enter different lists of points are displayed in the lower portion of the screen.

Point Range: is the area where you enter your point list using the same format as shown in the examples.

Note: Spaces in point lists are ignored. They are only used in the examples for clarity.

Once the list is entered, tap ✅ to return to the previous screen.

The examples for entering curves are explained in detail as follows:

- **7 (8) 9**
  The first example, defines a curve that passes through Points 7, 8 and 9, respectively.
- **7 (8, L) 9**
  The second example defines a curve where Point 8 is the radius point and the curve begins to the Left (from the point of view of the radius point), turning from Point 7 to Point 9.

Note: When defining a curve with a radius point, the other two points must be the same distance from the radius point for a solution.

- **7 (100, L, L) 9**
  The third example describes a curve with a radius of 100, using the same units as the job, that begins at Point 7, turning to the Left (from the point of view of the radius point), creating a Large arc (> 180°), and ending at Point 9.

Map Display Options

From the Map View, tap [icon]

The Map Display Options screen is used to configure the information that is displayed in the Map View.

Show Points: will show a dot for each point in view.

Smart Point Labels: displays only certain point labels (name and description) when many points are grouped together to reduce clutter.

Names: will show the point name for each point that is in view.

Descriptions: will show the point description for each point in view.

Show Lines: will show all the polylines that are on the DTM layer

Show Basemaps: will display any basemaps selected for the current job.

Show Only This Layer: When checked, will show only the selected point data that exists on the specified layer. When unchecked, point data from all layers is displayed.

[**Manage Layers…**]: opens the Manage Layers screen where the layers can be configured.

[**Manage Basemaps...**]: opens the Manage Basemaps screen where basemaps can be added to the current job.

Save as Default Display Options: When checked, will save the selections made to this screen as the default selections.

Map View

Many screens in Survey Pro have a map view. Map views have a common set of controls, described below:

[icon] from the command bar, or [icon] from various screens

Tip: You can pan around your map by dragging your finger or stylus across the screen.

[icon] **Zoom Extents Button**: will change the scale of the screen so that all the points in the current job will fit on the screen.

[icon] **Zoom In Button**: will zoom the current screen in by approximately 25%.

[icon] **Zoom Out Button**: will zoom the current screen out by approximately 25%.

 Zoom Window Button: allows you to drag a box across the screen. When your finger or stylus leaves the screen, the map will zoom to the box that was drawn.

 Zoom To Point Button: prompts you for a point name and then the map view will be centered to the specified point with the point label displayed in red.

 Turn To Point Button: Tap this button and then tap a point in the map view to automatically turn the total station to the selected point. This is only available when a robotic total station is selected and Remote Control is active in the Instrument Settings.

 Increase Vertical Scale: is only available when viewing a vertical profile. Each time it is tapped, the vertical scale of the view is increased.

 Decrease Vertical Scale: is only available when viewing a vertical profile. Each time it is tapped, the vertical scale of the view is decreased.

 Zoom Preview Button: will display only the points that are currently in use.

Map Display Options: opens the Map Display Options screen, described below.

Manage Basemaps: opens the Manage Basemaps screen, described below (only available from the main map view, accessed from the command bar button).

The main map and survey routine maps can function as an active map, where you can perform COGO and survey functions directly from the map. Tap and hold on the map to bring up a context menu where you can pick Active Map functions.

The main map can function as an active survey map, where you can measure and store points directly from the map. Tap and hold on the main map to bring up a context menu where you can toggle the map to enter Survey Map functions.

Active Map View

The main map as well as any map on a survey routine will also function as an active map, which allows you to perform several actions directly from the map. Tap and hold on the map to bring up a context menu of available actions. The actions available will depend on what you have selected at the tap and hold location:

- **Point to Point**: Select a second point to perform an Inverse Point to Point.
- **Point to Location**: Select a location from the map to perform an Inverse Point to Location.
- **Point to Line**: (when a point is selected) Select a line to perform an Inverse Point to Polyline, or select two additional points to perform an Inverse Point to Line.
- **Corner Angle**: Select a middle point and then an end point to perform a Corner Angle calculation.
- **Point to Line**: (when a line is selected) Select a point to perform an Inverse Point to Polyline.
- **Line to Location**: Select a location to perform an Inverse Location to Polyline.
- **Location to Point**: Select a point to perform an Inverse Point to Location.
- **Location to Location**: Select a second location to perform an Inverse Location to Location.
- **Location to Line**: Select a line to perform an Inverse Location to Polyline.

Stake to Point: Opens up the [Stake Point](#) screen (conventional mode), the [Remote Staking](#) screen (robotic mode), or the [GNSS Stake Point](#) screen (GNSS mode) where the selected point can be staked.

- **Stake to Line**: (when a point is selected) Select a second point to define the line, then opens the [Stake to Line Conventional](#) screen (conventional mode), or the [Stake to Line GNSS](#) screen (GNSS mode).
- **Stake to Line**: (when a line is selected) Opens the [Stake to Line Conventional](#) screen (conventional mode), or the [Stake to Line GNSS](#) screen (GNSS mode).
- **Stake to Location**: Opens up the [Stake Location](#) screen (conventional mode), the [Remote Staking](#) screen (robotic mode), or the [GNSS Stake Point](#) screen (GNSS mode) where the selected location can be staked.
- **Create Point**: Opens up the [New Point](#) screen where you can create a new point at the selected (2D) location.
- **Show Results**: Opens up a results view of all of the active map results generated for this instance of the map view.
- **Clear Selection**: Clears the active map results from the map view, and resets the selection of points and/or lines in the active map.

Survey Map View

The main map can also be placed into survey mode, which allows you to collect points directly from the map. Tap and hold on the main map to bring up the context menu that allows you to toggle between map view and survey map mode. The controls on the active survey map are:

 or **Topo Observation**: Takes a tracking mode observation and stores the point with the point name, description, and feature code (if showing) from the survey map controls at the bottom of the screen.

 or **Observation**: Starts a standard mode observation, and when the observation is accepted, prompts you for all of the surveying prompts you have selected on the [Surveying Settings](#) card of the [Job Settings](#).

 or **Height of Rod**: Opens up a height of rod (conventional mode) or height of GNSS antenna (GNSS mode) prompt, where you can change the current HR.

 Station Setup: (conventional mode) Opens up the [Station Setup](#) screen where you can check or modify the current instrument setup.

 GNSS Status: (GNSS mode) Opens up the [GNSS Status](#) screen.

Pt: Enter the point name for the next survey point to store.

Desc: Enter the description for the next survey point to store.

Show Autolinework Code Controls >: Shows the [Feature and linework](#) control. Show this control if you wish to add feature codes and/or auto linework control codes to topo survey points.

Hide >: Hides the [Feature and linework](#) control . When this control is hidden, topo survey points will be stored without feature codes or auto linework control codes. If you have prompt for Feature and Attributes set on the [Surveying Settings](#) card, you will still be prompted for feature codes for regular observation points.

Enter Key: Triggers a Topo Observation or a standard observation, depending on the **Survey Map Use Enter Button for Topo** setting on the [Surveying Settings](#) card of the [Job Settings](#).

Manage Basemaps

From the Map View, tap ▦

The Manage Basemaps screen is used to select the basemaps to display in the map view for the current job.

The main portion of the screen lists the names of all the basemaps that have been added to the current job. The other columns display if each basemap is visible and the number of elements in a vector basemaps.

Note: You can toggle the visibility of a basemap by tapping on the **Visible** column of the basemap list.

[**Add…**]: allows you to select additional basemaps for the current job.

[**Edit…**]: opens the Edit Basemap screen, described below, where you can preview or edit the selected basemap. (Raster basemaps cannot be edited.)

[**Remove…**]: removes the selected basemap from the list. (The source file will not be removed.)

[**Move Up**]: will move the selected basemap up one level in the list. (Consult the User's manual for information on how to manage basemaps.)

[**Move Down**]: will move the selected basemap down one level in the list.

[**Orient**]: opens the Orient Basemap wizard where you can calculate a shift and rotation of DXF basemaps to the job file.

Edit Basemaps

From the Map View, tap ▦, [**Edit…**]

The Edit Basemaps screen is used to preview the selected basemap and, if it is a DXF basemap, you can set the file units, modify the visibility and selectability of specific layers, and toggle the orientation of the DXF basemap on and off.

Layers Card (DXF basemaps only)

The Layers card is used to control the visibility and object selectability of specific layers of a DXF basemap. The Layers card contains four columns:

- **Layer**: Shows the name of each individual layer in the DXF file.
- **Visibility**: Displays the state of the layer visibility. You can toggle the state by tapping on the **Visibility** column. There are three states:

    Selectable - the layer is visible on the map, and objects on this layer can be selected in the active map.
    Shown - the layer is visible but objects on this layer cannot be selected in the active map.
    Hidden - the layer is not visible and objects on this layer cannot be selected on the active map.

- **Points**: Displays a count of point objects on the DXF layer.
- **Lines**: Displays a count of line objects on the DXF layer.

Hide All: Sets the **Visibility** state of all layers to hidden.

Show All: Sets the **Visibility** state of all layers to shown.

Selectable All: Sets the **Visibility** state of all layers to selectable.

General Card (DXF basemaps only)

The <u>General</u> card is used to set the units of the DXF basemap.

Distance Units: Set the distance units of the DXF basemap. The map will be converted from these units to job units for display and object selection.

Preview Card

The <u>Preview</u> card shows a preview of how the selected basemap will look in the map view

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Orientation Card (DXF basemaps only)

The <u>Orientation</u> card allows you to toggle the DXF orientation on or off.

Basemap Orientation Wizard

[**Manage Basemaps**] [**Orient**]

This wizard is used to calculate a shift and rotation of a DXF basemap to the job file coordinates.

Choose two points from the job, then choose two matching locations from the DXF basemap.

[Accept]: Applies the transformation to the display of the map in the map control.

Note: The orientation of the DXF basemap applies only a shift and rotation from the DXF coordinates to the job coordinates. The DXF coordinates are not scaled.

Smart Targets

Tap a ![dropdown] power button next to a ![prism icon] (indicating a *prism* Smart Target is currently selected) or ![reflectorless icon] (indicating a *reflectorless* Smart Target is currently selected). This item is available from any screen where the rod height can be adjusted.

Smart Targets provide a convenient way to work with different prisms and/or target types on the same job. See the User's Manual for more information.

Quickly change to any available user-configured smart target by tapping it from the upper portion of the list. The active Smart Target is marked with a ![checkmark].

Manage Smart Targets…: Opens the <u>Manage Smart Targets</u> screen where a custom target can be configured.

Manage Smart Targets

▼, **Manage Smart Targets**

The Manage Smart Targets screen is used to edit existing custom targets or configure a new custom target type.

The upper portion of the screen lists all the custom targets that are currently available. To select a target, tap it from this list. The selected target can then be edited, deleted, or activated.

[**Add**]: Opens the Edit Smart Target screen where a new custom target can be created.

[**Edit**]: Opens the Edit Smart Target screen where the selected Smart Target can be modified.

[**Delete**]: Deletes the selected Smart Target.

[**Activate**]: Activates the selected Smart Target. The active smart target is marked with the ● symbol.

Note: It is not necessary to access the Manage Smart Targets screen to activate a different Smart Target. You can quickly activate a Smart Target by tapping ▼ next to any HR field and then tap the desired Smart Target from the list that appears.

Edit Smart Targets

▼, **Manage Smart Targets**, [**Add**] or [**Edit**]

The Edit Smart Target screen is used to edit an existing Smart Target or create a new one.

Name: is the desired name for the Smart Target.

Target Type: defines the type of target as being a Prism, Reflectorless, Long Range, which increases the EDM power, or On Instrument, which uses whichever EDM settings are configured on the total station (for Leica total stations only).

HR: is the default HR for the Smart Target.

Add Offset to HR: when checked, the offset entered will always automatically be added to the HR entered for the Smart Target.

Prism Constant: is the prism constant for the Smart Target.

Note: If a prism constant is entered for a Smart Target while a prism constant is also set in the total station, the prism constant will be applied twice, resulting in incorrect distance measurements for every shot. Be sure the prism constant is set to zero in the total station if entering a value for a Smart Target, or vice-versa.

Use RMT: Check this box when using a remote target and specify the ID used by the prism in the associated box. (This option is only available when using a total station and prism that supports target IDs.)

Using Active Prism: Check this option when using an active prism. (This option is only available when using a total station that supports active prisms.)

Note: In order to perform automatic repetitions when using active prisms, active prisms must be set up over both the backsight and foresight.

Appendix Menu

[Transverse Mercator Zones](#)
[Lambert Zones](#)

[Main Index](#)

Transverse Mercator Zones

Central Meridians for State Plane Coordinates

E = East
W = West
C = Central

State	Zone	Central Meridian
Alabama	E	85 50
	W	87 30
Alaska	2	142 00
	3	146 00
	4	150 00
	5	154 00
	6	158 00
	7	162 00
	8	166 00
	9	170 00
Arizona	E	110 10
	C	111 55
	W	113 45
Delaware		75 25
Florida	E	81 00
	W	82 00
Georgia	E	82 10
	W	84 10
Hawaii	1	155 30
	2	156 40
	3	158 00
	4	159 30
	5	160 10
Idaho	E	112 10

	C	14 00
	W	115 45
Illinois	E	88 20
	W	90 10
Indiana	E	85 40
	W	87 05
Maine	E	68 30
	W	70 10
Michigan (1934)	E	83 40
	C	85 45
	W	88 45
Mississippi	E	88 50
	W	90 20
Missouri	E	90 30
	C	92 30
	W	94 30
Nevada	E	115 35
	C	116 40
	W	118 35
New Hampshire		71 40
New Jersey		74 40
New Mexico	E	104 20
	C	106 15
	W	107 50
New York	E	74 20
	C	76 35
	W	107 50
Vermont		72 30
Wyoming	1	105 10
	2	107 20
	3	108 45
	4	110 05

Lambert Zones

Central Meridian and Zone Constants for State Plane Coordinates

N = North
S = South
C = Central

NC = North Central
SC = South Central
M = Mainland
I = Island
O = Offshore

State	Zone	Central Meridian	Zone Constant
Arkansas	N	92 00	0.581899
	S	92 00	0.559691
California	1	122 00	0.653884
	2	122 00	0.630468
	3	120 30	0.612232
	4	119 00	0.596587
	5	118 00	0.570012
	6	116 15	0.549518
	7	118 20	0.561243
Colorado	N	105 30	0.646133
	C	105 30	0.630690
	S	105 30	0.613378
Florida	N	84 30	0.502526
Iowa	N	93 30	0.677745
	S	93 30	0.658701
Kansas	N	98 00	0.632715
	S	98 30	0.614528
Kentucky	N	84 15	0.622067
	S	85 45	0.606462
Louisiana	N	92 30	0.528701
	S	91 20	0.500013
	O	91 20	0.454007
Maryland		77 00	0.627634
Massachusetts	N	71 30	0.671729
	I	70 30	0.661095
Michigan	N	87 00	0.722790
	C	84 20	0.706407
	S	84 20	0.680529
Minnesota	N	93 06	0.741220
	C	94 15	0.723388
	S	84 20	0.700928
Montana	N	109 30	0.746452
	C	109 30	0.733354

	S	109 30	0.714901
Nebraska	N	100 00	0.673451
	S	99 30	0.656076
New York (Long Island)		74 00	0.654082
North Carolina		79 00	0.577171
North Dakota	N	100 30	0.744133
	S	100 30	0.729383
Ohio	N	82 30	0.656950
	S	82 30	0.634520
Oklahoma	N	98 00	0.590147
	S	98 00	0.567617
Oregon	N	120 30	0.709186
	S	120 30	0.684147
Pennsylvania	N	77 45	0.661540
	S	77 45	0.648793
South Carolina	N	81 00	0.564497
	S	8100	0.544652
South Dakota	N	100 00	0.707738
	S	100 20	0.689852
Tennesee		86 00	0.585440
Texas	N	101 30	0.579536
	NC	97 30	0.545394
	C	100 20	0.515059
	SC	99 00	0.489913
	S	98 30	0.454007
Utah	N	111 30	0.659355
	C	111 30	0.640579
	S	111 30	0.612687
Virginia	N	78 30	0.624118
	S	78 30	0.606925
Washington	N	120 50	0.744520
	S	120 30	0.726396
West Virginia	N	79 30	0.637773
	S	81 00	0.618195
Wisconsin	N	90 00	0.721371
	C	90 00	0.705577
	S	90 00	0.687103