SMI Version 8 Reference Manual

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# SMI Version 8 Reference Manual

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GETTING STARTED

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Overview

Figure 1-1 Allegro, Jett-ce, Titan & Pocket PC

One of the strengths of SMI products has been to help you perform your work with the fewest keystrokes possible. SMI continues to build on this strength with the release of SMI Version 8. This release centers on the bulk of the functionality within the Classic SMI interface environment, which is very similar to the super-efficient RPL interface with which so many of you are already familiar. Additionally, you can easily create your own command shortcuts using the function/command keys on your data collector or by using the Command Favorites menu. Command Favorites is a customizable screen menu that puts your most commonly-used commands only two taps away.

Manual Conventions

This manual, as well as other Eagle Point user manuals, uses the following typeface conventions:

<table>
<thead>
<tr>
<th>Instance</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module and Manual Names</td>
<td>All Eagle Point products and manuals are italicized and in bold face (i.e., SMI, SMI Version 8, SMI Version 8 User Guide).</td>
</tr>
</tbody>
</table>

16 SMI Version 8 Reference Manual
Section Names

When you are referred to another section in the manual, the section name will be italicized and the page number will be given (i.e., Introduction on page 1).

Data to Type in

If you need to type data into a field on the dialog box or on the command line, the information you are to type in shows as:

1234567890 AaBbCcDdEeFf GgHh

Prompts and Messages

Prompts from the software and system messages are shown as:

Please select node #12345.

There are two types of notes used to draw your attention to important information in the manual. The following shows each type, with a description of each note.

⚠️ This is an FYI note. It will contain helpful hints and information that can increase your productivity or enhance the use of this module.

✔️ This is a warning note. Read these notes very carefully. Information important to successfully using this module will be included in these notes.

Dialog boxes and soft key menus have a table below them to describe the different options available on them. A sample is shown below.

<table>
<thead>
<tr>
<th>Option</th>
<th>Icon</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Menu</td>
<td></td>
<td>This information indicates the menu that is currently being edited. Tap the triangle or press the up and down cursor keys while the current menu is selected to change to a different menu.</td>
</tr>
<tr>
<td>New</td>
<td>![New]</td>
<td>Tap this button to create a new command menu.</td>
</tr>
</tbody>
</table>

Throughout this manual numerous references are made to various key types utilized by SMI. Below is a definition for each and the convention used to reference each in the documentation:

Key

<table>
<thead>
<tr>
<th>Soft Keys</th>
<th>Function</th>
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<tr>
<td>These keys are called soft keys because their functions (and labels) change, depending on the menu selected. Soft keys are represented in this manual as white lettering on a black, rectangular background (i.e., INST soft key executes the SMI Instrument Menu command).</td>
<td></td>
</tr>
<tr>
<td><strong>Toggle Keys</strong></td>
<td>A toggle key is a key whose function changes each time you press it. Any soft key in the display that has a square after it is a toggle key (i.e., \texttt{RAWS} toggles the storage of raw data on and off).</td>
</tr>
<tr>
<td><strong>Hard Keys</strong></td>
<td>Hard key functions are imprinted on each key itself. The functions of these assigned keys are identified by the \textit{SMI} surveying overlay that came with your \textit{SMI} program. Hard keys are represented in this manual as black lettering on a gray, rectangular background (i.e., \texttt{SPACE} for the Space Bar key).</td>
</tr>
<tr>
<td><strong>Primary Keys</strong></td>
<td>Primary functions (or keys) are noted directly above each key on the \textit{SMI} overlay. Primary keys are represented in this manual as black lettering on a white, rectangular background (i.e., \texttt{TRAV} executes the Traverse Shot command).</td>
</tr>
<tr>
<td><strong>Special Keys</strong></td>
<td>Some special keys are called out use other conventions (i.e., the Enter key is represented with white lettering and a brown background \texttt{!}. This is also true for the \texttt{a} and \texttt{c} keys).</td>
</tr>
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Contacting SMI/Eagle Point

Eagle Point
4131 Westmark Drive

(563) 556-8392 Main Office
(800) 678-6565 Main Office Toll Free
(800) 477-0909 Support Number
(563) 556-5321 Fax Number

Normal business hours are 8:00 AM to 5:00 PM CST., Monday through Friday

authcodes@eaglepoint.com - Authorization Codes Request
ftp@eaglepoint.com - Help with the SMI and Eagle Point FTP sites
sales@eaglepoint.com - Eagle Point Relationship Building Department
support@eaglepoint.com - Eagle Point Product Support
webmaster@eaglepoint.com - Eagle Point Webmaster

http://www.eaglepoint.com - Eagle Point website
http://www.smi.com - SMI Field Survey Solutions website

Send an email directly to an Eagle Point employee by using the following convention: first name.last name@eaglepoint.com (i.e., Joe.Smith@eaglepoint.com).
This chapter provides an alphabetical listing of the SMI Field Surveying software commands.
2PFS Preserve Settings

PRODUCT: ALL

KEY IN: OLDRSCT

COMMAND GROUP: SETUP

This function is essentially the same as the standard Free Station command except the information from the prior Free Station (Resection) command is "preserved" or retained. This command is useful if you realize that an error occurred with one of the values entered or if you need to run another command before completing the two point free station setup.

See Two-Point Free Station/Resection (2PFS) on page 271 for more information on this command.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Setup Command Group.

Alpha Mode (ALPHA)

PRODUCT: ALL

KEYSTROKES: [ALPHA] (ALLEGRO INS KEY, TITAN KEY)

Press this key to switch to alpha mode entry. This changes the keyboard mappings from mapped commands (i.e., SETUP, RPTS, etc.) to regular keyboard text entry. Most commands that require text entry will automatically switch to Alpha mode.
**Angle Adjustment**

**PRODUCT:** ALL

**KEYSTROKES:** <RPTS> (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) ENTER DATA !

**KEY-IN:** COMPASS

**COMMAND GROUP:** COGO

This function performs an angle adjustment to balance the angles of a traverse using the current Random Points file. It can be accessed from the Random Points menu or the Compass menu.

When running the <AA> command once while the raw data flag is set on (a 2 2), the angular error and the number of angles are stored to the raw file.

> **Remember to copy or back up your job before performing an Angle Adjustment or Compass Rule function.**

![Figure 2-1 Angle Balance](image)
Example: Perform Angle Balance on a Closed Traverse

To perform an angle adjustment, proceed with the following example. Refer to Figure 2-1 on page 23 and assume that it represents a field traverse where you shot point 1 and called it point 5 and shot point 2 and called it 6. The direction from point 5 to 6 will be slightly different from the direction from 1 to 2.

1. Press <RPTS>.
2. Key in 1. 6 <SPACE> 1 <SPACE> 2 and press !.
3. To display the angular error, press MORE NeXT AA CR ~eRR.
4. Tap AA to adjust the angle error out of the traverse.

The program goes through its calculations and when it is done, the screen displays DONE. You will now confirm that the bearing from 5 to 6 is the same as from 1 to 2.

5. Key in 5 <SPACE> 6 and press PT-PT.

✓ Side shots from the traverse points should be entered as negative numbers (see the example below).

Example: Perform Angle Balance on a Closed Traverse with Side Shots

Using an unadjusted form of the previous traverse, assume that from point 4 there were 8 separate observations to point numbers 101 through 108. The Random Points file would now look like this: 1 2 3 4 -101.108 5 6 1 2.

One or more side shots are identified with a negative sign. To place a negative in front of 101.108, key in 101.108 and press a +/-.

1. Press <RPTS>.
2. Key in 1. 4 <SPACE> 101.108 a +/- <SPACE> 5 <SPACE> 6 <SPACE> 1 <SPACE> 2 and press !.
3. To display the angular error, press MORE NeXT AA CR ~eRR.
4. Tap AA to adjust the angle error out of the traverse.
The program goes through its calculations and when it is done, the screen displays DONE. You will now confirm the bearing from 5 to 6 is the same as from 1 to 2.

5. Key in 5 SPACE 6 and press the PT-PT key.

---

Example: Perform Angle Balance on an Open Traverse

![Diagram of Open Traverse to known points]

Figure 2-2  Angle Adjustment with an Open Traverse Diagram

In the above illustration, you traversed from point 1 to point 50, where points 1, 2, 149, and 150 are previously established points. The Random Points file would look like this: 1.50 149 150. To find the angle error, press c ~eRR. When AA is tapped, the direction from 49 to 50 will become the same as the direction from 149 to 150 with all of the angles between appropriately adjusted.

1. Press RPTS.

2. Key in 1. 50 SPACE 149 SPACE 150 and press !.

3. To display the angular error, press MORE NeXT AA CR ~eRR.

4. Tap AA to adjust the angle error out of the traverse.

The program goes through its calculations and when it is done, the screen displays DONE. You will now confirm the bearing from 49 to 50 is the same as from 149 to 150.

5. Key in 49 SPACE 50 and press the PT-PT key.
To enter Angle Left while traversing, key in the Angle Left, press ± to change the sign, then tap in the Traverse menu. The program understands that a negative Angle Right is an Angle Left.

**Angle Left/Right to Azimuth**

PRODUCT: ALL

KEYSTROKES: LEFT: a LT; RIGHT: c RT (ALLEGRO 7 KEY)

KEY-IN: LEFT: ANGL, RIGHT: ANGR

COMMAND GROUP: CONVERSIONS

These functions convert an angular value (either entered on the stack or at the functions prompt) and converts them to an azimuth using the current setup.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.

**Example**

If the current occupy point is 1 with the coordinates of 5000, 5000 and current back sight is point 2 with the coordinates of 5100, 5100. If an angle right of 45.0 degrees is entered the resulting value will be 90.0 degrees. Because the back azimuth was 45d +, the angle right of 45d equals the new azimuth of 90d.

**Angle Point and Intersection Point**

PRODUCT: ALL

KEYSTROKES: SETUP (ALLEGRO F KEY, JETT J KEY, TITAN G KEY) NeXT ~PT XPT

KEY-IN: ANGPT

COMMAND GROUP: COLLECT

Used to determine remote elevations and to locate hard to reach targets, these commands are used in conjunction to determine coordinates and elevations of features and structures without the need for a prism or a shot at the base of the feature. SMI creates an intersection to the feature when you record
observations to feature from more than one occupied point. The elevation is also determined using the same information in the same fashion.

✓ The height of instrument (HI) is necessary to obtain correct elevations on each of the features located.

Angle Point and Intersection Point Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>~PT</td>
<td>Angle point is used to collect observations from an occupied point. This determines the first leg, or angle of the intersection necessary to locate the coordinates of the feature.</td>
</tr>
<tr>
<td>XPT</td>
<td>Intersection point is used to collect observations from a second occupied point. These observations complete the intersection and determine the location of the feature.</td>
</tr>
</tbody>
</table>

From one instrument location, use ~PT to store angles to a point (or points), such as towers, bridge abutments, road centerlines, fence lines, and so on.

![Figure 2-3 Observations from 23](image)

From another instrument location, use XPT to create points at the intersection point of each of these points.

![Figure 2-4 Observations from 24](image)
Once you have stored an angle point from one instrument position, you can move to another setup or traverse point and point to the same object; the program will create an intersection point – with elevation (if Elevations are on).

When the program recognizes the number as an angle point, it collects the angles to the point and calculate the coordinates (and elevation, if on) of the point. The current angle automatically is intersected with the previous angle to create an intersection with the coordinates (and elevation, if on) by point number.

---

**Example: Determining Coordinates and Elevations of Three Remote Features**

This function can be used to get coordinates and elevations of inaccessible objects or when in dangerous places. Special thanks to Shelly Van Winkle of the Missouri Department of Highways for suggesting this innovative function!

In the illustration in Figure 2-5 on page 28, angle points were stored from control point 20. The angle points are numbered 21, 22, and 23.

![Figure 2-5 Stored Angle Points](image)

1. **When the instrument is occupying point 20, sight the tower and tap \(\simPT\).**
   This stores the direction to the tower (now point 21) from 20.

2. **Turn the gun to point to the top of the church steeple and tap \(\simPT\).**
   This stores the direction to the church steeple (now point 22) from 20.

3. **Turn the gun to point to the top of the radio tower and tap \(\simPT\).**
   This stores the direction to the radio tower (now point 23) from 20.

4. **Traverse through point 24 to point 25, which will carry the proper backsight orientation.**
5. From point 25, turn the instrument and sight the tower. Tap $\text{xPT}$ to store the intersecting direction to the tower (point 21) from 25.

6. Traverse through point 25 to point 26.

7. From point 26, turn the gun to point to the top of the church steeple and tap $\text{xPT}$.
   This stores the intersecting direction to the church steeple (point 22) from 26.

8. Traverse through point 26 to point 27.

9. Turn the gun to point to the top of the radio tower and tap $\text{xPT}$.
   This stores the intersecting direction to the radio tower (point 23) from 27.

Since the next number was set to 21, it was not necessary to key in 21 before tapping $\text{xPT}$. Since each $\text{xPT}$ was stored in the same order as $\text{xPT}$, it was not necessary to key in a point number before tapping each $\text{xPT}$. If Elevations are on, elevations will be stored from the $\text{xPT}$ positions. Remember, in order for the elevations to be correct, the height of instrument should be stored in $\text{SMI}$ before shooting the benchmark.

---

**Area**

PRODUCT: ALL

KEYSTROKES: [RPTS] (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) KEY IN DATA $\text{AREA}$

KEY-IN: AREA

COMMAND GROUP: RANDOM POINTS

This function computes the acreage of an area within a predefined boundary. If you are trying to determine a boundary with a predetermined area, refer to Predetermined Area on page 181.

To get the area and perimeter of a boundary, simply create a Random Points file of the points that comprise the boundary and tap $\text{AREA}$.
Example: Determine Area and Perimeter of a Boundary

Using the plat information below, you will enter the boundary and determine the area and precision.

![Figure 2-6 Compute Area Illustration](image)

1. Traverse from point 1 to point 4. This stores points 1 through 4. See Traverse (TRAV) on page 264 for more information.

2. Press the RPTS key in 1. 4 and press !.

3. Tap the AREA key.

<table>
<thead>
<tr>
<th>DOT</th>
<th>AREA: CRD</th>
<th>RZ</th>
<th>ZMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRES</td>
<td>2.6274</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQ FT</td>
<td>114494.2376</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PER</td>
<td>1594.7178</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 2-7 Find Area](image)

Example: Determine Area, Perimeter and Precision of a Boundary

1. Traverse from point 1 to point 5. This stores points 1 through 5. See Traverse (TRAV) on page 264 for more information.
2. Press \textbf{RPTS}, key in 1.5 \textbf{SPACE} 1, and press \textbf{!}.

3. Tap \textbf{prec}.

\begin{center}
\begin{tabular}{lrr}
\textbf{DOT} & \textbf{RZ} & \textbf{SMI} \\
\hline
\textbf{ACRES} & = & 2.6274 \\
\textbf{SF FT} & = & 1144.93832 \\
\textbf{PER} & = & 7183.222 \\
\textbf{PREC} & = & 7183.222 \\
\end{tabular}
\end{center}

\textbf{EDIT} DLT CK AREA PREC SLDT

\textit{Figure 2-8 Find Area, Precision, and Perimeter}

For more information about using Random Points files, see \textit{Random Point Station} on page 187.

\textbf{Example: Acreage Around a Boundary with a Curve}

\begin{center}
\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2-9}
\caption{Find Acreage Around Boundary with a Curve}
\end{figure}
\end{center}

For this example, refer to the illustration above.

\textit{Points 1 through 9 must be stored in the data collector.}

1. Press \textbf{RPTS}, key in 1.4 \textbf{SPACE} \textbf{c} (the minus key) \textbf{7 \ SPACE \ 8 \ SPACE \ 9 \ SPACE \ 6}, and press \textbf{!}.

The data should look like this 1.4 “7 8 9” 6 with 7 8 9 in quotes.
2. Tap **AREA**

---

**Example: Acreage Around a Boundary with a Non-tangent Curve**

For this example, refer to the illustration above.

1. Traverse around the boundary and store points 1 through 4.

2. Perform a distance — distance intersection from points 1 and 4 using the radius as the distance from points 1 and 4.

3. Store the radius point at 5.

4. Press **RPTS**, key in 1.3 $\text{SPACE}$ (to get quotes) key in 4 $\text{SPACE}$ 5 $\text{SPACE}$ 1, and press **!**.

   The data should like this **1.3 “4 5 1”**.

5. Tap **AREA**

---

*Figure 2-10 Compute the Area for a Lot with a Non-tangent Curve*
Azimuth-to-Bearing Conversion (ATB)

PRODUCT: ALL

KEYSTROKES: \texttt{c\ ATB} (THE 1 KEY)

KEY-IN: \texttt{A\ c\ 0\ B}

COMMAND GROUP: CONVERSIONS

This function converts an azimuth to a bearing. The display shows the value as angle right, bearing, and deflection angle.

Simply enter the azimuth value and press \texttt{c\ ATB} (the 1 key).

For example, a back azimuth of 301°12' would be converted to a bearing of N58°48'W. Other angles are displayed based on the current back azimuth.

![Figure 2-11 Azimuth-to-Bearing Conversion](image)

Backsight Azimuth

PRODUCT: ALL

KEYSTROKES: \texttt{SETUP} (ALLEGRO F KEY, JETT J KEY, TITAN G KEY) \texttt{NEXT\ NEXT\ BKAZ}

KEY-IN: \texttt{BKAZS}

COMMAND GROUP: SETUP

This function allows you to set the backsight either by entering the azimuth direction towards the backsight, or enter two points to compute the azimuth.
Key in the desired backsight direction and press [SETUP] [NeXT] [NeXT] [bk az]. The backsight direction is stored using the coordinates of the current occupied point.

You also can type two point numbers to establish the backsight direction. Simply enter two point numbers separated by a space and press [bk az].

**Backsight Bearing**

PRODUCT: ALL

KEYSTROKES: [SETUP] (ALLEGRO F KEY, JETT J KEY, TITAN G KEY) [NeXT] [NeXT] [bk br]

KEY-IN: BKAZS

COMMAND GROUP: SETUP

This function allows you to set the backsight either by entering the bearing direction then the quadrant or enter the quadrant and bearing together as one value.

Key in the desired backsight direction and press [SETUP] [NeXT] [NeXT] [bk br]. **SMI** then prompts you for the quadrant (NE=1; SE=2; SW=3; NW=4) the bearing is in. The backsight direction is stored using the coordinates of the current occupied point.

You also can type the quadrant in front of the bearing value. For example, S 69°35’14” W would be entered as 369.3514 where 3 infers the South West quadrant.

**Backsight Point (BKPT)**

PRODUCT: ALL

KEYSTROKES: [BKPT] (ALLEGRO D KEY, JETT C U KEYS, TITAN E KEY)

KEY-IN: BKPTS

COMMAND GROUP: SETUP

This function allows you to enter a backsight point from your occupied point, and computes and stores a back azimuth from the occupied point. This requires a zero set on the instrument when the backsight is pointed if doing an Angle Right survey.
Key in the desired backsight point and press \[BKPT\]. The backsight point is stored, and the back azimuth is computed and stored using the coordinates of the current occupied point.

You also can press \[BKPT\] to shoot the backsight point and compare it to the stored backsight point. After prompting for the backsight point number, a shot is taken that gives you a check on the backsight distance. Information about the backsight point check is stored in the raw data file if Raw Data is on.

You can also access this command through the \[SETUP\] menu.

---

**Bench**

PRODUCT: CONSTRUCTION

KEYSTROKES: \[CONST\] (ALLEGRO I KEY, JETT Q KEY, TITAN J KEY) \[NeXT\] \[NeXT\] \[BNCh\]

KEY-IN: \[BNCH\]

COMMAND GROUP: CONSTRUCTION

This function, used for a back-of-terrace position for slope staking, has been improved thanks to a suggestion by Jess Stanley and Mike Jones, two of our great customers from California.

Ditch data may now be entered without defining the vertical control or template. A horizontal control must be entered and the \[BNCH\] data (offset, elevation and slope) must be entered. Back slope can be down (fill area) or up (cut area); the program knows, based on where you take the shot.

The bench data also overrides the current template information. This is useful when a special ditch needs to be used that is not defined in the current template.

To understand how the Bench command may be helpful, let’s first take a look at how \textit{SMI} would work if there wasn’t a template defined at all, as shown in Figure 2-12 on page 36.

\textit{Elevations should be turned on when slope staking benches.}
**Figure 2-12 Ditch Without Using a Template**

If a template has not been defined, the program uses the ditch as defined by the `BNCH` key.

A second use of the Bench command may be illustrated along with the use of a template, as shown in the figure below.

**Figure 2-13 Ditch Using a Template**

When staking, if you take a shot that is located between the centerline and the alternate ditch slope point on the template, the program uses the template for the staked location. If you take a shot that is located beyond the alternate ditch slope point, `SMI` uses the alternate ditch created within the Bench command.
**Example**

![Diagram of Bench Area and Slope](image)

**Figure 2-14 Alternative Slope or Bench**

In the illustration above, the alternate slope or bench is defined by the offset from centerline, bench elevation, and bench slope.

When you tap `<BNCH>`, these are the items requested by *SMI*. When a shot is taken where the offset is greater than the bench offset used, the slope stake information given is based on the bench data that has been entered.

If the offset to the shot is less than the bench offset used, the template is used if a template has been entered.

The illustration indicates that the ground level is higher than the bench elevation. If the elevation at the rod is less than the elevation of the bench, *SMI* assumes the slope given was down instead of up.

For example, if the slope given was 2 and the elevation of the rod is above the bench elevation, the slope would be up at a 2:1 slope. If the elevation of the rod is less than the bench elevation entered, the data given would assume the slope to be down on a 2:1 slope.

If using bench information with shots that are beyond the bench offset, a template is not needed. If there is a template, it will be ignored for all points beyond the bench offset used.

Bench data entered for the right side of the road is mirror-imaged for the left side of the road. Therefore, if you want to use the template on the left side of the road beyond the bench offset, the bench should be nullified.
To nullify a bench, press \texttt{CONST} \texttt{NeXT} \texttt{NeXT} \texttt{BNCH}, key in 0, and press \texttt{!}.

Horizontal control should be entered to use benches; otherwise, \textit{SMI} does not know where the offset is from.

---

**Benchmark (BMRK)**

**PRODUCT:** ALL

**KEYSTROKES:** \texttt{BMRK} (ALLEGRO G KEY, JETT \texttt{a} V KEYS, TITAN H KEY) or \texttt{SETUP} (ALLEGRO F KEY, JETT J KEY, TITAN G KEY) \texttt{NeXT} \texttt{Bm}

**KEY-IN:** BM

**COMMAND GROUP:** SETUP

Use this function for shooting a location with a known elevation to establish the elevation of the occupied point. This function allows you to transfer a benchmark elevation to the instrument.

The comment record (CM) within the raw data reports benchmark elevation, height of instrument, height of rod, horizontal angle (reporting an angle right), zenith angle, and slope distance.

Press \texttt{SETUP} \texttt{NeXT} \texttt{BM}. If you are not connected to an instrument, you need to manually key in the slope distance, zenith angle and angle right – all values separated by a space. For example \texttt{122. 54 91. 1620 314. 4130}. When finished, press \texttt{!}.

You may now key in an elevation of the benchmark and tap \texttt{EL?} (or key in a point number that contains the benchmark elevation and tap \texttt{BMPT}). Or, you may flop the scope and tap \texttt{REV}. This either records the observation if you have an instrument, or prompts you to key in the slope distance, zenith angle and angle right, separated by a space, and press \texttt{!}.

The reference elevation is displayed and temporarily stored with the occupied point information (but it is not yet permanently stored in a point number). To store this elevation at a point, key in the point number and tap \texttt{STORE}.

If \texttt{HI} and \texttt{HROD} are left at 0.00, the elevation this benchmark routine brings to the instrument will be a “reference elevation.” This will not be the current elevation at the point under the instrument; however, when side shots are taken to the same rod (that has not been raised or lowered), \textit{SMI} will store the correct elevations along with the correct coordinates.
If you are using tripods for prism points, ~PT, and XPT, SDA, for remote elevations, or STOEL, it is necessary to enter the HI and HROD.

Figure 2-15 Transferring a Benchmark Elevation to the Instrument

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev</td>
<td>Tap this key to collect a second Zenith Angle (reversed or Face 2) to be averaged with the first shot.</td>
</tr>
<tr>
<td>BmPt</td>
<td>Tap this key to get the elevation from the given point number. This calculates a new elevation for the occupied point and occupies it.</td>
</tr>
<tr>
<td>EL?</td>
<td>Key in the elevation of the benchmark. Tap EL?. The elevation of the occupied point is now displayed and occupied.</td>
</tr>
<tr>
<td>Bm</td>
<td>Tap this key to start over by taking another shot. This shot needs to be in the Face 1, or normal position.</td>
</tr>
<tr>
<td>St or E</td>
<td>This soft key displays after the first menu has been acted upon. This function is optional. You may tap STORE to store the elevation with the occupied point. You may also key in a point number and tap STORE to store the coordinates and elevation in a different point. You may go to another function such as STAKE or Side Shot without using STORE. The elevation will stay intact. The new occupied point is displayed as COOR, since the point was not stored.</td>
</tr>
</tbody>
</table>
**Boot the Rod**

PRODUCT: DOT

COMMAND GROUP: DOT COMMANDS

Use this function when you want to temporarily adjust the height of the rod. This is useful when you need
to raise the rod for a clear shot over an obstruction.

Key in the boot value and tap \texttt{BOOT}. This value is temporarily stored as the height of rod.

\begin{itemize}
  \item The boot value may or may not be reset to zero, depending on how you set the \texttt{0ROD} function. See
  \textit{Zero the Rod} on page 285.
\end{itemize}

When 0ROD is on and the HI (height of instrument) has a nonzero value, the next shot uses the boot
value, after which the HI is automatically reset to zero. This is useful when you want the rod booted for
only one shot.

When 0ROD is off, the boot value (or HI) is not reset to zero, and is carried through to each subsequent
shot. This is the default.

**Change Sign (+/-)**

PRODUCT: ALL

KEYSTROKE: \texttt{+-} (THE . KEY)

KEY-IN: CHGS

COMMAND GROUP: CALCULATOR FUNCTIONS

This command lets you change the sign of the current value. This may be necessary when working with
either chains or random point files.
Change/Defaults (CHG)

PRODUCT: ALL

KEYSTROKE: CHG (THE B KEY)

KEY-IN: CHNG

COMMAND GROUP: OPTIONS

This menu key accesses the Change/Defaults menu, which includes functions that allow you to modify defaults used by the program for display and storage of data.

The Change/Defaults menu includes a large number of soft keys, some of which only appear in certain versions (e.g., ROBOTIC only). Many of the soft key options are toggle switches; a box in the soft key indicates that the item has been selected. Tap NEXT to scroll through the soft key menu screens.

Once you have set the defaults, press JOB NEXT SFLG (Save Flags). You can then make other changes or even clear the memory of the data collector. You can get your saved defaults back by pressing JOB NEXT rFLG to recall the flags.

The two categories of defaults that may not be restored from saving the flags are tolerances (TOLM) and beginning point defaults (BGPT).

Change/Defaults Menu 1

The settings on the first menu allow you to set the ON/OFF toggle for raw data and elevations, as well as provide settings that allow you to control the overwriting points, and set the next number, note prompts, and amount of significant digits reported on the screen. Change/Defaults Menu 1 has the following soft key options.

| OVRW | RAW | ELEV | NOTE | FIX4 | MN |

Figure 2-17 Change/Defaults Menu 1 Soft Keys
### Change/Defaults Menu 1 Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVRW</strong> / <strong>OVRW®</strong></td>
<td>This toggle key lets you control the replacement (or overwriting) of point data. When selected (<strong>OVRW®</strong>), the program automatically replaces points. The number 1 appears in the display to the left of SMI to indicate that this option has been activated. When deselected (<strong>OVRW</strong>), the program checks before replacing point data. The default is off, requiring you to confirm before a point is overwritten.</td>
</tr>
<tr>
<td><strong>RAW</strong> / <strong>RAW®</strong></td>
<td>This toggle key lets you select whether raw data will be stored with each point. When selected (on), the letter R appears in the display to the left of USER to indicate that this option is active. The default is off.</td>
</tr>
<tr>
<td><strong>ELEV</strong> / <strong>ELEV®</strong></td>
<td>This toggle key lets you select whether elevations will be stored with point data. When selected (on), the number 3 appears in the display to the left of USER to indicate that this option is active. The default is off.</td>
</tr>
</tbody>
</table>
| **NOTE** / **AUTO** / **Ln te** / **NTBL** | This four-way toggle key toggles between:
- PROMPTING OFF, WON’T STORE LAST NOTE
- PROMPTING OFF, WILL STORE LAST NOTE
- PROMPTING WITH LAST NOTE
- PROMPTING WITH NOTE TABLE
When Notes are on, you are prompted to enter a note or description for each new point when it is stored. If Notes are off, you can still enter a note on the last point or any other point if the coordinates have been stored. **SETUP note** prompts for a note on the last point. If a point number is entered before pressing **SETUP note**, it prompts for a note on the specified point number. When this option is used, the number 4 appears in the display to the left of SMI to indicate that this option is active. |
| **Fix4** | This function lets you modify the number of decimal places displayed on the screen when using the data collector for adding, subtracting, multiplying, and dividing, and when using SMI to display distance and elevation. The display prompts you to enter the fixed number of digits you want shown after the decimal point. That number then appears in this soft key. The default is four decimal places. Other values such as go/come, left/right, cut/fill, triangle solutions, and intersections are not affected by this fix point. To have this fix point also control these other values, press **CHG NeXT D spl y FI X4**. (See Display Options Menu on page 44.) HI and hrd are not affected by either of the fix points. These are always defaulted to three places after the decimal. |
This toggle key lets you select whether the program prompts for the next number to be stored. If this option is not selected, the program automatically uses the next available number, unless you manually key in a point number to be used.

### Change/Defaults Menu 2

**KEYSTROKES:** [CHG] [NeXT]

The settings on the second menu allow you control how information is displayed and entered, as well as establish initial point settings, units, direction type, scale factors and tolerances. The Change/Defaults Menu 2 has the following soft key options:

**Display**

The Display Options menu allows you to adjust how information is presented on your screen, to what precision and whether you want to be prompted with a beep. See *Display Options Menu on page 44*.

**Input**

This menu allows you to customize how SMI prompts you for raw data and HROD, as well as set the cursor location for notes and whether or not to write out a time stamp. See *Input Options Menu on page 45*.

**Mode**

These options are used to help you configure how you intend to use the program with respect to units, directions and collection methodology. See *Mode Options Menu on page 46*.

**Adjust**

These options control how the resultant coordinates are calculated based on factors such as Earth's curvature, refraction, grid, sea level or combined scale factors. The curvature and refraction (EC) setting defaults to ON. This affects your computed elevations and is noticeable over longer distances. See *Adjustment Options Menu on page 47*.

**TolM**

This soft key presents a submenu that allows you to modify current tolerance values for vertical and horizontal angles, elevations, and horizontal and slope distances when taking multiple angles and distances in your current job. Whenever a tolerance is exceeded, the data collector signals with a beep and/or an arrow pointing to the error. See *Tolerances Menu on page 48*.  

---

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN / NN®</td>
<td>This toggle key lets you select whether the program prompts for the next number to be stored. If this option is not selected, the program automatically uses the next available number, unless you manually key in a point number to be used.</td>
</tr>
</tbody>
</table>
**Option** | **Function**
--- | ---
*Bgpt* | This soft key lets you set your beginning point defaults. The normal defaults are 5000 for north and 5000 for east. If Elevations are on, the default elevation is 100 for the first point. The default first point number is 1. When you change these default values, they are used for the first point each time you create a new job. See *Beginning Point Defaults Menu* on page 49.

---

**Display Options Menu**

**KEYSTROKES:** [CHG] [NeXT] [DSPLY]

The Display Options menu allows you to adjust how information is presented on your screen and to what precision, as well as whether you want to be prompted with a beep. The Display Options menu has the following soft keys:

- **BRG** - **BEEP** - **FIX4** - **1"** - **CFIX** - **EXIT**

**Figure 2-19 Display Options Menu**

**Display Options Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th><strong>Option</strong></th>
<th><strong>Function</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>~RT® / COOR®</td>
<td>This key toggles the display between Angle Right, Coordinate, Bearing, and Azimuth formats (see <em>Display Format</em> on page 97).</td>
</tr>
<tr>
<td>BRG® / AZ®</td>
<td>This key turns the beep alert on and off.</td>
</tr>
<tr>
<td>BEEP / BEEP®</td>
<td>This key toggles between “Will use Fix4 for digits after decimal” and “Won’t use Fix4 for digits after decimal.” The digits after the decimal can be any amount you specify under [CHG] [fix4]. The number you specify is then displayed after the “FIX” on the soft key. For example, to have your distances, elevations, and Go/Come values set to three digits after the decimal, press [CHG] 3 [fix4]. The soft key toggle now displays [fix3] / [fix3®] to turn on and off “Will use Fix3 for digits after decimal” and “Will not use Fix3 for digits after decimal.” ([fix3®] is on.)</td>
</tr>
<tr>
<td>1&quot; / .1&quot;</td>
<td>This key toggles between 1 sec angles and .1 sec angles.</td>
</tr>
</tbody>
</table>
**Option** | **Function**
--- | ---
**CFIX** | This function prompts for a Construction Fix Point. This function lets you fix the number of places after the decimal for station and offset values.

*If you are in Meters mode, you can tap <NeXT> to see an option to toggle between 1+00 and 1+000. This indicates an option for how stations are displayed. The option is between two or three numbers after the plus and before the decimal. When in Feet mode, there are two numbers after the plus when displaying stations.*

**EXIT** | Tap this key to exit to the previous menu.

1+00 | 1+000 | If Meters mode is on, this key toggles between having stations every 100 meters and every 1000 meters. If Meters mode is off, this key is blank.

---

**Input Options Menu**

**KEYSTROKES:** [CHG] [NeXT] [INPUT]

This menu allows you to customize how SMI prompts you for raw data and HROD, as well as set the cursor location for notes and whether or not to write out a time stamp. The Input Options menu has the following soft keys:

- **DZH**
- **END**
- **TS**
- **HROD**
- **EXIT**

**Figure 2-20 Input Options Menu**

**Input Options Menu Soft Key Definitions**

**Option** | **Function**
--- | ---
**DZH / HZD** | This function chooses options for the MAN2 setting (manual instrument input) when using SIDS, TRAV or SHOT, and other manual inputs when the electronic instrument is turned off. This key toggles between entry of Slope Distance, Zenith Angle and Horizontal Angle (Angle Right), and HZD Horizontal Angle, Zenith, Angle and Slope Distance.

**BEG / END** | This option determines the cursor position of notes. By default, the cursor is at the beginning of the note for editing. However, if you want the cursor to be at the end of the note, tap [END] from this menu.

**TS** | If the Time Stamp is toggled on, it inserts a time stamp after each shot in the raw data file.
**Option** | **Function**
---|---
<HROD> / <HROD®> | Enter a new Height of Rod. This key is blank when Elevations are off. This key toggles between prompting for a rod height after the shot and using the current rod setting. When toggled on, you will see “WILL PROMPT FOR HROD BEFORE STORING.” Now, when you take a side shot or a traverse, the shot is taken first; then you are prompted for the HROD before the point is stored. Height of rod prompting is useful when frequently changing the rod height.

**EXIT** | This key exits to the previous menu.

**Mode Options Menu**

**KEYSTROKES:** [CHG] [NeXT] [MODE]

These options are used to help you configure how you intend to use the program with respect to units, directions and collection methodology. The Mode Options menu has the following soft keys:

**FEET** | **ARC** | **NAZ** | **ZERO®** | **EXIT**

**Figure 2-21 Mode Options Menu**

**Mode Options Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th><strong>Option</strong></th>
<th><strong>Function</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEET</strong> / <strong>METR</strong></td>
<td>This key toggles between Feet mode and Meters mode.</td>
</tr>
<tr>
<td><strong>ARC</strong> / <strong>CHORD</strong></td>
<td>This key toggles between “Arc definition degree of curvature” and “Chord definition degree of curvature.”</td>
</tr>
<tr>
<td><strong>NAZ</strong> / <strong>SAZ</strong></td>
<td>This toggle key lets you select North Azimuth (NAZ) or South Azimuth (SAZ). SAZ is used for surveys done where a 0 azimuth is pointing south. For example, Hawaii uses a south azimuth grid system. Some DOT controls also are based on south azimuth, but north azimuth is used most often.</td>
</tr>
<tr>
<td><strong>ZERO®</strong></td>
<td>This toggle key lets you use zero or a nonzero angle as the angle to the backsight. When this is toggled on, it sets the angle to the backsight to zero. When this option is selected, <strong>ZERO</strong> appears in other relevant soft key menus to allow you to set the Horizontal Angle in the instrument to zero.</td>
</tr>
</tbody>
</table>
**Option** | **Function**
---|---
<DTBS®> | lets you use a directional theodolite where you enter an angle in the backsight, enter a foresight angle, and the Angle Right is computed. **ZERO** will be replaced with <DTBS®> in all relevant soft key menus. When this option is selected, tapping <DTBS®> brings in the current Horizontal Angle from the instrument as the angle to the backsight.

<AZIM®> | assumes that the angle to the backsight is the back azimuth. When selected, <AZIM®> (azimuth survey) appears in all relevant soft key menus. When this option is selected, tapping <AZIM®> sends the backsight azimuth to the instrument (this may not be available on all instruments).

EXIT | This key returns to the previous menu.

---

**Adjustment Options Menu**

**KEYSTROKES:** CHG NeXT ADJ ST

These options allow you to control how the resultant coordinates are calculated based on either factors such as Earth’s curvature, refraction, grid, sea level or combined scale factors. The curvature and refraction (EC) setting defaults to ON. This affects your computed elevations and is noticeable over longer distances. The Adjustment Options menu has the following soft keys:

EC SCALE EXIT

**Figure 2-22 Adjustment Options Menu**

**Adjustment Options Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC / EC®</td>
<td>This toggle key lets you select whether to use the Earth’s curvature and refraction adjustment to the elevations that are stored with the points in your job calculations. This function defaults to ON (EC®). It is recommended that you leave this set to ON. The EC adjustment starts to lose accuracy at about 2000 to 4000 feet. After this distance, leave the function on, but go to the other end of the line and use Mean Backsight (SETUP NeXT NeXT MBS).</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCALE</strong></td>
<td>This key prompts for a scale factor. Entering 1 disables the option. When working with State Plane Coordinates, you may enter a scale factor here. If Scale is on in the <strong>2PFS</strong> function (Two-Point Free Station command), <strong>SMI</strong> automatically finds the scale factor for you and uses it when collecting points from the free station position.</td>
</tr>
<tr>
<td><strong>METR</strong></td>
<td>This key toggles between Feet mode and Meters mode.</td>
</tr>
<tr>
<td><strong>EXIT</strong></td>
<td>This key returns to the previous menu.</td>
</tr>
</tbody>
</table>

---

### Tolerances Menu

**KEYSTROKES:** [CHG] [NeXT] [TOLM]

This soft key presents a submenu that allows you to modify current tolerance values for vertical and horizontal angles, elevations, and horizontal and slope distances when taking multiple angles and distances in your current job. Whenever a tolerance is exceeded, the data collector will signal with a beep and/or an arrow pointing to the error. The Tolerances Menu has the following soft key options:

**HDTOL ** **SDTOL ** **ELTOL ** **VTOLS ** **HTOLS ** **EXIT**

**Figure 2-23  Tolerances Menu**

**Tolerances Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HDTOL</strong></td>
<td>Changes the horizontal distance tolerance. The default is .01 feet.</td>
</tr>
<tr>
<td><strong>SDTOL</strong></td>
<td>Changes the elevation tolerance. The default is .01 feet.</td>
</tr>
<tr>
<td><strong>ELTOL</strong></td>
<td>Changes the Slope Distance tolerance. The default is .01 feet.</td>
</tr>
<tr>
<td><strong>VTOLS</strong></td>
<td>Changes the vertical angle tolerance. The default is 1’.</td>
</tr>
<tr>
<td><strong>HTOLS</strong></td>
<td>Changes the Horizontal Angle tolerance. The default is 1’.</td>
</tr>
<tr>
<td><strong>EXIT</strong></td>
<td>Returns to the previous menu.</td>
</tr>
</tbody>
</table>
**Beginning Point Defaults Menu**

KEYSTROKES: `CHG` `NeXT` `BGPT`

This soft key lets you set your beginning point defaults. The normal defaults are 5000 for north and 5000 for east. If Elevations are on, the default elevation is 100 for the first point. The default first point number is 1. When you change these default values, they are used for the first point each time you create a new job.

**Figure 2-24 Beginning Point Defaults Menu**

**Beginning Point Defaults Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>POINT</td>
<td>Changes the default first point number created with a new job. The default is set to point 1.</td>
</tr>
<tr>
<td>N</td>
<td>Changes the default north coordinate of the first point created with a new job. The default is 5000.</td>
</tr>
<tr>
<td>E</td>
<td>Changes the default east coordinate of the first point created with a new job. The default is 5000.</td>
</tr>
<tr>
<td>EL</td>
<td>Changes the default elevation of the first point created with a new job. The default is 100.</td>
</tr>
<tr>
<td>NOTE</td>
<td>Changes the default note for the first point created with a new job.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the previous menu.</td>
</tr>
</tbody>
</table>
Check Backsight

PRODUCT: ALL
KEYSTROKES: a BKPT

KEY-IN: CKBS
COMMAND GROUP: SETUP

Use this function to shoot the backsight point and compare it to the stored backsight point. After prompting for the backsight point number, a shot is taken that gives you a check on the backsight distance. Information about the backsight point check is stored in the raw data file if Raw Data is on.

Clear (CLR)

PRODUCT: ALL
KEYSTROKES: c CLR (THE 8 KEY)

KEY-IN: CLR
COMMAND GROUP: TOTAL STATION

This command stops robotic instruments from tracking a prism and/or any search the instrument is performing. Run this command again to resume instrument tracking. This command does the same thing as the Pause command did in earlier versions.

Clear Classic SMI

PRODUCT: ALL
KEYSTROKES: FILE > CLEAR CLASSIC SMI

In some cases, you may need to clear the memory in an attempt to troubleshoot a problem you may be having. If you are doing this to resolve a problem, first attempt to reset the program by selecting File > Reset Classic SMI as this does not remove anything from memory.
If this doesn’t solve your problem, you can then clear the memory of the program using the Clear Classic SMI command. It is the similar to pressing ON + A + F on an HP 48. The program prompts: **Try to Recover Memory?** Tap `no` to clear the memory.

✓ Items such as your instrument driver, rod and instrument heights, note sequence(s) and other settings held in memory will be deleted. This will not delete any stored job files.

⚠️ It is possible, but highly unlikely, that if you have moved your job files to the collector’s internal memory, your job would appear in the upper left corner of the Setup screen with a 48D at the end of the job name instead of a CRD extension. CRD signifies that the job is stored on device and not stored in memory only.

See *When a Reset Might Help on page 353* for more information.

---

### Codes

**PRODUCT:** ALL

**KEYSTROKE:** `NOTE`

Some post-processing programs utilize a code as well as a note, whereby the code and note are separated with a ‘,’ (comma). When you are storing a point you can store a note and a code by adding a comma at the appropriate place.

To assign a note after the shot is taken, tap `NOTE`, type in the note you would like to give it, and insert a comma (Allegro `BLUE SHIFT` `W` keys, JETT `a` .. (decimal) keys).

---

### COM Port IO Test

**PRODUCT:** ALL

**KEY-IN:** `IO`

**COMMAND GROUP:** PROGRAM SETTINGS

If you are experiencing problems or receiving error messages, it would not be surprising if the problem lies within your cable. Check the following:

The pins on your data collector’s serial port should be clean, parallel, and equidistant. If one looks out of line, gently move it back into place and reconnect your cable. An internal problem in your cable is a little
more difficult to see. However, this function will verify that the data collector and cable is sending (and/or receiving) data correctly.

See IO Loop-Back Test on page 348 for more information.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.

---

**Command Bar**

PRODUCT: POCKET PC VERSIONS ONLY

The Command Bar is part of the Pocket SMI interface. To change command assignments for the buttons labeled 1-8, tap on the Select a Command Bar Menu icon (far right icon).

A maximum of 8 commands may be added to this shortcut command bar.

---

**Select Command Bar**

**KEY IN:** SELCMDBAR

**COMMAND GROUP:** PROGRAM SETTINGS

---

**Customize Command Bar**

**KEY IN:** CUSCMDBAR

**COMMAND LOCATION:** PROGRAM SETTINGS

---

**Command Keys**

PRODUCT: ALL

**KEYSTROKES:** F1 THROUGH F12

The command keys are special, easy to access keys on the data collector. These commands keys can be remapped to approximately 400 SMI functions for easy access and quick repeatability.
A common use of the command keys is to configure them so that they can be used to access the six soft keys. These commands (e.g. SOFT1, SOFT2, etc.) are located in the "Program Settings" command group.

**Important Notes for Allegro Users**

- You must use the BLUE SHIFT key to access the commands assigned to the F6 – F10 keys. On the color displays this is reinforced by the F6 – F10 commands being shown in blue (see above).
- The F11 key (Gold/Yellow Shift, F1) is permanently assigned to the About SMI command.
- The F12 key (Gold/Yellow Shift, F2) is permanently assigned to the Show/Hide SMI Title Bar toggle. Make sure the title bar is toggled off, otherwise you may not be able to see your key assignments.
- If you cannot see the F6-F10 key assignments you need to "Auto Hide" the Windows Taskbar. To do this, click on Start > Settings > Taskbar and toggle on the Auto Hide setting.

**Important Notes for JETT Users**

- You must use the BLUE key first to access the commands assigned to the F9 – F10 keys. On the color displays this is reinforced by the F9 – F10 commands being shown in blue on the screen.
- If you cannot see the F5-F10 key assignments you need to "Auto Hide" the Windows Taskbar. To do this, click on Start > Settings > Taskbar and toggle on the Auto Hide setting.
Select Command Keys

KEY IN: SELCMDKEY

KEystrokes: [MENU] (THE Y KEY)

Command Group: Program Settings

Figure 2-26 Select Command Keys Menu Dialog Box

This command is used to select the currently active mapping for the command keys (Pocket PC 1-4, Titan 1-5, JETT 1-10, Allegro 1-12).

Use the large up and down arrows on the turn button to move the highlighted line until the desired menu is displayed and press the Enter button. This can also be accomplished by using the touch screen.

Customize Command Keys

KEY IN: CUSCMDKEY

Command Group: Program Settings

Figure 2-27 Customize Command Keys Dialog Box
The Customize Command Keys command allows you to map your commonly used SMI commands to the command keys/function keys (Pocket PC 1-4, Titan 1-5, JETT 1-10, Allegro 1-12).

The order they are displayed in the command list is the order they are mapped to your command keys. Use the Up and Down arrows in the lower left side of the Customize Command Keys dialog box to reorder the selected functions.

The Command Groups table on page 287 shows all the available commands for mapping to the command keys / function keys and command favorites. The commands in bold are actually macros (multiple SMI commands batched together to save keystrokes). If you have an idea for additional macros, send them to SMI for inclusion in a future release.

The maximum number of command key mappings is determined by your hardware device.

Figure 2-28  Pocket PC (4) Function/Command Keys

Figure 2-29  Titan (5) Function/Command Keys
Figure 2-30 Allegro (12) Function/Command Keys

Figure 2-31 JETT (10) Function/Command Keys
**Compass Declination**

PRODUCT: ROBOTIC

KEYSTROKES: a SRVO (THE 8 KEY) NEXT NEXT CDECL

KEY-IN: CDECL

COMMAND GROUP: TOTAL STATION

This servo function is used to enter the magnetic declination for use with the CDIR command, which turns the instrument to point to the rod.

**Compass Direction From Prism (CDIR)**

PRODUCT: ROBOTIC

Keystrokes: a CDIR (THE 6 KEY)

KEY-IN: CDIR

COMMAND GROUP: TOTAL STATION

This command lets you enter the compass azimuth from the rod to the instrument. The instrument then turns to point to the rod. You can also access this command by pressing a SRVO (the 8 key) NEXT NEXT CDIR.

**Compass Rule**

PRODUCT: ALL

KEYSTROKES: MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) NEXT aa/cr

KEY-IN: COMPASS

COMMAND GROUP: COGO

This menu key allows you to perform compass rule or angle adjustment operations on points in the current Random Points file.
When running the `CR` command once while the raw data flag is set on (a 2), the distance adjustment factor and the angle adjustment are stored to the raw file.

✓ Remember to copy or back up your job before performing a compass rule adjustment.

**EDIT  ~ERR  AA  CRERR  CR**

**Figure 2-32 Compass Rule Menu**

**Compass Rule Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDIT</td>
<td>Modifies the current Random Points file. Tap or press <code>Esc</code> twice to clear the old data and type in the points to be adjusted. When you have finished editing your Random Points file, press <code>Enter</code> to save the file. See <code>AA</code> and <code>CR</code> in this table for more on how to enter points in the Random Points file. You may also store more than one Random Points files for reference. See Random Points on page 186.</td>
</tr>
<tr>
<td>~ERR</td>
<td>Calculates and displays the angle of error for your Random Points file without changing your points. (Use this before making any adjustment as after the points have been adjusted the error should be zero.)</td>
</tr>
<tr>
<td>AA</td>
<td>Performs an Angle Adjustment using the current Random Points file. The last two traverse points in the Random Points file should define the direction assumed to be correct; the two traverse points immediately before the last two points should define the error direction. See Angle Adjustment on page 23.</td>
</tr>
<tr>
<td>CRERR</td>
<td>Finds the compass rule error. See Angle Adjustment on page 23.</td>
</tr>
<tr>
<td>CR</td>
<td>Performs a compass rule adjustment using the current Random Points file. The last point in the Random Points file should be the accepted point. The second-to-last traverse point in the file should be the point shot to the accepted point at the end of the traverse.</td>
</tr>
</tbody>
</table>
Example: Compass Rule Adjustment

Refer to the figure below to perform a compass rule adjustment.

Figure 2-33 Performing a Compass Rule Adjustment

Points 1 through 5 should be stored in the data collector.

1. Press [RPTS], key in 1.5 SPACE 1, and press .
2. Tap <NeXT> cR .
   A compass rule adjustment is performed.
3. To check, key in 5 SPACE 1 and press PT-PT .
   The distance should now be zero.
Example: Compass Rule Adjustment on an Open Traverse

Once the angle adjustment is performed, change the Random Points file to look like this: 1, 49, 149.

![Open Traverse to known points](Image)

**Figure 2-34 Compass Rule Adjustment on an Open Traverse Diagram**

After keying in the random point values and pressing ![image](Image), tap ![image](Image). This gives the precision of the open traverse. Tap ![image](Image) and ![image](Image) (for Compass Rule Adjustment). When you inverse from point 49 to point 149, you should now have a zero distance and the points from 3 to 49 should be appropriately adjusted. Side shots should be entered as negative numbers.

You can also find the compass rule error by pressing ![image](Image), ![image](Image), ![image](Image), ![image](Image). Compass rule error (CRERR) should be pressed before ![image](Image).

Compute Angle Right

**PRODUCT:** ALL

**KEYSTROKES:** ![image](Image) (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) ![image](Image)

**KEY-IN:** ![image](Image)

**COMMAND GROUP:** COGO

This function is used to compute the Angle Right from the back bearing, or from the back azimuth. This routine makes it easy to get an Angle Right from two lines (defined by two points on each line), or by two azimuths defining the direction of the two lines. You also can use azimuth values to compute Angle Right.

This command assumes you are occupying the point where the two lines meet.
Figure 2-35 Compute Angle Right Menu

Compute Angle Right Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BKAZ</td>
<td>Allows you to enter the back azimuth or two points that define the back azimuth.</td>
</tr>
<tr>
<td>BKBR</td>
<td>Allows you to enter the back bearing.</td>
</tr>
<tr>
<td>FSBR</td>
<td>Allows you to enter the foresight bearing.</td>
</tr>
<tr>
<td>FSAZ</td>
<td>Allows you to enter the foresight azimuth or two points that define the foresight azimuth.</td>
</tr>
</tbody>
</table>

Construction Menu (CONST)

PRODUCT: CONSTRUCTION

KEYSTROKE: `CONST` (ALLEGRO I KEY, JETT Q KEY, TITAN J KEY)

KEY-IN: CONST

COMMAND GROUP: CONSTRUCTION

This function displays menus involved with staking and slope staking by station and offset using horizontal, vertical, and template control files called chains.

For examples on using Construction, refer to the SMI Version 8 User Guide. Construction has several submenus, so this section provides an explanation of those keys.

ientes.

Construction Menu 1

Keys that use a station and offset, such as BS, OCPY, and FS, also accept either a station; station and offset; or station, offset, and skew angle. If just one number is on the stack when the key is pressed, it is used as a station with a zero offset. If two numbers are on the stack, they are used as a station and
offset. If three numbers are on the stack, they are used as a station, offset, and skew angle. When a skew angle is entered, skew is measured clockwise from ahead with the offset measuring along the skew.

**Figure 2-36 Construction Menu 1**

**Construction Menu 1 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>Allows you to enter the backsight station and offset. Press a BS to enter a backsight point.</td>
</tr>
<tr>
<td>OCpy</td>
<td>Allows you to enter an occupied station and offset. Press a OCpy to enter an occupied point.</td>
</tr>
<tr>
<td>FS</td>
<td>Allows you to enter the foresight station and offset. If only the station is given, then the offset indicated by COFS or CBFS in the Construction Options (opt) menu is used. If nothing is on the stack when FS is tapped, then the station is incremented to the next station interval. Press a FS to use a point number to get a station and offset. Press c FS to store a foresight to the cutsheet.</td>
</tr>
<tr>
<td>Hrod</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off.</td>
</tr>
<tr>
<td>Stks</td>
<td>Takes a shot. Even if the shot is outside the shoulder, the Station Stakeout menu displays. See Station Stakeout Menu on page 62.</td>
</tr>
<tr>
<td>Sstk</td>
<td>Takes a slope stake shot. If the shot is inside the shoulder, the Station Stakeout menu displays. If the shot is outside the shoulder, the Slope Stake menu appears. See Slope Stake Menu on page 63.</td>
</tr>
</tbody>
</table>

**Station Stakeout Menu**

When a shot is taken inside the shoulder or if Elevations are turned off, the Station Stakeout Menu appears.

**Figure 2-37 Station Stakeout Menu**
**Station Stakeout Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuts</td>
<td>Saves shot information to the cutsheet.</td>
</tr>
<tr>
<td>Stosh</td>
<td>Stores the last shot. Press a stosh to store the point being staked.</td>
</tr>
<tr>
<td>Fs</td>
<td>Allows you to enter the foresight station and offset. Press a fs to enter the foresight point.</td>
</tr>
<tr>
<td>Hrod</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off.</td>
</tr>
<tr>
<td>Shot</td>
<td>Takes a shot. Even if the shot is outside the shoulder, the Station Stakeout menu displays.</td>
</tr>
<tr>
<td>Sstk</td>
<td>Takes a slope stake shot. If the shot is outside the shoulder, the Slope Stake menu displays. See <em>Slope Stake Menu on page 63</em>.</td>
</tr>
<tr>
<td>Exit</td>
<td>Returns to the Construction menu.</td>
</tr>
</tbody>
</table>

**Slope Stake Menu**

To access this menu, you must have a vertical and horizontal control and template already entered in the job. If you do not have a template, you can use Bench. Then tap the SSTK soft key in the first Construction menu.

---

Figure 2-38  Slope Stake Menu
## Slope Stake Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Sshot&gt;</td>
<td>Takes a second shot. The SDIN/SDOUT value will be a distance along the slope of the existing ground.</td>
</tr>
<tr>
<td>&lt;Cuts&gt;</td>
<td>Saves shot information to the cutsheet.</td>
</tr>
<tr>
<td>&lt;Stosh&gt;</td>
<td>Stores the last shot to a point number. Pressing a Stosh stores the catch point to a point number.</td>
</tr>
<tr>
<td>&lt;Refp&gt;</td>
<td>Displays the Reference Point Stake menu. If a distance is on the stack when this key is tapped, that distance is used as the reference point distance from the catch point. This turns servo-driven instruments to the reference point. See Reference Point Menu on page 65.</td>
</tr>
<tr>
<td>&lt;Catch&gt;</td>
<td>Displays the Catch Point Stake menu. This turns servo-driven instruments to the catch point. This also computes a catch point. See Catch Menu on page 66.</td>
</tr>
<tr>
<td>&lt;Shot&gt;</td>
<td>Takes a shot, ignoring the previous shot. If the shot is inside the shoulder, the Station Stakeout menu displays. If the shot is outside the shoulder, the Slope Stake menu displays.</td>
</tr>
<tr>
<td>&lt;Brkc&gt;</td>
<td>Displays the cut/fill and distances from the catch point to the breakpoints.</td>
</tr>
<tr>
<td>&lt;Brkr&gt;</td>
<td>Displays the cut/fill and distances from the reference point to the breakpoints.</td>
</tr>
<tr>
<td>&lt;Brki&gt;</td>
<td>Displays the cut/fill, distances, and intervals from the catch point to the breakpoints.</td>
</tr>
<tr>
<td>&lt;Cels&gt;</td>
<td>Allows you to enter a change in elevation from the last shot to the existing ground to simulate another shot. Use on flat ground when there is a sudden change in elevation.</td>
</tr>
<tr>
<td>&lt;Celf&gt;</td>
<td>Allows you to enter a change in elevation from the last shot to the existing ground to simulate another shot. Use on flat ground.</td>
</tr>
<tr>
<td>&lt;Exit&gt;</td>
<td>Returns to the Construction menu.</td>
</tr>
<tr>
<td>&lt;Hrod&gt;</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off.</td>
</tr>
</tbody>
</table>
Reference Point Menu

KEYSTROKES: REFP on the first page menu of the Slope Stake menu.

SHOT CUTS STOSH REFPS H ROD EXIT...

NeXT

BRKC BRKR BRKL

Figure 2-39 Reference Point Menu

Reference Point Menu Soft Keys Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shots</td>
<td>Takes a shot on the reference point.</td>
</tr>
<tr>
<td>Cuts</td>
<td>Saves shot information to the cutsheet.</td>
</tr>
<tr>
<td>Stosh</td>
<td>Stores the last shot. Pressing a Stosh stores the point being staked.</td>
</tr>
<tr>
<td>Refps</td>
<td>Stores a new distance for the reference point.</td>
</tr>
<tr>
<td>Hrod</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off.</td>
</tr>
<tr>
<td>Exit</td>
<td>Returns to the Slope Stake menu.</td>
</tr>
<tr>
<td>Brkc</td>
<td>Displays the cut/fill and distances from the catch point to the breakpoints.</td>
</tr>
<tr>
<td>Brkr</td>
<td>Displays the cut/fill and distances from the reference point to the breakpoints.</td>
</tr>
<tr>
<td>brki</td>
<td>Displays the cut/fill, distances, and intervals from the catch point to the breakpoints.</td>
</tr>
</tbody>
</table>
**Catch Menu**

KEYSTROKES: **CATCH** on the first page menu of the Slope Staking menu.

---

**Figure A-32 Catch Menu**

**Catch Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shot</td>
<td>Takes a shot on the catch point.</td>
</tr>
<tr>
<td>Cuts</td>
<td>Saves shot information to the cutsheet.</td>
</tr>
<tr>
<td>Stosh</td>
<td>Stores the last shot. Pressing a Stosh stores the point being staked.</td>
</tr>
<tr>
<td>Refp</td>
<td>Displays the Reference Point Stake menu. If a distance is on the stack when tapped, that distance is used as the reference point distance. This function will turn servo-driven instruments to the catch point. See Reference Point Menu on page 65.</td>
</tr>
<tr>
<td>Hrod</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off.</td>
</tr>
<tr>
<td>Exit</td>
<td>Returns to the Slope Stake menu.</td>
</tr>
<tr>
<td>Brkc</td>
<td>Displays the cut/fill and distances from the catch point to the breakpoints.</td>
</tr>
<tr>
<td>Brkr</td>
<td>Displays the cut/fill and distances from the reference point to the breakpoints.</td>
</tr>
<tr>
<td>Brki</td>
<td>Displays the cut/fill, distances, and intervals from the catch point to the breakpoints.</td>
</tr>
</tbody>
</table>
Construction Menu 2

**Figure 2-40  Construction Menu 2**

**Construction Menu 2 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chain</td>
<td>Displays the Chain menu. See <em>Chain Menu on page 67</em>.</td>
</tr>
<tr>
<td>Cut</td>
<td>Displays the Cutsheet menu. See <em>Cut Menu on page 68</em>.</td>
</tr>
<tr>
<td>Tadj</td>
<td>Displays the Template Adjustments menu. See <em>Template Adjustments Menu on page 69</em>.</td>
</tr>
<tr>
<td>Hccl</td>
<td>Allows you to enter the horizontal control for the current chain.</td>
</tr>
<tr>
<td>Vccl</td>
<td>Allows you to enter the vertical control for the current chain.</td>
</tr>
<tr>
<td>Tmpl</td>
<td>Displays the Template View menu. See <em>Template View Menu on page 70</em>.</td>
</tr>
</tbody>
</table>

**Chain Menu**

**KEYSTROKES:**

```
<CONST> NeXT CHAIN
```

```
NEW OLD TOPC TODR DELETE EXIT...
```

```
NeXT
```

**COPY**

**Figure 2-41  Chain Menu**

**Chain Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Creates a new chain.</td>
</tr>
</tbody>
</table>
### Option Function

- **Select**
  - Allows you to select a chain to become the current chain.

- **Topc**
  - Transfers a chain to a PC. Set the data collector format to v6 if using *SMI Transfer*.

- **to48**
  - Transfers a chain from a PC. Set the data collector format to v6 if using *SMI Transfer*.

- **Del et**
  - Deletes a chain.

- **Ex it**
  - Returns to the Construction menu.

- **Copy**
  - Copies the current chain into a chain with a new name.

### Cut Menu

**KEYSTROKES:** `CONST` `NeXT` `CUT`

![Figure 2-42 Cut Menu](image)

**Cut Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>View</strong></td>
<td>Allows you to view the cutsheet for the current chain.</td>
</tr>
<tr>
<td><strong>Print</strong></td>
<td>Prints the current cutsheet.</td>
</tr>
<tr>
<td><strong>Topc</strong></td>
<td>Sends the current cutsheet to a PC. Set the data collector format to v6 if using <em>SMI Transfer</em>.</td>
</tr>
<tr>
<td><strong>Del et</strong></td>
<td>Deletes the current cutsheet.</td>
</tr>
<tr>
<td><strong>Ex it</strong></td>
<td>Returns to the Construction menu.</td>
</tr>
</tbody>
</table>
Template Adjustments Menu

KEYSTROKES: CONST NeXT TAD

Options in this menu override whatever is in the current template. Entries with TMPL in the display mean that the template has not been overridden.

Figure 2-43 Template Adjustments Menu

Template Adjustments Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dslp</td>
<td>Allows you to enter the ditch slope - the slope from the shoulder to the ditch as a value with a ratio to 1.</td>
</tr>
<tr>
<td>Ddis</td>
<td>Allows you to enter the ditch distance - the distance from the shoulder to the ditch.</td>
</tr>
<tr>
<td>Bksl</td>
<td>Allows you to enter the back slope.</td>
</tr>
<tr>
<td>Dbw</td>
<td>Allows you to enter the ditch bottom width.</td>
</tr>
<tr>
<td>Subg</td>
<td>Boots the elevation of the entire template relative to the vertical control.</td>
</tr>
<tr>
<td>Exit</td>
<td>Returns to the Construction menu.</td>
</tr>
<tr>
<td>Tmpo</td>
<td>Allows you to enter a template offset. After entering an offset, indicate whether offsets will be from the centerline or from the template. This is useful when the vertical control is offset from the horizontal control.</td>
</tr>
<tr>
<td>Ssof</td>
<td>Allows you to enter a slope stake offset. When slope staking, the offset will be shown to where the shot was taken, but the slope stake information will be for the offset minus the slope stake offset (ssof). This is useful for placing reference stakes.</td>
</tr>
<tr>
<td>Cdis / cdsl</td>
<td>Toggles between “Constant distance from shoulder to ditch” (cdis) and “Constant ditch slope between templates” (cdsl).</td>
</tr>
</tbody>
</table>
**Template View Menu**

KEYSTROKES: `<CONST>` `<NeXT>` `<TMPL>` for viewing and editing the templates in the current chain.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;left&gt;</code> <code>&lt;right&gt;</code></td>
<td>Toggles between viewing the left and right templates.</td>
</tr>
<tr>
<td><code>&lt;Prev&gt;</code></td>
<td>Allows you to view the previous template.</td>
</tr>
<tr>
<td><code>&lt;Next&gt;</code></td>
<td>Allows you to view the next template.</td>
</tr>
<tr>
<td><code>&lt;Del&gt;</code></td>
<td>Deletes the template being viewed.</td>
</tr>
<tr>
<td><code>&lt;Edit&gt;</code></td>
<td>Allows you to edit the current template. See <em>Template Edit Menu on page 70</em>.</td>
</tr>
<tr>
<td><code>&lt;Exit&gt;</code></td>
<td>Returns to the Construction menu.</td>
</tr>
<tr>
<td><code>&lt;r−l&gt;</code></td>
<td>Replaces all the left templates with the right templates.</td>
</tr>
<tr>
<td><code>&lt;l−r&gt;</code></td>
<td>Replaces all the right templates with the left templates.</td>
</tr>
</tbody>
</table>

**Template Edit Menu**

KEYSTROKES: `<CONST>` `<NeXT>` `<TMPL>` `<EDIT>` for editing the current template.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;STA&gt;</code> <code>&lt;SEGL&gt;</code> <code>&lt;DEL&gt;</code> <code>&lt;DITCH&gt;</code> <code>&lt;REW&gt;</code> <code>&lt;EXIT&gt;</code></td>
<td>For editing the current template.</td>
</tr>
</tbody>
</table>

*Figure 2-44 Template View Menu

*Figure 2-45 Template Edit Menu*
### Template Edit Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sta</td>
<td>Allows you to enter the station number of the template to edit. If a template does not exist at that station, then a template is created from the previous template. If &lt;sta&gt; is tapped without a number, the next template is displayed. If there is no template, then you are prompted for a station number.</td>
</tr>
<tr>
<td>seg1</td>
<td>Allows you to enter the segment number to be edited or created. A segment is a slope and distance between the centerline and the shoulder. If no segment number is given, the segment shown on the key is used. After a segment has been entered, it is displayed and the key shows the next segment to be edited.</td>
</tr>
<tr>
<td>Del</td>
<td>Allows you to enter a segment number to be deleted.</td>
</tr>
<tr>
<td>Ditch</td>
<td>Allows you to enter the ditch slope, ditch distance, and back slope.</td>
</tr>
<tr>
<td>Dbw</td>
<td>Allows you to enter the ditch bottom width. If no ditch bottom widths are entered, the chain is still compatible with Version 5 chain files.</td>
</tr>
<tr>
<td>Exit</td>
<td>Returns to the Template View menu.</td>
</tr>
</tbody>
</table>

### Construction Menu 3

**Figure 2-46  Construction Menu 3**

**Construction Menu 3 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw</td>
<td>Displays the Construction Draw menu. See Draw Menu on page 72.</td>
</tr>
<tr>
<td>Ststo</td>
<td>Stores a point at a given station and offset; or station, offset, and skew.</td>
</tr>
<tr>
<td>Auto</td>
<td>Displays the Automatic Cutsheet/Points menu. See Auto Stationing Menu on page 73.</td>
</tr>
<tr>
<td>Opt</td>
<td>Displays the Construction Options menu. See Construction Options Menu on page 74.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>Bnch</td>
<td>Allows you to enter the bench offset, elevation, and back slope to slope stake to a bench. This uses the back slope as a cut/fill from the bench for slope staking.</td>
</tr>
</tbody>
</table>

**Draw Menu**

KEYSTROKES: \[\text{CONST} \, \text{NeXT} \, \text{NeXT} \, \text{DRAW}\]

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCCL</td>
<td>Draws the horizontal control. Spirals drawn on the screen are approximated by an arc.</td>
</tr>
<tr>
<td>VCCL</td>
<td>Draws the vertical control.</td>
</tr>
<tr>
<td>Tmpl</td>
<td>Draws a template given a station and side.</td>
</tr>
</tbody>
</table>

*Figure 2-47  Draw Menu*

**Draw Menu Soft Key Definitions**
**Option** | **Function**
---|---
Exit | Returns to the Construction menu.

**Auto Stationing Menu**

**KEYSTROKES:** [CONST] [NeXT] [NeXT] [AUTO]

This function automatically creates cutsheet entries or points at specified stations and offsets/breakpoints.

**Auto Stationing Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEG</td>
<td>Allows you to enter the beginning station.</td>
</tr>
<tr>
<td>END</td>
<td>Allows you to enter the ending station.</td>
</tr>
<tr>
<td>INTVL</td>
<td>Allows you to enter the interval distance between stations.</td>
</tr>
<tr>
<td>OFFST</td>
<td>Allows you to enter the offset. If 0 is used, points will be generated at each of the breaks in the template.</td>
</tr>
<tr>
<td>CUTS</td>
<td>Stores all the specified stations and offsets to the cutsheet.</td>
</tr>
<tr>
<td>COOR</td>
<td>Stores all the specified stations and offsets to a point number.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the Construction menu.</td>
</tr>
</tbody>
</table>

*Figure 2-48  Auto Stationing Menu*
### Construction Options Menu

**KEYSTROKES:** CONST NeXT NeXT OPT

![Keystrokes: CONST NeXT NeXT OPT](image)

#### Figure 2-49  Construction Options Menu

**Construction Options Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA1</td>
<td>Allows you to enter the station interval, which is used for rounding stations in the cutsheet and automatically incrementing the foresight point.</td>
</tr>
<tr>
<td>STAT</td>
<td>Allows you to enter the station tolerance, which indicates how close a station must be to the station interval to be rounded in the cutsheet. Shots that are within the station tolerance distance of the station interval are rounded to the station interval. For example, if the station interval was 50 and the station tolerance was 5, a shot taken to station 3+51.23 would be stored in the cutsheet as 3+50. A shot to 3+56.34 would be stored as 3+56.34.</td>
</tr>
<tr>
<td>CSTA</td>
<td>Allows you to enter the constant offset to be used when only the station is on the stack when foresight (FS) is tapped.</td>
</tr>
<tr>
<td>COFS</td>
<td>Allows you to enter the constant offset to be used when only the station is on the stack when foresight (FS) is tapped. For instance, to take shots on the ditch bottom when there are two segments before the shoulder, enter 3. This is useful when staking the same offset at several stations.</td>
</tr>
<tr>
<td>CBFS</td>
<td>Allows you to enter the constant breakpoint to be used when only the station is on the stack when foresight (FS) is tapped. This is useful when staking a particular breakpoint such as the shoulder or curb at several stations. If there are two segments in the template to get to the shoulder, enter 2 to stake the shoulder when you enter a station and tap FS.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the Construction menu.</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>M XOF</td>
<td>Allows you to enter the maximum offset to be used when trying to calculate the station and offset of a particular location. If set to zero, SMI searches the entire chain for the station with the smallest offset to the location. If not zero, the first station with an offset to the location less than the maximum offset is used. This can speed up how long the calculations take.</td>
</tr>
<tr>
<td>XTND</td>
<td>Extends the horizontal control past the beginning and ending points of the horizontal control to allow shots.</td>
</tr>
</tbody>
</table>

**Example: Horizontal Control**

![Figure 2-50 Horizontal Control](image)

Procedure for entering the above horizontal control in *SMI Construction*.

1. Press [CONST].
2. Tap [NeXT] hCCL.
   The data should resemble the following:
   
   1
   0
   2
4. Press !.

**Example: Breakpoints**

Use the same procedure as for a baseline, except you enter more point numbers.

The HCCL file for this water line will look like this: 1 0 2 3 4 5.
**Example: Simple Curves**

The entry into HCCL is: 1 0 "2 3 4" "5 6 7" 8.

**Example: Compound Curves**

The entry should look like this: 1 0 "2 3 4" "4 5 6" 7.

Notice how point 4 is part of both curves.
**Example: Spiral Curves**

The illustration below should have an entry that looks like this: 1 0 {2 3 4 500 300 200} {5 6 7 500 300 200} 8 where 2 and 5 are TS points, 3 and 6 are main PI points, 300 is the spiral length back, and 200 is the spiral length ahead.

![Figure 2-54 Spiral Curves Illustration](image)

One of the main features of **SMI** is that the spiral can be designed or checked for accuracy. If points 2, 4, 5, and 7 are only guessed positions and are along the tangent, **SMI** checks for accuracy and overrides the points with the correct coordinates. If you do not wish to override these points, **SMI** will warn you that it is about to override the point coordinates. At this time, just change the point number and press ![submit](image) to store the new coordinates at a different point number.

Combinations of lines, simple curves, and spirals: The data for this sample should look like this:

1 0 2 "3 4 5" {6 7 8 500 300 300} 9

where the radius of the simple curve is 500 and the SLB is 300.

![Figure 2-55 Spiral Curves](image)
Convert to SI Units

PRODUCT: ALL

KEY IN: UBASE

COMMAND GROUP: CONVERSIONS

This command converts a unit object to SI base units.

Press [ALPHA] UNITS and press ![enter]. The Units menu loads.

Tap the [LENG] soft key for the Length suffixes. Type the desired number (e.g., 23.34) and tap the appropriate soft key which represents the unit of length that the number is in (you may need to tap the [NeXT] key a couple of times).

Then key in [ALPHA] UBASE or select CONSI from the Command Keys, (in this example, 7.114_m is displayed.)

With _ and the original number_unit displayed in level one on the stack, you may also tap the desired unit to which you want the number converted.

Convert Units

PRODUCT: ALL

KEY-IN: CONVERT

COMMAND GROUP: CONVERSIONS

This command converts a source unit object to the dimensions of a target unit.

Enter the desired number and units and press ![enter]. Then key in _ and the units to which you want to convert and press ![enter]. Finally, key in [ALPHA] CONVERT or press the CNVRT command button.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.

**Figure 2-56  Length Units Soft Keys**

78      SMI Version 8 Reference Manual
Example: Converting Units

1. Type \texttt{ALPHA UNITS} and press \texttt{!}.

   The Units menu loads.

2. Tap the \texttt{LENG} soft key for the Length suffixes.

3. Type the desired number (e.g., 23.34) and tap the appropriate soft key, which represents the unit of length that the number is in (you may need to tap the \texttt{NeXT} key a couple of times).

4. Type \texttt{1} and then select the unit to which you want to convert.

5. Key in \texttt{ALPHA CONVERT} and press \texttt{!}, or select the command key mapped to \texttt{CNVRT}.

Coordinate Conversion

PRODUCT: ROBOTIC

KEY-IN: \texttt{COORCVT}

COMMAND GROUP: CONVERSIONS

The Coordinate Conversion function provides a means to convert a coordinate from any supported coordinate system to any other. It does not affect the coordinate system of the current job.

Select the coordinate system from which to convert from the From combo box. The “LL” coordinate system is the WGS84 system used in GPS receivers. If the desired coordinate system is not listed, tap the Add button to display the Select Coordinate System screen. See \textit{Select Coordinate System} on page 204 for more information.

The known coordinate entry boxes are labeled North and East for Cartesian coordinate systems. If the selected coordinate system uses latitude and longitude, the coordinate entry fields are labeled accordingly.

Tap on the Convert button to fill in the destination fields.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.
Coordinate to Coordinate Inverse

PRODUCT: ALL

KEY-IN: NETONED

COMMAND GROUP: COGO

This command inverses between two sets of coordinates that aren't stored.

Key in the north coordinate of the first pair and press ![enter]. Key in the east coordinate of the first pair and press ![enter]. Key in the north coordinate of the second pair and press ![enter]. Key in the east coordinate of the second pair and press ![enter]. Press ![alpha], type NETONED, and press ![enter]. The inverse is displayed.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the COGO Command Group.

Cross-section Offset

PRODUCT: DOT

COMMAND GROUP: DOT COMMANDS

This function allows you to store offset points from a cross-section.

Tap ![coff] and the display prompts you for the occupied point. Key in the point number and press ![enter].
Cross-section Offset Screen Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ</td>
<td>POL</td>
</tr>
<tr>
<td>DIST¹</td>
<td>Identifies the distance along the line.</td>
</tr>
<tr>
<td>¬DIST</td>
<td>Defines the distance left.</td>
</tr>
<tr>
<td>DIST¨</td>
<td>Defines the distance right.</td>
</tr>
<tr>
<td>NOTE</td>
<td>Allows you to enter a description for a point</td>
</tr>
</tbody>
</table>

Curve Stakeout

PRODUCT: ALL

KEYSTROKES: [STAKE] NEXT NEXT CURVE or tap CURVE, then enter curve information and tap STA.

KEY-IN: CURVES

COMMAND GROUP: STAKE

This key is used to stakeout a horizontal curve by station and offset.

*If you need to enter curve information different than radius and delta, you can use the Curve menu to enter the data, then tap STA in the Horizontal Curves menu. You will be prompted for a beginning station.*
If you are using a radius and delta, you can use the Curve Stakeout menu (STAKE CURVE). SMI requires that the PC be occupied and the backsight be along the tangent (away from the PI). You are prompted for the radius, delta, and beginning station: Radius Delta BegSTA.

Occupy the PC, backsight on the tangent, press CURVE (Allegro Q key, JETT a U keys, Titan R key), enter two elements of the curve (indicate whether the curve is turning to the left by entering a negative radius), then key in the station number of the PC, and tap STA.

You can now give any station number and get the angle right, deflection angle, tangent distance, tangent offset, and chord distance.

You can enter a constant offset for staking by station number, or you can enter tangent distances or chord distances and get stakeout data. Thus, it is easy to stake a simple curve by station or tangent or chord distances.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>STA</td>
<td>Allows you to enter a station to be staked. Pressing C STA stores a point at the given station.</td>
</tr>
<tr>
<td>INC</td>
<td>Increments to the next station. If a number is on the stack when INC is tapped, it will be used as the new increment. The default increment is 100. When the end of the arc is reached, it starts over.</td>
</tr>
<tr>
<td>TL / CHL</td>
<td>This key is different, depending on the setting of the TAN / CHORD toggle key setting. When TL is showing, enter the tangent length to stake. When CHL is showing, enter the distance along the chord to stake.</td>
</tr>
<tr>
<td>OFFSET</td>
<td>Allows you to enter an offset to be staked. The default is 0.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>SHOT</td>
<td>Allows for manual or electronic entry of shot info. Changes to the Shot screen (Go/Come Left/Right). a SHOT (ROBOTIC only): Shot screen information constantly updated. c shot shows the Shot screen using the last shot without taking another shot. This is useful to tell the rodman where to go from the previous foresight point instead of a direction and distance from the instrument.</td>
</tr>
<tr>
<td>STOPT</td>
<td>Stores the point being staked. Press a STOPT to store the last shot.</td>
</tr>
<tr>
<td>TAN / CHORD</td>
<td>Toggles between staking tangent length and offset and staking chord length offset. This toggle key changes the setting of the TL / CHL soft key and the second line of the display. The display toggles between showing TL (Tangent Length) and TOFF (Tangent Offset) for the TAN option, and CHL (Chord Length) and COFF (Chord Offset) for the chord option.</td>
</tr>
</tbody>
</table>

---

**Curves Menu (CURVE)**

**PRODUCT:** ALL

**KEYSTROKE:** CURVE (ALLEGRO Q KEY, JETT a U KEYS, TITAN R KEY)

**KEY-IN:** HCRVS

**COMMAND GROUP:** COGO

This function allows you to perform curve computations. The Curves functions are very flexible. You can choose in the CHG menu whether you wish to work with Arc Definition Curves or Chord Definition Curves. The default is Arc Definition Curves. To change this setting, press CHG NeXT MODE ARC and you will see CHORD (or if CHORD is displayed, tapping CHORD displays ARC).

When sufficient information has been entered, the curve can be computed and displayed. Usually, any combination of two of the elements described in this section will be enough to compute the missing data for the curve.

After the direction to the forward tangent and one other known dimension of the arc have been entered, the PC, CC, and PT points are stored in that order.

If you have entered only the direction to the forward tangent, after you store the points, the display shows the Distance submenu of the Traverse menu. This allows you to enter the distance and zenith angle to the PI and traverse to the PI of the next arc.
If the next PI point is already stored using the NPIPT or NPISH keys, the program traverses to that point and shows the third page of the Curves menu.

**Figure 2-60 Choose Curve Direction Menu**

After the curve has been calculated, the display presents the curve data; additional soft keys now are available to store points and traverse through the curve. You can traverse around the curve by defining the direction in which the curve is turning by tapping LEFT or RIGHT.

**Figure 2-61 View and Area Screens**

The direction of the curve is always defined from the PC toward the PT. You may view the curve data at any time by tapping VIEW from the soft key menu. Tap AREA to see area information for the curve: sector, segment, and fillet. The curve routine presents a final set of soft keys to help you further define and store the curve data.

**Figure 2-62 Continue Curves Screen**

To continue the curve using the same information, tap rep. To add another curve with a different length, tap L, enter the length of curve, and press L. Likewise, to add another curve section with the same data except for a change in the chord length, tap CH, type the length of curve, and press CH. To change the note without adding curve information, tap note and change the note of the next PT or POC to be placed.
**Curves Menu 1**

![Option](image)

**Figure 2-63 Curves Menu 1**

**Curves Menu 1 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;&gt;</td>
<td>Allows you to enter a delta angle in degrees (interior angle of arc).</td>
</tr>
<tr>
<td>R</td>
<td>Allows you to enter a radius length.</td>
</tr>
<tr>
<td>T</td>
<td>Allows you to enter a tangent length.</td>
</tr>
<tr>
<td>L</td>
<td>Allows you to enter an ARC length or Length of Curve when in Arc Definition mode. If in Chord Definition mode, the key changes to CCL and is used to enter a chord curve length. The Arc and Chord Definition modes can be changed by pressing CHG.</td>
</tr>
<tr>
<td>CH</td>
<td>Allows you to enter a chord length.</td>
</tr>
<tr>
<td>E</td>
<td>Allows you to enter an external length.</td>
</tr>
</tbody>
</table>

**Curves Menu 2**

**KEYSTROKES:** CURVE NEXT

✓ *Do not use the PC, CC, POC, or PT keys on the second menu when using the soft keys on the third menu.*

![Option](image)

**Figure 2-64 Curves Menu 2**
### Curves Menu 2 Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEGC</strong></td>
<td>Allows you to enter the degree of curvature. An arc length definition of 100’ is the default (flag 52 is clear). However, if flag 52 is set, the 100’ chord length definition is used. This flag is changed automatically using the <strong>ARC</strong>, <strong>CHORD</strong> soft toggle key in the Change menu: <strong>CHG</strong>: <strong>MODE</strong>. See Change/Defaults on page 41.</td>
</tr>
<tr>
<td><strong>PC</strong></td>
<td>Allows you to enter the point of curvature and occupy that point. If this is not entered, the current occupied point is assumed to be the point of curvature. Key in a point number for the PC and tap <strong>PC</strong>. Key in a point number for the PT and tap <strong>PT</strong>. Now you will have the option of keying a point number for the RP, PI, or POC and the curve will be computed. Find the radius of a curve defined by three points on the curve by using the PC, POC, and PT.</td>
</tr>
</tbody>
</table>
| **RP** | Allows you to enter the point number at the center of the curve. The radius is calculated from this point to the point of curvature (the occupied point).  

> The point of curvature should be occupied before using this function in order to compute a valid radius. |
| **PI** | Allows you to enter the point of intersection. This is the point at the intersection of the two tangents to the curve. |
| **PT** | Allows you to enter the point of tangency. The chord of the circle is calculated from this point if the point of tangency (PT) and the point of curvature (PC) have been defined. |
| **POC** | Allows you to enter a point on the curve. The curve can be calculated from this point if the point of tangency (PT) and the point of curvature (PC) have been defined. |

### Curves Menu 3

**KEYSTROKES:** CURVE NeXT NeXT

When using the functions on this menu, it is assumed the occupied point is the PI and the backsight is along the tangent line through the PC. The keys on Curves menu 3 are designed to calculate the delta of the arc based on the direction of the forward tangent. Any other information about the arc may be entered before or after entering the direction of the forward tangent.

> Do not use the PC, CC, POC, or PT keys on the second menu when using the soft keys on the third menu.
**Curves Menu 3 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;NPIPT&gt;</td>
<td>Allows you to enter the point number of the next PI.</td>
</tr>
<tr>
<td>&lt;NPISH&gt;</td>
<td>Allows you to take a shot on the next PI and store it as a side shot. If you are using electronic data collection, tapping this key causes the instrument to take a shot on the PI.</td>
</tr>
</tbody>
</table>

**Curves Menu 4**

This menu displays once a curve has been calculated but not stored.

**Curves Menu 4 Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>STORE</td>
<td>Stores a point on the curve that you have just calculated. This key also stores the “curve center” point that is used as a reference for calculations.</td>
</tr>
<tr>
<td>VIEW</td>
<td>Displays the curve data.</td>
</tr>
<tr>
<td>Area</td>
<td>Displays the area subtended by the calculated curve.</td>
</tr>
<tr>
<td>tan~</td>
<td>Allows you to change the forward tangent of the curve. If a value is not entered, the forward tangent from the current back azimuth is used. This function is not needed if you have traversed along the tangent to the PC or if the CC is used to define the curve.</td>
</tr>
<tr>
<td>crd~</td>
<td>Allows you to change the chord direction of the curve.</td>
</tr>
</tbody>
</table>
Option | Function
--- | ---
Sta | Allows you to set the PC station or distance along to the next PC.
Rad~ | Allows you to change the radial or radius direction of the curve.

Curves Menu 5
This menu displays once a curve has been calculated and stored.

Figure 2-67 Curves Menu 5

Curves Menu 5 Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>REP</td>
<td>Uses the arc length from the previous data to continue traversing around the curve.</td>
</tr>
<tr>
<td>L</td>
<td>Stores a new curve length and recalculates a new point based on the new curve length and radius.</td>
</tr>
<tr>
<td>Ch</td>
<td>Stores a new chord length and recalculates a new point based on the new chord length and radius.</td>
</tr>
<tr>
<td>NOTE</td>
<td>Allows you to store a note with the last point stored. To store a note at a different point, key in the desired point number before tapping NOTE.</td>
</tr>
</tbody>
</table>

Example: Insert Curve at Point of Intersection While Traversing

KEY: IC@PI

This soft key appears in the Traverse menu after a bearing is entered.

While traversing from PI to PI, you can insert a curve at each PI.

1. Press TRAV and traverse to the PI of a curve.

You can also tap SETUP, occupy the PI point and backsight a point along the tangent, and press TRAV.
2. **Enter the direction to the next PI (angle right, azimuth, bearing, or deflection angle).**
   
   This automatically computes the delta for the curve you wish to insert.

3. **Tap [IC@PI].**

   The first Curves menu displays. Use any of these options except delta, since delta is already computed.

4. **Key in a value and tap the appropriate key.**

   The curve data for the curve you are about to insert displays, along with the second Traverse menu.

5. **Key in the information to move you to the next PI point (like the horizontal distance).**

   The PC, RP, and PT points are stored, along with the next PI point. You will be occupying the next PI point, ready to traverse to another PI, and while doing so, insert another curve at this PI, if you wish.

---

**Example: Solving for a Non-Tangent Curve**

This example shows you how to create a new job, enter a traversed boundary, calculate an intersection (radius) point, and determine the area for the region with a non-tangent curve.

![Figure 2-68 Boundary with a Non-Tangent Curve](image)

Compute the area for this lot with a non tangent curve

---

**Figure 2-68 Boundary with a Non-Tangent Curve**

1. **If Elevations are on, turn them off [a 3].**

2. **Create a new job by pressing [JOB] NEW NEW.**
3. Key in EXAMPLE.

4. Now begin traversing from point 1 to 4. Press TRAV 15 AZ 200 HDIST.

5. Type 87.5030 AZ 540 HDIST to put in the second leg (point 3).

6. Type 218.20 BRG 200 HDIST to put in the third leg (point 4).

Now you need to intersect from 1 to 4 using the radius of the curve you are trying to enter. This radius distance entered from both point will create the radius point at the intersection. Store the resultant intersection point using point number 5.

7. Press X (INTERSECT - Allegro R key, JETT U key, Titan S key) and key in 1 PT1 500 DIST1.

```
<<<<<<<<<<< INTERSECTIONS >>>>>>>>>>
PT 1: 0
OFFSET 1: 0.00
DIR 1: 0°00'00"E
PT 2: 0
OFFSET 2: 0.00
```

Figure 2-69 Intersections Menu

8. Key in 4 PT2 500 DIST2.

```
<<<<<<<<<<< INTERSECTIONS >>>>>>>>>> FROM PT 1
1:S42°58'14"E 500.0000
2:N38°49'34"E 500.0000
FROM PT 4
1:S38°49'34"W 500.0000
2:N42°58'14"W 500.0000
1STO 2STO NOTE CONT
```

Figure 2-70 Possible Intersecting Directions

9. Tap the 1sTO key to store the intersecting point using the first set of directions.

10. To calculate the area for the new region, press RPTS 1.3 SPACE 3 SPACE 4 SPACE 5 SPACE 1 AREA.

11. Enter the Random Points file as 1.3 SPACE 4 SPACE 5 SPACE 1.
12. Tap the **AREA** soft key.

Figure 2-71 Area of Boundary

If you performed a screen plot, this is how it should look. The lower portion of the curve will be cut off since the radius point (5) is above the arc and there are no plotted points on the curve.

Figure 2-72 Screen Plot of Boundary

---

**Custom Menu (CUSTOM)**

**PRODUCT:** ALL

**KEYSTROKES:** CUSTOM (THE X KEY)

**KEY-IN:** CUSTOM

**COMMAND GROUP:** PROGRAM SETTINGS

This function lets you customize the functions of the user keyboard and save special values.

To assign a program or program name or a number, tap **KASN**. Type the number, program, or program name. For example, to assign a key that automatically displays the software version you are using you would tap **KASN**, type VER (for version), and press **!** and the key to which you want this function assigned.
If you want it to be assigned with a Shift Left, press a \( \text{Shift} \) and the desired key. Or, to assign a single key, just press that key. For example, to assign VER to \( \text{STAKE} \), with VER showing on the display, press \( \text{STAKE} \).

After any key change, the SMI at the top right side of the display changes to USER, indicating that the default key assignments have been changed. The rest of the SMI overlay is still active.

In the \( \text{CUSTOM} \) menu, tap \( \text{USER} \) to switch between having USER and SMI displayed at the top of the screen. Now STAKE is active, rather than VER. This function allows you to assign many of your own user key assignments and switch between using your own key assignments and the SMI key assignments.

**Figure 2-73 Custom Menu**

**Custom Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>KASN</td>
<td>Assigns a function to a key.</td>
</tr>
<tr>
<td>KDEL</td>
<td>Removes a user key assignment.</td>
</tr>
<tr>
<td>RSTO</td>
<td>Stores a number in a numbered register. Type the value to be stored and then the number of the register in which to store it, then tap ( \text{RSTO} ).</td>
</tr>
<tr>
<td>RRCL</td>
<td>Recalls a number from a register. Type the register number and tap ( \text{RRCL} ).</td>
</tr>
<tr>
<td>USER / USER¾</td>
<td>Toggles user keys on and off.</td>
</tr>
<tr>
<td>REGS</td>
<td>Displays the Memory Registers menu.</td>
</tr>
</tbody>
</table>

**Example: Create Custom Key**

You are traversing north 3 degrees and 30 minutes, and east for 33 1/2 poles. Multiply the poles in the deed by 16.5 and get feet, then use those feet in the traverse.

1. Press \( \text{CUSTOM} \).
2. Tap \( \text{kASn} \).


4. Press \( \text{X} \) (the multiplication key).

5. Press \( \text{R} \).

6. Press \( \text{R} \)

   This assigns 16.5 and multiply to \( \text{R} \).

7. Press \( \text{TRAV} \).

8. Key in 3.30 and tap \( \text{az} \).

9. Key in 33.5 (poles) and press \( \text{R} \).

   The display shows 552.75 (feet).

10. Tap \( \text{hDIST} \) to traverse to the next point with a distance of 552.75 feet.

---

**Date/Time**

To set the date and time on your data collector first exit the SMI software. Then enter the collector's Control Panel and double click on Date/Time. Choose the correct date. Click on the Time tab and change the time so that it is correct, then restart the program.

✔ If you are working with sunshots, it is of particular importance that your program be set to the correct date and time. To be sure that this is correct select File > Settings, and make sure the Authentic 48 Speed is toggled ON. You can now change the date and time using the information above.
**Deflection Left/Right to Azimuth**

PRODUCT: ALL  

KEY-IN: LEFT: **DEFL**, RIGHT: **DEFR**  

COMMAND GROUP: CONVERSIONS

These functions convert a deflection angle to an azimuth (either entered on the stack or at the functions prompt) using the current setup information.

If your backsight direction and occupied point are established, and you have entered a deflection angle on the stack, you can convert this value to an azimuth. Simply key in the deflection angle and run this command.

**Example: Enter a Deflection Right**

The current occupy point is 1 with the coordinates of 5000, 5000 and current backsight is point 2 with the coordinates of 5100, 5100. If a deflection right of 45.0 degrees is entered, the resulting value is 270.0 degrees. Because the back azimuth was 45d +, the deflection right (180 AR = 0d DR) of 45d equals the new azimuth of 270d.

---

**Degree Symbol**

PRODUCT: ALL  

KEY-IN: **DEGSYMS**  

COMMAND GROUP: VIEW

This function sets the ASCII Code used for representing the degree symbol when printing to a COM Port printer. The default is 176. To enter these on your PC hold the Alt key down while at the same time typing the code. Depending on the font your printer supports you may need to experiment with other codes. See the ASCII chart that comes with your printer.
Other ASCII codes which could be used to represent a degree symbol are:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Example</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>*</td>
<td>42</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>68</td>
</tr>
<tr>
<td>d</td>
<td>d</td>
<td>100</td>
</tr>
<tr>
<td>°</td>
<td>°</td>
<td>176 (Default)</td>
</tr>
<tr>
<td>’</td>
<td>’</td>
<td>183</td>
</tr>
<tr>
<td>°</td>
<td>°</td>
<td>186</td>
</tr>
</tbody>
</table>

**Degrees, Minutes, and Seconds (HMS or DMS)**

PRODUCT: ALL

KEY-IN: D c 0 HMS

COMMAND GROUP: CONVERSIONS

Same as Hours, Minutes, and Seconds.

This function is used to convert a decimal number to the Degrees, Minutes, and Seconds format.

Key in your decimal number on the stack. Press ALPHA, type D c 0 HMS, and press ![right_arrow]. The decimal value entered is now converted to Degrees, Minutes, and Seconds (DMS/HMS) format.

* It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.*
Delete Menu (DELETE)

PRODUCT: ALL

KEYSTROKES: DELETE

KEY-IN: DELM

COMMAND GROUP: JOB

This function allows you to delete points, jobs, Random Points files, raw data, or all the jobs currently in the list.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNTS</td>
<td>Allows you to delete points. The display prompts you to enter the point number(s) to be deleted. Key in the point number and press !. To delete a range of points, key in the first point number followed by a space, then the last point number to be deleted, and tap PNTS. All points within that range will be deleted.</td>
</tr>
<tr>
<td>JOBS</td>
<td>Allows you to delete a job. The display prompts you to enter the name of the job to be deleted. The names of your jobs are shown on a stack (press the up and down arrow keys to scroll through the menu and find the job you wish to delete. To delete it, with the job highlighted, press ! or tap NO to cancel.</td>
</tr>
<tr>
<td>RAW</td>
<td>Allows you to delete raw data. The display prompts you to confirm that you wish to delete raw data for the current job. Tap YES to confirm or NO to cancel.</td>
</tr>
<tr>
<td>RPTS</td>
<td>Allows you to delete a Random Points file. After you have selected this option, the display shows the names of Random Points files in the current job (you may need to tap NEXT to see additional files). Tap the soft key corresponding to the name of the file you wish to delete. Press ! YES to confirm.</td>
</tr>
<tr>
<td>CARD</td>
<td>Allows you to delete card data. The display prompts you to confirm that you wish to erase the contents of port 2, which is actually the entire contents of the current storage file. All jobs and project data in this storage file will be deleted. You are prompted to select YES to confirm or NO to cancel the deletion.</td>
</tr>
</tbody>
</table>
**Display Format**

PRODUCT: ALL

KEYSTROKES: `CHG` (THE B KEY) `NeXT` and `DSPLY`

KEY-IN: **Di SPM**

COMMAND GROUP: OPTIONS

This toggle key switches between four types of display: angle right, bearing, azimuth, and coordinate. The screen confirms as each is selected (e.g., DISPLAY BEARING). The display format may be changed at any time and does not affect how data is stored or calculated.

---

**DOT Menu**

PRODUCT: DOT

KEY-IN: **SCDOT**

COMMAND GROUP: DOT COMMANDS

This menu contains functions specific to the DOT version of the software.

The following custom programs are designed to simplify or provide more immediate access to special functions and routines that may be used more frequently in certain applications. Many of these special programs were initially developed for the South Carolina Department of Transportation.

Programs include the following: Two-point resection; Two- and three-corner shots; Manual entry of cross-section data; One-time boot of the rod; Store offset points; Cross-section offsets; Cross-sections; Zero the rod; and Random point station.

One way to access the DOT menu is to press **ALPHA**, type **SCDOT**, and press `!`.

There may already be a DOT command favorites menu created for your installation if you are using a DOT version of the program. These commands can only be accessed if you have that version installed. If you don’t have these commands added as a menu or key group, it is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the DOT Commands Command Group.
## Figure 2-75 DOT Menu

### DOT Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>2cor</td>
<td>Allows you to shoot two corners of a building and measure the third side. See <em>Two Corner Shot on page 270</em> for more information.</td>
</tr>
<tr>
<td>3cor</td>
<td>Allows you to shoot three corners of a building and have the data collector compute the fourth corner. See <em>Three-Corner Shot on page 258</em> for more information.</td>
</tr>
<tr>
<td>Manx</td>
<td>Use this function when you are taking cross-section shots and get an obstruction that requires you to switch to manual entry of cross-section data. See <em>Manual Cross-Section Entry on page 157</em> for more information.</td>
</tr>
<tr>
<td>Boot</td>
<td>Allows you to temporarily adjust the height of the rod. See <em>Boot the Rod on page 40</em> for more information.</td>
</tr>
<tr>
<td>Stof</td>
<td>Allows you to store offset points. See <em>Store Offset on page 250</em> for more information.</td>
</tr>
<tr>
<td>Coff</td>
<td>Allows you to store offset points from a cross-section. See <em>Cross-section Offset on page 80</em> for more information.</td>
</tr>
<tr>
<td>0rod</td>
<td>Used in conjunction with the Boot function. See <em>Zero the Rod on page 285</em> for more information.</td>
</tr>
<tr>
<td>Rps</td>
<td>Allows you to set up within sight of two known stations and shoot the two stations to establish your occupied station. See <em>Random Point Station on page 187</em> for more information.</td>
</tr>
</tbody>
</table>
**Elevation Mode - ON/OFF (EL)**

PRODUCT: ALL

KEYSTROKES: \[a \text{ EL} \] (THE 3 KEY)

KEY-IN: TOGELEV

COMMAND GROUP: OPTIONS

This function allows you to toggle Elevations on or off.

Press this toggle key to switch between Elevations on and Elevations off. The screen confirms your setting. When Elevations are on, the letter Z will appear at the top of the display to indicate that this setting is active. Additional soft keys relating to Elevations will appear in various menus; these do not appear when Elevations are off.

 ✓ Construction and DOT Users: Elevations must be on when slope staking. See Construction Menu on page 61 for more information.

---

**Establish Instrument Communication (SMI Flex System)**

PRODUCT: ROBOTIC

KEY-IN: ESTI COM

COMMAND GROUP: SETUP

This command finds the baud rate to which the receiver is currently set. This only works with the SMI Flex GPS system. The default baud rate for this system is 19200.

![Establishing Instrument Communication Dialog Box](image)

*Figure 2-76 Establishing Instrument Communication Dialog Box*
Exit

PRODUCT: ALL

KEYSTROKES: FILE > EXIT

This command properly exits the program. It is not necessary to exit the program when turning off the data collector. SMI should be closed using this menu item before installing a new version of SMI or performing a soft or hard reset on the data collector.

Exporting Jobs

PRODUCT: ALL

KEYSTROKES: TRANSFER > EXPORT JOBS

This command allows you to export the selected jobs and selected job types to independent files on the device’s drive. These files can then be automatically copied using Active Sync to your desktop computer or another data collector using Beam-It.

Select the Transfer > Export Jobs. Select the jobs that you want exported. You must have at least one job toggled on. Toggle on the job data types you want produced. You must have at least one job data type toggled on. Press the Export button to export the selected jobs and their associated files.

The toggles on the right side of the Export Jobs dialog box are the different types of SMI Job Data that can be exported from SMI.

The Job listing on the left indicates for which of the jobs the selected data type will be exported. You may select multiple files to export at the same time.

The Browse button sets the active directory for this export. To permanently set the export directory select Transfer > Settings.

✔ If you browse to the My Documents directory on the Windows CE device, the exported job files will be automatically sent to the desktop computer when the device is synchronized. This will only happen if you have established a partnership with this device and have toggled files to synchronize within Microsoft ActiveSync.
### Figure 2-77  Export Jobs Dialog Box

#### Export Jobs Dialog Box Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinate</td>
<td>Toggling this ON exports the coordinate or *.ASC file for each of the selected jobs.</td>
</tr>
<tr>
<td>Raw</td>
<td>Toggling this ON exports the SMI raw or *.RAW file for each of the selected jobs.</td>
</tr>
<tr>
<td>Chains</td>
<td>Toggling this ON exports the chain or *.CH file(s) for each of the selected jobs.</td>
</tr>
<tr>
<td>Cut Sheet</td>
<td>Toggling this ON exports the cut sheet or *.CUT file for each of the selected jobs.</td>
</tr>
<tr>
<td>Backup</td>
<td>Toggling this ON exports a backup file or *.48D file for each of the selected jobs.</td>
</tr>
<tr>
<td>Select All</td>
<td>Highlights all of the jobs currently in the storage file.</td>
</tr>
<tr>
<td>Clear</td>
<td>Clears the list of selected jobs.</td>
</tr>
<tr>
<td>Data Directory</td>
<td>Allows you to select the location on the device to which to export the files.</td>
</tr>
<tr>
<td>Export</td>
<td>Exports the selected jobs and their associated files.</td>
</tr>
<tr>
<td>Cancel</td>
<td>Cancels this command.</td>
</tr>
</tbody>
</table>
Favorites

PRODUCT: ALL

KEYSTROKES: SPACE OR FAVORITES

COMMAND GROUP: PROGRAM SETTINGS

Command Favorites allows you to select from a list of SMI commands. There are several predefined menus (lists of commands) and you can create menus of your favorite commands. Command Favorites can be accessed by:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegro</td>
<td>Tapping the FAVORites button, or pressing the SPACEBAR.</td>
</tr>
<tr>
<td>JETT</td>
<td>Tapping the FAVORites button, or pressing the SPC key.</td>
</tr>
<tr>
<td>Titan</td>
<td>Tapping the FAVORites button on screen.</td>
</tr>
<tr>
<td>Pocket PC</td>
<td>Tapping the Favorites icon in the Menu bar.</td>
</tr>
</tbody>
</table>

You can also assign the Command Favorites command to a Command Key or Command Bar button. Tap on the command in the list of commands that you want to run. If you prefer not to use the touch screen, use the up and down arrows on the Navigation button, and press the key (Allegro and JETT) or press the center of the Navigation button (Titan) to run the selected command.
Select Favorites Menu

PRODUCT: ALL

KEYSTROKES: FAVORITES SELECT or ALLEGRO SPACE JETT

COMMAND GROUP: PROGRAM SETTINGS

Use the Select Menu command in the main Favorites dialog box to select a different Favorites menu. For example, you could have a Favorites menu for your total station, one for your GPS receiver, and yet another for doing office calculations and job reduction work.

To select a different Favorites menu, open the Favorites dialog by either tapping FAVORITES on screen (Allegro, JETT & Titan) or tapping the Favorites icon (Pocket PC). Click on the Select Menu button in the upper right corner of the Favorites dialog box. Click on a different Favorites menu. Either tap the screen or use the directional key(s) to move the active menu selection, then press ! or tap OK.

The selected menu is then set active and you are automatically returned to the list of Favorite commands. You can dismiss the dialog box by either tapping or pressing Esc.

Customize Favorites Menu

KEYSTROKES: SPACE OR FAVORITES then tap CUSTOMIZE

COMMAND GROUP: PROGRAM SETTINGS

Use the Customize Favorites command to add (or remove) SMI commands from the easy-to-use Favorites menu. There are over 400 commands available for one click execution from the Favorites menu and function keys. They are grouped in a similar order to where they are found within the SMI menu system.

Add A Command

To add a command to the Favorites menu:

1. Open the Favorites dialog box by either:
   A. Tapping FAVORITES on screen (Allegro, JETT & Titan).
   B. Pressing SPACE (JETT SPC key).
   C. Tapping the Favorites icon (Pocket PC).
2. Click on the Customize button to customize the currently active Favorites menu.
3. Click on the Add button.
4. Select the Command Group that contains the desired SMI command.
5. Select the actual SMI command and click OK.

For a complete listing of commands that can be added, see Command Group Reference, which begins on page 287.

Remove a Command

To remove a command from the Favorites menu:

1. Open the Favorites dialog by either:
   A. Tapping FAVORites on screen (Allegro, JETT & Titan).
   B. Pressing the SPACE (JETT SPC key).
   C. Tapping the Favorites icon (Pocket PC).
2. Click on the Customize button to customize the currently active Favorites menu.
3. Highlight the unwanted command.
4. Click on the Remove button.
5. Click OK to close the dialog box.

Feet to Inches

PRODUCT: ALL
KEY-IN: FT2IN
COMMAND GROUP: CONVERSIONS

If you need to convert decimal feet values to feet and inches, you may run this command to convert the value on the stack. Simply, enter the decimal feet and get feet and inches to the nearest sixteenth on the stack.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.
Fine/Coarse Toggle (FINE)

PRODUCT: ALL

KEYSTROKES: a [FINE] (THE 1 KEY)

KEY-IN: TOGFINE

COMMAND GROUP: TOTAL STATION

The Fine/Coarse toggle indicates whether it will use fine or coarse EDM distances. Most instruments allow the user to choose between Fine and Coarse modes. Here are some notes using this setting:

- The default setting for this mode is Fine.
- Some instrument drivers allow you to set the mode on the instrument and have SMI ignore the setting on the data collector. For example, the Leica TCA driver has as soft key function of DIST. This key toggles between “WILL USE DIST MODE ON LEICA” and “WON’T USE DIST MODE ON LEICA”. The “WILL” option allows the Distance mode to be set on the Leica and not have the data collector change the mode based on the Fine/Coarse toggle key.
- When using the Zeiss Elta S20 & S20R when in Coarse mode (<CRs in INST menu), Finelock mode is not used unless the Coarse mode in the Zeiss [SETUP] menu is set to “Accurate.” When using the Accurate Coarse mode, Finelock takes two seconds. When in Fine mode, Finelock adds about five seconds to the shot.
- Some of the instrument drivers can measure a distance in Fine or Coarse mode. This is selected using the <CRs / fine key in the INST menu or ROBOT menu. Because of limitations of some instruments, some instrument functions may not be available. When an instrument function is not supported, usually you will see a message to do it manually or that it is not supported in the current driver. For example, the Leica TC(S) 500 and TC 800 only work in Fine mode.
- The Geodimeter 422 works twice as fast in Coarse mode (@ 10 seconds) than Fine mode (@ 20 seconds).
- The Geodimeter 600 or Trimble 5600 in Coarse mode takes about 3 seconds if in Track mode and <AIM and <FLW flags are turned off. A shot in Fine mode takes about 10-15 seconds.
First Available Point (FAP)

PRODUCT: ALL

KEYSTROKES: a FAP (THE ! KEY)

KEY-IN: FAP

COMMAND GROUP: COLLECT

This function key lets you identify the first available (non-used) point for the current job.

When executed, this function briefly shows the first available point for the current job. If there are no point numbers in the command line, this function searches from the beginning of the job for the first unused point number, and assigns it to be the next number to be stored (see Next Number (NEXTNO) on page 167). Or key in a point number and press the key; the search begins from that point. If that point is used, the search goes forward to the next highest unused point number. If the entered point number is unused, the search goes backward until it finds the FAP after the next lowest used point.

For example, to find the last point number stored, enter a point number beyond the end of your job into the command line and press a and the FAP key. The program searches backwards from that point until it finds a stored point. The “first available point” displayed is the point number just after the highest point stored.

To find an available point number in a gap between a group of points, key in the number of a used point number that falls somewhere in the group of stored points before the gap. The program searches forward for the first empty point; this is displayed as the next available number.

Flop Scope (FLOP)

PRODUCT: ALL

KEYSTROKES: a FLOP (ALLEGRO BKSP KEY, JETT H KEY)

KEY-IN: FLOP

COMMAND GROUP: COLLECT

This command may be used to automatically flop the scope of the instrument sighted on the current target. This may be particularly useful when collecting one or more sets of observations. The command can also be accessed via the a INFN (Allegro Esc key, JETT J key, Titan SP key) menu.
You must have a motorized or servo-driven instrument for this command to work.

---

**Foresight to Cutsheet**

PRODUCT: ALL

KEYSTROKES: c  FS

KEY-IN: FSCUT

COMMAND GROUP: CONSTRUCTION

This function stores a foresight to the cutsheet.

✓ With the FS command, enter the foresight station and offset. If only the station is given, then the offset indicated by COFS or CBFS in the Construction Options (Opt) menu is used. If nothing is on the stack when FS is tapped, then the station is incremented to the next station interval. Press a FS to use a point number to get a station and offset.

---

**Geoid**

PRODUCT: ALL

KEYSTROKES: GEOID > USE GEOID

COMMAND GROUP: GPS

To use a Geoid file when collecting GPS data, toggle this option ON. For relatively small project areas, if you are using a known benchmark to establish an elevation, using a Geoid file or geoid departure is optional.

Geoid refers to the equipotential surface of the Earth’s gravity field which best fits, in a least squares sense, global mean sea level. An equipotential surface is a surface where the potential is constant for every point on that surface. Level surfaces on the earth are equipotential.
The above drawing is a schematic diagram showing the relationship between the geoid, orthometric heights, and ellipsoid. Note that the ellipsoid is drawn above the geoid. This is the actual case for all points within the lower 48 states. Also note that the ellipsoid does not coincide with any level surface, but rather cuts across them. This is because the ellipsoid is a geometric invention, and not defined by the actual gravitational field of the Earth itself.

After a Geoid file has been installed in the data collector, the Use Geoid option should be turned on.

6. Tap on the Geoid menu in the Classic SMI interface.
7. If Use Geoid has a checkmark beside it, the option is already on. If it is not on, tap the Use Geoid option to turn it on.

A message box confirms the status of the setting.

Figure 2-80 Using Geoid Message Box

- Do not turn on or off the Use Geoid option after setting up the base. If you do so, it will cause the elevations to be off by the amount of the Geoid separation (potentially dozens of feet).

If you turn off the Use Geoid option after having taken shots with it on, press GPS (the Z key), tap the opt soft key, type in 0 and tap the geoid soft key. This sets the Geoid separation back to 0.

SMI supports the following Geoids: Geoid03, Geoid99, Geoid96, and all other Ordinance Survey data files produced by the NGS.

Geoid Models

Here is a map illustrating the 8 different geoid files and their location over the continental United States.
Geoid 99 for Alaska, Hawaii, Puerto Rico and the Virgin Islands

It must be emphasized that the GEOID99 models in Alaska, Hawaii, Puerto Rico, and the Virgin Islands were NOT computed by incorporating GPS on leveled benchmarks. This was due to a shortage of reliable NAD 83 GPS ellipsoidal heights on NAVD 88 benchmarks in these regions. The GEOID99 Geoid models provided in these areas are relative to a geocentric, GRS 80 ellipsoid. For this reason, you should refer to Deriving Orthometric Heights From GPS on page 111.

Due to poorer data coverage, error estimates for GEOID99 in these regions are larger. Long-wavelength errors may be as large as 4-5 parts-per-million in some areas. Particular care must be used in computing heights in the tectonically active areas in southern Alaska. Crustal motion may exceed 1 meter even after accounting for the shift of the 1964 Prince William Sound Earthquake.
The MEXICO 97 GEOID MODELS

The MEXICO 97 model is a high resolution Geoid height model covering the region 14-33N, 119-86W. It has been prepared in cooperation with the Instituto Nacional de Estadistica, Geografia e Informatica (INEGI). The MEXICO 97 Geoid model has been designed specifically for Mexico. Due to data coverage and computational issues, you will find offsets between MEXICO 97 and either GEOID96 or G96SSS in regions of overlap.

The CARIB 97 GEOID MODELS

The CARIB 97 model is a high resolution Geoid height model covering the region 9-28N, 86-58W. It has been prepared in a cooperative effort with the National Imagery and Mapping Agency (NIMA). The CARIB 97 Geoid model has been designed specifically for the Caribbean Sea. Due to data coverage and computational issues, you will find offsets between CARIB 97 and either GEOID96 or G96SSS in regions of overlap.

The GEOID99 Model

The GEOID99 model is known as a "hybrid Geoid model," combining gravimetric information with GPS ellipsoid heights on leveled bench marks. The GEOID99 model was developed to support direct conversion between NAD 83 GPS ellipsoidal heights and NAVD 88 orthometric heights.

When comparing the GEOID99 model with GPS ellipsoidal heights in the NAD 83 reference frame and leveling in the NAVD 88 datum, it is seen that GEOID99 has roughly a 4.6 cm absolute accuracy (one sigma) in the regions of GPS on Benchmark coverage. In those states with sparse (150 km+) GPS on Benchmark coverage, less point accuracy may be evident; but relative accuracy at about a 1 to 2 part-per-million level, or better, should still be obtained. For users with less stringent accuracy requirements, simple height conversions with GEOID99 in the conterminous United States can be sufficient. For users with more stringent accuracy requirements, please see Deriving Orthometric Heights From GPS below. You should be aware that GPS ellipsoid height error, by itself, will be significantly greater than error in Geoid height differences.

Deriving Orthometric Heights From GPS

One key problem is deciding which orthometric height datum to use. NGVD 29 is not a sea-level datum, and the heights are not true orthometric heights. The datum of NAVD 88 is selected to maintain reasonable conformance with existing height datum, and its Helmert heights are good approximations of true orthometric heights. And, while differential ellipsoidal heights obtained from GPS are precise, they are often expressed in the NAD 83 datum, which is not exactly geocentric. In addition, GEOID99 rests upon an underlying EGM96 global geopotential model, and EGM96 does possess some error of commission.
Do not expect the difference of a GPS ellipsoidal height at a point and the associated GEOID99 height to exactly match the vertical datum you need. The results will be close when converting NAD 83 GPS ellipsoidal heights into NAVD 88 elevations; but, maybe not accurate enough for your requirement. However, you can combine the precision of differential carrier phase GPS with the precision of GEOID99 height differences to approach that of leveling.

Include at least one existing benchmark in your GPS survey (preferably many benchmarks). The difference between the published elevation(s) and the height obtained from differencing your adopted GPS ellipsoidal height and the GEOID99 model could be considered a "local orthometric height datum correction." If you are surveying an extensive area (100+ km), and you occupy a lot of benchmarks, then you might detect a trend in the corrections up to a one part-per-million level. This may be error in the GEOID99 model.

The NGS does not currently consider Geoid-corrected GPS orthometric heights as a substitute for geodetic leveling in meeting the Federal Geodetic Control Subcommittee (FGCS) standards for vertical control networks. Studies are underway, and many less stringent requirements can be satisfied by Geoid modeling. Widespread success has been achieved with the preceding models.

**Geoid Departure**

If you do not have room on your data collector for a full Geoid file or if the area of the world you are working on is not covered by a supported Geoid file you can manually enter a Geoid departure for that area. The Geoid separation is entered in meters using the **geoid** soft key. You should be able to find your local Geoid separation at: [http://www.ngs.noaa.gov](http://www.ngs.noaa.gov).

For relatively small project areas, if you are using a known benchmark to establish an elevation, using a Geoid file or Geoid departure is optional.

**Geoid File Download**

PRODUCT: ALL

COMMAND GROUP: JOB

You can download a Geoid file directly to your device using this command – however the suggested method is to use the installation from the CD and perform a modify of your installation. Refer to the *SMI V8 User Guide* for more information.
Georgia Scale Factor

PRODUCT: CONSTRUCTION & DOT

KEY-IN: GF

COMMAND GROUP: DOT COMMANDS

Use this command to calculate a grid scale factor for use with a total station in the state of Georgia.

*: (ROBOTIC only): When using GPS, the scale factor for any state plane coordinate system is automatically determined when the base command is used. Distances and inverses are reported with a * in front of them.

When executed the command prompts for NAD27 or NAD83. The cursor is automatically placed at the 2 for 27.

Figure 2-82  Grid Factor

Type either 83 or press enter for 27. If you select NAD83, you will need to know if your job coordinates are for either the Eastern Zone or Western Zone of the Georgia NAD83 System.

If you already know your average elevation and X-coordinate for the jobsite tap yes, otherwise tap no to enter one or two known points for the determination of the average.

If you selected No, enter the point numbers stored in the current job that best represent the furthest east and west points or center point for only one point.

If you selected Yes, enter the average elevation and average state plane X-coordinate.
Figure 2-83 Restore Grid Factor

A screen similar to the one above will display. Verify the number shown and tap either YES or NO to set the active grid scale factor for the job.

The active scale factor is used to multiply all measured distances. This means that you should see an ‘*’ (asterisk) displayed next to all distances which indicates they have had a scale factor applied to them.

You may also determine the scale factor for a job if you have known grid coordinates for two or more points using the Two Point Free Station command.

✓ The current setting of Feet or Meters will affect your calculations.

Georgia Next Chain

PRODUCT: DOT

KEY-IN: CHNNO

COMMAND GROUP: DOT COMMANDS

Shows the current "next chain" number and allows for it to be changed.

Chain numbers have been used for connecting line work using a Georgia DOT CAD program. These numbers are only used for what are considered '4D' features codes. What are considered '2D' feature codes have only X- and Y-coordinates, 3D feature codes have X-, Y-, and Z-coordinates, and the 4D feature codes have X-, Y-, and Z-coordinates and Line Number (Chain).
**GPS Menu (GPS)**

PRODUCT: ROBOTIC

KEYSTROKES: 📡GPS (THE Z KEY)

KEY-IN: 📡GPS

COMMAND LOCATION: GPS

Commands within this menu help you configure SMI to work with your GPS system.

---

**GPS Main Menu**

Use these commands to configure SMI for your GPS system. You may select the instrument driver, establish the base and rover relationships, adjust acceptable tolerances for recorded information, configure log files for static post processing (SMI Flex GPS only) and choose your desired coordinate system – whether it is local or state plane.

Not all the commands in the GPS menu may be available for your GPS instrument.

---

Not all the commands in the GPS menu may be available for your GPS instrument.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>Configures a GPS receiver as the base station. You may also be prompted for base radio baud rate, communication settings and whether to obtain the location from satellites or from known or assumed coordinates.</td>
</tr>
<tr>
<td>Rover</td>
<td>Configures a GPS receiver as the rover. You may also be prompted for base radio baud rate and communication settings.</td>
</tr>
<tr>
<td>Inst</td>
<td>Allows you to select the type of GPS receiver from the list of instrument drivers.</td>
</tr>
<tr>
<td>Opt</td>
<td>Displays the GPS Options Menu.</td>
</tr>
</tbody>
</table>

---

Figure 2-84 GPS Main Menu

**GPS Main Menu Soft Key Definitions**
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tol</td>
<td>Displays the GPS Tolerance Menu.</td>
</tr>
<tr>
<td>Util</td>
<td>Displays the GPS Utility Menu.</td>
</tr>
<tr>
<td>LOG</td>
<td>Launches the Static Logging command for <em>SMI Flex GPS</em> system.</td>
</tr>
</tbody>
</table>

### GPS Instruments Menu

#### GPS Instruments Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGA</td>
<td>Driver for NMEA GGA data stream.</td>
</tr>
<tr>
<td>NCT</td>
<td>Driver for NavCom Technologies receivers.</td>
</tr>
<tr>
<td>NCTG</td>
<td>Driver for NavCom Technologies StarFire receivers (Autonomous Mode QuickStart Only).</td>
</tr>
<tr>
<td>JAVAD</td>
<td>Driver for Topcon/Javad receivers.</td>
</tr>
<tr>
<td>LEICA</td>
<td>Driver for Leica 500 series receivers.</td>
</tr>
<tr>
<td>ASH</td>
<td>Driver for Ashtech Z family receivers</td>
</tr>
<tr>
<td>LLQ</td>
<td>Driver for NMEA LLQ data stream.</td>
</tr>
<tr>
<td>PJK</td>
<td>Driver for NMEA PJK data stream.</td>
</tr>
<tr>
<td>MAN5</td>
<td>Driver for manual entry of latitude, latitude, and height. Also, used for setting up multiple rovers and entry of base station data for permanent base stations.</td>
</tr>
</tbody>
</table>
### GPS Options Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPCS</td>
<td>Allows you to select the State Plane Coordinate system. The format to use is the state abbreviation followed by the zone abbreviation, if there is more than one zone. Examples of valid entries are: ALE, CA3, UTS, TXNC, SC. A space can be put between the state and zone if desired: AL E, CA 3, UT S, TX NC, SC. Refer to the Select Coordinate System command on page 204 for more information.</td>
</tr>
<tr>
<td>SPC / LOCAL</td>
<td>Toggles between using a state plane system and local system.</td>
</tr>
<tr>
<td>REPS</td>
<td>Allows you to enter the number of measurements to average for each shot; the default is 1. If REPS is set to a number other than 1, the GPS Average Shots screen is displayed when a shot is taken. Enter 0 to indicate that you want to continue to collect measurements until you tap the use key in the GPS Average Shots menu.</td>
</tr>
<tr>
<td>GEOID</td>
<td>Allows you to enter the Geoid separation. Use 0 if it is not known or if the local benchmark you will be using at the job site is small. This option will not appear if Use Geoid is not toggled ON.</td>
</tr>
<tr>
<td>Gtog</td>
<td>Toggles the Geoid ON or OFF.</td>
</tr>
<tr>
<td>CUTOF</td>
<td>Tap this key to have the data collector get the current cutoff elevation from the receiver. To change the cutoff elevation, type in that value and press ! This is also referred to as the elevation mask.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the Main GPS menu.</td>
</tr>
</tbody>
</table>
GPS Tolerances Menu

The GPS Tolerances menu allows you to change various tolerance values that are compared to the measured GPS data. When a tolerance value is exceeded, the type of tolerance and the value of the bad measurement are shown. The data collector continues to try to collect a good measurement and report bad values until a measurement within the acceptable tolerance is received.

✓ If you are using GPS receivers that consider Quality 4 to be Quality 5 (per our definition) and vice-versa, you need to set your Horizontal Error and Vertical Error tolerances to something other than 0 and the Quality tolerance will need to be set to 4 instead of 5. The tolerances for the horizontal and vertical errors will catch and prevent undesirable observations from being used while the Quality tolerance is set to 4. When using such a system, this may be the only way to collect survey-grade data.

Figure 2-86  GPS Tolerances Screen

Figure 2-87  GPS Tolerances Menu

GPS Tolerances Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hsdev</td>
<td>Sets the Horizontal Standard Deviation used when collecting a set of shots. When the GPS Average Shots screen is finished collecting measurements, the horizontal standard deviation of the shots is compared to this tolerance value. If the tolerance is exceeded, the data collector prompts whether you want to use the collected measurements.</td>
</tr>
<tr>
<td>Vsdev</td>
<td>Sets the Vertical Standard Deviation used when collecting a set of shots. When the GPS Average Shots screen is finished collecting measurements, the vertical standard deviation of the shots is compared to this tolerance value. If the tolerance is exceeded, the data collector prompts whether you want to use the collected measurements.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Qual</strong></td>
<td>Sets the GPS Quality. This quality is a value representing typical accuracy modes of operation for GPS. 1 - 5 are valid settings. To have survey-grade accuracy, the quality must be 5. Setting the quality tolerance to any value except 5 is not recommended unless you plan to do lower quality locations (the <strong>Smi Flex GPS</strong> system has numerous other quality settings ranging from RTK sub-centimeter to RTG Backup of 1 inch to RTG 4” to Dual Frequency WAAS 2 foot).</td>
</tr>
<tr>
<td><strong>HDOP</strong></td>
<td>Sets the maximum allowed Horizontal Dilution of Precision to be allowed during GPS work. This value is compared to the HDOP sent from the receiver on each measurement and should be less than 2 for accurate positions. This value has no units.</td>
</tr>
<tr>
<td><strong>VDOP</strong></td>
<td>Sets the maximum allowed Vertical Dilution of Precision to be allowed during GPS work. This value is compared to the VDOP sent from the receiver on each measurement and should be less than 3 for accurate elevations. This value has no units.</td>
</tr>
<tr>
<td><strong>EXIT</strong></td>
<td>Returns to the GPS menu.</td>
</tr>
<tr>
<td><strong>HERR</strong></td>
<td>Sets the maximum allowed diagonal horizontal error of all points collected during a repetition session. This value is compared to the receiver's estimate of the horizontal error on each measurement. This value is in the current distance units. The default value is 0.00.</td>
</tr>
<tr>
<td><strong>VERR</strong></td>
<td>Sets the maximum allowed vertical error of all points collected during a repetition session. This value is compared to the receiver's estimate of the vertical error on each measurement. This value is in the current distance units. The default value is 0.00.</td>
</tr>
</tbody>
</table>

**GPS Utility Menu**

**LL2N | NE2L | PSES | POS | LL2PT | EXIT**

**NeXT**

**LBASE | SBASE**

*Figure 2-88 GPS Utility Menu*

**GPS Utility Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LL2N</strong></td>
<td>Allows you to enter the latitude and longitude to convert to Northing and Easting.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>NE2L</td>
<td>Allows you to enter the Northing and Easting to convert to latitude and longitude.</td>
</tr>
<tr>
<td>PSES</td>
<td>Allows you to enter the State Plane Northing and Easting to get plane scale and ellipsoid scale on the stack. Multiply these numbers to get the combined scale factor.</td>
</tr>
<tr>
<td>POS</td>
<td>Obtains the latitude/longitude and height values from the receiver and puts them on the stack.</td>
</tr>
<tr>
<td>LL2PT</td>
<td>Obtains the latitude/longitude and height values from the stack and converts them to coordinates and stores them to a point.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the GPS menu.</td>
</tr>
<tr>
<td>Lbase</td>
<td>Displays the current latitude/longitude and height value for the base station. Use this command to configure multiple rovers for the same base station.</td>
</tr>
<tr>
<td>Sbase</td>
<td>Sets the base position to the entered point number. This command is used to switch reference points for all side shots when using the GPS drivers.</td>
</tr>
</tbody>
</table>

**GPS Diagnostics (SMI Flex System)**

PRODUCT: ROBOTIC

COMMAND GROUP: GPS

Use this command to help diagnose problems with the SMI Flex GPS system. It may be used to determine problems at either the base or rover units.

**Using GPS Diagnostics at the Base**

Press the function key assigned to GPSD or select GPS Diagnostics from the Favorites menu. It queries the receiver about its current state and puts checkmarks in the boxes accordingly. If the receiver is configured as a rover, the Rover Receiver Diagnostics dialog box displays; if as a base, then the Base Receiver Diagnostics dialog box displays. If the Rover Receiver Diagnostics dialog box displays and you are connected to the base, tap the BASE soft key in the GPS menu to reconfigure the receiver as the base.
### Figure 2-89  Base Receiver Diagnostics Dialog Box

#### Base Receiver Diagnostics Dialog Box Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking at least 5 healthy satellites</td>
<td>&quot;Healthy&quot; means that the receiver is able to get both GPS frequencies from the satellite and the satellite is above the elevation mask. You can see the satellites being tracked by closing the GPS Diagnostics and pressing Esc POS (Allegro J key, JETT J key, Titan SP key) to display the GPS Instrument Status dialog box.</td>
</tr>
<tr>
<td>In dual frequency mode</td>
<td>Dual frequency mode is achieved after tracking five healthy satellites for about 50 seconds (this time will vary based on local environment and satellite coverage).</td>
</tr>
<tr>
<td>Base locked within 1km of actual position</td>
<td>When the BASE soft key is pressed, the data collector tells the base receiver a position to hold as its true position. On local jobs, the data collector has the receiver collect a stand-alone position and hold it as true. This is fine because a stand-alone position will be well within 1 km of the base receiver's true position. On a State Plane job, the position to lock is based on the point number entered using the BASE soft key. If the point contains coordinates that do not match the actual State Plane location of the base, the base receiver will be trying to fit the position solution to impossible conditions. Another source of coordinate error is having the meters/feet flag set incorrectly. The wrong State Plane zone will also cause an error in the position calculation. If you use the Get Position here option for state plane, the SMI Flex GPS system is so accurate that even in autonomous mode at the base it will be within 2 feet of its true position (the best that other systems can do is 10 – 60 feet). If you have the StarFire version of the SMI Flex GPS system this position will be within 4&quot; of truth (after QuickStart or sufficient burn in time)!</td>
</tr>
<tr>
<td>Sending RTK corrections for 5 satellites</td>
<td>Although the base receiver may be tracking five healthy satellites, it may not yet have corrections that are valid. It should not take long for the receiver to start sending valid corrections after getting into dual frequency mode.</td>
</tr>
</tbody>
</table>
Using GPS Diagnostics at the Rover

Press the function key assigned to GPSD or select GPS Diagnostics from the Favorites Menu to display the Diagnostics dialog box. It queries the receiver about its current state and puts checkmarks in the boxes accordingly. If the receiver is configured as a rover, the Rover Receiver Diagnostics dialog box displays; if as a base, then the Base Receiver Diagnostics dialog box displays. If the Base Receiver Diagnostics dialog box displays and you are connected to the rover, tap the <ROVER> soft key in the GPS menu to reconfigure the receiver as a rover.

Figure 2-90  Rover Receiver Diagnostics Dialog Box

Rover Receiver Diagnostics Dialog Box Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking at least 5 healthy satellites</td>
<td>&quot;Healthy&quot; means that the receiver is able to get both GPS frequencies from the satellite and the satellite is above the elevation mask angle. You can see the satellites being tracked by closing the GPS Diagnostics and pressing &lt;POS&gt; (Allegro Esc key, JETT J key, Titan SP key) to display the GPS Instrument Status dialog box.</td>
</tr>
<tr>
<td>In dual frequency mode</td>
<td>Dual frequency mode is achieved after tracking five healthy satellites for about 50 seconds (this time will vary based on local environment and satellite coverage).</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Receiving RTK corrections</td>
<td>Perhaps the most common reason for not getting RTK mode is the current configuration with the data link. A number of things that must be present for this checkmark to be enabled:</td>
</tr>
<tr>
<td></td>
<td>• The base must be within 1 km of truth.</td>
</tr>
<tr>
<td></td>
<td>• The base must be transmitting corrections.</td>
</tr>
<tr>
<td></td>
<td>• A radio link must be established between the base and rover radios (if using internal radios they must be on the same NetID).</td>
</tr>
<tr>
<td></td>
<td>• All the communication parameters must be correctly set.</td>
</tr>
<tr>
<td></td>
<td>If this option is not checked, see <em>Receiving RTK Corrections on page 363</em> for more information.</td>
</tr>
<tr>
<td>Receiving RTK corrections for at least 5 satellites</td>
<td>If this checkmark is not on, then the base receiver is not transmitting corrections for at least 5 satellites. Two solutions for this problem:</td>
</tr>
<tr>
<td></td>
<td>• Locate your base station where it has an unobstructed view of the sky and as clear a view of the horizon as you can get.</td>
</tr>
<tr>
<td></td>
<td>• Locate your base station away from any objects generating a large amount of radio noise (transmitter stations, high voltage power lines, etc.)</td>
</tr>
<tr>
<td></td>
<td>Wait a few minutes (may require 10–20 minutes) for the satellite constellation to change enough that the base station has a clear view of 5 satellites.</td>
</tr>
<tr>
<td>In fixed RTK mode</td>
<td>If all the checkmarks are on except the &quot;In Fixed RTK Mode,&quot; you simply need to wait a couple of seconds for everything to get resolved. This process takes from 1 second in ideal conditions to 30 seconds in difficult environments. The <em>SMI Flex GPS</em> system is the only US Only satellite system capable of resolving the RTK integers in one second or less.</td>
</tr>
</tbody>
</table>
GPS Receiver Logging (SMI Flex GPS System)

PRODUCT: ROBOTIC

KEYSTROKES: GPS (THE Z KEY) NeXT log

COMMAND GROUP: GPS

The GPS Receiver Logging window controls and manages GPS Raw Data log files stored in the GPS receiver’s onboard memory. The files on the receiver are shown with their name, size, modified time and created time. The times shown are in GMT. The status bar shows the memory available, the last time the file display was refreshed, the total memory of the receiver and the number of files.

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Modified</th>
<th>Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>001100301.DAT</td>
<td>3 GB</td>
<td>03/03 15:21</td>
<td>28/03 13:15</td>
</tr>
<tr>
<td>011100302.DAT</td>
<td>1 GB</td>
<td>03/03 12:11</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100303.DAT</td>
<td>1 GB</td>
<td>03/03 12:22</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100304.DAT</td>
<td>1 GB</td>
<td>03/03 12:32</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100305.DAT</td>
<td>1 GB</td>
<td>03/03 12:42</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100306.DAT</td>
<td>1 GB</td>
<td>03/03 13:12</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100307.DAT</td>
<td>1 GB</td>
<td>03/03 13:22</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100308.DAT</td>
<td>1 GB</td>
<td>03/03 13:32</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100309.DAT</td>
<td>1 GB</td>
<td>03/03 13:42</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100310.DAT</td>
<td>1 GB</td>
<td>03/03 14:12</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100311.DAT</td>
<td>1 GB</td>
<td>03/03 14:22</td>
<td>28/03 13:30</td>
</tr>
<tr>
<td>011100312.DAT</td>
<td>1 GB</td>
<td>03/03 14:32</td>
<td>28/03 13:30</td>
</tr>
</tbody>
</table>

Figure 2-91 GPS Receiver Logging Window

GPS Receiver Logging Window Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Log</td>
<td>Starts the log file on the receiver. If the receiver is not currently logging a file, the first button will be Start Log. If a logging session is in progress, the first button will be Stop Log.</td>
</tr>
<tr>
<td>Refresh</td>
<td>Displays the current file information from the receiver.</td>
</tr>
<tr>
<td>Delete</td>
<td>Deletes the selected file from the receiver memory.</td>
</tr>
<tr>
<td>Delete All</td>
<td>Deletes all the files from the receiver memory.</td>
</tr>
<tr>
<td>Close</td>
<td>Closes the GPS Receiver Logging window. Does not affect any logging sessions in progress.</td>
</tr>
</tbody>
</table>

Grads

PRODUCT: ALL

KEY-IN: G2D

COMMAND GROUP: CONVERSIONS

To convert from Grads to degrees, minutes and seconds and tenths of a second, key in a value in Grads, press [ALPHA], type G2D, and press ! . This angle on the stack can be used in the Side Shot or Traverse menu by tapping az .

To convert from DMS (degrees, minutes, and seconds) to Grads, key in a DMS angle, press [ALPHA], type D2G, and press ! .

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.

Example

Problem: Traverse 60.555 Grads for 500 meters.

To do so, you first need to set the fixed number of digits past the decimal to 5.

1. Press CHG , key in 5 , and tap FIX4 .
   You will see FIX5 .
2. To work in Meters mode, press CHG NeXT MODE .
3. Tap FEET to toggle to METR .
   This converts to 54 degrees 29 minutes and 58.2 seconds.
5. Tap az .
6. Key in 500 and tap hDIST .
SMI Version 8 Reference Manual

If you now wish to convert 54 degrees 29 minutes and 58.2 seconds to Grads, key in 54.2958 or press 3 AZ to recall the azimuth to the stack and press ALPHA D2G. You will see 60.555.

---

**Graphical Stakeout**

**PRODUCT:** ALL

**KEYSTROKES:** [GRAPHICAL STAKEOUT]

**COMMAND GROUP:** STAKE

The Graphical Stakeout command allows for onscreen guidance to locate a stored point. The point to be staked is set by updating the foresight point number. This is done by using the FS command in the Stake menu (defaults to the last stored point) or Graphical Stakeout can be started after tapping the fs, Catch, or FFPP commands in the Construction Menu to stake a station and offset, catch point, or reference point. In general, any calculated location can be found using Graphical Stakeout.

Press STAKE (Allegro O key, JETT S key, Titan P key), type in the point number of the point to stake and tap fSPt. The direction and distance shown are from the base to the point being staked. Tap [GRAPHICAL STAKEOUT] on the right side of the screen or press GSTK (Allegro _ key) to start the Graphical Stakeout screen. On the Pocket PC devices, click on the Graphical Stakeout icon. Tap the Close button to exit.

When the prism/rover appears within the tolerance distance of the point being staked, the icon representing your position changes into a large stake icon. To change points you are staking to, tap the Close button and start the process again.

The status displays at the top of the window. For example: "The Rod is within X.XX feet/meters of the point" distance is controlled by the Options dialog box. Depending on your application you may want to adjust this value. For example, if you are locating a buried monument a value of 1 foot would be sufficient. However, to drive a paving hub you may want to set the tolerance at .075 so that when the hub is driven it will be close enough for the nail.

The Come/Go Left/Right directions are given assuming you are facing the base station receiver (if using two receivers), the base point (if using 1 receiver) or the last point staked, if this option is enabled.

If you are using GPS, your position may be updated anywhere from 5 to 25 times per second with the SMI Flex GPS System. All GPS systems and robots generally updates as fast as the device can send SMI a measurement.
Use the standard Stake Shot command to develop more accurate final stake data (Fine Mode with robotic total stations or multiple reps with a GPS receiver).

✓ The **Graphical Stakeout command intentionally doesn’t use the GPS tolerances, so you will want to keep an eye on Status and Horizontal Error.**

The three screen captures below shows the various screens that you would see as it gets closer to the point to be staked (GPS Driver Shown).

**Figure 2-92 Graphical Stakeout Screens**

**Graphical Stakeout Screen Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>Displays information about communications with the base receiver or instrument. For GPS, the quality and information related to the horizontal error is displayed here.</td>
</tr>
<tr>
<td>Setup</td>
<td>Displays the backsight point/direction, occupied point and foresight point, or the point currently being staked.</td>
</tr>
<tr>
<td>Distance</td>
<td>Displays the distance between the foresight point and the shot being taken. These buttons toggle between displaying Go/Come and Left/Right data and North/South and East/West data. When the orientation is switched, the graphical display changes as well. When set to Go/Come Left/Right, the top of the screen is</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pointed</td>
<td>pointed towards the base/instrument location. When North/South-East/West is</td>
</tr>
<tr>
<td></td>
<td>displayed, the top of the screen is oriented toward North.</td>
</tr>
<tr>
<td>Come/Go</td>
<td>Displays how far to come towards or go away from the instrument to get to the</td>
</tr>
<tr>
<td></td>
<td>point being staked.</td>
</tr>
<tr>
<td>Left/Right</td>
<td>Displays how far to go left or right. This can be configured to be from the</td>
</tr>
<tr>
<td></td>
<td>rodman’s/rover’s perspective or set to the instrument’s/base station’s</td>
</tr>
<tr>
<td></td>
<td>perspective. This relationship is generally determined when you select the</td>
</tr>
<tr>
<td></td>
<td>instrument driver, but can be changed.</td>
</tr>
<tr>
<td>Cut/Fill</td>
<td>Displays the distance between the grade elevation and the shot elevation.</td>
</tr>
<tr>
<td>Grade</td>
<td>Displays the elevation of the point being staked.</td>
</tr>
<tr>
<td>Elev</td>
<td>Displays the elevation of the last shot being taken.</td>
</tr>
<tr>
<td>Rod at Center</td>
<td>Switches between showing the rod in the center of the display area and</td>
</tr>
<tr>
<td></td>
<td>showing the foresight point at the center.</td>
</tr>
<tr>
<td>Options</td>
<td>Displays the Graphical Stakeout Options dialog box.</td>
</tr>
<tr>
<td></td>
<td>• Close enough to stake: The maximum distance between the shot and the point</td>
</tr>
<tr>
<td></td>
<td>being staked required before the Stake icon displays.</td>
</tr>
<tr>
<td></td>
<td>• Smallest length of scale bar: Limits how tightly the display zooms in. The</td>
</tr>
<tr>
<td></td>
<td>scale bar is one-fourth the width of the graphical display area.</td>
</tr>
<tr>
<td></td>
<td>• Factor to increase scale by: The scale to use when zooming to fit the</td>
</tr>
<tr>
<td></td>
<td>foresight point and the Shot icon is determined by the following formula:</td>
</tr>
<tr>
<td></td>
<td>S * F * I where S is the smallest scale and F is the factor to increase</td>
</tr>
<tr>
<td></td>
<td>the scale and I is an integer larger than 1.</td>
</tr>
<tr>
<td>Display</td>
<td>The display shows the point being staked and the location of the rod. When</td>
</tr>
<tr>
<td></td>
<td>staking with GPS, the top of the screen is north. With non-GPS equipment,</td>
</tr>
<tr>
<td></td>
<td>the top of the screen is toward the occupied point. The point being staked is</td>
</tr>
<tr>
<td></td>
<td>a plus icon. A prism is shown with a target icon and a GPS receiver is</td>
</tr>
<tr>
<td></td>
<td>shown as an antenna. The icons get larger when at the tightest zoom. How</td>
</tr>
<tr>
<td></td>
<td>tightly the display will zoom is controlled by the “Smallest length of scale</td>
</tr>
<tr>
<td></td>
<td>bar” setting in the Options dialog box. When the centers of the icons line</td>
</tr>
<tr>
<td></td>
<td>up, a smiley face displays, indicating that the shot is close enough to</td>
</tr>
<tr>
<td></td>
<td>stake. How close that is can also be changed in the Options dialog box.</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close</td>
<td>Closes the Graphical Stakeout screen and allows you to select a new point to stake.</td>
</tr>
</tbody>
</table>

---

**Half Baud Rate**

**PRODUCT: ROBOTIC**

**KEYSTROKES:** [SETUP] [NEXT] [NEXT] [INST] [HALF]

Choosing the **HALF** soft key reduces the current instrument drivers baud rate by one half its normal rate. This command is now obsolete because of the new “Force Baud Rate” (File > Settings) command's ability to set any baud rate needed.

---

**High Accuracy Reference Network (HARN)**

A High Accuracy Reference Network (HARN) and a High Precision Geodetic Network (HPGN) were two designations used for a statewide geodetic network upgrade. The generic acronym HARN is now used for both HARN and HPGN and was adopted to remove the confusion arising from the use of two acronyms. A HARN is a statewide or regional upgrade in accuracy of NAD 83 coordinates using Global Positioning System (GPS) observations. HARNs were observed to support the use of GPS by federal, state, and local surveyors, geodesists, and many other applications. The cooperative network upgrading program began in Tennessee in 1986. The last field observations were completed in Indiana in September 1997 after horizontally upgrading some 16,000 survey stations to A-order or B-order status. Horizontal A-order stations have a relative accuracy of 5 mm +/- 1:10,000,000 relative to other A-order stations. Horizontal B-order stations have a relative accuracy of 8 mm +/- 1:1,000,000 relative to other A-order and B-order stations. Of these 16,000 stations, NGS has committed to maintaining about 1,400 survey stations, named the Federal Base Network, and the various states will maintain the remainder.
HMS/DMS Trig Functions

PRODUCT: ALL

KEY-IN: SEE BELOW

COMMAND GROUP: TRIG FUNCTIONS

The normal calculator trig functions assume that angles entered are in decimal degrees and that inverse trig functions should return decimal degrees. HMS refers to “Hours Minutes Seconds,” which means that a value will be treated as Degrees, Minutes and Seconds versus decimal degrees. Enter the value to be operated on and press the keys to execute the desired functions.

Refer to the Command group listing for all the commands available and the key-ins needed to run the commands in the Calculator Functions Command Group on page 288.

Hours-Minutes-Seconds – Adding

PRODUCT: ALL

KEY-IN: ALLEGRO & ALPHA HMS+ , JETT & ALPHA HMS+ (THE DEL KEY)

COMMAND GROUP: CALCULATOR FUNCTIONS

This function adds two numbers that are in degrees, minutes, and seconds.

Type the first value in degrees, minutes and seconds and press & ALPHA . Type the second value in degrees, minutes and seconds and press & ALPHA . You should have now have numbers in the stack, in HMS or DMS format. Press & ALPHA and key in HMS+ (Allegro BLUE SHIFT J, JETT BLUE SHIFT DEL ) to see the sum. The sum of both values is still in degrees, minutes and seconds.

For use on the Allegro, It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.
Hours-Minutes-Seconds – Subtracting

PRODUCT: ALL

KEY-IN: ALLEGRO [ALPHA] HMS-, JETT C [HMS-] (THE 3 KEY)

COMMAND GROUP: CALCULATOR FUNCTIONS

This function subtracts two numbers in degrees, minutes and seconds.

Type the first value in degrees, minutes and seconds and press [HMS-]. Type the second value in degrees, minutes and seconds and press [HMS-]. You should have now have numbers in the stack, in HMS or DMS format. Press [ALPHA] and key in HMS- (Allegro BLUE SHIFT . (decimal key), JETT BLUE SHIFT 3)) to see the result. The resulting value is still in degrees, minutes and seconds.

For use on the Allegro, It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.

Horizonal Search Range

PRODUCT: ALL

KEYSTROKES: [INFN] [NEXT] SRHA

KEY-IN: SRHA

COMMAND GROUP: TOTAL STATION

This function changes the horizontal search range used by certain robotic instruments.

When using the Real-Time Side Shots [RSIDS] routine in traffic, setting a narrow search range helps to overcome problems when the prism is temporarily obstructed. It is recommended that you use 5° for both [srha] and [srza].
**HP 48 Calculator Mode**

**PRODUCT:** All

**KEY-IN:** QUIT

**COMMAND GROUP:** PROGRAM SETTINGS

This function allows you to quit the command line Classic interface of the SMI program to enter the emulation mode of an HP 48 calculator and all of its functions. It might help to have an HP 48 reference manual to assist you in using these commands.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Program Settings Command Group called Exit.

To exit SMI and be entirely in the calculator mode, press ↓ALPHA↓ and key in QUIT. To go back into SMI, press ↓ALPHA↓ K !.

When in calculator mode the following keys have these functions:

<table>
<thead>
<tr>
<th>KEY</th>
<th>FUNCTION</th>
<th>LEFT SHIFT</th>
<th>RIGHT SHIFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>=</td>
<td>→</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>I/O</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>LIBRARY</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>EQ LIB</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>TIME MENU</td>
<td>TIME</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>STAT</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>UNITS</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>SOLVE</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>PLOT</td>
<td></td>
</tr>
<tr>
<td>KEY</td>
<td>FUNCTION</td>
<td>LEFT SHIFT</td>
<td>RIGHT SHIFT</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td></td>
<td>SYMBOLIC</td>
</tr>
<tr>
<td>.</td>
<td>. (Period)</td>
<td></td>
<td>RETURN</td>
</tr>
<tr>
<td>A – F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>MTH</td>
<td>RAD Toggle</td>
<td>POLAR</td>
</tr>
<tr>
<td>H</td>
<td>PRG</td>
<td>PRG BRCH MENU</td>
<td>CHARS</td>
</tr>
<tr>
<td>I</td>
<td>CST MEMU</td>
<td>MODES MENU</td>
<td>MODES</td>
</tr>
<tr>
<td>J</td>
<td>VAR</td>
<td>MEMORY MENU</td>
<td>MEMORY</td>
</tr>
<tr>
<td>K</td>
<td>UP ARROW</td>
<td>STACK MENU</td>
<td>STACK</td>
</tr>
<tr>
<td>L</td>
<td>NeXT</td>
<td>PREV</td>
<td>MENU</td>
</tr>
<tr>
<td>M</td>
<td>'</td>
<td>UP</td>
<td>HOME</td>
</tr>
<tr>
<td>N</td>
<td>STO</td>
<td>DEF</td>
<td>RCL</td>
</tr>
<tr>
<td>O</td>
<td>EVAL</td>
<td>→NUM</td>
<td>UNDO</td>
</tr>
<tr>
<td>P</td>
<td>LEFT ARROW</td>
<td>SCREEN PLOT</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>DOWN ARROW</td>
<td>VIEW</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>RIGHT ARROW</td>
<td>SWAP</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>SIN</td>
<td>ASIN</td>
<td>ð</td>
</tr>
<tr>
<td>T</td>
<td>COS</td>
<td>ACOS</td>
<td>ţ</td>
</tr>
<tr>
<td>U</td>
<td>TAN</td>
<td>ATAN</td>
<td>Σ</td>
</tr>
<tr>
<td>V</td>
<td>SQRT</td>
<td>SQUARE</td>
<td>$^{1/x}$</td>
</tr>
<tr>
<td>W</td>
<td>^</td>
<td>$^{10{x}}$</td>
<td>LOG</td>
</tr>
<tr>
<td>X</td>
<td>INV</td>
<td>e$^{x}$</td>
<td>LN</td>
</tr>
</tbody>
</table>
### Import Jobs

**PRODUCT: ALL**

**KEYSTROKES: TRANSFER > IMPORT JOBS**

Use this command to select job files on your device and import the selected jobs and job types into *SMI*. This allows you to gather files via ActiveSync from your desktop computer or from another data collector using Beam-It and import them directly without the need for *SMI Transfer*.

Select the Transfer > Import Jobs. Select the jobs you want to import. You may select multiple files to import at the same time. Select the file types you want to import from those jobs (Coordinates, Chains, etc.). Tap the Import button to import the selected jobs and their associated files. If you have selected one or more chains, choose with which job to associate each chain.
**Figure 2-93 Import Jobs Dialog Box**

**Import Jobs Dialog Box Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select All</td>
<td>Imports all the files listed in the window.</td>
</tr>
<tr>
<td>Clear</td>
<td>Clears any selected job files in the window.</td>
</tr>
<tr>
<td>Show</td>
<td>Displays the desired types of files. You may select from the following file types: All Files, Coordinates, Chains, and Backups.</td>
</tr>
<tr>
<td>Data Directory</td>
<td>Displays the current directory on the device from which to import files.</td>
</tr>
<tr>
<td></td>
<td>Allows you to browse to a different data directory to locate files.</td>
</tr>
<tr>
<td>Import</td>
<td>Imports the selected job files.</td>
</tr>
</tbody>
</table>

When you select chain files, you may be asked with which coordinate (*.ASC) file to associate the chain file. Simply select the appropriate chain file.
Inches to Feet

PRODUCT: ALL

KEY-IN: IN2FT

COMMAND LOCATION: CONVERSIONS

This command is used to convert inches or feet and inches to decimal feet.

Type in the feet and press \[ \text{<} \]. Enter 0 if there are no whole feet to convert. Type in the inches and press \[ \text{<} \]. Press \[ \text{ALPHA} \], type \[ \text{IN2FT} \], and press \[ \text{<} \]. If there are fractional inches, type in the numerator of the fraction (top number) in the third position on the stack and enter the denominator on the fourth position on the stack, then press \[ \text{ALPHA} \], type \[ \text{IN2FT} \], and press \[ \text{<} \].

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.
**Instrument Functions (INFN)**

**PRODUCT:** ROBOTIC

**KEYSTROKES:** a INFN (ALLEGRO ESC KEY, JETT J KEY, TITAN SP KEY)

**COMMAND GROUP:** SETUP

The Instrument Function command displays a screen that is specific to the current instrument driver. The Instrument Functions command allows control of settings that are specific to a particular model of instrument.

Refer to the *Instrument Reference* on page 364 for functions available for your specific instrument.

> If this command is not supported for the current instrument driver, running this command results in the error message: The current instrument driver does not have Instrument Functions.

**Instruments with Additional Supported Functions**

- Listed below are the instrument makes and models that have some additional functions that are enabled when the correct instrument driver is selected. For more information on your instrument, refer to the sections listed. *Leica TC/TCM Instrument Functions Menu on page 377.*

- *Leica TCA Instrument Functions Menu on page 378.*

- *Leica GPS Instrument Functions Menu Soft Key Definitions on page 379.*

- *NavCom/SMI Flex GPS Custom Instrument Functions Menu on page 391.*

- *Sokkia Instrument Functions Menu on page 407.*

- *Thales/Ashtech Custom Instrument Functions Menu on page 409.*


- *Topcon 800 Series Instrument Functions Menu on page 416.*

- *Topcon/Javad Custom Instrument Functions Menu on page 417.*

- *Zeiss Elta S20Q (Georadio QL) Functions Menus on page 435.*
**Instrument Position (POS)**

**PRODUCT:** ROBOTIC

**KEYSTROKES:** `c POS` (ALLEGRO ESC KEY, JETT J KEY, TITAN SP KEY)

**KEY-IN:** POSMENU

**COMMAND GROUP:** SETUP

The Instrument Position screen shows a live data update if you are using either GPS or a robotic instrument. For example, you will see angles, distance, and tracking status of a robotic instrument or the sky view of the satellites and the quality of the measurements if using GPS.

✔️ **If the current driver does not support this feature or there is a communication problem, the screen displays the message:** POSITION DATA NOT AVAILABLE.
Here are some examples of the screen based on the instrument driver being used:

**Figure 2-95 GPS Instrument Position Screens**

**GPS Instrument Position Screen Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAT</td>
<td>Displays the latitude in HMS.</td>
</tr>
<tr>
<td>LONG</td>
<td>Displays the longitude in HMS.</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SATS</td>
<td>Displays the number of satellites being used. The graphical POS command also shows all satellites available and their location. The satellites marked with the double ticks are the ones considered healthy. The ones with the single ticks are unhealthy. Since the satellite in the upper right corner is outside the dotted red line where the elevation mask is, it is ignored by the receiver until it is above the elevation cutoff.</td>
</tr>
<tr>
<td>LINK</td>
<td>Displays the number of seconds since last receipt of a radio transmission from the base. The number 999 indicates that no transmissions are being received. This number should be 1 when connected to the rover receiver. The base does not receive radio messages, so the link will be 999 when connected to the base receiver.</td>
</tr>
<tr>
<td>QUAL/Solution</td>
<td>Displays the quality of solution for the current GPS position. At the base the quality is 1-4 (stand-alone); at the rover it should be 5 (fixed RTK) for high accuracy.</td>
</tr>
<tr>
<td>HDOP</td>
<td>Displays the horizontal dilution of precision. This value should be less than 2 for accurate positions.</td>
</tr>
<tr>
<td>VDOP</td>
<td>Displays the vertical dilution of precision. This value should be less than 3 for accurate elevations.</td>
</tr>
<tr>
<td>HERR</td>
<td>Displays the receiver’s estimate of the horizontal error in the current distance units.</td>
</tr>
<tr>
<td>VERR</td>
<td>Displays the receiver’s estimate of the vertical error in the current distance units.</td>
</tr>
</tbody>
</table>

---

### Instruments

**PRODUCT: ALL**

**KEYSTROKES: TOTAL STATIONS:**

```
SETUP NeXT NeXT INST
```

**LEVELS:**

```
MORE NeXT LEVEL NeXT INST
```

**KEY-IN:** I NSTR

**COMMAND GROUP: SETUP**

This function allows you to select an instrument for electronic data collection. It also permits you to select manual data entry.

From the Setup menu, tap **INST** for the Instruments menu.
Tap **NeXT** to scroll through the menu screens to see available instruments (for a description of each instrument supported, see *Instrument Configuration, which begins on page 364*). Tap the appropriate soft key to select the instrument you will be using.

When you select an instrument, the letter I will appear at the top of the display to indicate that an instrument driver has been selected.

Even if you are using an instrument to collect data, you can select manual data entry for side shot and traverse functions. For manual input of traverse and side shot data, choose one of the manual drivers (e.g., `man1`).

**Instruments Menu**

Select the instrument that you are working with and answer any additional questions if prompted. The following menu is taken from the ROBOTIC version, so some instrument drivers may not be available to your version.

![Instruments Menu Soft Key Definitions](image)

**Figure 2-96 Instruments Menu**

**Instruments Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>fine</strong></td>
<td>Toggles between Fine and Course modes on the instrument. Course mode generally takes less time to acquire a distance, whereas fine mode is generally better when the accuracy needs are greater.</td>
</tr>
<tr>
<td><strong>crs</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Prism</strong></td>
<td>Switches between using a prism and taking measurements without a prism or reflector.</td>
</tr>
<tr>
<td><strong>ltoff</strong></td>
<td>Controls the light(s) on the instrument.</td>
</tr>
<tr>
<td><strong>lton</strong></td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Half</strong></td>
<td>Takes the current baud rate and halves the rate for instrument communications. This option was added to the software to allow for a ‘turbo’ HP 48GX or one that has had the chip speed doubled to work as if it were a normal HP 48GX.</td>
</tr>
<tr>
<td><strong>man1</strong></td>
<td>Sets the current instrument driver to Manual 1. This driver offers several options when manually entering raw data and offers the most flexibility. See <em>Side Shot (SIDS)</em> on page 230 for more information on the options available when using this driver.</td>
</tr>
<tr>
<td><strong>MAN2</strong></td>
<td>Sets the current instrument driver to Manual 2. This driver offers only one method of entry at the time this command is run, but allows for faster entry with fewer prompts, as all components of the observation can be entered on one line in the stack separated by spaces. The prompts can be altered by using the <em>Change/Defaults (CHG)</em> menu starting on page 41.</td>
</tr>
<tr>
<td><strong>man3</strong></td>
<td>Sets the current instrument driver to Manual 3. When manually entering observations, it prompts you for the coordinates of the point.</td>
</tr>
<tr>
<td><strong>Zeiss</strong></td>
<td>Allows you to select a Zeiss instrument. Refer to <em>Zeiss on page 434</em> for more information.</td>
</tr>
<tr>
<td><strong>Topco</strong></td>
<td>Allows you to select a Topcon total station. Refer to <em>Topcon/Javad on page 414</em> for more information.</td>
</tr>
<tr>
<td><strong>NIKN</strong></td>
<td>Allows you to select a Nikon driver. Refer to <em>Nikon on page 401</em> for more information.</td>
</tr>
<tr>
<td><strong>Leica</strong></td>
<td>Allows you to select a Leica Total station. Refer to <em>Leica/Wild on page 376</em> for more information.</td>
</tr>
<tr>
<td><strong>Sokki</strong></td>
<td>Allows you to select either a Sokkia or Lietz instrument driver. Refer to <em>Error! Not a valid result for table. on page 407</em> for more information.</td>
</tr>
<tr>
<td><strong>Geo</strong></td>
<td>Allows you to select a Geodimeter or Geodolite instrument. Refer to <em>Geodimeter on page 366</em> for more information.</td>
</tr>
<tr>
<td><strong>Trim</strong></td>
<td>Allows you to select a Trimble total Station driver. Refer to <em>Trimble on page 427</em> for more information.</td>
</tr>
<tr>
<td><strong>Pent</strong></td>
<td>Allows you to select a Pentax instrument driver. Refer to <em>Pentax on page 405</em> for more information.</td>
</tr>
<tr>
<td><strong>Gps</strong></td>
<td>Allows you to select a GPS driver. See the <em>GPS Instruments Menu on page 143</em> for more information.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>Other</td>
<td>Allows you to select one of the other types of instrument drivers available. See the Other Instruments Menu on page 144 for more information.</td>
</tr>
</tbody>
</table>

### GPS Instruments Menu

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GGA</td>
<td>Allows you to receive GGA messaging to the collector, which is most commonly used with Trimble GPS equipment. Please refer to Setting Up a Trimble 5700/5800 GPS Receiver as an SMI Rover on page 429 for more information.</td>
</tr>
<tr>
<td>NCT</td>
<td>Allows you to select the driver for the NavCom or SMI Flex GPS system units.</td>
</tr>
<tr>
<td>NCTG</td>
<td>Allows you to select the driver for the NavCom StarFire GPS system. This driver is intended for the StarFire version of the SMI Flex GPS system when running in Autonomous (Standalone) RTG mode QuickStart option only.</td>
</tr>
<tr>
<td>JAVAD</td>
<td>Allows you to select the driver for use with either Javad or Topcon equipment. For more information on instrument configuration, refer to Setting Up the Topcon (Javad) GPS Base Station Receiver starting on page 421.</td>
</tr>
<tr>
<td>ash Z</td>
<td>Allows you to select the driver for use with either Ashtech or Thales GPS equipment. Refer to Thales/Ashtech starting on page 409.</td>
</tr>
<tr>
<td>Liq</td>
<td>Allows you to receive LLQ messaging to the collector, which is most commonly used with Allen Osborne GPS equipment. Please refer to NMEA LLQ GPS Driver/Allen Osborne on page 404 for more information.</td>
</tr>
<tr>
<td>Pjk</td>
<td>Allows you to receive PJK messaging to the collector.</td>
</tr>
</tbody>
</table>

Figure 2-97 GPS Instruments Menu

GPS Instruments Menu Soft Key Definitions
Option | Function
--- | ---
**man5** | Allows you to manually enter geodetic coordinates. This is useful for keying in known geodetic positions. Format is latitude, longitude, and height.

**Other Instruments Menu**

**KERN 3820 LASER CRIT MDL CRAFT**

*Figure 2-98  Other Instruments Menu*

**Other Instruments Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kern</td>
<td>This driver is to be used with Kern instruments. Refer to <em>Kern on page 374.</em></td>
</tr>
<tr>
<td>3820</td>
<td>This driver is to be used with the HP3820 instrument. Refer to <em>Hewlett Packard on page 374.</em></td>
</tr>
<tr>
<td>Laser</td>
<td>This driver is to be used with Laser Atlanta instruments. Refer to <em>Laser Atlanta on page 375.</em></td>
</tr>
<tr>
<td>Crit</td>
<td>This driver is to be used with Laser Technology Criterion instruments. Refer to <em>Laser Technologies on page 376.</em></td>
</tr>
<tr>
<td>mdl</td>
<td>This driver is to be used with MDL instruments. Refer to <em>MDL on page 390.</em></td>
</tr>
<tr>
<td>Craft</td>
<td>This driver is to be used with LaserCraft instruments. Refer to <em>LaserCraft on page 375.</em></td>
</tr>
</tbody>
</table>
**Instrument Mode – ON/OFF (INST)**

PRODUCT: ALL

KEYSTROKES: \[ \text{a INST} \] ( THE 5 KEY )

KEY-IN: TOG NST

COMMAND GROUP: TOTAL STATION

This key lets you toggle between instrument (electronic data collection) and manual data entry. When Instrument mode is on, the letter I will appear at the top of the display to indicate that this setting is active.

---

**Intersections ( X )**

PRODUCT: ALL

KEYSTROKES: \[ X \] (ALLEGRO R KEY, JETT U KEY, TITAN S KEY)

KEY-IN: I NTSC

COMMAND LOCATION: COGO

This function allows you to define the intersection from any two stored points, which include bearing-bearing, bearing-distance, distance-distance, and perpendicular offset.

To use an offset from line one, give an offset value and tap \[ \text{OFS1} \] before you tap \[ \text{PT1} \] \[ \text{CONT} \], which allows you to use an old point number without reentering. Just tap \[ \text{CONT} \]. If a direction from point 1 has been entered, you may also use \[ \text{CONT} \] etc.

The display will prompt you to define line 1. Use the soft keys to enter a reference point for line 1. Key in a point number, and tap \[ \text{PT1} \]. Then, further define line 1 by keying in either the direction (tap \[ \text{BRG1} \] or \[ \text{AZ1} \]), a point on line (tap \[ \text{POL1} \]), or the distance to point (tap \[ \text{DIST1} \]). The direction also can be defined by keying in two point numbers (separated by a space) and tapping \[ \text{AZ} \].

The display will now prompt you to define line 2. Use the soft keys to enter a reference point for line 2. Key in a point number, and tap \[ \text{PT2} \]. Then, further define line 2 by keying in either the direction (tap \[ \text{BRG2} \] or \[ \text{AZ2} \]), a point on a line (tap \[ \text{POL2} \]), the distance to point (tap \[ \text{DIST2} \]), or tap \[ \text{PERPO} \] to get a perpendicular distance to the first defined line.
The display will show the intersection. Perpendicular offset lets you move a point to a line while occupying a remote point.

```
 pt 1: 0
 offset 1: 0.00
 dir 1: N0°00'00"E
 pt 2: 0
 offset 2: 0.00
```

Figure 2-99 Intersections Menu

**Example**

1. Take a shot near the line.
2. Press `<X>`. 
3. Key in shot 2 and tap `PT1` to enter it as point 1.
4. Key in shot 3 and tap `POL1` to enter it as a point on line 1 (to define the line).
5. Key in shot 1 and tap `PT2`, then tap `PERPO` for a perpendicular offset.

The display shows the distance to the right or left of the line on which that point number is located (as a + or - value). If you press `store` here, the point will be stored on the line between points 2 and 3 and perpendicular from point 1.

The Intersections menu lets you enter an offset distance from point 1 and/or point 2. The perpendicular offset example above can be accomplished even more efficiently (and more easily) using the Stake to a Line command.
Inverse to Coordinates

PRODUCT: ALL

KEY-IN: NE I NVR

COMMAND GROUP: COGO

Inverse to Coordinates (or Point Inverse) allows you to start with a set of coordinates entered on the stack and then inverse to one or more points from that location. The command then allows you to set a BKPT and PINV so you can calculate bearings, azimuths, and angle rights from the known XY position. The command allows for automatic inversing in sequential order by simply tapping $\text{Pinv}$, or traversing by tapping $\text{Ptrav}$. You can also compute the area from the resultant traverse.

Other uses:

- Useful for checking a traverse by using the display of angle right.
- Displays calculated angle rights from each occupy point to each foresight point, allowing for easy verification of existing traverses.

Job Menu (JOB)

PRODUCT: ALL

KEYSTROKES: [JOB] (THE A KEY)

KEY-IN: J OBS

COMMAND GROUP: JOB

This function allows you to create a new job, select an existing job, delete, copy, move, or transfer a job, and define parameters for your job.
Job Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLD</td>
<td>Use the ▲ and ▼ arrow keys to highlight the job you want to select. Use the PGUp and PGDN soft keys to move up and down the list a page at a time. When the correct job is highlighted, press !. Tap exit or Esc to cancel the selection.</td>
</tr>
</tbody>
</table>
| COPY   | Copies a job to or from the memory on the collector.  
✓ This command was designed for the HP 48GX with a RAM card. It is not necessary to copy jobs to or from memory nor is it recommended. |
| MOVE   | Moves a job. Select the job to move and press !.  
✓ This command was designed for the HP 48GX with a RAM card. It is recommended that you do not move jobs into memory as they could be lost if the device loses power for any length of time. |
| XFER   | Transfers an entire job, including points, raw data, etc., to a PC or another data collector. The data collector receiving the job cannot already contain a job with the same name. Refer to your Transfer User Guide for more information on transferring to/from a PC. |
| KERM   | This function is an alternate transfer utility and is used to send and receive coordinates to/from a PC. Use this method if you do not wish to send an entire job or if you only have Kermit installed on your PC. When coming from the PC, Kermit allows you to merge a job with an existing job on the data collector.  
✓ If you are in the wrong job in the data collector, sending a job from the PC using Kermit will replace points without warning. |
| NEW    | Displays the submenu for creating a new job. See New Menu on page 149. |
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEL</strong></td>
<td>Deletes a job. Select the job to be deleted and press <img src="image" alt="enter" /> Press <img src="image" alt="enter" /> to confirm or tap or press <img src="image" alt="Esc" /> to cancel and return to the Job menu.</td>
</tr>
<tr>
<td><strong>sFLG</strong></td>
<td>Saves the current flag settings of the <strong>CHG</strong> menu.</td>
</tr>
<tr>
<td><strong>rFLG</strong></td>
<td>Recalls the flag settings.</td>
</tr>
<tr>
<td><strong>SEQ</strong></td>
<td>Toggles to sequence notes.</td>
</tr>
<tr>
<td><strong>T SE</strong></td>
<td>Toggles from note table to sequence list.</td>
</tr>
<tr>
<td><strong>DELN</strong></td>
<td>Deletes the note table.</td>
</tr>
</tbody>
</table>

### New Menu

**Figure 2-101 New Menu**

**New Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POINT</strong></td>
<td>Changes the beginning point number for the next job to be created.</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>Changes the north default value for the first point in the next job to be created.</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Changes the east default value for the first point in the next job to be created.</td>
</tr>
<tr>
<td><strong>EL</strong></td>
<td>Changes the elevation default value (providing you have selected elevations – see <em>Change/Defaults on page 41</em>) for the first point in the next job to be created.</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>Allows you to enter a note for the first point in the next job to be created. The note should be keyed in only after <strong>NOTE</strong> is tapped. When you are finished, press <img src="image" alt="enter" /> Tap or press <img src="image" alt="Esc" /> twice to cancel.</td>
</tr>
</tbody>
</table>
| **NEW** | Creates a new job using the default values on the screen for point 1. The display prompts you for a job name. Key in the name and press ![enter](image) (this also brings up this job as the
<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>current job), or tap or press Esc twice to cancel and return to the Job menu.</td>
</tr>
</tbody>
</table>

**Lat-Long Base**

PRODUCT: ROBOTIC

KEY-IN: LBASE

COMMAND GROUP: GPS

When running the LBASE command, the screen displays the geodetic coordinates (latitude and longitude) of the base receiver. This is useful when using multiple rovers for a single base station, and you need to manually key in the geodetic coordinates for the base station.

**Latitude and Departure**

PRODUCT: ALL

KEYSTROKES: MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) \text{NeXT} LT DP

KEY-IN: LTDP

COMMAND GROUP: COGO

You may display the difference in latitude, departure, and elevation from any two points. This may be used to check closure data on a known point.

The command prompts you to select the first and second points that you want to inverse between, then it reports the change in latitude, departure, and elevation from the first point to the second point.
Level Notes

PRODUCT: ALL

KEYSTROKES: MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) NEXT LEVEL

KEY-IN: LEVEL

COMMAND GROUP: COLLECT

This function lets you run 1-wire or 3-wire levels with a rod and manual or electronic level. To clear previous data, MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) NEXT 3 LEVEL.

Figure 2-103 Level Notes Menu
### Level Notes Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BM</strong></td>
<td>Allows you to enter the starting benchmark. All other values are cleared when this key is used. BM in the display shows the original benchmark elevation. ( \Delta BM ) in the display shows the difference between the original benchmark and the last turning point (BM - TBM). This should be close to 0 when you complete the loop (tap (&lt;FS TP&gt;) while pointing at the original benchmark).</td>
</tr>
<tr>
<td><strong>BS</strong></td>
<td>Takes a reading on the backsight. BS in the display shows the last entered rod reading at the backsight.</td>
</tr>
<tr>
<td><strong>HI</strong></td>
<td>Manually updates the elevation of the HI. HI in the displays shows the elevation of the level at its axis. This soft key is not normally used.</td>
</tr>
<tr>
<td><strong>FS</strong></td>
<td>Takes a reading without moving up the benchmark. FS in the display shows the last entered rod reading at the foresight (&lt;FS&gt; or &lt;FS TP&gt;). EL in the display shows the elevation at the point measured to.</td>
</tr>
<tr>
<td><strong>EL</strong></td>
<td>Allows you to enter the desired elevation. EL in display shows the elevation of the last shot. FS in the display shows the desired rod reading.</td>
</tr>
<tr>
<td><strong>FS TP</strong></td>
<td>Takes a reading on the foresight turning point. The TBM and BM values in the display are updated. TBM in the display shows the elevation of the original benchmark or last turning point (&lt;FS TP&gt;). Data is stored to the raw data file if the STO option on the next menu page is toggled on.</td>
</tr>
<tr>
<td><strong>STO</strong></td>
<td>Toggles between storing or not storing data to the raw data file. The coordinate file does not get updated.</td>
</tr>
<tr>
<td><strong>GRDE</strong></td>
<td>Allows you to enter a grade elevation to see a Cut or Fill value on the screen when FS and EL are used.</td>
</tr>
<tr>
<td><strong>1WIRE</strong>/<strong>3WIRE</strong></td>
<td>Toggles between using a 1-wire or 3-wire level. When a 3-wire level is used, distances are shown and accumulated, as well as the elevations.</td>
</tr>
<tr>
<td><strong>INST</strong></td>
<td>Allows you to select an Instrument. If you are using a supported electronic level, you can select the driver for your level by pressing ( \text{MORE} \ \text{NeXT} \ \text{LEVEL} \ \text{NeXT} \ \text{INSt}).</td>
</tr>
<tr>
<td><strong>MAN</strong></td>
<td>Allows you to manually enter level measurements.</td>
</tr>
<tr>
<td><strong>2002</strong></td>
<td>This is the Leica NA 2002 level. Use settings of 2400-Even-7-1. This was ( \text{DGT}).</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>DINI</td>
<td>This is the Zeiss DiNi series level. Use settings of 9600-None-8-1.</td>
</tr>
<tr>
<td>DL100</td>
<td>This is the Topcon DL 100 level. Use settings of 1200-Even-7-1.</td>
</tr>
</tbody>
</table>

**Example**

![Level Notes Example Diagram](image)

**Figure 2-104 Level Notes Example**

1. Press MORE NeXT LEVEL.

```
+----------------------------------------+----------+
|              LEVEL NOTES               |          |
| BM: 0.00    | TBM: 0.00 |
| BS: 0.00    |           |
| HI: 0.00    |           |
| FS: 0.00    |           |
| EL: 0.00    |           |
| BM | BS | HI | FS | EL | FS TP |
```

**Figure 2-105 Level Notes Screen**

2. Enter a benchmark of 100 and a backsight of 5.42. Type 100 and tap BM. Type 5.42 and tap BS.

```
+----------------------------------------+----------+
|              LEVEL NOTES               |          |
| BM: 100.00   | TBM: 100.00 |
| BS: 5.42     |           |
| HI: 105.42   |           |
| FS: 0.00     |           |
| EL: 0.00     |           |
| BM | BS | HI | FS | EL | FS TP |
```
3. Now enter a foresight reading of 10.68. Type 10.68 and tap <FS>.

Figure 2-107  Specifying Foresight

The elevation at the foresight is shown as 94.74 in the display. If the <STO> soft key on the next page is turned on, this entry is saved to the raw data file. The <FS> key does not change the location of the level.

4. If Notes are toggled on, key in the description and press <FS TP>.

These level notes with the description are stored in the raw data file, even if Notes are off.

5. If there is a design grade on a project and a desired elevation of 96 feet, key in 96 and tap <el>.

This provides the desired rod reading. This tells you that the foresight needs to be (9.42) to have a desired elevation of 96’.

Figure 2-108  Desired Rod Reading

6. Tap <FS TP> and enter 10.2 to move the level to Station 2.
7. Tap $b$ and enter 8.02 to see that the elevation at Station 2 is 103.24.

8. Tap $f$ and enter 2.25 to calculate the elevation at the last benchmark.

The ending benchmark elevation is 101, which is a .01 difference from the TBM elevation shown. This means we have an open loop error of .01. Notice that the BM shown is -0.99. If this had been a closed loop (the ending benchmark is the same as the beginning benchmark), the BM would show the closed loop error.
Line Stakeout

PRODUCT: ALL

KEYSTROKES: [STAKE] (ALLEGRO O KEY, JETT S KEY, TITAN P KEY) [NeXT] [NeXT] [LINE].

KEY-IN: LI NES

COMMAND GROUP: STAKE

This function is used to stake out a tangent line by station and offset, and is found on the third page of the Stake menu. Unlike the Curve Stakeout menu, the program does not require that a point on the line be occupied.

When [LINE] is first tapped, you are prompted for the beginning point, beginning station, and ending point: BegPT BegSTA EndPT. Type in the beginning point number, press [SPACE], type the beginning station, press [SPACE] type the ending point number, and press !. A screen similar to the following displays:

```
Putting up 1+00.00 +0.00
```

EL: 0.00'00"  H: 4.800
DTS: 0.00000  RDR: 6.900
SETUP STA INC OFFSET SHOT STOPT

**Figure 2-112 Line Stakeout Screen**

Put the rodman on line, sight on the prism, and tap [SHOT] to get the Go/Come, Left/Right information. After staking the point, tap [INC] to stake the next station.

```
SETUP STA INC OFFSET SHOT STOPT
```

**Figure 2-113 Line Stakeout Menu**

**Line Stakeout Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP</td>
<td>Prompts for same information as [LINE].</td>
</tr>
<tr>
<td>STA</td>
<td>Allows you to enter a station to be staked. Pressing C STA stores a point at the given station.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>INC</td>
<td>Increments to the next station. If a number is on the stack when INC is tapped, it is used as the new increment. The default increment is 100. When the end of the line is reached, it starts over.</td>
</tr>
<tr>
<td>OFFSET</td>
<td>Allows you to enter an offset to be staked. The default is 0.</td>
</tr>
<tr>
<td>SHOT</td>
<td>Allows you for manual or electronic entry of shot information. Tap this key to change to the shot screen. If you are using the Robotic version, press SHOT to take repeated shots and perform a live update of the screen.</td>
</tr>
<tr>
<td>STOPT</td>
<td>Stores the point being staked. Pressing STOPT stores the last shot.</td>
</tr>
</tbody>
</table>

---

**Manual Cross-Section Entry**

**PRODUCT:** DOT  
**COMMAND GROUP:** DOT

Use this function when you are taking cross-section shots and get an obstruction that requires you to switch to manual entry of cross-section data. This program uses the last two points shot to compute manual cross-section data.

---

**Figure 2-114  Manual Cross-Section Menu**

**Manual Cross-Section Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azimuth</td>
<td>Displays the current direction of the cross-section.</td>
</tr>
<tr>
<td>From PT</td>
<td>Displays the reference point.</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>Prompts you for the change in elevation if elevations are toggled on. Key in the difference in elevation and press ![enter]. You are then prompted for the distance from your reference point. Key in the distance and press ![enter]. The new point (“next number”) is stored.</td>
</tr>
<tr>
<td>MOVE</td>
<td>Prompts you for a distance from your reference point. Key in the distance and press ![enter]. The new point (“next number”) is stored.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the main DOT menu.</td>
</tr>
</tbody>
</table>

---

**Manual Side Shots**

PRODUCT: ALL

KEYSTROKES: ALLEGRO □ SID$ [J KEY], JETTA □ SID$ [M KEY], TITAN □ SID$ [K KEY).

KEY-IN: SI DES

COMMAND GROUP: COLLECT

This command is used when you need to manually enter side shot information without actually taking a shot with the instrument. This keystroke does not switch the Instrument mode, as it retains the instrument settings, and the SID$ command still takes a shot using the current instrument driver.

To switch to manual mode, see Side Shot (SID$) on page 230 for more information.
Manual Traverse Input

PRODUCT: ALL

KEYSTROKES: ALLEGRO c TRAV ( K KEY), JETT a TRAV ( P KEY), TITAN c TRAV ( L KEY).

KEY-IN: TRAVR

COMMAND GROUP: COLLECT

This command is used when you need to manually enter traverse observations without actually taking shots with the instrument. This keystroke maintains the Instrument mode and the TRAV command still takes shots using the instrument when an instrument driver is loaded.

Mean Backsight

PRODUCT: ALL

KEYSTROKES: SETUP NeXT NeXT Mbs

KEY-IN: MBS

COMMAND GROUP: SETUP

This function allows you to shoot a backsight point twice, directly and with the scope flopped. The new elevation and new horizontal distance are meaned with the occupied point's elevation and horizontal distance from the backsight point. These values are then used to restore the occupied point.

The comment record (CM) reports the resultant horizontal angles.

If you are using an electronic instrument, the direction and distance will be collected automatically; otherwise, you will be prompted to enter the data. Once MBS data is entered, the display will show the Mean Backsight soft keys.

Figure 2-115 Mean Backsight Menu
Mean Backsight Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBSR</td>
<td>Brings in the zenith angle and horizontal angle after the scope has been flopped. The data collector shows an arrow symbol next to the error if any of the tolerances have been exceeded. If you decide to store the occupied point based on the meaned backsight, tap store, or key in a point number and tap STORE.</td>
</tr>
<tr>
<td>SHOT2</td>
<td>Takes two direct backsights instead of flopping the scope.</td>
</tr>
<tr>
<td>VTOLS</td>
<td>Changes the zenith angle tolerance.</td>
</tr>
<tr>
<td>HDTOL</td>
<td>Changes the horizontal distance tolerance.</td>
</tr>
<tr>
<td>ELTOL</td>
<td>Changes the elevation tolerance.</td>
</tr>
</tbody>
</table>

Mean Points

PRODUCT: ALL

KEYSTROKES: RPTS (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) Type points to be meaned

KEY-IN: MEANPT

COMMAND GROUP: RANDOM POINTS

This command is used for calculating the mean coordinates of a group of points, which is useful for averaging several shots made to the same point or averaging several free station shots. One value of this function is that you can find the midway point between two points.

After MEAN is tapped, the points are averaged and shown on the screen. MNR shows the MEAN ERRORS display and WORS shows the point that is the farthest from the average.

Figure 2-116  Mean Points Menu
Mean Points Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNER</td>
<td>Displays the mean errors.</td>
</tr>
<tr>
<td>WORS</td>
<td>Displays the worst point.</td>
</tr>
<tr>
<td>MEAN</td>
<td>Displays the mean coordinates.</td>
</tr>
<tr>
<td>STORE</td>
<td>Stores the mean coordinates to a point.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the Random Points menu.</td>
</tr>
</tbody>
</table>

Example

1. Press [RPTS] (Allegro S key, JETT N key, Titan T key) and type 1 [SPACE] 4 !.
2. Tap [NeXT].
3. Tap [MEAN].

Figure 2-117 Random Points Screen

Figure 2-118 Mean Points Screen
4. You can now tap `STORE` to store a point at the meaned location or type a point number and tap `STORE`.

Another value of mean is that it allows you to use 2PFS (Two-Point Free Station) to store points from several sets of points and mean the position along with the elevation and store it.

You will now enter new points 15, 16, and 17.

5. Press `STOPT`.

6. Key in 5093.5603 and tap `N` for the north coordinate.

7. Key in 5440.1664 and tap `E` for the east coordinate.

8. Key in 60 and tap `EL` for the elevation.

9. Key in 15 and tap `STORE` (if you just tap `STORE`, the program uses the next number (NN) as the point.)

```
NODE COORDINATE
Pt. 15 NN 16
NORTH: 5093.5603
EAST: 5440.1664
ELEV: 60.0000
NOTE:
```

```
Figure 2-119 Entering Point 15
```

Now enter point 16 in the same manner so that it matches the following screen.

```
NODE COORDINATE
Pt. 16 NN 17
NORTH: 5093.5803
EAST: 5440.2064
ELEV: 60.0500
NOTE:
```

```
Figure 2-120 Entering Point 16
```

Now enter point 17 in the same manner so that it matches the following screen.
To mean the above points, press RPTS, key in 15.17, and press ![E]

Tap <NeXT> mean.

Tap MNER to get the mean error of points.

Tap WORS to get the worst point.
Point 15 displays as the worst point. You can delete it by using the Delete function or, if the errors are within your tolerances, you can tap STORE. This stores the mean point as the next available point number. You can also key in a point number and tap STORE.

---

### Menu

PRODUCT: ALL

KEYSTROKES: ALLEGRO & POCKET PC: MENU (THE Y KEY)

KEY-IN: SELCMDKEY

COMMAND GROUP: PROGRAM SETTINGS

This command is used to select the currently active mapping for the command keys (Pocket PC 1-4, Titan 1-5, JETT 1-10, and Allegro 1-12). Press this key to switch between one or more Command Key menus. Use the large up and down arrows on the turn button to move the highlighted line until the desired menu is displayed and press the Enter button. This can also be accomplished by using the touch screen.

Refer to the Command Keys section on page 52 for information on how to utilize these commands.

---

### Meter Mode – Feet/Meter

PRODUCT: CONSTRUCTION

KEYSTROKES: CHG (THE B KEY) NEXT MODE FEET METR

KEY-IN: TOGMF

COMMAND GROUP: OPTIONS

This function toggles between feet and meters. All distances are assumed to be in meters when in Meter mode.

Meter mode affects how stations, precisions, areas, volumes, degree of curvature, Earth's curvature, and distances are calculated and displayed. An M is shown in the display across the top when Meter mode is active.

✔ _This is a system setting and not a job specific setting. Therefore, if you open another job that used a different mode than the one you are currently set to, be sure you toggle back before_
running any calculations or making any changes. The program stays in Meter mode until you change it back to feet, regardless of the job in which job you are working.

More Menu (MORE)

PRODUCT: ALL

KEYSTROKES: [MORE] (ALLEGRO T KEY, JETT O KEY, TITAN U KEY)

KEY-IN: MORE

COMMAND GROUP: COGO

This function lets you carry out miscellaneous functions, including compute angle right, compute volume, contouring, and triangle solutions.

In the More menu, some options are only available in certain versions of the program. Tap [NeXT] to scroll through the menu screens.

Figure 2-125  More Menu

More Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
</table>
| **CAR** | Computes the angle right from the back bearing and foresight bearing, or from the back azimuth and foresight azimuth. This function assumes you are occupying the point where the two lines meet. This key accesses a submenu that lets you key in the appropriate data values:  
  - **BKBR** allows you to enter the back bearing.  
  - **BKAZ** allows you to enter the back azimuth or two points that define the back azimuth.  
  - **FSBR** allows you to enter the foresight bearing.  
  - **FSAZ** allows you to enter the foresight azimuth or two points that define the foresight azimuth. |

Option | Function
---|---
**ZSLOP** | Allows you to enter a zenith and slope distance on the stack or command line and get a change in elevation and horizontal distance on the stack.
**VC** | Accesses the Vertical Curve menu. See *Vertical Curves on page 275.*
**TRI** | Performs triangle solutions. See *Triangle Solutions on page 265.*
**VOL** | Computes volumes. See *Volume on page 281.*
**TOPO** | Scales the distance to each contour line from an elevation point in the direction of another elevation point. See *Topo (Contouring) on page 260.*
**LEVEL** | Allows you to run levels with a rod and a level. See *Level Notes on page 151.*
**LTDP** | Calculates the latitude, departure, and change in elevation between two points. Latitude is the distance north and departure is the distance east.
**Sun** | Calculates an azimuth using solar observations. See *Sunshots on page 252.*

---

**Next (NeXT)**

PRODUCT: ALL

KEYSTROKES: NEXT OR NeXT

KEY-IN: NEXT

COMMAND GROUP: PROGRAM SETTINGS

This command advances the soft key menu to the next page.
**Next Number (NEXTNO)**

PRODUCT: ALL

KEYSTROKES: `c` **NEXTNO** (THE `!` KEY)

KEY-IN: **NNUM**

COMMAND GROUP: COLLECT

This command lets you set the next point number to be stored in your current job. If a point number already exists in the job file, it may be overwritten.

Key in the point number you wish to use as your next point for storing data and press `c` **NEXTNO** (the `!` key).

---

**Next Point (NXTP)**

PRODUCT: ALL

KEYSTROKES: **STAKE** (ALLEGRO O KEY, JETT S KEY, TITAN P KEY) `c` **NEXT** **NXTP**

KEY-IN: **NXTPT**

COMMAND GROUP: STAKE

If there is no point on the stack, it searches the Random Points file for the closest point to the last shot and gives the Go/Come value. If there is a point on stack, it gives the Go/Come value to that point from the last shot. If two points are on the stack, NXTP searches the range of points for the one closest to the last shot and gives the Go/Come value.

If several points are to be staked, you can select EDIT from the RPTS menu and enter the point numbers or range of points, separated by a period, to stake.

After entering the points in the Random Points file, `FSNXT` (Foresight Next Random Point) and `fSPRv` (Foresight Previous Random Point) can be used to walk through the points in the Random Points file instead of entering one point at a time in FSPT.
**North West Bearing (NW)**

**PRODUCT:** ALL

**KEYSTROKES:** C NW (THE 4 KEY)

**KEY-IN:** NC 0 W

**COMMAND GROUP:** CONVERSIONS

This function key converts the value on the stack from a northwest bearing to azimuth. Running the command again converts the value back to a northwest bearing.

Type a northwest bearing and press <NW>. Press C NW (the 4 key). The display shows the value in azimuth format.

---

**Note Mode – Note/Auto/Last Note/Table (NOTE)**

**PRODUCT:** ALL

**KEYSTROKES:** a NOTE (THE 4 KEY) OR CHG (THE B KEY)

**KEY-IN:** TOGNOTE

**COMMAND GROUP:** OPTIONS

This overlay function allows you toggle on and off the note prompt, last note recall, and note table prompt.

Tap this key to toggle between four settings NOTE / AUTO / LNTA / NTBL:

- PROMPTING OFF – WILL NOT STORE LAST NOTE
- PROMPTING OFF – WILL STORE LAST NOTE
- PROMPTING WITH LAST NOTE
- PROMPTING WITH NOTE TABLE

The display confirms your selection. When Notes are turned on, the letter N appears at the top of the display to indicate that this function is active.
If using a note table is preferred to typing in a note, use the Notes toggle key to turn on Prompting with Note Table. Then, the note table will start immediately, instead of having to tap $\text{TBL}$.

---

**Note Search**

**PRODUCT:** ALL

**KEYSTROKES:** RPTS  NEXT  NEXT  NOTE

**KEY-IN:** NOTER

**COMMAND GROUP:** RANDOM POINTS

This command allows you to create a Random Points list by filtering out only the points with the desired note.

Press RPTS (Allegro S key, JETT N key, Titan T key). Enter the range of points to search from and press !. Tap NEXT  NEXT  NOTE and enter the note to search on.

---

**Example**

Suppose you want to only stake or locate the points with a note of IPS within a job. First thing to do is create a random points file with which to work as described below.

1. **Press** RPTS, enter a range of points, and press !.
2. **Tap** NEXT  NEXT  NOTE.
   
   You are prompted for the note to search for.
3. **Type** IPS and press !.
4. **Press** RPTS.
   
   Note that the Random Points file has been changed to include only the points that have the note IPS.
**Note Sequencing**

**PRODUCT:** ALL

**KEYSTROKES:** JOB NEXT SEQ

There is a special note sequence that can be used when your 4-state note toggle is set to PROMPTING WITH LAST NOTE. Note sequencing allows you to cycle through a list or sequence of notes. When in a sequence, the next shot automatically cycles to the next note in the sequence until the sequence is completed. To ‘enter’ a sequence, simply type or use a note that is in a sequence.

*NOTE: Since you may have more than once note sequence within the same list (or note table), you therefore cannot have a duplicate note the sequence.*

Before you can use note sequencing, you must either transfer the note table with your desired sequence(s) to the device using SMI Transfer using JOB XFER PC or by constructing it on the device by adding the notes you want and deleting the ones you don’t in the current note table. The note sequence is derived from the note table and the order in which the table is in. As a suggestion, it might be better to first write down the desired sequence as when you enter the sequence, the first note entered needs to be the last note in the sequence. This is because each subsequent note that is added is added to the top of the note table (as it has always worked).

Once the note table represents the note sequence(s) that you desire, you then need to copy the current note table to be the sequence. This is done by selecting JOB NeXT t"SE.

Now that the sequence is copied over, you need to toggle ON the sequence option by selecting JOB NeXT seq. You should see a message stating ‘WILL SEQUENCE NOTES’.

To turn off this feature tap the seq toggle button again or just switch your note prompt to something other than prompting with last note.

If you want to create a note table with a list of sequences in it first, then use a different note table to be used as your note table, first transfer the note table that represents your sequence(s). Then delete the current note table by pressing JOB NeXT del n. Finally, send the note table to be used as your actual note table up to the device with SMI Transfer.

*Warning: If you perform a Clear Classic SMI, your sequence(s) are cleared from memory and will need to be re-entered.*

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Example
For example, let’s say your note sequence is comprised of the following notes in the following order:

ES1
EP1
CL
EP2
ES2

When prompted for notes, if you enter ES1, the next default note will not be ES1 but will be the next note in the sequence, which in this case is EP1. If you would have entered CL, the next note prompted will be EP2, etc.

You may also change the note and enter into the sequence at any desired point. For example large highway cross sections may require collection of a number of unrelated topo points before resuming a 10 point cross section sequence. When the program reaches the end of the sequence it will display a blank default, if you want the program to start over again type the starting note of the sequence (i.e., ES1).

NOTE: When entering a note table on the collector to be made into a sequence, build it in reverse order that the sequence is run as SMI always puts the most recently note added or used at the top of the note table.

Note Table

PRODUCT: ALL

KEYSTROKES: [TBL].

This function allows you to create and select from a pre-defined list of notes stored in a note table.

✓ This screen is not touch-sensitive. You must use the directional keys on your keypad to select a note from the table.

Whenever you are prompted to enter a note (with the cursor flashing on the command line), you may view the note table by tapping [TBL]. Scroll through the notes using the directional keys on your collector and press [ ] to select the desired note. You may also configure the note mode to prompt with the note table each time you record an observation. See Note Mode – Note/Auto/Last Note/Table (NOTE) on page 168 for more information.

There are a few predefined notes that can be edited, deleted, or added. These options only appear when you are using the Note Table option and being prompted to select a note from the table.
There is only one note table installed at a time on the data collector, and this may be downloaded or uploaded to your collector and edited from the PC. When transferred to the PC, the name of the file is Notes.NTB.

---

**Figure 2-126  Note Table Menu**

**Note Table Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECHO</td>
<td>Allows you to edit the highlighted note.</td>
</tr>
<tr>
<td>ADD</td>
<td>Allows you to add a new note to the note table.</td>
</tr>
<tr>
<td>DEL</td>
<td>Deletes the highlighted note.</td>
</tr>
<tr>
<td>USE</td>
<td>Uses the highlighted note by placing it in the point number. Pressing performs the same function as when the note is highlighted.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Exits the note table and repeats the last note used.</td>
</tr>
</tbody>
</table>

---

**Occupy a Point (OCCUPY)**

**PRODUCT:** ALL

**KEYSTROKES:** OCCUPY (ALLEGRO E KEY, JETT C OCPY (THE Q KEY), TITAN F KEY)

**KEY-IN:** OCPY

**COMMAND GROUP:** SETUP

This command allows you specify the base receiver or instrument location by point number. Key in the desired point number and press OCCUPY. This point is now occupied in the current job.
You can also access this command by pressing `<SETUP>` `<OCPY>` or `<STAKE>` `<OCPY>` or `<CONST>` `<OCPY>`.

---

**Occupy a Station**

PRODUCT: CONSTRUCTION

KEYSTROKES: `<CONST>` (ALLEGRO I KEY, JETT Q KEY, TITAN J KEY) `<OCPY>`

KEY-IN: **OCSTA**

COMMAND GROUP: CONSTRUCTION

This command allows you specify the base receiver or instrument location by station and offset. Key in the desired station and offset and press `<CONST>` (Allegro I key, JETT Q key, Titan J key) `<OCPY>`.

---

**Offset from Random Points**

PRODUCT: ALL

KEYSTROKES: `<RPTS>` (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) `<NEXT>` `<OFFSET>`

KEY-IN: **OFFSET**

COMMAND GROUP: RANDOM POINTS

This command stores offset points perpendicular on either the left or right side of points in the current Random Points file. Press `<RPTS>`, enter a range of points, and press `<OFFSET>`. Tap `<NEXT>` `<OFFSET>`.

For an offset to the right, key in the offset distance and press `<CONST>` For an offset to the left, key in the offset distance and press `<+/->` (Allegro `+/-` key, JETT Y key, Titan BLUE SHIFT `+/-` (the `Esc` key)). The offset points are automatically stored.
Offset Intersection

PRODUCT: ALL

KEYSTROKES: □ (ALLEGRO R KEY, JETT U KEY, TITAN S KEY) OFS1

This function lets you store a point at an offset distance from any intersection.

Example

To demonstrate this function, use the following illustration:

![Example Illustration]

Figure 2-127 Offset Procedure

Create an intersection 50' north of the line defined by points 3-4, and 75' east of the line defined by points 1-2.

1. Press □ for the Intersections menu.

The Intersections screen displays.

```
+---------------------------------------+
| INTERSECTIONS |                        |
| PT 1:        | 0                        |
| OFFSET 1:    | 0.00                     |
| DIR 1:       | N0°00'00"E               |
| PT 2:        | 0                        |
| OFFSET 2:    | 0.00                     |
| PT 1 OFS1:   | AMPT PERPO               |
| CONT         |                          |
+---------------------------------------+
```

Figure 2-128 Intersections Screen

2. Enter the offset distance from line 1-2. Key in 75 and tap OFS1.
3. Key in 1 and tap **PT1**.

4. Key in 2 and tap **POL1**.

```
INTERSECTIONS
PT 1: 1
OFFSET 1: 75.00
DIR 1: N15°00'00" E
PT 2: 0
OFFSET 3: 0.00
```

*Figure 2-129 Defining Line 1*

5. Enter the offset distance from line 2. Key in 50 and tap **OFS1**.

The offset distance is entered as a negative value because the offset point occurs to the left of the line.

6. Key in 3 and tap **PT2**.

```
INTERSECTIONS
PT 1: 1
OFFSET 1: 75.00
DIR 1: N15°00'00" E
PT 2: 3
OFFSET 3: -50.00
```

*Figure 2-130 Intersections from Points 1 and 3*

7. Key in 4 and tap **POL2**.

```
INTERSECTIONS
FROM PT 1
N27°59'31" E 333.6087

FROM PT 3
N77°28'43" E 377.8164
LEFT OF LINE
STORE NOTE: PT 2 PERPD
```

*Figure 2-131 Defining Line 2*

8. To store your new intersection as a new point, key in a point number and tap **STORE**. If you do not key in the point number, it stores the point with the next number.
If you would like to see the point that has just been stored, select RPTS, key in 1. 5, and press !. Then tap SPLOT, select any options and tap SPLOT again.

1

Figure 2-132 Offset Example

Perpendicular Offset

PRODUCT: ALL

KEYSTROKES: \( \times \) (ALLEGRO R KEY, JETT U KEY, TITAN S KEY) PERPO

This function allows you to determine distance from a point to a line.

Example

Continuing from the example in Figure 2-132 on page 176:

1. Press \( \times \) for intersections.
2. Key in 1 and tap PT1.
3. Key in 2 and tap POL1.
4. Choose the point for which you want to find the perpendicular offset. Key in 3 and tap PT2.
5. Tap PERPO.

This shows the distances from two points.
If you tap \textbf{STORE} here, a new point is stored on the line that you designated and is perpendicular to the point that was designated.

**Point Inverse**

**PRODUCT:** ALL

**KEY-IN:** \textbf{PINVR}

**COMMAND GROUP:** COGO

This command lets you inverse (compute the direction and distance) from the occupied point to another point in the current job.

Starting from the desired occupied point (see \textit{Occupy a Point on page 172}), key in the value for the point you are inverting to, press \textbf{ALPHA}, and type \textbf{PINVR}. The display shows the inverse from the occupied point.

\textit{It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the COGO Command Group.}

\begin{table}[h]
\centering
\begin{tabular}{|c|p{15cm}|}
\hline
\textbf{Option} & \textbf{Function} \\
\hline
\textbf{BKPT} & Allows you to enter a backsight point number. \\
\hline
\textbf{OCPY} & Allows you to occupy the next available point, or key in a specific point number before tapping this soft key to occupy that point. \\
\hline
\textbf{Inst} & Allows you to select the type of GPS receiver from the list of instrument drivers. \\
\hline
\textbf{PINV} & Executes another point inverse from the current occupied point to any other point in the job. The display prompts you to enter the \textit{inverse to} point. \\
\hline
\textbf{PTRA} & Executes a point traverse from the current occupied point to another point in the job. The display prompts you to enter the \textit{traverse to} point. \\
\hline
\end{tabular}
\caption{Point Inverse Menu Soft Key Definitions}
\end{table}
### Point on Grade

**PRODUCT:** DOT  
**KEY-IN:** PTONGR  
**COMMAND GROUP:** DOT COMMANDS

This function computes the grade and distance between two stored end points, and stores new points at a predetermined interval (or stores a predetermined number of points) between those two end points. Elevations must be on.

The display prompts you to enter both end points. Key in the points (separated with a space) to define your line and press ![Enter]. A soft key menu then gives you options for creating new points along the line (and grade).

When a soft key is tapped, the calculations are automatic and the new points are stored.

> It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the COGO Command Group.

#### Figure 2-134  Point on Grade Menu

#### Point on Grade Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRV</td>
<td>Allows you to enter a distance interval for the new points (i.e., 25 INTRV creates and stores points every 25 feet along the grade until the end point is reached).</td>
</tr>
<tr>
<td># PTS</td>
<td>Allows you to enter a number of points to be inserted (i.e., 3 # PTS creates and stores three equidistant points along the grade between the end points).</td>
</tr>
<tr>
<td>XTND</td>
<td>Allows you to continue storing points beyond the end point for a specified distance (i.e., 50 XTND continues storing point(s) for 50 feet beyond the end point).</td>
</tr>
</tbody>
</table>
**Point-to-Point Inverse (PT-PT)**

PRODUCT: ALL

KEYSTROKES: [PT-PT] (ALLEGRO U KEY, JETT X KEY, TITAN V KEY)

KEY-IN: PTTOPTD

COMMAND GROUP: COGO

This function key inverses between any two points in the current job and is used to check distance and direction (azimuth and bearing, delta elevation, and grade) between the two points.

Key in the first point number you wish to inverse. Press [SPACE]. Key in the second point you want to inverse. Press [PT-PT] (Allegro U key, JETT X key, Titan V key). The display shows the inverse between the two points, including distance, bearing, and azimuth.

When using a scale factor other than 1.00, both the scaled distance and the ground, or the non-scaled distance, display. The scaled distance is marked with an asterisk (*).

---

**Point-to-Point on Stack**

PRODUCT: ALL

KEY-IN: PTTOPTT

COMMAND GROUP: COGO

This function key inverses between any two points in the current job and is used to check distance and direction between the two points.

What makes this command different than [PT-PT] is that it then places the inversed distance and azimuth on the stack. You can also load up two point numbers on the stack before running this command. If the two point numbers are not already on the stack, the command prompts for them.
**Point Traverse**

PRODUCT: ALL

KEY-IN: PTRVR

COMMAND GROUP: COGO

This function lets you traverse from the occupied point to another point in the current job.

Starting from the current occupied point (see *Occupy a Point on page 172*), key in the point number to which you are traversing, press **ALPHA**, and type **PTRVR**. The display shows the new occupied point, as well as the backsight and foresight points. Point Traverse has the same submenu as Point Inverse (see *Point Inverse on page 177*).

*It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the COGO Command Group.*

---

**Polar to Rectangular**

PRODUCT: ALL

KEY-IN: P c 0 R

COMMAND GROUP: CALCULATOR FUNCTIONS

Use this command to convert from polar to rectangular coordinates.

Type a distance and press **ALPHA**. Enter a direction in degrees, minutes and seconds. Press **ALPHA** and type **P c 0 R**.

*It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.*
**Predetermined Area**

PRODUCT: ALL

KEYSTROKES: MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) NEXT PREA

KEY-IN: PREA

COMMAND GROUP: COGO

This function lets you compute a predetermined area using either the Hinge (pivot), Slide, or Trapezoidal method, which is similar to the Slide method but does not require stored points.

**Hinge Method**

The Hinge Method uses the current Random Points file to solve for the area. The first point in the file should be the hinge (pivot) point and the file should end with the two points defining the line along which the calculated point will be stored.

---

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>HINGE</td>
<td>Displays the Predetermined Area Hinge Method menu. This function holds a defined hinge point and pivots one line of the boundary from that point along another line to create the desired area. The points defining the boundary should be in the Random Points file. The pivot line cannot intersect the boundary on a curve. See Hinge Method on page 181 for additional information.</td>
</tr>
<tr>
<td>SLIDE</td>
<td>Tap this key to start the Predetermined Area Slide Method menu. This function slides a line from a baseline to form a four-sided figure with the desired area. See Slide Method on page 182 for additional information.</td>
</tr>
<tr>
<td>TRAP</td>
<td>This is a simple routine to find the lengths of the sides of a trapezoid. It prompts for the baseline distance, two interior angles, and area in square feet or meters. It is assumed that the baseline and opposite side are parallel. After performing the calculations, the lengths of the other three sides are put on the stack.</td>
</tr>
</tbody>
</table>
Figure 2-136  Hinge Method Menu

Hinge Method Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDIT</td>
<td>Allows you to edit the Random Points file. The Random Points file should begin with the hinge (pivot) point and end with the two points defining the line along which the calculated point will be stored. The last point you enter in the Random Points file must be on the line along which you are moving to make your adjustment. Curves can be in the boundary, but the calculated point cannot be put on a curve. See Random Points on page 186 for help on entering points and curves in a Random Points file.</td>
</tr>
<tr>
<td>ACRES / HECTa</td>
<td>Toggles between acres and hectares. Calculates where the point should be stored to get the desired area. This function displays the result and Predetermined Area Hinge Method Store menu.</td>
</tr>
<tr>
<td>SQFT / M^2</td>
<td>Toggles between square feet and square meters. Calculates where the point should be stored to get the desired area. This function displays the result and Predetermined Area Hinge Method Store menu. The distance shown after entering the desired area is the distance from the second-to-last point in the Random Points file along the line defined by the last point.</td>
</tr>
<tr>
<td>STPt</td>
<td>Stores the point that makes the boundary fit the area required.</td>
</tr>
</tbody>
</table>

Slide Method

Predetermined Area Slide Method Menu – Point 1 Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT1</td>
<td>Allows you to enter the first point on the baseline of the area.</td>
</tr>
<tr>
<td>BRG1</td>
<td>Allows you to enter the bearing from the first point defining the first side.</td>
</tr>
<tr>
<td>AZ2</td>
<td>Allows you to enter the azimuth from the first point defining the first side.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>POL1</td>
<td>Allows you to enter the point on line from the first point defining the first side.</td>
</tr>
<tr>
<td>PT2</td>
<td>Allows you to enter second point on the baseline of the area.</td>
</tr>
<tr>
<td>BRG2</td>
<td>Allows you to enter bearing from second point defining second side.</td>
</tr>
<tr>
<td>AZ2</td>
<td>Allows you to enter azimuth from first point defining second side.</td>
</tr>
<tr>
<td>POL2</td>
<td>Allows you to enter point on line from first point defining second side.</td>
</tr>
<tr>
<td>ACRES / HECTA</td>
<td>Allows you to specify acres or hectares to calculate the solution. This displays the solution and Predetermined Area Slide Method Store menu.</td>
</tr>
<tr>
<td>SQFT / M^2</td>
<td>Allows you to specify square feet or square meters to calculate the solution. This displays the solution and Predetermined Area Slide Method Store menu.</td>
</tr>
<tr>
<td>SLDAZ</td>
<td>Displays the default azimuth of the sliding line, which is defined by the first and second baseline points. Enter a different azimuth to use for the direction of the sliding line. This function must be used before entering the area.</td>
</tr>
<tr>
<td>PT3</td>
<td>Stores a point on the intersection of the first line and the sliding line.</td>
</tr>
<tr>
<td>PT4</td>
<td>Stores a point on the intersection of the second line and the sliding line.</td>
</tr>
<tr>
<td>NOTE</td>
<td>Stores a note for stored points.</td>
</tr>
</tbody>
</table>
**Previous/Next Menu (PREVIOUS/NEXT)**

**PRODUCT:** ALL

**KEYSTROKES:** <PREVIOUS> or <NEXT> (Allegro TAB key) or JETT BLUE SHIFT |← (the C key) or →| (the D key)

This key reverse scrolls the soft key menu screen.

Press <PREVIOUS> to scroll backwards through the soft key menus. The <NEXT> button opposite of <PREVIOUS> functions the same as the <NeXT> button on the screen.

---

**Print Menu (PRINT)**

**PRODUCT:** ALL

**KEYSTROKES:** PRINT (ALLEGRO V KEY, TITAN D KEY)

**KEY-IN:** PRI NT

**COMMAND GROUP:** VIEW

This function allows you to print coordinates or raw data directly from the current job.
Whenever the data collector is sending data to print, you will see an arrow enunciator flashing at the top right of the display. At any time, you may interrupt the printing of points by pressing \texttt{Esc}.

![Print Menu](image.png)

**Print Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPT</td>
<td>Allows you to select different printing options using the Print Options menu. See \textit{Print Options Menu on page 185}.</td>
</tr>
<tr>
<td>PRINT</td>
<td>Prints a point, range of points, or the entire job file. If there are no point numbers entered into the stack, all the points in the current job are printed. Enter one point number into the stack to print that single point number; or enter starting and ending point numbers to print the range of points between them (inclusive).</td>
</tr>
<tr>
<td>PRDM</td>
<td>Prints the points in the current Random Points file.</td>
</tr>
<tr>
<td>STAK</td>
<td>Prints staking information about the points in the current Random Points file. The current back azimuth and the occupied point are used.</td>
</tr>
<tr>
<td>RAW</td>
<td>Prints the entire raw data file. If your data collector is in Serial Print mode, this soft key may be used to send the raw data to a serial printer or DOS-based personal computer. To send the data to a file in your PC, connect the data collector to your PC’s serial port using a serial cable, then set the PC to Text Receive mode.</td>
</tr>
</tbody>
</table>

**Print Options Menu**

CODR B-D N-E EL ND EXIT

\texttt{NeXT}

![Print Options Menu](image.png)
**Print Options Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>COOR¾ / COOR</td>
<td>Toggles the printing of coordinates with each point. When selected (on), coordinates are printed. The default is on.</td>
</tr>
<tr>
<td>B- D¾ / B- D</td>
<td>Toggles the printing of bearing and distance between the points as they are printed. When selected (on), the bearing and distance are printed. The default is off.</td>
</tr>
<tr>
<td>N+E¾ / N+E</td>
<td>Toggle the printing of north and east coordinates of each point. When selected (on), the north and east coordinates of each point are printed. The default is on.</td>
</tr>
<tr>
<td>EL¾ / EL</td>
<td>Toggles the printing of the elevation of each point. When selected (on), the elevation of each point is printed. The default is on.</td>
</tr>
<tr>
<td>NOTE¾ / NOT¾</td>
<td>Toggles the printing of the note for each point. When selected (on), notes are printed. The default is on.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Returns to the Print menu.</td>
</tr>
<tr>
<td>Delay</td>
<td>Allows you to set a delay to the printer.</td>
</tr>
<tr>
<td>Degs</td>
<td>Allows you to change the ASCII value for the degree symbol. The default value is 176.</td>
</tr>
</tbody>
</table>

**Radio Settings**

PRODUCT: ALL

KEY-IN: RADSET

COMMAND GROUP: SETUP

This function varies depending on the current instrument driver and selected radio system. Each GPS driver and selected radio system has a different interface.
Random Point Station

PRODUCT: DOT

COMMAND GROUP: DOT COMMANDS

This function lets you set up within sight of two known stations and shoot the two stations to establish your occupied station.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sta</td>
<td>(Station 1) Identifies a station on the centerline before the line enters a curve.</td>
</tr>
<tr>
<td>2sta</td>
<td>Takes a shot to the PI (point of intersection) of the curve.</td>
</tr>
<tr>
<td>&lt;</td>
<td>Allows you to enter the delta of the curve (negative value indicates that the curve turns to the left).</td>
</tr>
<tr>
<td>Degc</td>
<td>Allows you to set the degree of curvature, assuming arc definition.</td>
</tr>
<tr>
<td>Pista</td>
<td>Allows you to enter the station number for the point of intersection.</td>
</tr>
</tbody>
</table>
Option | Function
--- | ---
Cont | Runs the main body of the program. This program occupies the coordinates 5000/5000, and generates a horizontal control file based on the information you have entered using this menu.

### Random Points Menu (RPTS)

PRODUCTS: ALL

KEYSTROKES: [RPTS](ALLEGRO S KEY, JETT N KEY, TITAN T KEY)

KEY-IN: RDMPTS

COMMAND GROUP: RANDOM POINTS

This command lets you work with a subset of points within a project. This subset of data is called a Random Points file.

The Random Points display begins with an Edit menu that lets you define a temporary Random Points file. To create a temporary Random Points file, define the range of points by keying in two points numbers separated with a period. To define points individually, separate each point with a space.

If the display shows another temporary Random Points file on the stack, tap or press [Esc] to clear the stack. You may now define your new Random Points file.

A number-space-number (e.g., 1 [SPACE] 20) only enters the two points (1 and 20). A number-point-number (e.g., 1.20) enter the two points and any points in between (1 through 20).

You can get creative in entering the points into your Random Points file: 1.5 [SPACE] 7 [SPACE] 10.20 are points 1 through 20 with 6, 8, and 9 left out. Descending ranges, such as 20.10 to indicate 20 through 10, are also permitted.

In some examples that include side shots (such as angle adjustment), the side shots need to be entered as a negative number. When entering a range of side shots, only one negative needs to be entered. For example, -6.20 represents side shots 6 through 20. Do not enter -6.-20; this will cause an error.

Curves are defined using the following points (separated with a space): point of curvature (PC), center of curve (CC) or radius point, and point of tangent (PT). These points are entered on the command line inside double quotes (e.g., “15 18 24”). To move the cursor outside the second double quote, press the directional keys on the keyboard of your collector.
To indicate an arc with a delta greater than 180°, make the radius point negative by pressing the \(+/-\) key while the cursor is on the radius point.

When you have finished editing your Random Points file, press \(\text{!}\) to save the file. You will then see a menu of functions that can be used with the current Random Points file. These functions also are found in the More menu.

### Random Points Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(&lt;\text{EDIT})</td>
<td>Allows you to edit the points in the current Random Points file. You may edit and add/delete points to the file using the standard editing keys. After you are finished editing, press (\text{!}) and you are prompted for the name of the Random Points file. The default file name is TEMP. To save the random points list to a different file name, press (&lt;\text{Esc})&gt; to clear the command line and enter a new name. Each Random Points file is associated with the job in which it was created.</td>
</tr>
<tr>
<td>(&lt;\text{OLD})</td>
<td>Creates a menu of old Random Points files from which you can select a file. When the corresponding soft key is tapped, the old file becomes the current Random Points file. The current Random Points file is then used by all functions that require a valid Random Points file for their computations.</td>
</tr>
<tr>
<td>(&lt;\text{CX})</td>
<td>Performs transformations. See Transformation (Translating, Rotating, Scaling, and Changing the Elevation) on page 262.</td>
</tr>
<tr>
<td>(&lt;\text{AREA})</td>
<td>Computes the area. See Area on page 29.</td>
</tr>
<tr>
<td>(&lt;\text{PREC})</td>
<td>Computes the acreage, square feet, perimeter, and precision. When running this command once while the raw data flag is set on (2), the precision for the random points is stored to the raw file. See Area on page 29.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>SPLIT</td>
<td>Plots lines on the data collector display. Lines are oriented so that north appears at the top of the display, and they are scaled to fit on the screen. Curves defined by &quot;PC RP PT&quot; are also plotted. Point numbers may be turned on or off.</td>
</tr>
<tr>
<td>OFFSET</td>
<td>Computes points from a line with break points.</td>
</tr>
<tr>
<td>XPLT</td>
<td>Plots cross-section areas by point number. See XPlot on page 282.</td>
</tr>
<tr>
<td>AA</td>
<td>Performs an angle adjustment. See Angle Adjustment on page 23 for additional information.</td>
</tr>
<tr>
<td>CR</td>
<td>Performs a compass rule adjustment. See Compass Rule Menu on page 57 for additional information.</td>
</tr>
<tr>
<td>COPYP</td>
<td>Copies the points listed in the Random Points file to another job or a different location in the same job. You are prompted for the destination job, then the beginning point number. The default beginning point number with which you are prompted is the same as the first point number in the Random Points file. If you want to renumber the points, enter a new beginning point number.</td>
</tr>
<tr>
<td>MEAN</td>
<td>Means (averages) the north, east, and elevation values of the points in the Random Point list. See Mean Points (Random Points Menu) on page 160 for additional information.</td>
</tr>
<tr>
<td>HINGE</td>
<td>Computes a predetermined area using the Hinge method. See Predetermined Area on page 181.</td>
</tr>
<tr>
<td>ELADJ</td>
<td>Adjusts the elevations in a traverse similar to the way the compass rule adjustment adjusts the north and east coordinates.</td>
</tr>
<tr>
<td>STAK</td>
<td>Stakes points within a certain distance of the occupied point. This function stakes all points listed in the Random Points file. If you would like to pre-specify the points to stake, you may place them in the Random Points file and when you occupy a point and backsight a point, go to stake and simply press [\text{a} \text{f}\text{pt}]. To back up to a previous point, press [\text{c} \text{f}\text{pt}].</td>
</tr>
<tr>
<td>NOTE</td>
<td>Allows you to search the Random Points files for a particular point that has a note you are looking for. For example, include your whole job in the Random Points file. Tap [\text{next}] twice to bring up the [\text{note}] soft key. Tap it and type the note you are looking for (e.g., IPS for Iron Pin Set), and press [\text{l}]. Now tap [\text{RPTS}] again. All the points that have IPS as their note are now the only things in your Random Points file.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>TOPC</td>
<td>Sends the points listed in the current Random Points file to another computer. The points are sent in an ASCII comma-delimited format. To use SMI Transfer to get this type of transfer, set the current data collector to SMI Kermit V6 and select just the coordinate format. See Transfer Procedure below for more information.</td>
</tr>
</tbody>
</table>

**Transfer Procedure**

Using the **SMI V7 Transfer** program, you can transfer a Random Points file.

1. On the PC, open the SMI V7 Transfer program.
2. Select From DC from the Main menu.
3. Choose SMI Kermit V6 from the Data Collector drop list.
4. Adjust the options on the Setup tab if necessary and click on the Transfer button.

   You are prompted to enter the name of file in which to save coordinates.

   ![Enter String Dialog Box](image)

   *Figure 2-143 Enter String Dialog Box*

5. Type a path and file name to create on your computer for the random points (e.g., C:\CONTROL.ASC), or just type a file name to be placed in your data directory (e.g., CONTROL) and click on OK.

6. On the SMI data collector, select a group of random points using the RPTS command and tap TOPC to send the data.

   This displays a dialog box that lists the file name and the amount of data transferred.
**Raw Data Mode – ON/OFF (RAW)**

PRODUCT: ALL

KEYSTROKES: a [RAW] ( THE 2 KEY )

KEY-IN: TOGRAWR

COMMAND GROUP: SURVEY SETTINGS

This key lets you toggle between collecting raw survey data and just coordinate information.

---

**Re-Authorize**

PRODUCT: ALL

KEYSTROKES: HELP > RE-AUTHORIZE

When you tap this option, you are prompted for a new password to change the software authorization (e.g., to key in a permanent authorization code over a temporary code). You may also need to re-authorize in the event the data collector was reset to factory defaults. If you receive an authorization code from Eagle Point, please save this code as these codes never change for a card or device.
Re-Zero (RE-0)

PRODUCT: ROBOTIC

KEYSTROKES: a RE-0 (THE 0 KEY)

KEY-IN: REZERO

COMMAND GROUP: TOTAL STATION

This command turns a robotic instrument back to the backsight, shoots a prism, reports the angular difference from the original backsight reading, records the difference in the raw data file, and sets the horizontal angle to zero.

✓ The c zero or ZERO key must have been used previously so the data collector knows the zenith angle to turn to the backsight.

Real-Time Side Shots (RSIDS)

PRODUCT: ROBOTIC

KEYSTROKES: c RSIDS (THE 5 KEY)

KEY-IN: TRKS

COMMAND GROUP: COLLECT

This command stores a point whenever the rod moves farther than the minimum distance from the last shot taken. The current distance from the last stored point is displayed until a new point is stored.
default minimum distance is 10. To change the minimum distance, type it in before pressing \texttt{RSIDS} (the 5 key).

To be prompted before the point is stored, type in a negative distance (e.g., -100).

---

**Real-Time Slope Stake**

PRODUCT: CONSTRUCTION

KEY-IN: \texttt{QSSTAKE}

COMMAND GROUP: CONSTRUCTION

This command allows you to constantly get updated information on the collector screen while slope staking.

---

**Reboot Allegro**

PRODUCT: ALLEGRO CE UNITS (This does not work on the Allegro CX units)

KEYSTROKES: HOLD DOWN ON (WARM BOOT) OR ON AND SHIFT TOGETHER (BOOT OPTIONS)

✓ If you are attempting this due to a software problem, first attempt the following:

1. Perform a File > Reset Classic SMI.
2. Perform a File > Clear Classic SMI.

   For more information, refer to When a Reset Might Help on page 353.

To perform a warm boot of an Allegro CE/CX device, hold down \texttt{ON} for 7-8 seconds until the screen display clears and the unit appears to restart.

To perform a cold boot of an Allegro CE device only, hold down the \texttt{ON} and \texttt{Shift} keys for 7-8 seconds or until the following screen displays.
Figure 2-146 Allegro Boot Screen

Then select the desired boot by using the UP and DOWN arrows and press Enter.

A warm boot is a boot when the Allegro is powered on, whereas a cold boot is a boot when the power is off. A warm boot should be used after a software crash or hardware reset.

Recall Point

PRODUCT: ALL

KEYSTROKES: <STOPT> (ALLEGRO P KEY, JETT K KEY, TITAN Q KEY) <RCLPT> FOR EDITING COORDINATES OF POINTS OR <VIEW> (ALLEGRO & TITAN C KEY, JETT V KEY) <PNTS> FOR VIEWING ONLY

KEY-IN: VI EW

COMMAND GROUP: VIEW

This command lets you recall and view the data for any point in the current job.

When you execute this function, the display prompts you to enter the point to recall. Key in the point number and press Enter, or key in the point number first and then press the appropriate function key(s).

Tap <PNTS> to display the data for the first point in the current job. See View on page 279.
Tap **NEXT** to increment to the next stored point. The program automatically skips any point numbers not used and jumps to the next stored point.

---

**Rectangular to Polar**

**PRODUCT**: ALL

**KEY-IN**: $R \ c \ 0 \ P$

**COMMAND GROUP**: TRIG FUNCTIONS

This command converts from rectangular to polar coordinates. Type a Northing and press $!$. Type an Easting, press $\text{ALPHA}$, and key in $R \ c \ 0 \ P$. The polar distance and HMS/DMS angle are put on the stack.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.

---

**Reflectorless Mode**

**PRODUCT**: ALL

**KEYSTROKES**: $a \ \text{SRVO} \ (\text{THE 8 KEY}) \ \text{PRISM} \ \text{REFL}$

This button toggles between Prism mode and Reflectorless mode. The mode of the instrument is changed when the key is tapped.

If the current instrument driver does not support Reflectorless mode, the message **REFLECTORLESS MODE NOT SUPPORTED** displays.
Registers Menu

PRODUCTS: ALL

KEYSTROKES: CUSTOM REGS

KEY-IN: REGS

COMMAND GROUP: PROGRAM SETTINGS

This function stores information in "registers" so that a single keystroke can be used to quickly recall the information when needed. When appropriate, a single key assignment will insert frequently used data that would otherwise have to be manually entered.

Press CUSTOM REGS. Memory registers will appear on the soft keys (1 through 6). For more registers, tap Next and you will see 7 through 12.

To store a number in a register, key in the number and press a and a soft key.

To recall a value from a stored register, just tap the soft key.

Example

In this example, you will store and recall numbers in registers.

1. Press CUSTOM REGS.
   A list of memory registers 1 through 12 displays.

2. To store 5280 in register 1, key in 5280 and press a 1. To recall 1, just press 1.

3. Press CUSTOM REGS.

4. The same set of registers displays.

5. Press 1 to see 5280.

You will now use RSTO and RRCL to store and recall registers.

6. To store 43560 in register 5, key in 43560 and press a 5. Key in 5 and tap RSTO.

7. To recall register 5, key in 5 and tap RRCL.
43560 displays on the stack.

8. Key in 1 and tap RRCL.

5280 displays on the stack.

Even though there are only 12 numbers shown in the Register Menu, registers 1 through 26 are available by using RRCL and RSTO.

To find the acreage of a 10,000 square-foot lot, simply key in 10000 ! and press 5 RRCL to recall 43560 stored earlier, then press ÷. You will see 0.2296 (acres).

A number or a keystroke sequence can also be assigned to a key.

---

**Remote Elevations**

Tap STOEL to use Stake to turn to a point of known north and east coordinates. Set the horizontal crosshair on the desired elevation and tap STOEL. The elevation at the crosshair is stored with the coordinates at that point number. This function is useful when the north and east coordinates of a point are known or can be calculated, but the elevation is unknown and inaccessible.

To determine remote elevations without the need for a prism or the need to take an observation directly above or below the feature being observed, refer to Angle Point and Intersection Point on page 26.

---

**How to Stake Points within a Certain Distance**

1. Press RPTS and key in the point numbers you wish to search (i.e., 201.300 would let you search all points from 201 to 300 inclusive).

2. Press ! NeXT NeXT STAK.

You are prompted for the maximum distance you wish to stake points from the occupied point.

3. Key in a distance and press !.

4. Choose whether you wish to sort by distance or angle.

5. To check the numbers that were found to be within that range, press RPTS.

6. Delete any points you do not wish to stake and press !.
7. To stake these points, press \textbf{STAKE} and use \textbf{FSPT}.

Establishing an Elevation from a Point with Known Coordinates

![Diagram of establishing elevation from a point with known coordinates]

**Figure 2-147 Establishing Elevation from Point with Known Coordinates**

In the above illustration, the unknown elevation at the instrument can be established by pointing the horizontal crosshair on the desired point if the following conditions exist:

1. The instrument must be occupying a known point stored in the current job, or a stored or un-stored free station.

2. A good elevation must be at the instrument. One of the following methods can be used to obtain a good elevation at the instrument:
   
   A. If the instrument point has a good elevation stored with the point number under the instrument, you can measure up from this point and enter this distance as the HI value in \textit{SMI} under \textbf{SETUP} (Allegro F key, JETT J key, Titan G key).
   
   B. The best way to get a good elevation at the instrument is to take a benchmark reading on a prism at a benchmark. For this to work properly, measure the distance from the bottom of the prism rod to the center of the prism and enter this value as the HROD under \textbf{SETUP} (Allegro F key, JETT J key, Titan G key) in \textit{SMI}.

You can now get the elevation of a stored north and east point with or without a prism.

**How to Get the Elevation of a Point with a Prism**

1. Use the same prism that you used to shoot the benchmark.

2. Set the prism over the point and press \textbf{STAKE} (Allegro O key, JETT S key, Titan P key).

3. Key in the point number of the point at which you want the elevation stored.
4. Tap \texttt{FSPT} and turn to the prism at the point.

5. Tap \texttt{NeXT STOEL}.

   This stores the correct elevation of the point.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2-148}
\caption{Storing the Correct Elevation of a Point}
\end{figure}

\textbf{How to Get the Elevation of a Point without a Prism}

1. Measure and enter the HROD.

2. Shoot a benchmark.

3. Press \texttt{STAKE} (Allegro O key, JETT S key, Titan P key).

4. Key in the point number of the point at which you want the elevation stored, then turn the angle specified.

5. Tap \texttt{FSPT}.

   \texttt{SMI} displays the angle to turn to the point.

6. Turn the horizontal angle to the point.

7. Move the horizontal crosshair to the desired place for the elevation to be stored.

8. Tap \texttt{NeXT STOEL}.

   This stores the elevation of the crosshair position with the coordinates of the point.
Repetitions (GPS Averaging)

Averaging RTK GPS measurements can increase the accuracy. Averaging for just 5 or 10 seconds can make a big difference.

Press [GPS] (the Z key) and then [OPT] to display the GPS Options menu.

Type in how many measurements to average and then tap [reps]. Enter 0 repetitions if you want to watch the averaging process and then decide when to take the average.

The data collector can average several measurements from the receiver to get a more precise position. Anytime the data collector needs to get a position from the receiver, if REPS (press [GPS] [OPT] [REPS]) is set to a number other than 1, the GPS Average Shots screen appears to show the progress of the collection of the measurements. Individual measurements that do not meet the current tolerance settings are not used. A lot of useful information about how close together the positions being collected are is shown, along with some soft keys that give you several options while the positions are coming in.

After the shots specified have been measured, the shots are averaged and used. If the horizontal and/or vertical standard deviation tolerances have been set in the GPS Tolerance menu ([GPS] [toL] [hsdev] and/or [vsdev]), the standard deviations are compared to the tolerance values. If the standard deviation tolerances are not met, you are prompted to decide whether to use or discard the results.

Figure 2-149  GPS Average Shots Screen

GPS Average Shots Screen Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>H RANGE</td>
<td>Displays the diagonal length of a box drawn around all the measurements.</td>
</tr>
<tr>
<td>V RANGE</td>
<td>Displays the farthest vertical distance between all the measurements.</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>H SDEV</td>
<td>Displays the horizontal standard deviation; 68% of the measurements are within this distance of the average. The lower the number, the closer together the measurements are.</td>
</tr>
<tr>
<td>V SDEV</td>
<td>Displays the vertical standard deviation; 68% of the measurements are within this distance of the average. The lower the number, the closer together the measurements are.</td>
</tr>
<tr>
<td>H ¥-3</td>
<td>Displays the distance from the average horizontal measurement to the last measurement collected. The number after “-” is the number of the measurement.</td>
</tr>
<tr>
<td>V ¥-3</td>
<td>Displays the distance from the average vertical measurement to the last measurement collected. The number after “-” is the number of the measurement.</td>
</tr>
<tr>
<td>use</td>
<td>Stops collecting measurements and uses measurements already taken. When REPS is set to 0, the GPS Average Shots screen averages measurements until the soft key is used. This allows you to take as many shots as you want.</td>
</tr>
<tr>
<td>Draw</td>
<td>Draws a scatter plot of all the measurements on the screen. No measurements are collected while in the Draw screen. Press any key to return to the GPS Average Shots screen.</td>
</tr>
<tr>
<td>Redo</td>
<td>Discards all measurements taken so far and starts over.</td>
</tr>
<tr>
<td>Abort</td>
<td>Discards all measurements and cancels the current operation.</td>
</tr>
</tbody>
</table>

## Reset Classic SMI

**PRODUCT: ALL**

**KEYSTROKES:** FILE > RESET CLASSIC SMI

This command can be used to recover from program problems. It is similar to pressing the reset switch under the rubber foot of the HP 48.

Reset may restore the default SMI keys. No job data or settings should be lost.

Refer to *When a Reset Might Help on page 353* for more information.
**Return (RTN)**

PRODUCT: ALL

KEYSTROKES: `c  RTN` (THE . KEY)

This function allows text to continue on the next line.

When keying in a note or Random Points file, it may be easier to read them on the screen if a return is inserted into the text when the characters approach the right edge of the screen.

This drops your text entry to the next line.

---

**Scale**

PRODUCT: ALL

KEYSTROKES: `CHG  NeXT  ADJST  SCALE`

KEY-IN: **SCALES**

COMMAND GROUP: OPTIONS

This key prompts for a scale factor. Enter 1 to disable the scale factor. When working with State Plane Coordinates, you may enter a scale factor here.

---

**Screen Plot**

PRODUCT: ALL

KEYSTROKES: `[RPTS] (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) SPLIT`

KEY-IN: **SPL**

COMMAND GROUP: RANDOM POINTS

Use this command to plot lines and points on the data collector display; lines are oriented so that north appears at the top of the display, and they are scaled to fit on the screen. Curves defined by "PC RP PT" are also plotted.
To view a graphic representation of the plat, including points, point number, and lines, tap **SPLOt** (screen plot) from the Random Points soft key menu.

To prevent lines drawn through certain points, enter those points into the Random Points file as negative numbers.

---

**Search For Prism (SRCH)**

PRODUCT: ROBOTIC

KEYSTROKES: **c TOPT** (THE 9 KEY)

KEY-IN: SRCH

COMMAND GROUP: TOTAL STATION

Press this button to have the instrument start searching for a prism.

---

**Select Coordinate System**

PRODUCT: ROBOTIC

KEYSTROKES: **GPS TOPT SPCS**

COMMAND GROUP: GPS

This command allows you to select the coordinate system for the current job, or to select a coordinate system in the Coordinate Conversion window after tapping the Add button. Turn on the SPCS check box if you only want to see State Plane Coordinate Systems listed in the Group combo box. Turn the SPCS check box off to see all available coordinate system groups. Select the desired coordinate system group and then select the name of the particular coordinate system. The coordinate system information section of the window shows a description, the datum of the current system and the units.
A quick way to browse through the groups or names is to select the combo box and press the up or down arrow keys. Pressing a letter key advances the current selection to the first item starting with that letter.

Most of the coordinate systems have a version for meters, US feet and International Feet. The group name ends with ‘F’ for US feet and the Units field shows FOOT. The group name ends with ‘I’ for International feet and the Units field shows IFOOT.

**Select Radio**

PRODUCT: ALL

KEY-IN: RADSEL

COMMAND GROUP: SETUP

This command allows you to select the radio you are using with your instruments.

Select a radio manufacturer and type so that the settings will be set appropriately.
**Send Chain to PC/Collector**

**PRODUCT:** CONSTRUCTION

**KEYSTROKES:**  
CONST NEXT CHAIN TOPC (PC) TO48 (COLLECTOR)

**KEY-IN:** PC: TOPCCH; COLLECTOR: TO48CH

**COMMAND GROUP:** CONSTRUCTION

This command is one way that you can receive or send a chain file from a computer running SMI Transfer. Tap <topc> to send the active chain to the PC. Tap <to48> to transfer a chain file from the PC to the collector. Within SMI Transfer, set the data collector format to v6 as this version only supported the transfer of one file at a time.

**Separate Distance and Angle (SDA)**

**PRODUCT:** ALL

**KEYSTROKES:**  
SDA (ALLEGRO L KEY, JETT a Y KEYS, TITAN M KEY), OR SETUP (ALLEGRO F KEY, JETT J KEY, TITAN G KEY) SDA

**KEY-IN:** SDA

**COMMAND GROUP:** COLLECT

This function allows you to enter a separate distance and angle, as well as offset distances, to store a point. This is useful when you are trying to shoot power poles, building corners, around trees or creek banks, and for determining elevations of (or distances to) inaccessible objects.

If your data collector is set for electronic data collection, the instrument takes a reading and collects the distance to the prism when you tap the SDA key. If your data collector is set for MAN2 collection, the display prompts you for slope distance, zenith angle, and angle right (horizontal angle).

If the HD keys are used, they should be used before the ZHA key.
When working with elevations, if you move the crosshair more than 1 foot vertically, the program gives the elevation at the crosshair (it zeroes the height of the rod).

The comment record (CM) in the raw data reports the height of instrument, height of rod, horizontal angle (reporting an angle right), zenith angle, and slope distance.

When selecting a Robotic or GPS instrument driver SMI automatically changes the POLE/INSTR toggle in the SRVO menu (a8). If you want this to work with the same pole/instrument relationship as with a standard total station, you need to manually set this value back to INSTR.

Once data has been collected (or manually entered), the Separate Distance and Angle menu displays.

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZHA</td>
<td>When not in GPS mode, this is the first soft key. It brings in the horizontal and zenith angles. The horizontal distance of the first shot taken when sdA was tapped is used with the new angles to calculate a new position. If the Zenith Angle is different by more than 1 foot, the height of rod is not used in the calculations. This allows a spot high above the prism to be pointed to on the second shot and you can get an accurate elevation without having to set the Height of Rod to 0. Pressing a ZHA instead of just ZHA does not take new angle measurements but uses the offset distances to move the shot taken when sdA was tapped.</td>
</tr>
<tr>
<td>Store</td>
<td>When in GPS mode, this is the first soft key. It stores the point measured when sdA was tapped with the offset distances applied.</td>
</tr>
<tr>
<td>hd↑</td>
<td>Adds the specified distance to the distance just measured. Key in the distance and tap hd↑.</td>
</tr>
<tr>
<td>hd↓</td>
<td>Moves the point toward the instrument the desired distance. Key in the distance and tap hd↓.</td>
</tr>
<tr>
<td>hd→</td>
<td>Moves the point to the right the desired number of feet. Key in the distance and tap hd→.</td>
</tr>
<tr>
<td>hd←</td>
<td>Moves the point to the left the desired number of feet. Key in the distance and tap hd←.</td>
</tr>
</tbody>
</table>

Figure 2-152 Separate Distance and Angle Submenu

Separate Distance and Angle Submenu Soft Key Definitions
**Example: Shooting a Tree**

1. Point the instrument to a prism at the side of the tree and press SDA.
2. Turn the instrument towards so that it is pointing to the center of the tree and tap ZHA.
   
   The distance and angle to the tree are stored as the point.

**Offset Method**

1. Point the instrument to a prism at the side of the tree (1) and tap SDA.
2. Type the radius of the tree and press the correct direction key: 5 HD−.
3. Press 5 ZHA to store a point in the center of the tree.
Example: Shooting a Utility Pole/Line

Figure 2-154  Shooting a Utility Pole/Line

1. Point the instrument to a prism at the front of the utility pole and tap SDA.
2. Point the instrument to the top of the utility pole or line.
3. Tap ZHA to store a point representing the top of the utility pole/line.

Servo Menu (SRVO)

PRODUCT: ALL

KEYSTROKES: a SRVO (THE 8 KEY)

KEY-IN: SERVO

COMMAND GROUP: TOTAL STATION

The Servo menu contains routines that are useful when using robotic instruments, as well as servo motor instruments and conventional total stations.
### Figure 2-155 Servo Menu

#### Servo Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FINE</strong></td>
<td>These are the same Coarse and Fine measure mode keys used in the <strong>INST</strong> menu and a <strong>[FINE]</strong> (the 1 key).</td>
</tr>
<tr>
<td><strong>CRS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>PRISM</strong></td>
<td>If the instrument driver supports it, you can switch between Prism mode and Reflectorless mode.</td>
</tr>
<tr>
<td><strong>REFL</strong></td>
<td></td>
</tr>
<tr>
<td><strong>LTON</strong></td>
<td>(ROBOTIC only). Toggles between the track light being on and off if the instrument driver supports it.</td>
</tr>
<tr>
<td><strong>LTOFF</strong></td>
<td></td>
</tr>
<tr>
<td><strong>AZ</strong></td>
<td>(ROBOTIC only). Allows you to enter an azimuth to which to turn the instrument. Alternatively, enter two numbers that define a direction. The zenith angle is assumed to be 90.</td>
</tr>
<tr>
<td><strong>FLOP</strong></td>
<td>(ROBOTIC only). Changes the face of the instrument.</td>
</tr>
<tr>
<td><strong>FS</strong></td>
<td>(ROBOTIC only). Controls whether the instrument turns to the foresight point when the <strong>FSPL</strong> or <strong>FS</strong> keys are used. This flag is turned on every time an instrument driver that has servo ability, but not robotic ability, is selected. Other instrument drivers turn this flag off when selected. Note that if Elevations are off, the instrument turns to a zenith angle of 90. If the difference in elevation between the occupied point and foresight point requires a zenith angle greater than 45° up or down, the zenith angle is set to 90 because this usually is caused by a point that does not have an elevation stored.</td>
</tr>
<tr>
<td><strong>FS®</strong></td>
<td></td>
</tr>
<tr>
<td><strong>POLE</strong></td>
<td>(ROBOTIC only). Determines whether left/right is from the instrument perspective or the rodman's perspective.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SRCH / SRCH®</td>
<td>(ROBOTIC only). Toggles between turning on and off Search mode, allowing you to start a search for the prism. This is useful when using robotic instruments at the instrument.</td>
</tr>
<tr>
<td>BRG</td>
<td>(ROBOTIC only). Allows you to enter a bearing to which to turn the instrument. The zenith angle is assumed to be 90.</td>
</tr>
<tr>
<td>HAZA</td>
<td>(ROBOTIC only). Turns the instrument to the angle right and zenith angle entered. If only one number is entered, it is assumed to be the angle right and the zenith angle is assumed to be 90°.</td>
</tr>
<tr>
<td>TOPT</td>
<td>(ROBOTIC only). Allows you to enter the point number to turn the instrument. The current backsight, HI, HROD, and occupied point are used in the calculation. If Elevations are off, or if the point has a zero elevation, the zenith angle is set to 90.</td>
</tr>
<tr>
<td>CDIR</td>
<td>(ROBOTIC only). Allows you to enter the compass azimuth from the rod to the instrument. The instrument turns to point to the rod.</td>
</tr>
<tr>
<td>CDECL</td>
<td>(ROBOTIC only). Allows you to enter the magnetic declination for use with the CDIR function.</td>
</tr>
</tbody>
</table>

**Set GPS Radio Port**

**PRODUCT:** ROBOTIC

**KEY-IN:** RADPORT

**COMMAND GROUP:** SETUP

The Set GPS Radio Port command tries to get the current radio port and baud rate from the GPS receiver as the command is starting. If communication is successful, the current radio port and baud rate are shown.
**Figure 2-156 Set GPS Radio Port Dialog Box**

**Set GPS Radio Dialog Box Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Port</td>
<td>Displays the current port being used by the radio.</td>
</tr>
<tr>
<td>New Port</td>
<td>Allows you to set the radio to the appropriate port.</td>
</tr>
<tr>
<td>Current Baud Rate</td>
<td>Displays the current baud rate being used for radio communications with the data collector.</td>
</tr>
<tr>
<td>New Baud Rate</td>
<td>Allows you to select the radio baud rate for radio communication.</td>
</tr>
</tbody>
</table>

**Set Radio Channel**

PRODUCT: ROBOTIC

KEY-IN: RADCHNL

COMMAND GROUP: SETUP

The Set Radio Channel command tries to get the current radio channel from the radio as the command is starting. If communication is successful, the current channel is shown.

Select a different channel and tap OK to set the new channel on the radio.
Set Radio Sensitivity

PRODUCT: ROBOTIC

KEY-IN: RADSENS

COMMAND GROUP: SETUP

The Set Radio Sensitivity command tries to get the current radio sensitivity from the radio as the command is starting. If communication is successful, the current channel is shown.

Use the radio buttons to select a different sensitivity and tap OK to set the new sensitivity on the radio.
**Settings**

PRODUCT: ROBOTIC

KEYSTROKES: FILE > SETTINGS

COMMAND GROUP: SETUP

This command opens the Settings dialog box.

![Settings Dialog Box](image)

**Figure 2-159  Settings Dialog Box**

**Settings Dialog Box Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentic 48 Speed</td>
<td>By default, this setting is off, as the program actually runs slower when this is toggled on. If this option is toggled on, <em>Classic SMI</em> matches the speed of the HP 48. This is generally only useful for performing sun shots where very accurate clock information is required.</td>
</tr>
<tr>
<td>Size of Storage File</td>
<td>Allows you to choose the size of the data file being used by <em>Classic SMI</em>. The data file is used to store all the jobs in current use. You can select from the following sizes: 256K, 512K, 1M, and 2M. A larger storage file size allows you to store more data (more points).</td>
</tr>
<tr>
<td>Wire</td>
<td>Allows you to select which serial port on the unit will be used for communications. By default, this setting is set to COM 1.</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Force baud rate to</td>
<td>Toggle on this option if you want to override the default baud rates used when communicating with an instrument or the PC. <em>Transfer</em> also has an option on the Settings tab to force the baud rate. Forcing the baud rate in both <em>Classic SMI</em> and <em>Transfer</em> allows baud rates as high as 115200 to be used. Setting this option correctly is important for being able to communicate.</td>
</tr>
<tr>
<td>Flow Control</td>
<td>If this option is toggled on, the RTS serial port line is enabled. Communicating with devices that require hardware flow control is not possible unless this option is turned on. Most devices do not require hardware flow control.</td>
</tr>
<tr>
<td>StarFire</td>
<td>This button contains a number of <em>SMI Flex GPS</em> StarFire type functions: RTK Extend (RTG Backup of RTK is Quality 5 otherwise it is Quality 4), ITRF Displacement Vectors, and QuickStart Values.</td>
</tr>
</tbody>
</table>

---

**Setup Menu (SETUP)**

**PRODUCT:** ALL

**KEYSTROKES:** [SETUP] (ALLEGRO F KEY, JETT J KEY, TITAN G KEY)

**KEY-IN:** SETUP

**COMMAND GROUP:** SETUP

This menu key allows you to enter setup parameters for side shots and traverses; it also contains routines for specialized side shots. The Setup menu includes various soft keys which may vary depending upon the version of the program you have (e.g., ROBOTIC only). Tap [NeXT] to scroll through the soft key menus.
Figure 2-160 Setup Menu

Setup Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bkpt</td>
<td>Creates a back azimuth based on the inverse between the current occupied point and the backsight point entered. Pressing a bkpt prompts for a backsight point number, takes a reading on the back point, and gives data as though you were staking the point. The purpose is to make sure this is the right backsight point. If the instrument is turned on, it takes a reading on the prism on the backsight point and displays any discrepancy. This is automatically stored to the raw data file, even if Raw Data is turned off.</td>
</tr>
<tr>
<td>Ocpy</td>
<td>Occupies a point in the current job. Enter the desired point number and tap this key to occupy that point, or tap this key first, and you will be prompted for a point number.</td>
</tr>
<tr>
<td>Note</td>
<td>Allows you to place a note at the last point stored, even if note prompting is off. This key can also be used to enter a note for any point that has been previously stored. Key in the point number before tapping note.</td>
</tr>
<tr>
<td>Hi</td>
<td>Stores the height of the instrument. This key is blank if Elevations are turned off. Press a Elev (the 3 key) to toggle Elevations mode.</td>
</tr>
<tr>
<td>Hrod</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off. If you wish to be prompted for HROD after the shot is taken, press CHG NeXT input hrod. To toggle this feature off, tap hrod again.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| Sda    | Allows you to electronically take separate distance and angle measurements for a point. See Separate Distance and Angle on page 205.  
  * Shortcut: SDA (Allegro L key, JETT a Y keys, Titan M key). |
| 2PFS   | Turns on Two-Point Free Station Resection. This function is also used for Multiple Point Free Station Resection. See Two-Point Free Station on page 271.  
  * Shortcut: 2PFS (Allegro H key, Titan I key). |
| BM     | Brings a benchmark elevation to the occupied point. See Benchmark Menu on page 38. |
| SHOTS  | Allows you to make multiple shots to the same point, or to multiple points, either directly or with a flopped scope. See Shots on page 219.  
  * Shortcut: SHOTS (Allegro M key, JETT c T keys, Titan N key). |
| ~PT    | Used with ~PT to create a point at the intersection of angle measurements from two different occupied locations. Coordinates and elevations may be collected from the remote points without a prism.  
  From one instrument location, use ~PT to store angles to a point (or points), such as towers, bridge abutments, road centerlines, fence lines, etc. The coordinates of the occupied point are stored in the next number and the Horizontal Angle is stored in the note with a tag. See Angle Point and Intersection Point on page 26.  
  | XPT    | Sight on the point shot using ~PT, move the instrument to a new location, tap this soft key. If a point number is not entered before tapping XPT, it is assumed that the first point shot using ~PT is being pointed again. To shoot points out of order, type the point number assigned by ~PT at that location before tapping XPT. XPT calculates the coordinates and elevation of the remote and stores it in the same point number that ~PT used. See Angle Point and Intersection Point on page 26. |
| ZERO   | Zeroes the horizontal angle in most electronic total stations.  
  * Shortcut: 0. |
<p>| INST   | Allows you to select an instrument or select manual data entry using one of two manual entry methods. See Instruments on page 140. |
| MBS    | Shoots a backsight point directly and with the scope flopped. These two measurements are meaned to recreate the elevation of the occupied point. See Mean Backsight on page 159. |</p>
<table>
<thead>
<tr>
<th><strong>Option</strong></th>
<th><strong>Function</strong></th>
</tr>
</thead>
</table>
| **TRIG**  | Allows for trig leveling on a shot. See *Trigonometric Leveling on page 266.*  
*Shortcut:* **TRIG** *(Allegro N key, JETT E 8 keys, Titan O key).* |
| **BKAZ**  | Sets the back azimuth to the backsight point. See *Backsight Azimuth on page 33.* |
| **BKBR**  | Stores the back bearing. After entering the bearing, you are prompted for the quadrant (NE = 1, SE = 2, SW = 3, NW = 4). If you want to enter the quadrant with the bearing, key it in as the first digit of the bearing (e.g., S 69°35'14" W would be entered as **369.3514**). See *Backsight Bearing on page 34.* |
| **RAWD**  | Displays the raw shot data from the last shot taken. This option is available only when data is gathered using either MAN2 (manual entry method 2 – see *Instruments on page 140*) or electronic entry. |
| **Azpt**  | Stores a direction without a prism. This command stores a point by using the horizontal circle of the instrument, next available number, and distance of 234.0123. The distance stored is always 234.0123.  
*To remotely locate points with north, east, and elevation points without a prism, see *Angle Point and Intersection Point on page 26.* |
| **brg®/az®/~rT/coor®** | Switches modes between 4 different styles of display after taking a shot. You can choose between bearing, azimuth, angle right, and coordinate. |
**Shots Menu (SHOTS)**

PRODUCT: ALL

KEYSTROKES: **SHOTS** (ALLEGRO M KEY, JETT T KEYS, TITAN N KEY) OR **SETUP**

KEY-IN: **SHOTS**

COMMAND GROUP: COLLECT

This command allows you to take multiple sets of angles and distances to one or more points, mean them, convert these meaned angles and distances to coordinates, and store them by point number as side shots. If multiple angles are taken to one point, the point may be stored as a side shot or traverse point.

Any number of sets can be used. A set is defined as direct and reverse readings to one or more points. In some cases, a reverse is not desired, such as when there is a top-mounted electronic distance meter. In this case, you define a set as a direct reading only.

**SHOTS** not only improves the accuracy of your northing and easting coordinates, but elevations as well. **SHOTS** computes the elevations more accurately than if you had only recorded a single side shot. If you are using tripods or different prism heights, you should enter a rod height for each point separately. However, the rod height cannot be entered until some shots have been read. To enter the rod height of each point being shot, press **SETUP** **NEXT** **SHOTS** **EVAL** **pTROD**. You will be prompted for the point number.

When taking shots, you will see something like this near the center of the display: **NN DIR 17 REV 16**.

This indicates that you can either take another direct on the next point (17), or if you have finished taking direct readings, you can take the reverse on the same point (16). If you prefer to not comply with the suggestion, key in the proper point number and tap **SHOT**. To see the errors, tap **EVAL** error.

If you exit the Shots menus and you have not used **STPTS** to store the point or points, press **SETUP** **NEXT** **SHOTS** to get back into the display. As long as **STPTS** is not tapped, the shots is not lost.

If you have tapped **STPTS** and press **SETUP** **NeXT** **shots**, the variables are erased. After **STPTS** has been tapped, if you wish to go to Shots without erasing the variables, press **a** **SHOTS**.

If you have not tapped **STPTS** and you wish to erase the shot values anyway, press **c** **SHOTS**.
Once the shots have been taken, you can evaluate each reading to each point in each set. If you are uncomfortable with a reading, you may re-shoot any point in any set, either direct or reverse. You can then reevaluate the readings. Once you are pleased with each reading, tap STPTS to store the mean of all data in all points. The mean of all angles and distance to each point is stored as a side shot.

If you prefer to traverse to one of these points, use the Point Traverse command. Run this command from a Command Favorites menu or the command keys. You can also run it by keying in the point number and pressing ALPHA, typing PTRVR, and pressing !.

**Shots Menu**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZERO</td>
<td>Sets the horizontal angle in the instrument to zero. Zeroing the instrument is optional. Some instruments cannot be zeroed from the data collector using this key. In this case, you may choose to zero from the instrument. BS is used to take a backsight reading whether the scope is direct or reverse. If the instrument has been zeroed, tapping this key with the scope direct is optional if not using the AUTO function.</td>
</tr>
<tr>
<td>BS</td>
<td>Reads the horizontal angle only to the backsight point. A prism is not required for the backsight point unless using the AUTO key.</td>
</tr>
<tr>
<td>SET1</td>
<td>The default beginning set. Once SET1 is finished, tap SET2 to increment to SET2. Tapping SET2 increments to SET3, etc. If you wish to go to a specific set, key in the set number then tap the SET key. For example, if you are on SET4 and you wish to go to SET2, key in 2 and tap SET4. The soft key switches to SET2 and decrements to the previous set.</td>
</tr>
<tr>
<td>EVAL</td>
<td>If one or more sets are shot, tap this key to the angles and distance(s) direct and reverse, as well as the meaned angles and distance. Refer to Shots Evaluation Menu on page 222.</td>
</tr>
</tbody>
</table>

---

Do not use ZERO after you have started taking readings.
<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZPT</td>
<td>Allows you to take multiple angles on a point far away without a prism. It operates like any other point using &lt;SHOT&gt;, except a prism is not needed and a specific distance is always stored. The distance is 234.0123. &lt;AZPT&gt; is also found under &lt;SETUP&gt; . NeXT. At this location, it is used for taking a single side shot to establish the direction to a point without a prism. The distance is always 234.0123.</td>
</tr>
<tr>
<td></td>
<td>This function was suggested by Charles Elam of Lincolnton Georgia.</td>
</tr>
<tr>
<td></td>
<td>To remotely locate points with north, east, and elevation points without a prism, see Angle Point and Intersection Point on page 26.</td>
</tr>
<tr>
<td>SHOT</td>
<td>Allows you to take both direct and reverse readings to foresight points when taking multiple angle and distance readings. If a specific point is entered before &lt;SHOT&gt; is tapped, then the reading is taken for the specified point. Each time &lt;SHOT&gt; is tapped, it first determines whether it is a direct or reverse face shot. It then collects the shot information and assigns that shot to a point number in the current set. The point number shown after DIR in the Shots Menu display is the point where the Shots program thinks the next direct shot will be taken. REV in the display is the point number where the program thinks the next reverse shot will be taken. These point numbers are especially important to watch when taking shots to multiple points at the same time. If the point numbers shown in the display are not where you want to take the next shot, type the correct point number before tapping &lt;shot&gt;. If the next point number is zero when &lt;SHOT&gt; is tapped, you are prompted to enter the point number.</td>
</tr>
<tr>
<td>FSOPT</td>
<td>Provides a list of soft keys that let you choose which angles and distances will be used in the Multiple Angles program. Refer to Foresight Options on page 222.</td>
</tr>
<tr>
<td>AUTO</td>
<td>This option is only available with robotic instruments. After using &lt;ZERO&gt; BS &lt;shot&gt; to take the first shots on the backsight and foresight points, enter the total number of sets to be taken and the data collector controls the robotic instrument to turn the remaining sets. See Auto Shots in the SMI Version 8 User Guide for additional information.</td>
</tr>
<tr>
<td>FLOP</td>
<td>This is only available with servo instruments. The instrument reverses face.</td>
</tr>
</tbody>
</table>

This function was suggested by Charles Elam of Lincolnton Georgia.
Foresight Options

Each of these options are toggles. If the box is displayed, the function is active. If the box is not displayed, the function is not active. Note that the default is on for all, except the slope distance reversed. You may wish to turn this on by tapping \texttt{sdR} once.

\textbf{Figure 2-162 Foresight Options Menu}

\textbf{Foresight Options Menu Soft Key Definitions}

\begin{tabular}{|l|l|}
\hline
Option & Function \\
\hline
\texttt{HA} & Displays the horizontal angle. \\
\texttt{ZA} & Displays the zenith angle. \\
\texttt{SD} & Displays the slope distance. \\
\texttt{HAR} & Displays the horizontal angle reversed. \\
\texttt{ZAR} & Displays the zenith angle reversed. \\
\texttt{sdR} & Displays the slope distance reversed. \\
\hline
\end{tabular}

\textbf{Shots Evaluation Menu}

\texttt{SHOW ERROR DELS DELPT PTRD STPTS}

\textbf{Figure 2-163 Shots Evaluation Menu}
## Shots Evaluation Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
</table>
| **SHOW** | Displays the angles and distances direct and reverse, as well as the mean of these angles and distances.  
  ◊ If you have more than one point being used to take multiple readings, each time **show** is tapped, a new point is displayed. If **SHOW** is tapped one more time after the last point is displayed, the point number is rotated back to the first point. To see the readings for a specific point, key in the point number before you tap **SHOW**. |
| **ERROR** | Displays the mean error deviation for each point shot. Tapping **ERROR** increments just as **SHOW**. Each time you tap **ERROR**, the error for the next point number is displayed. To find the errors of a specific point, key in the point number and tap **ERROR**. |
| **DELS** | Allows you to delete any shot for the current point shown. Tap **SHOW** until the point containing the shot is displayed. The shots are numbered sequentially as shown on the screen. This means that to delete the reverse shot in the second set, enter 4 before tapping **DELS**. Each set has two shots and the reverse shot is listed after the direct shot, so 4 is the correct number.  
  ◊ If a shot is not acceptable, it is not necessary to delete it. You can just re-shoot it. For example, to re-shoot point 16 reversed, tap **NeXT** (or **SETUP** **NeXT** **a** **SHOTS**), key in 16, reverse the scope, and tap **SHOT**. Now tap **EVAL** and **show** until 16 is displayed. |
| **DELPT** | Allows you to delete an entire point from the list of points on which you are taking readings. |
| **PTROD** | Allows you to enter the rod height for each point. To go to a specific point, key in the point number before tapping **PTROD**. |
| **STPTS** | When all angles are turned and acceptable, tap this key and the mean of each angle and distance to each point is used to convert to coordinates and be stored as side shot points. If data was collected for only one point, you are prompted to choose whether to store it as a side shot or traverse. Before **STPTS** is tapped, just tapping **SHOTS** retains the old values.  
  ◊ If you wish to go back to Shots without deleting these values, press **a** **SHOTS**. |
**Example: Record Multiple Angles to a Single Point**

There are two popular methods to recording a set of angles to a point.

- Method 1 (BS-FS-FS-BS) involves taking two separate direct observations to each target, then flopping the scope and taking the final two observations with the scope inverted, or in Face 2.

- Method 2 (BS-BS-FS-FS) takes both direct and indirect shots to one target before moving to the next target. The first shot taken for each observation is also shot in direct mode, or Face 1.

**Method 1**

You should be occupying a point and backsighting a point.

1. Turn the scope to the backsight point and tap BS.
2. Turn the scope to the foresight point and tap SHOT.
3. Reverse the scope and tap SHOT.
4. Turn the scope to the backsight point and tap BS.
5. Tap SET1.
   
   The soft key switches SET2.
6. Repeat steps 1 through 5. Perform as many sets as you wish.
7. Tap EVAL, re-shoot any bad readings, and tap STPTS.

You now have the option of storing the point as a side shot or traverse point.

**Method 2**

You should be occupying a point and backsighting a point.

1. Turn the scope to the backsight point and tap BS.
2. Reverse the scope to the backsight and tap BS.
3. Turn the scope to the foresight point and tap SHOT.
4. Reverse the scope to the foresight and tap SHOT.
5. Tap \texttt{SET1}.

The soft key switches \texttt{SET2}.

6. Repeat steps 1 through 5. Perform as many sets as you wish.

7. Tap \texttt{EVAL}, re-shoot any bad readings, and tap \texttt{STPTS}.

You now have the option of storing the point as a side shot or traverse point.

\textbf{Replacing a Bad Shot}

If you find a point that has a direct or reverse in a set that is outside your tolerance, it can be deleted and re-shot. Values that exceed the tolerance have a small arrow next to the value. However, it is not necessary to delete it. You can just re-shoot it. Suppose you wish to re-shoot the direct reading for set 2 on point 25:

1. Tap \texttt{\textlangle NeXT \textrangle exit}. (If you have exited the Shots program, press \texttt{SETUP \textlangle NeXT \textrangle a \textlangle shot \rangle}.)

2. Key in 2 and tap the SET key (not necessary if it is showing \texttt{\textlangle SET2 \textrangle}).

3. Point the instrument in the direct position at point 25.

4. Key in 25 and tap \texttt{SHOT}.

The values for the direct shot in set 2 to point 25 are replaced with the new reading.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure2-164.png}
\caption{Multiple Angles to Multiple Points (SHOTS)}
\end{figure}
In the illustration, the instrument is occupying 1 and backsighting 2. You zeroed the instrument on point 2.

When taking shots, there is a prompt in the middle of the display that indicates an expected point direct or reverse.

![Image](image_url)

**Figure 2-165  Replacing a Bad Shot Example Display**

For example, in the screen display above, you see NN DIR 22 REV 0. This means you can turn the instrument scope to direct, point at 22, and tap **SHOT**. Since the display shows REV 0, if you take a reading in the reverse position, **SMI** prompts for the point number. However, you can point the instrument at any point at any time in direct or reverse, key in the correct point number that you are sighting, and tap **SHOT**. The data will be collected for that point.

**Example: Record Multiple Angles to Multiple Points**

There are two popular methods to recording a set of angles to multiple targets.

- Method 1 involves taking all the direct observations to each target first, then flopping the scope and taking the second set of observations with the scope inverted, or in Face 2 (BS-FS-FS-BS).

- Method 2 takes both direct and indirect shots to one target before moving to the next target. The first shot taken for each observation is also shot in direct mode, or Face 1 (BS-BS-FS-FS).

**Method 1**

If using a Robotic version of the program in conjunction with either a robotic total station or a GPS unit, you can use **AUTO** after the first five steps and all the other shots will be taken automatically.

1. Point the instrument at 2 and tap **ZERO** **bS**.
2. Point the instrument at 22 and tap **SHOT**.

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Figure 2-166  Taking the Shot at Point 22

3. Point the instrument at 23 and tap \texttt{SHOT}.

4. Point the instrument at 24 and tap \texttt{SHOT}.

5. Point the instrument at 25 and tap \texttt{SHOT}.

6. Reverse the scope.

7. Point the instrument at 25 and tap \texttt{SHOT}.

8. Point the instrument at 24 and tap \texttt{SHOT}.

9. Point the instrument at 23 and tap \texttt{SHOT}.

10. Point the instrument at 22 and tap \texttt{SHOT}.

11. Point the instrument at 2 and tap \texttt{SHOT}.

12. With the scope still reversed, tap \texttt{SHOT}.

   The soft key changes to \texttt{SET2}.

13. Point the instrument at 2 and tap \texttt{BS}.

14. Point the instrument at 22, key in 22, and tap \texttt{SHOT}.

15. Point the instrument at 23 and tap \texttt{SHOT}.

16. Point the instrument at 24 and tap \texttt{SHOT}.

17. Point the instrument at 25 and tap \texttt{SHOT}.

18. Flop the scope to direct.

19. Point the instrument at 25 and tap \texttt{SHOT}.
20. Point the instrument at 24 and tap **SHOT**.

21. Point the instrument at 23 and tap **SHOT**.

22. Point the instrument at 22 and tap **SHOT**.

23. Point the instrument at 2 and tap **BS**.

   Additional sets may be taken as needed.

24. Tap **eVAl** and **SPTS**.

   Each point is stored as a side shot.

   To traverse to one of these points, key in the point number, press **[ALPHA]** and key in **PTRVR**.

### Method 2

1. Point the backsight (point 2) direct and tap **BS**.

2. Reverse the scope, point the backsight (point 2), and tap **BS**.

3. Turn to point 22, key in **22**, and tap **SHOT**.

4. Flop the scope (to direct), point 22, key in **22**, and tap **SHOT**.

5. Turn to point 23, key in **23**, and tap **SHOT**.

6. Flop the scope (to reverse), point 23, key in **23**, and tap **SHOT**.

7. Turn to point 24, key in **24**, and tap **SHOT**.

---

**SMI** tries to predict the point number and the face (direct or reverse) you are shooting next (**NN DIR 23 REV 22**). If you wish to take a reading to a point that **SMI** does not predict correctly, key in the point number before tapping **SHOT**.

---

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8. Flop the scope (to direct), point 24, key in 24, and tap \texttt{SHOT}.

9. Turn to point 25, key in 25, and tap \texttt{SHOT}.

10. Flop the scope (to reverse), point 25, key in 25, and tap \texttt{SHOT}.

11. Tap \texttt{SET1}.

   The soft key changes to \texttt{SET2}.

12. Point the backsight (point 2) direct and tap \texttt{BS}.

13. Reverse the scope, point the backsight, and tap \texttt{BS}.

14. Turn to point 22, key in 22, and tap \texttt{SHOT}.

15. Flop the scope (to direct), point 22, key in 22, and tap \texttt{SHOT}.

16. Turn to point 23, key in 23, and tap \texttt{SHOT}.

17. Flop the scope (to reverse), point 23, key in 23, and tap \texttt{SHOT}.

18. Turn to point 24, key in 24, and tap \texttt{SHOT}.

19. Flop the scope (to direct), point 24, key in 24, and tap \texttt{SHOT}.

20. Turn to point 25, key in 25, and tap \texttt{SHOT}.

21. Flop the scope (to reverse), point 25, key in 25, and tap \texttt{SHOT}.

   Additional sets may be taken as needed by tapping \texttt{SET2} (\texttt{SMI} increments to \texttt{SET3}), and repeating these steps.

22. When satisfied with the results, tap \texttt{EVAL STPTS}.

   Each point is stored as a side shot.

   To traverse to one of these points, key in the point number, press \texttt{ALPHA}, and key in \texttt{PTRVR}.

   At any time while taking shots, you can tap \texttt{EVAL} to see the results of the angles.

   You can tap \texttt{SHOW} to increment the point number.
23. Tap \texttt{SHOW} to increment to 25 then back to 22.

To show a specific point number, key in the point number before tapping \texttt{SHOW}.

24. Tap \texttt{ERROR} to see the errors in angles and distances for each point.

25. Tap \texttt{ERROR} again to increment back to point 22.

\textit{Close Horizon}

For those that had used a command called Close Horizon (CH) to record sets of angles, proceed through the following steps to get the same results.

1. Zero on the backsight point.

2. Turn to the foresight point and tap \texttt{SHOT}.

3. Flop the scope, zero on the foresight point (optional now), and tap \texttt{SHOT}.

4. Turn to the backsight point and tap \texttt{BS}.

   This is one set.

5. Go to set 2 and repeat steps 1 through 4 or go to step 6.

6. Tap \texttt{EVAL STPTS}.

---

\textbf{Side Shot (SIDS)}

\textbf{PRODUCT: ALL}

\textbf{KEYSTROKES:} SIDS (ALLEGRO J KEY, JETT M KEY, TITAN K KEY)

\textbf{KEY-IN:} 48SI DESHOT

\textbf{COMMAND GROUP: COLLECT}

This function/menu key allows you to electronically or manually take a single horizontal angle, zenith angle, and slope distance to a point; convert to coordinates; and store by point number without changing the occupied point and backsight point.
You can record survey data either electronically using an instrument or you can key in the data manually using a manual driver.

When an instrument driver has been selected, pressing SIDS electronically collects the horizontal angle, zenith angle and slope distance; converts to coordinates; and stores by point number. After the data is collected in the electronic mode, the Setup menu is displayed on the soft keys for additional data entry options.

To choose an instrument, press SETUP NeXT NeXT INST and choose your brand. You may need to tap NeXT to find your instrument brand. Choose the model by tapping the appropriate soft key. For further information about instruments, see Instrument Reference, which begins on page 364.

When an instrument is not chosen or you are using a manual instrument driver, pressing SIDS displays soft keys for manual entry. To configure the data collector for manual entry only, press SETUP NeXT INST MAN1 or MAN2. To temporarily switch to manual entry, press 5. This turns the instrument flag (the I symbol at the top of the display) off. Now press SIDS for manual entry. To turn the instrument (I symbol) on again, press a 5. SIDS now electronically collects again.

If you are using MAN1, pressing SIDS displays the Side Shot Direction menu. You may enter the value first and then tap the soft key; or tap the soft key and you will be prompted to key in the value and press !.

If you are using MAN2 and you press SIDS, you are prompted for slope distance, zenith angle, and angle right. Key in the appropriate values (separated by a space - the SPACE key) and press ! to convert the angles and distance to coordinates stored by point number.

To change the order of data entry in manual mode, press CHG NeXT INPUT DZH. The soft key toggles to HZD. Now instead of being prompted for SDIST, ZENITH ANGLE, and ANGLE RT, you are prompted for ANGLE RT, ZENITH ANGLE, and SDIST.

### Side Shot Direction Menu

<table>
<thead>
<tr>
<th>&amp;RT</th>
<th>&amp;Z</th>
<th>BRG</th>
<th>DEF &amp;</th>
<th>H</th>
<th>I</th>
<th>ADD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NeXT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| BKPT | DCPV | NOTE | REP | BRG | |

*Figure 2-168 Side Shot Direction Menu*
### Side Shot Menu Direction Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>~RT</td>
<td>Allows you to enter an angle right. For angle left, key in the angle, press +/- and tap ~RT.</td>
</tr>
<tr>
<td>AZ</td>
<td>Allows you to enter an azimuth. Enter two point numbers if you want to use the inverse between those points as the azimuth to the next point. Tap AZ to see the last azimuth. Tap DEF~ to use this value as the new azimuth. Press HI to put the last azimuth on the stack. Then you can add or subtract to the azimuth using the HMS+ or HMS- commands found in the Trig Functions.</td>
</tr>
<tr>
<td>BRG</td>
<td>Allows you to enter a bearing. After entering the bearing, you are prompted for the appropriate quadrant (NE=1, SE=2, SW=3, NW=4). An optional way to enter bearing and quadrant is to enter the quadrant as the first digit of the bearing (e.g., you would key in a bearing of S 23° 11’12” W as 323.1112 and tap BRG).</td>
</tr>
<tr>
<td>DEF~</td>
<td>Allows you to enter a deflection angle to the right. Key in a negative number to enter a deflection angle to the left. Key in the number first, then use the +/- key, rather than the minus key, to change to a negative number. After a direction has been entered, the angle is presented at the top of the display. Also shown is the Side Shot Distance Menu, allowing you enter a distance. See Side Shot Distance Menu on page 233.</td>
</tr>
<tr>
<td>HI</td>
<td>Allows you to enter the height of the instrument. HI is defined as the vertical distance from the point under the instrument to the axis of the scope on the instrument. To change the last height of the instrument, key in the new HI and tap HI. When Elevations are on, the current height of the instrument is displayed.</td>
</tr>
<tr>
<td>HROD</td>
<td>Allows you to enter a new height of rod. This key is blank when Elevations are off. You may choose to have the HROD prompt each time you take a shot. This allows you to take a reading before you enter the HROD. To use this option, press CHG</td>
</tr>
<tr>
<td>BKPT</td>
<td>Allows you to enter a backsight point. The backsight azimuth is calculated based on the current occupied point when this key is tapped.</td>
</tr>
<tr>
<td>CCPY</td>
<td>Allows you to occupy a point with the data collector. If a back point has been entered, the back azimuth is automatically updated.</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>Allows you to enter a note for the last point stored. After you tap this soft key, the display prompts you to enter a note. The alpha keyboard is turned on automatically. A note can be stored at any time at any point number that exists. If a point number is keyed in before <strong>NOTE</strong> is tapped, you will see <strong>NOTE FOR POINT 123</strong> (if you pressed 123 before you pressed <strong>SETUP</strong> and <strong>NOTE</strong>). Key in the note and press !. The note is stored at the specified point. If no number is keyed in first, the note is stored at the last point number stored or staked.</td>
</tr>
<tr>
<td><strong>REP</strong></td>
<td>Repeats the last direction and distance to store another side shot. If this key is tapped while in Traverse mode, it uses the last direction and distance to create a traverse point. See <strong>Traverse on page 264</strong>.</td>
</tr>
<tr>
<td><strong>BRG¾ / AZ¾ / ~RT¾ / COOR¾</strong></td>
<td>This is a toggle key that lets you switch between the four methods of angle display: bearing, azimuth, angle right, and coordinates.</td>
</tr>
</tbody>
</table>

**Side Shot Distance Menu**

Once you have entered a direction using the MAN1 driver, the display prompts you to enter a distance.

$\triangle RT \quad AZ \quad BRG \quad DEG \quad H \quad I \quad H \quad RDOO$

*Figure 2-169 Side Shot Distance Menu*
## Side Shot Menu Distance Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HDIST</strong></td>
<td>Allows you to enter a horizontal distance. Key in the desired value before tapping the soft key, or enter two point numbers separated by a space to use the inverse between them as the horizontal distance to the next point. To use the last horizontal distance, tap <strong>HDIST</strong> before entering a value; the last value used displays on the command line. Press ! to save the value as the current horizontal distance. After the distance has been entered, a point is stored, and you are returned to the Side Shot menu. Pressing c <strong>HDIST</strong> displays the last horizontal distance on the stack. Press a <strong>HDIST</strong> to enter feet and inches instead of decimal feet. You are prompted for FEET INCH NUM DEN. Enter the feet, inches, numerator of the fraction of an inch, and denominator of the fraction of an inch separated by spaces. If there is no fraction, just enter the feet and inches. Example: Traverse North 30 East for 28 feet, 41/2 inches. Press <strong>TRAV</strong> Key in 30 and tap <strong>AZ</strong>. Press c <strong>HDIST</strong>. You are prompted for FEET INCH NUM (numerator) DEN (denominator). Key in 28 SPACE 4 SPACE 1 SPACE 2 and press ! The distance is converted to a decimal value and displayed as DIS: 28.3750. The numerator and denominator are optional. For example, if you only have 28 feet and 6 inches, you may enter 28 SPACE 6 and tap <strong>HDIST</strong>. This is converted to 28.5 feet.</td>
</tr>
<tr>
<td><strong>SDIST</strong></td>
<td>Allows you to enter a slope distance. Key in the desired value before tapping the soft key. To use the last slope distance, tap <strong>SDIST</strong> before entering a value; the last value used displays on the command line. Press ! to save the value as the current slope distance.</td>
</tr>
<tr>
<td><strong>Z~</strong></td>
<td>Allows you to enter a zenith angle. Key in the desired value before tapping the soft key. A zenith angle is an angle where straight up is zero, and horizontal (level) is 90 degrees or 270 degrees. To use the last zenith angle, tap <strong>Z~</strong> before entering a value; the last value used displays on the command line. Press ! to save the value as the current zenith angle.</td>
</tr>
<tr>
<td><strong>V~</strong></td>
<td>Allows you to enter a vertical angle. Key in the desired value before tapping the soft key. A vertical angle is an angle where the horizontal (level) is zero. Pointing down below level is negative and above level is positive. To use the last vertical angle, tap <strong>V~</strong> before entering a value; the last value used displays on the command line. Press ! to save the value as the current vertical angle.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>[IC@PI]</td>
<td>This function assumes that the occupied point is on a Point of Intersection (PI) of a curve. The backsight is assumed to be back along the tangent toward the Point of Curvature (PC). The angle entered in the previous side shot or Traverse menu is assumed to be on the tangent toward the Point of Tangency (PT). When [IC@PI] is tapped, the delta is calculated based on these assumptions and a new menu is shown to allow the entry of one more attribute of the curve. After entering that value, the Side Shot Distance menu is restored to allow the entry of the distance of the side shot. When the distance is entered, the following points are calculated and stored in the order shown: PC, Radius Point, PT, and Side Shot. This routine is usually used in the Traverse menu to traverse from PI to PI and store the curve points as the traverse progresses. See Insert Curve at Point of Intersection While Traversing on page 88 for additional information.</td>
</tr>
</tbody>
</table>

---

**SMI Mode**

**PRODUCT:** ALL

**KEY-IN:** K

This function is used to reassign the default SMI keys if the system had reassigned them to the HP 48 Calculator Mode. The screen you will see if you are in calculator mode, will look like the following.

```
< HOME CDGO DOT:CRD >
```

*Figure 2-170 HP 48 Calculator Mode*

When you see this screen and your SMI commands do not work, simply press [ALPHA] K [ALPHA] to be taken back into the SMI mode.

To enter the calculator mode, press [ALPHA] QUIT.
Soft Key Menus

PRODUCT: ALL

KEY-IN: MENU

This function allows for manual loading of a specified soft key menu.

Using the table below, type the number of the menu you wish to load and press ![enter]. Then, type **MENU** and press ![enter]. The desired soft key menu is then activated.

<table>
<thead>
<tr>
<th>Menu #</th>
<th>Menu Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Last Menu</td>
</tr>
<tr>
<td>1</td>
<td>CST</td>
</tr>
<tr>
<td>2</td>
<td>VAR</td>
</tr>
<tr>
<td>3</td>
<td>MTH</td>
</tr>
<tr>
<td>4</td>
<td>MTH VECTR</td>
</tr>
<tr>
<td>11</td>
<td>MTH LIST</td>
</tr>
<tr>
<td>12</td>
<td>MTH HYP</td>
</tr>
<tr>
<td>13</td>
<td>MTH PROB</td>
</tr>
<tr>
<td>14</td>
<td>MTH REAL</td>
</tr>
<tr>
<td>21</td>
<td>MTH CONS</td>
</tr>
<tr>
<td>28</td>
<td>EDIT</td>
</tr>
<tr>
<td>30</td>
<td>SOLVE ROOT SOLVR</td>
</tr>
<tr>
<td>42</td>
<td>UNITS CATALOG</td>
</tr>
<tr>
<td>Menu #</td>
<td>Menu Name</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>43</td>
<td>UNITS LENG</td>
</tr>
<tr>
<td>44</td>
<td>UNITS AREA</td>
</tr>
<tr>
<td>45</td>
<td>UNITS VOL</td>
</tr>
<tr>
<td>46</td>
<td>UNITS TIME</td>
</tr>
<tr>
<td>47</td>
<td>UNITS SPEED</td>
</tr>
<tr>
<td>48</td>
<td>UNITS MASS</td>
</tr>
<tr>
<td>49</td>
<td>UNITS FORCE</td>
</tr>
<tr>
<td>50</td>
<td>UNITS ENRG</td>
</tr>
<tr>
<td>51</td>
<td>UNITS POWR</td>
</tr>
<tr>
<td>52</td>
<td>UNITS PRESS</td>
</tr>
<tr>
<td>53</td>
<td>UNITS TEMP</td>
</tr>
<tr>
<td>54</td>
<td>UNITS ELEC</td>
</tr>
<tr>
<td>55</td>
<td>UNITS ANGL</td>
</tr>
<tr>
<td>56</td>
<td>UNITS LIGHT</td>
</tr>
<tr>
<td>57</td>
<td>UNITS RAD</td>
</tr>
<tr>
<td>58</td>
<td>UNITS VISC</td>
</tr>
<tr>
<td>59</td>
<td>UNITS Commands</td>
</tr>
<tr>
<td>73</td>
<td>STACK</td>
</tr>
</tbody>
</table>
Additional menus covering programming and advanced functions are available. Contact SMI for a complete listing.

Sort Stakeout Points

PRODUCT: ALL

KEYSTROKES: RPTS NeXT NeXT STAK

The STAK function searches the Random Points file for points within a given distance from the occupied point. The resulting Random Points file can be sorted by either distance from the occupied point or the angle from zero.

Example: Staking Certain Points in Sequence

As an example, suppose that you want to stake all the IPS (Iron Pin Set) points in sequence from your occupied point 4. You should go to the RPTS menu and enter the points or range of points to be staked. In this example, you will enter a range of points and let the software pick out the IPS points.
1. Press `<RPTS>` (Allegro S key, JETT N key, Titan T key), type `1. 10`, and press `!`.
2. Tap `<NeXT>` twice and then `<NOTE>`. You are prompted for the note to search for.
3. Type `IPS` and press `!`.
4. Press `<RPTS>` again. Note that the Random Points file has been changed to include only (1, 2, 8, 9, and 10), the points that have the note `IPS`.

Next you will stake all the points within 500 feet of the occupied point.

5. Press `<RPTS>` since you already have the IPS points listed.
6. Tap `<NeXT>` twice and then `<STAK>`. You are prompted to enter the maximum distance to stake.
7. Key in `500` and press `!`. You are prompted to choose whether to sort by distance or angle.
8. Answer YES to Sort by Distance Instead of Angle.

If you want to sort by angle, answer NO and the program begins with the point closest to the last staked angle. Since you are staking using the Distance mode, the program stakes the points in
order of their distance away from the occupied point. In this example, your new Random Points file will be (8,9,10,1,2).

---

### Southeast Bearing (SE)

**PRODUCT:** ALL

**KEYSTROKES:** `c SE` (THE 2 KEY)

**KEY-IN:** `S c 0 E`

**COMMAND GROUP:** CONVERSIONS

This function key converts the value on the stack from a southeast bearing to azimuth. Running the command again converts the value back to a southeast bearing.

Type a southeast bearing and press ![4]. Press `c SE` (the 2 key). The display shows the value in azimuth format.

---

### Southwest Bearing (SW)

**PRODUCT:** ALL

**KEYSTROKES:** `c SW` (THE 3 KEY)

**KEY-IN:** `S c 0 W`

**COMMAND GROUP:** CONVERSIONS

This function key converts the value on the stack from a southwest bearing to azimuth. Running the command again converts the value back to a southwest bearing.

Type a southwest bearing and press ![4]. Press `c SW` (the 3 key). The display shows the value in azimuth format.
Stake Menu (STAKE)

PRODUCT: ALL

KEYSTROKES: STAKE (ALLEGRO O KEY, JETT S KEY, TITAN P KEY)

KEY-IN: STAKE

COMMAND LOCATION: STAKE

This menu key allows you to stake a point, line, or curve; get a cut or fill; store a cutsheet; or use the instrument crosshairs to store an elevation at a point, in addition to many other functions.

If you tap FSPT with a point number on the stack or command line, the screen displays the inverse from the occupied point to the point given. When SHOT is tapped, the instrument measures the distance or you are prompted for the shot information. The screen displays the go/come, left/right information.

If you type in two point numbers before tapping FSPT, the Stake to a Line (STKL) menu displays. See Stake to a Line on page 246 for more information.

If you type in three point numbers before tapping FSPT, the Stake to a Curve (STKC) menu displays. See Stake to a Curve on page 245 for more information.

If you would like to pre-specify the points to stake, you may place them in the Random Points file. Then, when you occupy a point and backsight a point, go to stake and simply press c FSPT. To back up to a previous point, press a FSPT.

If you have elevations toggled OFF, you will see BKPT and OCPY as the first two soft keys. If elevations are ON, HI and HROD are displayed on the soft keys instead. You may use the BKPT OCPY HI and HROD keys in the SETUP menu prior to running the stake command.

Figure 2-172 Stake Menu
## Stake Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hi</td>
<td>Stores the height of the instrument. Key in the distance from the point under the instrument to the axis of the instrument and tap <code>Hi</code>. <strong>SMI</strong> adds the elevation of the occupied point to the HI value to get the total elevation of the instrument.</td>
</tr>
<tr>
<td>HROD</td>
<td>Stores the height of the rod. Measure the distance from the bottom of the rod to the center of the prism. Key this value into the data collector and tap <code>HROD</code>.</td>
</tr>
<tr>
<td>FSPT</td>
<td>Allows you to enter a point number for staking a point. You can also enter two points to stake a line, or three points (PC, RP, PT) to stake a curve. <code>c</code> <code>fspt</code> stakes the next point in the current Random Points file. <code>a</code> <code>fspt</code> stakes the previous point in the current Random Points file.</td>
</tr>
<tr>
<td>STOSH</td>
<td>Stores the last shot to a point number. Press <code>a</code> <code>STOSH</code> to store the point being staked.</td>
</tr>
<tr>
<td>CUTR</td>
<td>Stores the difference between the foresight point and the shot in the raw data file. This also stores a “PT”, “LINE”, or “CURVE” label in the raw data with the points used to define a point, line, or curve. The “DERR” value in the raw data shows how far the shot was from the point, line, or curve.</td>
</tr>
<tr>
<td>SHOT</td>
<td>Brings in a distance from the instrument to get go/come, left/right, and cut/fill values. Press <code>a</code> <code>SHOT</code> (ROBOTIC only) to continuously update the measured distance. Press <code>c</code> <code>SHOT</code> to switch to the Go/Come, Left/Right screen without taking another shot.</td>
</tr>
<tr>
<td>HDIST</td>
<td>Allows you to enter a horizontal distance and a change in elevation to get go/come and cut/fill values.</td>
</tr>
<tr>
<td>SDIST</td>
<td>Allows you to enter a slope distance and zenith angle to get go/come and cut/fill values.</td>
</tr>
<tr>
<td>FSEL</td>
<td>Allows you to enter the desired (grade) elevation for a foresight point and get a cut or fill based upon the shot elevation.</td>
</tr>
<tr>
<td>ZERO</td>
<td>Zeroes the instrument from the data collector. Press <code>a</code> <code>ZERO</code> (ROBOTIC Only) to turn the instrument to the back sight and re-zero the instrument after displaying and storing the circle reading in the raw data.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| NXPT   | Allows you to change the foresight point and display the go/come, left/right values to get from the last shot to the new foresight point. The next point to be staked is determined as follows:  
  - If no points are on the stack, it searches the Random Points file for the closest point to the last shot.  
  - If one point number is on the stack, it becomes the new foresight point.  
  - If two point numbers are on the stack, it searches that range of points, including the two point numbers, for the closest point to the last shot. |
| STOEL  | Allows you to obtain the elevation of a point with known northing and easting coordinates. This function is useful when the northing and easting coordinates of a point are known or can be calculated, but the elevation is unknown and inaccessible.  
To accurately calculate the elevation of a sighted point without a prism, reflectorless instrument or GPS, first determine the elevation of the instrument. This can be done through the use of the Benchmark or Two-Point Free Station commands or by occupying a point with a known elevation. Then, measure and enter the correct height of instrument (HI), and set the HROD to zero.  
Set the horizontal crosshair on the desired point of which you wish to determine the elevation and tap STOEL. The elevation that is sighted at the center crosshair is determined and stored at that point number. |
<p>| LINE   | Allows you to stake a line by station and offset. This function replaces the Stake Offset function from Version 5. See Line Stakeout on page 156. |
| CURVE  | Used for stakeouts of curves and offsets of curves by deflection angle. See Curve Stakeout – (Horizontal Curve Stakeout) on page 80. |
| STKL   | Provides another way to enter the Stake to a Line program. It is the same as pressing STAKE, keying in two stored points separated by a space, and tapping FSPT. See Stake to a Line on page 246. |
| STKC   | Provides another way to enter the Stake to a Curve program. It is the same as pressing STAKE, keying in the PC, Radius Point, and PT separated by spaces, and tapping FSPT. See Stake to a Curve on page 245. |</p>
<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BKPT</td>
<td>Creates a back azimuth based on the inverse between the current occupied point and the backsight point entered. Tapping BKPT prompts for a backsight point number, takes a reading on the back point, and gives data as though you were staking the point. The purpose is to make sure this is the right backsight point. If the instrument is turned on, it takes a reading on the prism on the backsight point and displays any discrepancy. This is automatically stored to the raw data file, even if raw data is turned off.</td>
</tr>
<tr>
<td>CCPY</td>
<td>Allows you to occupy a point in the current job. Enter the desired point number and tap the soft key to occupy that point, or tap the soft key first to be prompted for a point number.</td>
</tr>
</tbody>
</table>

**Stake by Distance**

PRODUCT: ALL

KEYSTROKES: RPTS NEXT NEXT STAK

KEY-IN: STAKER

COMMAND GROUP: RANDOM POINTS

This command allows you stake points within a certain distance of the occupied station. This can be useful to keep stake distances relatively short, as well as throwing out the points that are in the file but not to be staked.

**Example: Stake Points within a Certain Distance**

1. Press RPTS and key in the point numbers you wish to search.
   
   For example, 201.300 would let you search all points from 201 to 300 inclusive.

2. Press NEXT NEXT STAK.
   
   You are prompted for the maximum distance you wish to stake points from the occupied point.

3. Key in a distance and press !.

4. Choose whether you wish to sort by distance or angle.

5. To check the numbers that were found to be within that range, press RPTS.
6. Delete any points you do not wish to stake and press !.

7. To stake these points, press STAKE C FSPT.

---

**Stake to a Curve**

**PRODUCT:** ALL

**KEYSTROKES:** STAKE NEXT NEXT STKC OR STAKE FSPT

**KEY-IN:** FSCRV

**COMMAND GROUP:** STAKE

This function allows you to take shots to determine how close you are to a curve. It also interpolates the elevation along the curve between the PC and PT points to create a grade elevation at any station.

Pressing STKC prompts for the PC, RP, and PT. Enter the point numbers separated by spaces and press !.

![Figure 2-173 Entering the Point Numbers](image)

**Figure 2-173 Entering the Point Numbers**

You are now ready to take a shot near the curve. Once you tap SHOT and the measurement is taken, a screen similar to the following displays.

![Figure 2-174 Stake to a Curve Measurement](image)

**Figure 2-174 Stake to a Curve Measurement**
This screen indicates the curve you are staking is defined by points 5, 6, and 7. The first shot is 1.09 feet away from the curve (PERPO).

To stake the curve, the rodman can move toward the instrument 3.63 feet or move 1.14 feet to his right. The grade is the elevation on the curve perpendicular to the shot. The rodman should measure over 1.14 feet to his right as he faces the instrument and the instrument man should take another reading.

The keys in the Stake to a Curve menu work just like the keys in the main Stake menu (STAKE). See Stake on page 241 for more information about these soft keys.

---

**Stake to a Line**

**PRODUCT:** ALL

**KEYSTROKES:** STAKE NeXT NeXT STKL or STAKE FSPT.

**KEY-IN:** FSLINE

**COMMAND GROUP:** STAKE

This function allows you to take shots to determine how close you are to a line. It also interpolates the elevation between the points to create a grade elevation at any station.

Pressing STKL prompts for the beginning point and ending point on a line. Key in the beginning point, press SPACE, key in the ending point, and press ENTER. Put the rod at a point near the line specified and tap SHOT.

The following screen is an example where we have tapped STKL, keyed in 1 SPACE 3, pressed ENTER, pointed the prism, and tapped SHOT.

![Screen shot](image)

---

**Figure 2-175 Staking Line 1 - 3**

This screen indicates that the line we are staking is defined by points 1 and 3. The first shot is only 0.27 feet from the line (PERPO). To stake the line, the rodman can move toward the instrument 10.15 feet or move just 0.27 feet to his right. The grade is the elevation on the line perpendicular to the shot.
The keys in the Stake to a Line menu work just like the keys in the main Stake Menu \(\text{STAKE}\). See Stake on page 241 for more information about these soft keys.

**Staking Light (LGT)**

PRODUCT: ROBOTIC

KEYSTROKES: \(\text{c} \text{LGT}\) (THE BKSP KEY)

This command toggles on/off the red/green staking lights that exist on some instruments. The light(s) are intended to put the rod online with the point being staked.

**State Plane Base**

PRODUCT: ROBOTIC

KEY-IN: \text{SBASE}

COMMAND GROUP: GPS

When running the \text{SBASE} command, the display shows the State Plane Coordinates (northing and easting) of the base.

**Storage Files**

PRODUCT: ALL

KEYSTROKES: FILE NEW/ RESTORE/ BACKUP STORAGE FILE

✓ Whether you do a New, Backup or Restore, you are first prompted to take the current Storage File and save it to a location on your device. Therefore, before performing a New, Restore or Backup of a storage file, you must make sure that your device has enough memory to perform the manipulation.

A storage file is where all the job files are stored at any given time. If you are familiar with the HP 48, a storage file is basically the contents of a RAM card on your data collector.
It is always recommended that you use the non-volatile storage area to store your data. This built-in non-volatile storage card would be a good place to store information because it is not dependent upon the data collector's battery. On the data collector, the internal storage area is labeled something like \C_Drive or \StorageCard. This internal storage location exists so that you have the option to save your storage files here in lieu of an external storage card.

✓ The use of a storage card storage device is highly recommended over saving information to the main memory location on the device. A reset causes you not only to reinstall SMI, but also deletes any job data not already downloaded to your PC.

New Storage File

To clear out the current storage file and start from scratch, select the New Storage File command. This command allows you to create a file which can be up to 2 MB in size. You can have as many storage files as your free space allows. After selecting this menu item, you are prompted to save the existing storage file. If you cancel while saving the storage file, the entire operation is canceled and a new storage file is not created. This is done to prevent accidental loss of data.

Select File > New Storage File. The Save As dialog box displays. Key in the name of the file in the Name edit field. Select the folder in which to save the file and choose the file destination from the Location drop list. Tap OK.

![New Storage File Screen](image)

Figure 2-176 New Storage File Screen

Restore Storage File

This command allows you to reload the storage file that was previously stored.

You can save the current job information that you have to a separate storage file and create a new file to upload all the new project data from a PC to SMI in the new, empty storage file.
To switch to a different job list, simply choose the Restore Storage File command, save your current job list (if desired), and select a storage file from the list.

**Backup Storage File**

To copy your current job information in SMI to a separate storage file, use the Backup Storage File command. The current storage file retains all of the current job data within the program.

The Backup Storage File command saves the current ‘virtual’ RAM card to a file on the data collector. This allows you to save up to 2 MB of job information of this ‘virtual’ RAM card to a separate location on the data collector to be accessed later.

Each virtual card file may take up to 4 MB of space on the data collector. Be aware of how much room is available on the storage device prior to creating a backup storage file on the device as this may adversely affect the performance of the device.

**Store Coordinates (STO PT or SC)**

PRODUCT: ALL

KEYSTROKES: \texttt{STOPT} (ALLEGRO P KEY, JETT K KEY, TITAN Q KEY)

KEY-IN: CSTO

COMMAND GROUP: COGO

This menu key lets you enter points using coordinates and data for existing points.

The Store Coordinates screen displays data for the last point stored. To store the data at a specific point, key in the point number, then tap \texttt{STORE}. If that point already exists, you are asked if you want to overwrite the existing point. Press \texttt{!} to confirm or \texttt{<Esc>} to cancel.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{store_coordinates_menu.png}
\caption{Store Coordinates Menu}
\end{figure}

**Store Coordinates Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{N}</td>
<td>Allows you to enter a new north coordinate. Key in the value and tap \texttt{N}, or tap the soft key first and you are prompted for the north value. Key in the number and press \texttt{!}.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Allows you to enter a new east coordinate. Key in the value and tap <strong>E</strong>, or tap the soft key first and you are prompted for the east value. Key in the number and press ![E].</td>
</tr>
<tr>
<td><strong>EL</strong></td>
<td>Allows you to enter a new elevation. Key in the value and tap <strong>EL</strong>, or tap the soft key first and you are prompted for the elevation. Key in the value and press ![EL].</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>Prompts to enter a description. Key in the note (up to 128 characters; Alpha is automatically turned on). When you are finished, press ![NOTE].</td>
</tr>
<tr>
<td><strong>STORE</strong></td>
<td>Stores the north and east coordinates, elevation, and note as a new point. The point is automatically stored as the next number indicated on the display.</td>
</tr>
<tr>
<td><strong>RCLPT</strong></td>
<td>Recalls a point number. See Recalling a Point for Editing and Recalling a Point for Viewing on page 250.</td>
</tr>
</tbody>
</table>

**Example: Recalling a Point for Editing**

If you want to recall data for an existing point, key in the point number and tap **RCLPT** (or tap the soft key first, and you are prompted to enter the point number and press ![RCLPT]). The values for that point are displayed. You are now ready to edit the coordinate and description, then store at the same point or at another point number.

**Example: Recalling Points for Viewing**

If you want to view a large number of points, tap **PNTS** in the **VIEW** menu (see View on page 279). Tap **NEXT** or **PREV** to view additional points, or **RCL** to view specific points.

**Store Offset**

PRODUCT: DOT

COMMAND GROUP: DOT COMMANDS

This function lets you store offset points.

Tap **STOF**, key in the point number, and press ![STOF]. Then, key in the backpoint number and press ![STOF]. You are now ready to store offset points.
Figure 2-178  Store Offset Screen

Typically, you will use the \( \text{DIST}^+ \) (distance right) and \( \text{DIST}^- \) (distance left) soft keys to store offset points.

Example

In the illustration below, point 15 is the occupied (centerline) point and point 10 is the backsight point. Points 16 through 18 were stored using \( \text{DIST}^+ \). Points 19 through 21 were stored using \( \text{DIST}^- \). \( \text{DIST}_+ \) was used to move up for storing points 22 through 27. \( \text{RT}^- \) was used to store point 28.

Figure 2-179  Store Offset Illustration
Sunshots

PRODUCT: ALL

KEYSTROKES: <MORE> (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) <NeXT> <SUN>

KEY-IN: SUN

COMMAND GROUP: COGO

The Sunshots command lets you take a sunshot or calculate a previous sunshot. This command uses the local hour angle method with built-in ephemeris, which requires the use of Greenwich Mean Time (GMT). This method is generally accepted as the most accurate method of determining north from the sun.

GMT, as used in this manual, is equivalent to UT1 time. National Bureau of Standards Time, WWV, and WWVH announce UTC time and the double ticks to adjust to UT1 time. UT1 time is based on the Earth’s rotation. When double ticks are immediately after the tone, add one tenth of a second per double tick. Subtract one tenth of a second per double tick when the double ticks are nine seconds after the tone.

It is absolutely essential that you use a solar filter when taking readings on the sun. Without a filter, you will only get two attempts at a sunshot: one with the right eye, the other with the left eye!

The sun will ruin a diode in a total station EDM unless you have installed a sun filter in front of the lens.

Benefits of the Local Angle Hour Method

- Greater accuracy is possible.
- Observations are possible during more of the day; in the winter months, observations can be obtained from sunup to sundown for most of North America.
- It is not necessary to read vertical or zenith angles.
- Parallax and refraction do not affect your readings.
- Readings can be made faster and more easily than with other methods.

This Local Angle Hour program was developed by Charles Elam, of Lincolnton, Georgia. He tells of a 28.14 - mile traverse with 81 traverse stations and 20 solar stations to control direction. His angles had a 3-second accuracy and his closure was better than 1 in 100,000.
**Some Facts About Elam’s Method**

- Gets 3-second accuracy with a 1-second theodolite.
- Uses the sun to control direction.
- Isolates his angle errors using the sun.
- Uses Grid North, which does not vary as the observation point moves east and west (True, or Astronomic North, does vary as the observation point moves east and west).
- The trailing edge method is at least as accurate (if not more so) than Roelof’s Prism.
- Uses four direct and four reverse sightings.

**About SMI’s Sunshots Routine**

![Figure 2-180  Sunshots Illustration](image)

The Sunshots program is used to determine the direction of a line. It can be used to determine True (Astronomic) North or Grid North, based on a State Plane grid system.

Both True North and Grid North are preferred over Magnetic North, as Magnetic North is in a constant state of change. In the South, for example, it is now changing at a rate of 1° in six years (normal rate of change is approximately 1° in 20 years).

At any point along a line of Earth’s longitude (pole to pole), Astronomic (True) North does not change. However, running east and west, True North lines converge at a rate of about 1 minute per mile. This value increases as you move north, and decreases as you move south. Since most of the work is confined to small areas, this does not create a serious problem – until you start tying projects together or get a job that covers a longer distance ranging east and west.
State Plane Coordinate systems have been defined to solve this problem. A State Plane Coordinate system includes large areas (sometimes an entire state) which use the True North of one longitudinal line; all other north-south lines are parallel to it. Thus, in this system, north-south lines are parallel.

The Sunshots routine is designed to give the azimuth from State Plane North, or azimuth from True North. If you store the constants from your State Plane system in the data collector, it maintains those values until you modify or clear them. Whenever you take a sunshot, it gives the azimuth in State Plane values. If State Plane values are not stored, it gives the azimuth in Astronomic, or True North.

Two common State Plane grid systems are used, the Lambert system and Transverse Mercator system. If you are in the Mercator system, you only need to key in one constant. The Lambert system requires two constants.

**Southern and Eastern Hemisphere Sunshots**

If your position is south of the path of the sun and you are using the center of the sun as the option, the ephemeris should work fine. However, if you are using the trailing edge of the sun, you should choose LEAD as your option for the leading edge of the sun. When you are south of the equator, the latitude should be entered as a negative number. When you are east of Greenwich, England, the longitude should be entered as a negative angle from Greenwich.

As far as it can be determined, there is no known time limit to the ephemeral data, which should continue to work well past 2006.

---

**Sunshots Menu**

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>E SCIR</th>
<th>CSUN</th>
<th>RUN</th>
<th>T C R</th>
</tr>
</thead>
<tbody>
<tr>
<td>NeXT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2-181 Sunshots Menu**

**Sunshots Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>Allows you to enter the current (or desired) date. The format is MM.DDYYYY (for example, October 23, 1997 would be entered as 10.231997). If a date is not entered on the stack when the key is tapped, the program uses the current date in the data collector (the data collector has a running clock to maintain date and time).</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td>Allows you to enter time of day (military time, or a 24-hour clock, is used). The format is HH.MMSS (for example, 2:32:15 P.M. would be entered as 14.3215). If a time is not entered on the stack when the key is tapped, the program uses the exact time (as maintained by the data collector) when the key is tapped.</td>
</tr>
<tr>
<td><strong>BSCIR</strong></td>
<td>Allows you to enter the backsight circle reading.</td>
</tr>
<tr>
<td><strong>CSUN</strong></td>
<td>Allows you to enter the circle (horizontal angle) to the sun.</td>
</tr>
<tr>
<td><strong>RUN</strong></td>
<td>Performs the calculation using the current values displayed on the screen.</td>
</tr>
<tr>
<td><strong>REP</strong></td>
<td>If one or more sunshots have already been made, <strong>REP</strong> appears as the soft key instead of <strong>RUN</strong>. The resulting average circle to the sun is put in the display.</td>
</tr>
<tr>
<td><strong>tCR</strong></td>
<td>Records the current time (<strong>time</strong>) and current circle to the sun (<strong>CSUN</strong>), and performs the calculations (<strong>RUN</strong>) in one step.</td>
</tr>
<tr>
<td><strong>SHOW</strong></td>
<td>Shows the results of <strong>RUN</strong> or <strong>AVG</strong>.</td>
</tr>
<tr>
<td><strong>LAT</strong></td>
<td>Allows you to enter the latitude of the point of observation.</td>
</tr>
<tr>
<td><strong>LONG</strong></td>
<td>Allows you to enter the longitude of the point of observation. You should achieve sufficient accuracy if you scale the latitude and longitude from a USGS quadrangle map. The accuracy should be +/- 300 feet.</td>
</tr>
<tr>
<td><strong>TRAIL</strong></td>
<td>This is a toggle key used to select the trailing edge, center, or leading edge of the sun for pointing. <strong>LEAD</strong> is for use in the southern hemisphere. The default is set to <strong>TRAIL</strong>.</td>
</tr>
<tr>
<td><strong>C.L.</strong></td>
<td>Allows you to enter the longitude constant.</td>
</tr>
<tr>
<td><strong>Z.C.</strong></td>
<td>Allows you to enter the zone constant.</td>
</tr>
<tr>
<td><strong>SHOW</strong></td>
<td>Displays the set astronomic azimuths.</td>
</tr>
</tbody>
</table>
Both the longitudinal constant and zone constant should be zero for computing Astronomic North. Refer to the State Plane Grid Constants for entering longitude and zone constants for your area. When these constants are entered, the Sunshots program automatically gives you State Plane Grid North, rather than Astronomic North.

This Sunshots program has a built-in ephemeris accurate to normally within +/- 10 arc seconds. However, under worst-case conditions, assuming you do everything perfect, it is possible to be off by 42 arc seconds.

**Controlling Direction During a Large Traverse**

For large traverses, a desirable way to control direction would be to take a sunshot at each fifth traverse point. While the errors in the sunshot can be up to 42 seconds, if sunshots are taken over a period of one to five days, the variation in consistency should not exceed one to three arc seconds.

As mentioned earlier, when traversing east and west for one mile, the Astronomic North from the sun converges approximately one minute. Therefore, when surveying large boundaries with great east/west movement, it is better to use State Plane Grid North requiring longitudinal constant and zone constant. This keeps north parallel throughout the survey.

With careful observations, you should get a consistency of readings within approximately two to four arc seconds.

**Leveling the Instrument**

In taking sunshots, leveling of the instrument is critically important, especially as the sun gets higher in the sky. More dependable readings can be taken when the sun is close to the horizon.
Readings on the Trailing Edge of the Sun

**Figure 2-182 Trailing Edge Method Diagram**

When taking a reading on the trailing edge, move the vertical crosshair slightly into the sun and, at the instant the vertical crosshair passes the trailing edge, tap \( \text{TIME} \).

The rest of the data can be entered before or after the time, but all data must be entered (except the optional longitude constant and zone constants) before you tap \( \text{RUN} \).

For repeated readings, you only need to re-establish \( \text{TIME} \) and \( \text{CSUN} \) readings; backsight circle is optional.

If the instrument is flopped, the backsight circle should be reread, as well as time and circle to the sun.

**Important Information about Sunshots**

SMI's built-in ephemeris is accurate to +/- 10 seconds, assuming your data is correct. In a worst-case situation, accuracy may fall to +/- 42 seconds. This is why it is important to periodically verify the time accuracy of your data collector (Generally, over a period of two to three days, time is consistent within one to two seconds).

How important is time accuracy to your calculations? If the time entered is one second off, the angle error may be as much as +/- 7 seconds. (You can test this by entering your data at a certain time, then entering it again after adjusting your time by one second.)

The best time to take sunshots is early in the morning or late afternoon, when the sun is closer to the horizon. The worst time is when the sun is greater than 45° from horizontal.

> The Earth’s curvature and refraction do not affect the accuracy of the angle. Therefore, a low angle is most desirable.
How to Avoid Sunshot Problems

If you take consecutive sunshots spaced a few minutes apart and your resulting angle tends to drift in a certain direction, this is an indication that the date, time, latitude, or longitude is incorrect.

The steeper the sunshot angle, the more critical it is for your instrument to be precisely level.

Since this is very time-sensitive, make sure your collector is set to Authentic 48 Speed. This setting can be found under File > Settings.

Swap

PRODUCT: ALL

KEY-IN: SWAP

COMMAND GROUP: CALCULATOR FUNCTIONS

This function key lets you swap, or exchange, the last two items on the stack (level 1 and level 2).

Make sure the items to be swapped appear in the first and second levels of the stack. Press \texttt{ALPHA}, type \texttt{SWAP}, and press !. Their respective positions on the stack are now reversed.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Calculator Functions Command Group.

Three-Corner Shot

PRODUCT: DOT

KEY-IN: COR3

COMMAND GROUP: DOT COMMANDS

This function key is used when shooting three corners of a building.

Shoot the three corners and press \texttt{ALPHA}, type \texttt{COR3}, and press !. The missing corner is now stored. The first point is also stored for auto-plotting purposes.
Time

PRODUCT: ALL

KEYSTROKES: c 4

This function sets or changes the current time.

If you are working with sunshots, it is of particular importance that your program be set to the correct date and time. To be sure that this is correct select File > Settings and make sure Authentic 48 Speed is toggled on. Then, complete the following instructions to change the date and time.

1. Exit SMI.
2. Go to your Window’s Control Panel.
3. Double click on the Date/Time icon.
4. Select the Time tab.
5. Change the time so that it is correct and click Apply.
6. Enter SMI and the time is changed.

How to Check the Current Time

For greatest accuracy in your measurements, you should set your time based on Greenwich Mean Time. This generally is broadcast from the Naval Observatory in Washington, DC.

You may call the US Naval Observatory’s Master Clock for a recorded time announcement. Time is broadcast in Universal time and EST (adjust for your local time zone) and includes a beep every five seconds for accurate time synchronization.
**Topo (Contouring)**

PRODUCT: ALL

KEYSTROKES: **MORE TOPO**

KEY-IN: **TOPO**

COMMAND GROUP: COGO

This soft function key allows you to scale the distance to each contour line from a starting elevation point in the direction of another elevation point.

After you tap `<topo>` and `<INTVL>`, the display prompts you for the interval. This defines the elevation intervals between the two points at which you want to see the distance to the interval. Key in the number of feet and press `!`. For example, if you want to see how often the elevation changes by 2 feet, type 2 and press `!`.

The Topo menu then lets you define the elevation points.

**PT 1 PT 2 INTVL INC**

**Figure 2-183 Topo Menu**

**Topo Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PT1</strong></td>
<td>Allows you to define the starting elevation point. The elevation should be stored with the point number and the elevation of point 1 should be lower than point 2.</td>
</tr>
<tr>
<td><strong>PT2</strong></td>
<td>Allows you to define the elevation of the second point. The elevation should be stored with the point number. The elevation of point 2 should be higher than point 1 and the difference in elevation should be larger than the interval.</td>
</tr>
<tr>
<td><strong>INTVL</strong></td>
<td>Allows you to define the interval or difference in elevation of the topo lines.</td>
</tr>
<tr>
<td><strong>INC</strong></td>
<td>Executes the function. As you tap <strong>INC</strong>, the display shows the distance from point 1 to each topo interval and the elevation at that point.</td>
</tr>
</tbody>
</table>
Transfer Files from One Data Collector to Another

PRODUCT: ALL

KEYSTROKES: JOB XFER

KEY-IN: XFER

COMMAND GROUP: JOB

This function key allows you to transfer data via a cable from one data collector to another.

✓ You cannot transfer data directly from an HP 48 running SMI version 5 or earlier with a newer data collector as the data formats are incompatible. You must transfer the data to a PC, then to the other collector.

In order to transfer files between data collectors, both data collectors must be running SMI field surveying software.

Plug the PC cable to each data collector and press JOB XFER rECV on the receiving data collector. Then, press JOB XFER send on the sending data collector. The current job is sent.

Transfer Jobs to/from the PC

PRODUCT: ALL

KEYSTROKES: JOB XFER AND PC SEND OR RECV

KEY-IN: RECj OR SENDj

COMMAND GROUP: JOB

This function allows you to transfer data from your data collector to an IBM-compatible PC (a serial cable is required). You should have SMI Transfer to communicate with SMI's data collector software. However, there are a few PC software manufacturers who can receive SMI files directly into their programs.

Also refer to either the Import Jobs command on page 134 or Exporting Jobs on page 100 for more information.
**Transformation (Translate, Rotate, and Scale)**

**PRODUCT:** ALL

**KEYSTROKES:** RPTS (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) CX

**KEY-IN:** CX

**COMMAND GROUP:** RANDOM POINTS

This soft function key allows you to manipulate your current Random Points file. This may involve one or more of the following: changing the (X,Y) location; rotating about a point; or scaling about a point or in the Z.

Press RPTS. Key in the point numbers you wish to transform and press CX. Define the changes to be made to the points and tap RUN.

You can enter the old incorrect point (OLDPT) and the new correct point (NEWPT). This sets the command to translate the coordinates of the Random Points file from the old point to the new point. OLDPT is also used as the rotation point. This is ignored if there is no rotation angle, or replaced if ROTPT is used in the Rotate menu.

Old elevation (OLDEL) and new elevation (NEWEL) can be used to change the elevation of each of the points.

Tap NEXT to see another option. If you do not have the new coordinates stored by point number, use New North (NEWN) and New East (NEWE) to enter the north and east coordinates to which you wish to translate. If NEWP is used, you do not need to use NEWN and NEWE.

If Elevations are on, and the elevations are stored in the old point (OLDPT) and new point (NEWPT), the elevation difference is applied to the elevations of the random points. However, entering OLDEL and NEWEL overrides this value.

The difference between the old and new elevations is applied to all the elevations of the points involved in the transformation.

Tap EXIT to return to the Transformation menu.

If you wish to enter a scale factor, key in the scale factor and tap SCALE.

Figure 2-184  Transformation Menu
### Transformation Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>› NEZ</td>
<td>Allows you to translate coordinates. Displays the Translate menu.</td>
</tr>
<tr>
<td>ROT</td>
<td>Allows you to rotate the points of the Random Points file. Displays the Rotate menu.</td>
</tr>
<tr>
<td>SCALE</td>
<td>Allows you to enter a scale factor and apply it only to horizontal measurements. Scale factors greater than 1 increase the distance between points, while scale factors less than 1 decrease the distance between points.</td>
</tr>
<tr>
<td>ZSCL</td>
<td>Allows you to set SMI to scale the elevations of all the points in the RPTS file. This can be used to scale the elevations from feet to meters or meters to feet.</td>
</tr>
<tr>
<td>RUN</td>
<td>Performs the actual transformation based on the displayed values.</td>
</tr>
</tbody>
</table>

### Translate Menu

**Figure 2-185  Translate Menu**

**Translate Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLdpt</td>
<td>Allows you to enter the old point to translate from.</td>
</tr>
<tr>
<td>Newp</td>
<td>Allows you to enter the new point to translate to.</td>
</tr>
<tr>
<td>OLdel</td>
<td>Allows you to enter the elevation of the old (incorrect) point.</td>
</tr>
<tr>
<td>NWel</td>
<td>Allows you to enter the new, desired elevation.</td>
</tr>
</tbody>
</table>

### Rotate Menu

**Figure 2-186  Rotate Menu**
**Rotate Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>old</strong></td>
<td>Allows you to enter the direction from which the rotation angle is turning. If two points are on the stack (in levels 1 and 2), the inverse between the points is used. <strong>old</strong> is subtracted from <strong>new</strong> to get the rotation angle.</td>
</tr>
<tr>
<td><strong>new~</strong></td>
<td>Allows you to enter the direction to which the rotation angle is turning. If two points are on the stack (in levels 1 and 2), the inverse between the points is used. <strong>old~</strong> and <strong>new~</strong> values can be entered as azimuths, or as two points (separated by a space) to define direction. If you have a bearing (e.g., S 23° E), you can convert this angle to an azimuth. For a bearing of S 23° E, key in 23 and press <strong>c~2</strong> (to indicate Southeast direction). <strong>SMI</strong> automatically converts the SE bearing to the correct azimuth value; this can then be used to indicate direction.</td>
</tr>
<tr>
<td><strong>rotpt</strong></td>
<td>Allows you to enter the point around which the other points in the Random Points file will be rotated. This point number is also set by pressing <strong>olpt</strong> in the Translate menu.</td>
</tr>
<tr>
<td><strong>rot~</strong></td>
<td>Allows you to enter the rotation angle. If <strong>old~</strong> and <strong>new~</strong> are used, it is not necessary to use this key.</td>
</tr>
</tbody>
</table>

---

**Traverse (TRAV)**

PRODUCT: ALL

KEYSTROKES: **TRAV** (ALLEGRO K KEY, JETT P KEY, TITAN L KEY)

KEY-IN: **DOTRAV**

COMMAND GROUP: COLLECT

This function key allows you to electronically or manually traverse to a new point and occupy that point.

The traverse soft keys work exactly as the side shot soft keys, with one exception. After the point has been stored, the new point is occupied and the backsight point and direction are updated.

For an example and detailed explanation of the soft key menus, see *Side Shot on page 230.*

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Triangle Solutions

PRODUCT: ALL

KEYSTROKES: MORE (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) TRI

KEY-IN: TRI

COMMAND GROUP: COGO

The function shows soft key options for triangle solutions when sides or a combination of sides and angles are known.

Tap the soft key that corresponds to the known variables. The display prompts you to enter those variables on the command line (remember to separate each with a space). Key in the known variables and press ENTER. The display shows the solution, as well as the area of the triangle. SSA has two solutions. After using SSA, a toggle key labeled SOL1 appears as the last soft key. Tap it to toggle to SOL2 to see the other solution.

Figure 2-187  Triangle Solutions Menu

Triangle Solutions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSs</td>
<td>Allows you to enter three sides.</td>
</tr>
<tr>
<td>SSA</td>
<td>Allows you to enter two sides and an opposite angle.</td>
</tr>
<tr>
<td>Sas</td>
<td>Allows you to enter two sides with an included angle.</td>
</tr>
<tr>
<td>Saa</td>
<td>Allows you to enter a side, opposite angle, and another angle.</td>
</tr>
<tr>
<td>asa</td>
<td>Allows you to enter two angles and an included angle.</td>
</tr>
<tr>
<td>Sol 1</td>
<td>Toggles between two different solutions when SSA is used. The key is blank for other types of solutions.</td>
</tr>
<tr>
<td>Sol 2</td>
<td></td>
</tr>
</tbody>
</table>

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**Option**  | **Function**  
---|---
`aaa`  | Allows you to enter the area and two angles.

---

**Trigonometric Leveling (TRIG)**

**PRODUCT:** ALL

**KEYSTROKES:** TRIG (ALLEGRO N KEY, JETT 8 KEYS, TITAN O KEY) or SETUP NeXT

**KEY-IN:** TRI G

**COMMAND GROUP:** COLLECT

This function takes a side shot on a point collecting northing, easting, and elevation values. TRIG takes a single horizontal angle and slope distance on a point, but unlike SIDS, TRIG requires a reverse reading on the point where the zenith angles are meaned, thus taking out the vertical circle error of the instrument and giving a more accurate elevation.

In the comment record (CM), the Trig Leveling command (TRIG) reports angles if raw data (a 2) is toggled on.

The first shot should be done with the instrument in face 1 position (direct); the second shot assumes face 2 where the scope is in reversed position (flopped).

To manually enter data, tap TRIG, enter the face 1 data (the slope distance, zenith angle, and angle right separated with a space between each), and press !. REV now appears in the soft key menu, indicating that you should take the second shot. Tap REV, key in the zenith angle in face 2, and press !. The angle right, mean zenith angle, and slope distance are displayed, along with the vertical circle error. To store the coordinates and meaned elevation as a side shot, tap STORE.

If you are using an electronic instrument, the measurement is performed automatically. The data collector displays an arrow symbol beside the angle error if the vertical angle tolerance is exceeded. The average zenith angle and error are displayed. Tap STORE to store the point if you are satisfied with the results.

> If you are using a servo-controlled instrument with the Robotics/GPS version of SMI, the reverse shot is done automatically for you.
Principles That Should be Considered When Doing Trigonometric Leveling

Trig leveling is becoming a more accepted method of running levels. An article in POB magazine indicated that trig leveling was more accurate than conventional leveling. It is certain that trig leveling is faster in almost all cases, and with proper equipment and proper procedures, trig leveling can be more accurate. It should be noted that trig leveling can be performed in the course of storing north and east coordinates with little or no extra effort.

Following are some principles that should be considered when doing trig leveling:

- For accurate trig level work, when distances are greater than 300 feet, use direct and reverse. This means or averages the zenith angles and takes out the vertical circle index error of the instrument. This can be accomplished using the TRIG (Allegro N key, JETT 8 keys, Titan O key) command.

- Use the Earth’s curvature and refraction formula. SMI defaults with this turned on, and there is no reason to turn this off. Some instruments allow you to turn this feature on or off in the instrument. That does not matter. SMI gets the raw angles and distances from the electronic total stations. Therefore, whatever your instrument setting, leave SMI’s EC (Earth’s curvature) turned on.

- Use the same rod height to do the foresight as to do the backsight. This eliminates “measure up” errors.

- Use a benchmark away from where the instrument is occupying. When you use an elevation under the instrument, this introduces “measure up” errors.

- On extremely long shots, use “Mean Reverse Reciprocals.” This takes a direct and a reverse from both ends of the line and means the results. This not only takes away the error of the vertical circle of the instrument, it also takes away the error due to the Earth’s curvature and refraction. Mean Back Sight (MBS) means the elevation at the end of a line which has been reduced based on a direct and reverse reading. This is achieved by a direct and reverse to the backsight from the end of the line to the beginning of the line, then meaning the two elevations.

- Remember that BM (benchmark) brings an elevation to the instrument just like a level gets an HI (height of instrument) from a backsight reading. SIDS, TRIG, and SHOTS send an elevation to the point just like FS and find the foresight elevation using levels.

Think of trig leveling as adding another dimension to the north and east coordinates where the instrument performs the function of a level. Just as the HI of the instrument is not important in levels to carry the elevation to the foresight point, the same is true with trig levels. When you are running levels do you ever measure down to find the elevation under the level? No. You could, but it would introduce an error. The same is true when doing trig levels. You can measure down. There is even a place to put it in the software called HI. This introduces a measuring error of perhaps a hundredth or so. Normal trig leveling
does not require that you measure the distance from the ground or the axis of the instrument and enter it as the HI. There are times this is important; one is when working with tripods rather than prism rods. The other is when performing mean reverse reciprocals. Most often, it is not necessary to know the elevation under the instrument.

Methodology

There are times when it is acceptable, and a great time saver, to leave the HI and HROD both set to zero and still do very accurate trig leveling. Other times, the rod should be measured and entered into SMI as HROD. Still other times, both the HI and HROD should be measured and entered. The following discussion might help you decide your policies regarding measuring and setting these values using SMI.

If you can avoid measuring and entering the HI and HROD, it may be a big time saver. The elevations may be even more accurate than when you measure up.

It is acceptable to leave both the HI and HROD at Zero:

- When the rod height and the instrument height are the same (such as if you are using 2-meter GPS rover and base poles), you can leave the HI and HROD set to zero.

- When using a prism on a rod to shoot a benchmark using the same rod to take readings to other points AND the height of the rod and instrument are different, whether staking or collecting, the correct elevation is transferred from the benchmark to these other points. If the rod height needs to be changed, enter the new height of rod (HROD) as if the initial setting was zero. For example: If the rod was initially set to 5 feet and you raise the rod 2.5 feet, you should set the HROD to 2.5. If the rod started at 5 feet and you lower the rod 1.5 feet, you should set the HROD to be a negative 1.5.

* ✓ If you shoot a benchmark with a prism, the actual elevation at the instrument will be incorrect because the height of rod has not been entered. Therefore, when you shoot a benchmark, do not store the elevation. The occupied point position will display COOR instead of the point number. The instrument will still be occupying the correct north and east coordinates and the elevation will be a “reference elevation” similar to the HI elevation of a level. Note that when using a level, you are never concerned with the elevation of the point under the level.

It is acceptable to only measure the height of instrument:

- When there is a known elevation at the instrument and you are using Separate Distance and Angle (SDA) to determine remote elevations without a prism.

- When there is a known elevation at the instrument and you are using STOEL in the Stake menu to determine elevations of calculated/known points.

- When you did not use a benchmark or the Two-Point Free Station command to establish the elevation and the rod height will not be changing frequently.
Both the heights of the instrument and the rod should be measured:

- When the rod height will be changing frequently.
- When using the meaned forward and reverse reciprocals where the elevation is determined from both ends of the line. This requires using the elevation under the instrument.
- When using either bipods or tripods with prisms that may be set at different heights.
- When checking the elevation of the instrument position.

---

**Turn Robot (TURN)**

PRODUCT: ROBOTIC

KEYSTROKES: ◀, ►, ▲, AND ▼ KEYS

If you are using an instrument driver that is configured to work with instruments that have servo motors, you can turn the instrument using either the arrow keys or the large directional key on your data collector. You may turn the instrument to the left, right, up or down when a direction is pressed. To control the increment in degrees of the turn, just type in that value and press a Turn key.

---

**Turn Robot to Point (TOPT)**

PRODUCT: ROBOTIC

KEYSTROKES: ◀ TOPT (THE 9 KEY)

KEY-IN: TURNTOPT

COMMAND GROUP: TOTAL STATION

This command turns the instrument to sight a certain point. First type the point number to which to turn the instrument, then run this command. The current backsight, HI, HROD, and occupied point are used in the calculation. If Elevations are off, or if the point has a zero elevation, the Zenith Angle is set to 90°.
**Turn Robot Using Horizontal and Zenith Angles (HAZA)**

PRODUCT: ALL

KEYSTROKES: `c HAZA` (THE 6 KEY)

KEY-IN: HAZA

COMMAND GROUP: TOTAL STATION

This key turns the instrument to the Angle Right and Zenith Angle entered. If only one number is entered, it is assumed to be the Angle Right, and the Zenith Angle is assumed to be 90°.

---

**Two Corner Shot**

PRODUCT: DOT

KEY-IN: COR2

COMMAND GROUP: DOT

This function/menu key is used when shooting two corners of a building and measuring the third side.

> It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the DOT Command Group.

---

**Example: Two Corner Shot**

1. Shoot two corners of the building and tap `2COR`.

   The display asks you to identify whether you are moving clockwise (CLK) or counterclockwise (CCLK) around the building.

   1. Enter distance as
   2. CLK: CLOCKWISE
   3. CCLK: CNTR CLOCKWISE
   4. to store two corners based on the last two.

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Figure 2-188  Two Corner Prompt

2. Tap <CLK> (clockwise) or <CCLK> (counterclockwise) to indicate the direction around the structure.

You are prompted to ENTER LENGTH OF LAST SIDE?

3. Key in the length of the missing side and press !.

Three points are stored: the two points not shot and the first point shot. By storing the first point shot, the PC can automatically plot the four sides of the building.

Two-Point Free Station/Resection (2PFS)

PRODUCT: ALL

KEYSTROKES: 2PFS (ALLEGRO H KEY, JETT Z KEYS, TITAN I KEY)

KEY-IN: RSCT

COMMAND GROUP: SETUP

This function establishes an occupied point based on sighting two known points, referred to as points A and B. The program works as though you were occupying A, back sighting B, and traversing to a third point (the instrument position). Therefore, A should be the more accurate position.

Point B can be considered to be a good backsight point from A (on the line from A). If the Scale option is used, a scale factor is applied, giving A and B equal weight. If you are using State Plane Coordinates, you should use the Scale option so the instrument position is a State Plane Coordinate and future shots from this free station position are stored as State Plane Coordinates.

Resection programs sometimes are only distance-distance intersection programs. As most surveyors know, distance-distance concerns itself with instrument position and strength of triangles. If the triangle formed is weak, the positional accuracy of the instrument may be in error anywhere from several hundredths of a foot to several feet.

SMI's Reection program has always been a true free station program with a high degree of accuracy, without a need to be concerned with the strength of the triangles. However, just as you would not want a short backsight, you would want to avoid too short a distance between the two control points from which you are free stationing.
SMI added the option to mean any number sets of points stored by 2PFS. Even though it is called 2PFS, it is actually a multiple point free station program. However, it is referred to as 2PFS (rather than MPFS) because the procedure uses only two points at a time. Each time 2PFS is used, an instrument position can be stored by point number. Multiple instrument points can be stored for various sets of control points for the same instrument position. These instrument points can then be meaned using \texttt{RPTS mean}.

The result can be evaluated for errors. If one point is found to be too much in error, the remaining points can be meaned and stored.

\textit{For an example using Two-Point Free Station, consult the SMI Version 8 User Guide.}

\hspace{1cm} \textbf{Figure 2-189 Two Point Free Station Menu}

\textbf{Two Point Free Station Menu Soft Key Definitions}

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{a dir}</td>
<td>Takes a direct shot on point A. Press \texttt{a} and this key to display the shot information without taking a shot. If a point number for A has not yet been given, tapping \texttt{a dir} prompts for a point number.</td>
</tr>
<tr>
<td>\texttt{arev}</td>
<td>Takes a reverse shot on point A. Press \texttt{a} and this key to display the shot information without taking a shot. If point A has not yet been given, it prompts for a point number. If Elevations are turned off, or in GPS mode, this key is blank.</td>
</tr>
<tr>
<td>\texttt{bdir}</td>
<td>Takes a direct shot on point B. Press \texttt{a} and this key to display the shot information without taking a shot. If point B has not yet been given, it prompts for a point number.</td>
</tr>
<tr>
<td>\texttt{brev}</td>
<td>Takes a reverse shot on point B. Press \texttt{a} and this key to display the shot information without taking a shot. If point B has not yet been given, it prompts for a point number. If Elevations are turned off, or in GPS mode, this key is blank.</td>
</tr>
<tr>
<td>\texttt{Rsits / store}</td>
<td>Uses the shot information to calculate and display the occupied coordinate information. The \texttt{Rsits} key is replaced by the \texttt{store} key to allow storing the occupied coordinates to a point and the raw data file.</td>
</tr>
</tbody>
</table>
### Option | Function
--- | ---
hold | The Two-Point Free Station command automatically calculates the scale factor for a project based on making a comparison between two known sets of coordinates and the raw measurements during the 2pfs made to them. Use scale to set as the scale for the current job. Selecting hold holds the current scale factor without applying the recomputed scale to the project.
real/scale | Use this toggle key to choose between calculating a scale factor (real) and calculating real world coordinates (scale) where the scale factor is 1.
PTA | Allows you to enter the point number. Point numbers for A and B can be entered at any time, even before you go to the 2PFS program. These control point numbers are remembered when you go to another program and return even if you tap 2pfs instead of 2PFS.
PTB | Allows you to enter the point number.
MNEL/ELFa/eLFb | Toggles between using the mean elevation, the elevation from point A, and the elevation from point B. If Elevations are turned off, this key is blank.
RODa | Allows you to enter the rod height for point A. If Elevations are turned off, this key is blank.
RODb | Allows you to enter the rod height for point B. If Elevations are turned off, this key is blank.
HI | Allows you to enter the height of the instrument. These values (ROD A, ROD B, and HI) are also remembered, even when you exit and return to 2PFS. If Elevations are turned off, this key is blank.
HAR | This toggle key determines whether reverse shots collect a horizontal angle.
ZAR | This toggle key determines whether reverse shots collect a zenith angle.
SDR | This toggle key determines whether reverse shots collect a slope distance.
Units

PRODUCT: ALL

KEY-IN: UNITS

COMMAND GROUP: CONVERSIONS

This function provides access to the HP units application and menu.

The HP units application contains a catalog of 147 units that you can combine with real numbers to create unit objects. This lets you convert, factor, and calculate between different units of measurement.

To convert from one unit to another, type the value to convert and tap the soft key with the units of that value. The value is tagged on the stack with those units. Press and the soft key with the new units. The new value is shown on the stack with the new units.

It is suggested that you add this command to either a Command Favorites menu or the Command Keys for easier access. This command is located in the Conversions Command Group.

Example

1. Press and type UNITS.
2. Tap LENG.
3. Type 100 and tap M.
   100_m displays on the stack.
4. Tap NeXT NeXT a FTUS.
   328.0833_ftUS displays on the stack.
Version

PRODUCT: ALL

KEY-IN: VER

This function displays the exact version of the SMI software on the screen.

Press [ALPHA], type VER, and press !. You may also get version information by selecting Help > About Classic SMI.

Vertical Curves

PRODUCT: ALL

KEYSTROKES: MORE VC

KEY-IN: VC

COMMAND GROUP: COGO

This function lets you access the Vertical Curve Equation menus, which use the equation solver programming built into the data collector.

Vertical Curves Menu

Figure 2-190  Vertical Curves Menu

Vertical Curves Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>Allows you to enter the curve by the PVC or point of vertical curvature where the curve starts.</td>
</tr>
<tr>
<td>PVI</td>
<td>Allows you to enter the curve by the PVI or point of vertical intersection.</td>
</tr>
</tbody>
</table>
Example: PVC (Point of Vertical Curve)

![Vertical Curve Diagram]

**Figure 2-191 Vertical Curve**

Use the information in the illustration to find elevations at 50-foot increments.

1. Press **MORE VC PVC**.
2. Tap or press **<Esc>** to clear the display.
3. Key in **300** (the station number) and press **!**.
4. Key in **120** (the PVC elevation) and tap **PVCEL**.
5. Key in **3.45** and tap **%IN**.
6. Key in **4.60**, press **+/−**, and tap **%OUT**.
7. Key in **600** and tap **PVT**.

The first station interval (3+00) and the elevation at that station display.

8. Key in **50** (for a 50-foot interval) and tap **INC**.
9. Tap \texttt{INC}. \(\text{SMI}\) increments to the next station.

\textbf{Figure 2-192 Entering the Interval}

10. Continue tapping \texttt{INC} as needed until you get to the PVT.

You may enter any station along the vertical curve and get the elevation at that point. Or you may enter any elevation and get the station or stations for that elevation.

11. To get the high or low point on the vertical curve, tap \texttt{H/L}.

\textbf{Example: PVI (Point of Vertical Intersection)}

\textbf{Figure 2-194 Getting the High or Low Point on the Vertical Curve}

Use the information in the illustration to compute various elevations at 25-foot increments.

1. Press \texttt{MORE} \texttt{VC} \texttt{pVI}.

You are prompted for the PVI.
2. Tap or press Esc to clear the current display.

3. Key in 500 and press ![image]

4. Key in 150 and tap PVIEL .

5. Key in 3.45 and tap %IN .

6. Key in 4.6, press +/- , and tap %OUT .

7. Key in 450 and tap LEN .

![Figure 2-195 Entering the Length]

8. To increment the stations 25 feet at a time, key in 25 and tap INC .

Now each time INC is tapped, the station is incremented 25 feet and the appropriate elevation is displayed.

![Figure 2-196 Displaying the Elevation of a Point Along the Vertical Curve]

You may now enter any station along the vertical curve and get the elevation at that point, or you may enter any elevation and get the station or stations for that elevation.

9. To get the high or low point on the vertical curve, tap H/L .

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This menu key lets you view points, area, back azimuth, or raw data.

### View Menu (VIEW)

PRODUCT: ALL

KEYSTROKES: **VIEW** (THE C KEY)

KEY-IN: **VI EW**

GROUP COMMAND: **VIEW**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNTS</td>
<td>Displays the View Points menu. Entering a point number before tapping <strong>PNTS</strong> displays the point. See the screen shots to see how the menus are arranged.</td>
</tr>
<tr>
<td>mem</td>
<td>Displays available points as shown.</td>
</tr>
<tr>
<td>ocpt</td>
<td>Displays the current occupied point information.</td>
</tr>
<tr>
<td>bkaz</td>
<td>Displays the current back azimuth.</td>
</tr>
<tr>
<td>lstpt</td>
<td>Displays the last point stored.</td>
</tr>
</tbody>
</table>

**Figure 2-197** View Menu

**View Menu Soft Key Definitions**
<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>raw</td>
<td>Displays the current raw data file. The display shows the last raw data record and a soft key menu to select another record.</td>
</tr>
<tr>
<td></td>
<td>next</td>
</tr>
<tr>
<td></td>
<td>prev</td>
</tr>
<tr>
<td></td>
<td>rcl</td>
</tr>
<tr>
<td></td>
<td>desc</td>
</tr>
<tr>
<td></td>
<td>TS</td>
</tr>
</tbody>
</table>

**View Points Menu**

**Figure 2-198 View Points Menu**

**View Points Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>next</td>
<td>Increments to the next point number.</td>
</tr>
<tr>
<td>prev</td>
<td>Decrements to the previous point number.</td>
</tr>
<tr>
<td>rcl</td>
<td>Recalls any point number. Key in the point number and tap rcl, or tap rcl and you are prompted for a point number.</td>
</tr>
<tr>
<td>begp</td>
<td>Displays the values of the beginning point in the job.</td>
</tr>
<tr>
<td>endp</td>
<td>Displays the values of the last point in the job.</td>
</tr>
</tbody>
</table>

**Example: Display Available Points**

1. Press VIEW.
2. Tap mem.
The approximate number of points available for storage in the storage file of the collector displays.

```
AVAILABLE POINTS
RAM CARD: 21334
N° NOTES: 18340
```

Figure 2-199 Displaying Available Points

3. To change the size of the storage file, select File > Settings.

The largest size available is 2mb.

---

**Volume**

PRODUCT: ALL

KEYSTROKES: [MORE] (ALLEGRO T KEY, JETT O KEY, TITAN U KEY) VOL

KEY-IN: VOL

COMMAND GROUP: COGO

This soft key allows you to use cross-sectional areas (in square feet or meters) and the distance between them (in feet or meters) to compute the volume in cubic yards or meters.

To calculate in metric units, set Metric mode by pressing CHG NeXT MODE FEET to toggle to mETR.

Enter the first area using the AREA key, then the distance to the next end area using DIST. Enter the second end area using AREA and the program calculates and displays the volume. Continue entering end areas and the total volume displayed accumulates each new volume. If the distance between the end areas changes, enter the distance using DIST before entering the next end area. Use clear to clear all values and start over.

See the example in XPlot on page 282 for a more detailed explanation.
**XPlot**

PRODUCT: ALL

KEYSTROKES: RPTS (ALLEGRO S KEY, JETT N KEY, TITAN T KEY) NeXT XPLoT

KEY-IN: XPLoT

COMMAND GROUP: RANDOM POINTS

This soft function key lets you perform a cross-section plot to calculate area and volume. This command requires a valid Random Points file.

---

**Example: Calculating the Volume of a Gravel Pile**

![Figure 2-200  Calculating the Volume of a Gravel Pile](image)

In this example (a gravel pile), Elevations must be on.

1. Position the instrument and occupy point 1, then shoot a backsight (point 2).
2. After establishing a base line, shoot points to define the perimeter and topography of the gravel pile you are measuring. To simplify your calculations, place reference stakes equally spaced along your base line and use them as reference markers to line up your shots. For this example, assume that the markers are spaced 30 feet apart.

After taking your shots (storing points 3-24 in the example), you need to calculate the area for each cross-section. In this example, refer to the cross-section defined by points 3-5 as "AA" - the cross-section defined by points 6-9 will be called "BB" and so on.

3. Press RPTS.

4. Key in 3.5 (to define the cross-section of "AA") and press !.

5. Tap NeXT XLOT.

The program calculates the area of the "AA" cross-section; write down the value displayed (you will need these values later to calculate volume).

6. Repeat the process in step 4 for each cross-section (points 6-9: "BB"; points 10-13: "CC"; points 14-18: "DD"; points 19-23: "EE"; there is no area calculation for point 24.). Be sure to write down each area value calculated.

Now calculate volume of the gravel pile.

7. Press MORE NeXT NeXT VOL.

8. Key in the area of "AA" and tap AREA.

9. Key in the distance between "AA" and "BB" (in this case, 30) and tap DIST.

10. Key in the area of "BB" and tap AREA.

The program displays the volume (cubic yards) of the area between the two cross-sections. The distance between the end areas does not change, so you do not need to tap DIST again.

11. Key in the area of "CC" and tap AREA.

12. Key in the area of "DD" and tap AREA.

13. Key in the area of "EE" and tap AREA.

14. Key in 0 for the last area at point 24 and tap AREA.

The total volume now shows the volume of the gravel pile.
Example: Calculating the Area of a Barrow Pit

![Diagram of a barrow pit with coordinates 165 and 166, and points 56-59.

RPTS. 56.59 165 166 (ENTER) (XPLT)

Figure 2-201 Calculating the Area of a Barrow Pit

1. In your design grade, store coordinates and elevation of points 165 and 166 so they are in the same cross-section station (the same plane) as points 56-59.

2. Press **MORE**.

3. Enter the points (clockwise) by keying in **56** **59** **165** **166** and pressing **!**.

4. Tap **NeXT** **XPLOT**.

The program calculates and displays the area of the cross-section you have defined.

To calculate volume, you need several cross-section areas (and the distances between them) to adequately define the perimeter and depth of the pit. You can then compute the volume between each consecutive cross-section area to arrive at a total volume for the pit.

Zero the Instrument (ZERO)

PRODUCT: ALL

KEYSTROKES: **C** **ZERO** (THE 0 KEY)

KEY-IN: ZERO

COMMAND GROUP: TOTAL STATION

This function key lets you zero the instrument from the data collector. Pressing this key sets the horizontal angle to the backsight to zero.
**Zero the Rod**

PRODUCT: DOT

COMMAND GROUP: DOT COMMANDS

This function is used in conjunction with the Boot function, described in *Boot the Rod on page 40*.

This is a toggle key. Tap 0ROD once to toggle it on. The display shows 0 ROD EACH SHOT and the key changes to 0ROD® to indicate that this function has been selected.

When 0ROD is on, the height of rod will be reset to zero after the shot.

To deselect this function, tap 0ROD® to toggle the key off. The display shows WILL NOT 0 ROD and the key changes to indicate that this function is no longer active. The default for this function is off.
COMMAND GROUP REFERENCE

This chapter provides a listing of the SMI Field Surveying software commands by command group.
Listed below are the command groups and the commands contained within that group. There are over 400 commands that may be configured to work with either the Command Favorites or the Command Keys.

**Method** | **Definition**
--- | ---
Key In | Displays the key in that you would type to run the command. Precede this by pressing **ALPHA**.
Display | What is displayed on the screen in the Command Key area.
Page Ref. | Click on this link to refer to more information about this command.
Command Description | The description of command. This description should closely match the name of the command.

### Calculator Functions Command Group

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FSPREV  FSPRV     140  Foresight Previous RPt
DELRDM  DELRD     205  Delete Random Points

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<td>Instrument Functions Menu</td>
</tr>
<tr>
<td>POS</td>
<td>POS</td>
<td>138</td>
<td>Instrument Status</td>
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<tr>
<td>POSMENU</td>
<td>48POS</td>
<td>138</td>
<td>Instrument Status</td>
</tr>
<tr>
<td>RASEL</td>
<td>RASEL</td>
<td>205</td>
<td>Select Radio</td>
</tr>
<tr>
<td>RASET</td>
<td>RASET</td>
<td>186</td>
<td>Radio Settings</td>
</tr>
<tr>
<td>RCHAN</td>
<td>RCHAN</td>
<td>212</td>
<td>Set Radio Channel</td>
</tr>
<tr>
<td>RSENS</td>
<td>RSENS</td>
<td>213</td>
<td>Set Radio Sensitivity</td>
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<td>RPORT</td>
<td>RPORT</td>
<td>209</td>
<td>Set GPS Radio Port</td>
</tr>
<tr>
<td>BGPTM</td>
<td>BGPTM</td>
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<td>Beginning Point Menu</td>
</tr>
<tr>
<td>BKPTS</td>
<td>BKPTS</td>
<td>34</td>
<td>Backsight Point</td>
</tr>
<tr>
<td>BKAZ</td>
<td>BKAZ</td>
<td>33</td>
<td>Backsight Azimuth or Point-to-Point</td>
</tr>
<tr>
<td>Key In</td>
<td>Display</td>
<td>Page Ref.</td>
<td>Command Description</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>-----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>BKBR</td>
<td>BKBR</td>
<td>34</td>
<td>Backsight Bearing</td>
</tr>
<tr>
<td>MBS</td>
<td>MBSM</td>
<td>159</td>
<td>Mean Backsight Menu</td>
</tr>
<tr>
<td>OCPY</td>
<td>OCPY</td>
<td>172</td>
<td>Occupied Point</td>
</tr>
<tr>
<td>CKBS</td>
<td>CKBS</td>
<td>50</td>
<td>Check Backsight</td>
</tr>
<tr>
<td>HI</td>
<td>HI</td>
<td>216</td>
<td>Height of Instrument</td>
</tr>
<tr>
<td>HROD</td>
<td>HROD</td>
<td>216</td>
<td>Height of Rod</td>
</tr>
<tr>
<td>BOOTS</td>
<td>BOOTS</td>
<td>40</td>
<td>Boot height of Rod</td>
</tr>
<tr>
<td>RSCT</td>
<td>2PFS</td>
<td>271</td>
<td>2 Point Free Station</td>
</tr>
<tr>
<td>OLDRSCT</td>
<td>2PFSP</td>
<td>3</td>
<td>2PFS Preserve Settings</td>
</tr>
<tr>
<td>BM</td>
<td>BM</td>
<td>38</td>
<td>Benchmark Menu</td>
</tr>
<tr>
<td>RAWD</td>
<td>RAWD</td>
<td></td>
<td>Show Last Shot Data</td>
</tr>
<tr>
<td>AZPT</td>
<td>AZPT</td>
<td></td>
<td>Azimuth Point</td>
</tr>
<tr>
<td>AZPTS</td>
<td>AZPTS</td>
<td>220</td>
<td>Azimuth Points</td>
</tr>
</tbody>
</table>

**Stake Command Group**

<table>
<thead>
<tr>
<th>Key In</th>
<th>Display</th>
<th>Page Ref.</th>
<th>Command Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAKE</td>
<td>STAKE</td>
<td></td>
<td>Stake Menu</td>
</tr>
<tr>
<td>FSPT</td>
<td>FSPT</td>
<td></td>
<td>Foresight Point</td>
</tr>
<tr>
<td>FSNEXT</td>
<td>FSNXT</td>
<td></td>
<td>Foresight Next RPt</td>
</tr>
<tr>
<td>FSPREV</td>
<td>FSPRV</td>
<td></td>
<td>Foresight Previous RPt</td>
</tr>
<tr>
<td>NXTPT</td>
<td>NXTP</td>
<td></td>
<td>Stake Next Point</td>
</tr>
<tr>
<td>RMEL</td>
<td>STOEL</td>
<td></td>
<td>Store Remote Elevation</td>
</tr>
<tr>
<td>SHOT</td>
<td>SHOT</td>
<td></td>
<td>Stakeout shot</td>
</tr>
<tr>
<td>Key In</td>
<td>Display</td>
<td>Page Ref.</td>
<td>Command Description</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>-----------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>LINES</td>
<td>LINES</td>
<td></td>
<td>Line Stakeout by Station</td>
</tr>
<tr>
<td>CURVES</td>
<td>CURVS</td>
<td></td>
<td>Curve Stakeout by Station</td>
</tr>
<tr>
<td>FSLINE</td>
<td>STKL</td>
<td></td>
<td>Stake to a Line</td>
</tr>
<tr>
<td>FSCRV</td>
<td>STKC</td>
<td></td>
<td>Stake to a Curve</td>
</tr>
<tr>
<td>RADSTK</td>
<td>GPSTK</td>
<td></td>
<td>Graphical Stakeout</td>
</tr>
</tbody>
</table>

**Survey Settings Command Group**

<table>
<thead>
<tr>
<th>Key in</th>
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<th>Page Ref.</th>
<th>Command Description</th>
</tr>
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<tbody>
<tr>
<td>CHNG</td>
<td>CHNGM</td>
<td>41</td>
<td>Change Menu</td>
</tr>
<tr>
<td>TOGRAW</td>
<td>RAW</td>
<td>42</td>
<td>Raw Data Toggle</td>
</tr>
<tr>
<td>TOGELEV</td>
<td>EL</td>
<td>42</td>
<td>Elevations Toggle</td>
</tr>
<tr>
<td>TOGNOTE</td>
<td>NOTET</td>
<td>42</td>
<td>Note Prompt Toggle</td>
</tr>
<tr>
<td>HRDOT</td>
<td>RODP</td>
<td>45</td>
<td>Rod Prompt Toggle</td>
</tr>
<tr>
<td>TOGGMF</td>
<td>M/FT</td>
<td>46</td>
<td>Meter/Feet Toggle</td>
</tr>
<tr>
<td>DISPM</td>
<td>DISPM</td>
<td>44</td>
<td>Display Options Menu</td>
</tr>
<tr>
<td>INPUTM</td>
<td>INPUT</td>
<td>45</td>
<td>Input Options Menu</td>
</tr>
<tr>
<td>MODESM</td>
<td>MODEM</td>
<td>46</td>
<td>Mode Options Menu</td>
</tr>
<tr>
<td>ADJSTM</td>
<td>ADJST</td>
<td>47</td>
<td>Adjustments Menu</td>
</tr>
<tr>
<td>SCALES</td>
<td>SCALE</td>
<td>203</td>
<td>Scale Factor</td>
</tr>
<tr>
<td>TOLR</td>
<td>TOLM</td>
<td>48</td>
<td>Tolerance Menu</td>
</tr>
<tr>
<td>HDTOLS</td>
<td>HDTOL</td>
<td>48</td>
<td>Horizontal Distance Tolerance</td>
</tr>
<tr>
<td>SDTOLS</td>
<td>SDTOL</td>
<td>48</td>
<td>Slope Distance Tolerance</td>
</tr>
<tr>
<td>ELTOLS</td>
<td>ELTOL</td>
<td>48</td>
<td>Elevation Tolerance</td>
</tr>
<tr>
<td>Key in</td>
<td>Display</td>
<td>Page Ref.</td>
<td>Command Description</td>
</tr>
<tr>
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<td>---------</td>
<td>-----------</td>
<td>---------------------</td>
</tr>
<tr>
<td>VTOLS</td>
<td>VATOL</td>
<td>48</td>
<td>Vertical Angle Tolerance</td>
</tr>
<tr>
<td>HTOLS</td>
<td>HATOL</td>
<td>48</td>
<td>Horizontal Angle Tolerance</td>
</tr>
<tr>
<td>DFLT</td>
<td>BGPTM</td>
<td>49</td>
<td>Beginning Point Menu</td>
</tr>
</tbody>
</table>

**Total Station Command Group**

<table>
<thead>
<tr>
<th>Key In</th>
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<th>Command Description</th>
</tr>
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<tbody>
<tr>
<td>ZERO</td>
<td>ZERO</td>
<td>284</td>
<td>Set 0 on Total Station</td>
</tr>
<tr>
<td>TOGFINE</td>
<td>FINE</td>
<td>140</td>
<td>Fine/Coarse Toggle</td>
</tr>
<tr>
<td>- Key in N/A -</td>
<td>INST</td>
<td>145</td>
<td>Instrument Toggle</td>
</tr>
<tr>
<td>CLR</td>
<td>CLR</td>
<td>50</td>
<td>Clear Instrument Mode</td>
</tr>
<tr>
<td>SERVO</td>
<td>SERVO</td>
<td>209</td>
<td>Robot Servo Menu</td>
</tr>
<tr>
<td>SRCH</td>
<td>SRCH</td>
<td>204</td>
<td>Search for Prism</td>
</tr>
<tr>
<td>SRHA</td>
<td>SRHA</td>
<td>131</td>
<td>Horizontal Search Range</td>
</tr>
<tr>
<td>SRVA</td>
<td>SRVA</td>
<td></td>
<td>Vertical Search Range</td>
</tr>
<tr>
<td>TURNTOPT</td>
<td>TOPT</td>
<td>269</td>
<td>Turn Servo Motor to Pt</td>
</tr>
<tr>
<td>REZERO</td>
<td>RE-0</td>
<td>193</td>
<td>Turn to 0, Check &amp; Set</td>
</tr>
<tr>
<td>HAZA</td>
<td>HAZA</td>
<td>270</td>
<td>Turn to HA &amp; ZA</td>
</tr>
<tr>
<td>CDECL</td>
<td>CDECL</td>
<td>57</td>
<td>Compass Declination</td>
</tr>
<tr>
<td>CDIR</td>
<td>CDIR</td>
<td>57</td>
<td>Compass Dir From Prism</td>
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</table>

**View Command Group**

<table>
<thead>
<tr>
<th>Key in</th>
<th>Display</th>
<th>Page Ref.</th>
<th>Command Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIEW</td>
<td>VIEWM</td>
<td>279</td>
<td>View Points &amp; Raw Menu</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Key in</th>
<th>Display</th>
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<th>Command Description</th>
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<tr>
<td>CKMEM</td>
<td>CKMEM</td>
<td>279</td>
<td>Available Memory</td>
</tr>
<tr>
<td>BKAZ</td>
<td>BKAZ</td>
<td>279</td>
<td>Back Azimuth to Stack</td>
</tr>
<tr>
<td>BKPT</td>
<td>BKPT</td>
<td>34</td>
<td>Back Point to Stack</td>
</tr>
<tr>
<td>DESC</td>
<td>DESC</td>
<td>279</td>
<td>Put Description in Raw</td>
</tr>
<tr>
<td>TS</td>
<td>TS</td>
<td>279</td>
<td>Put Time Stamp in Raw</td>
</tr>
<tr>
<td>PRINT</td>
<td>PRINT</td>
<td>184</td>
<td>Print Menu</td>
</tr>
<tr>
<td>PRAW</td>
<td>PRAW</td>
<td>185</td>
<td>Print Raw Data</td>
</tr>
<tr>
<td>DEGSYMS</td>
<td>DGSYM</td>
<td>94</td>
<td>Degree Symbol</td>
</tr>
</tbody>
</table>
RAVEN 3210 CDMA CELLULAR MODEM

In this chapter:

Communication Overview ..................................................310
HyperTerminal .................................................................311
Power-up Time .................................................................312
Querying Current Settings .................................................313
This chapter is geared towards explaining some of the more commonly used features of the Raven CDMA modems by AirLink Communications when they are used as a means to broadcast GPS signal corrections in conjunction with SMI Flex GPS receivers and SMI Field Surveying applications by Eagle Point. Although this document contains some of the more widely accepted modem configurations, the power of the AirLink Embedded Operating System (ALEOS) allows the Raven modems to configured into a variety of different communications scenarios that exceed the scope of this discussion.

For a more generic discussion on the various files permitted by the AirLink Raven modems, please refer to the Raven CDMA User Guide in the documentation section of the SMI Installation CD. The most up-to-date version of the Raven CDMA User Guide can be freely downloaded from AirLink Communications at http://www.airlink.com/support/modems/ravenCDMA.asp.

When used in conjunction with a fully charged 12-volt DC, 2000 milli-Amp-hour battery and the specified “Typical Transmit/Receive” power consumption of 250 mA is continually used, you can expect a full 8 hours of continual use. When sitting idle, the supplied battery can power the modem for up to 40 hours.

As standard practice, the Raven CDMA modems are activated and configured by Eagle Point prior to being shipped to you. As such, the equipment should be ready to be put into immediate use when it arrives to you. The following sections discuss the theory behind the equipment configuration along with recovery information in the event the configuration settings need to be re-established.

---

**Communication Overview**

The following illustration describes how GPS signal corrections are broadcast from a base GPS receiver to a rover GPS receiver using the Raven CDMA modems and a wireless data network.
**Figure 4-1 Communication Overview**

GPS Satellite → Base GPS → Raven → 1X RTT Network → IP Address → Internet → IP Address → 1X RTT Network → Raven → Rover GPS → Data Collector/Controller

All of this happens within 2 seconds from the time the correction leaves the base receiver to the time the correction arrives at the rover receiver.

---

**HyperTerminal**

The Raven CDMA cellular modem conforms to the "Hayes" (or "AT Command") style for modem commands. To query settings from the modem or to establish new settings in the modem, an 'AT' (ATTention) prefix needs to be supplied in front of the documented modem commands. Any "terminal emulation" program can gain access to the modem itself and one such program that ships with Windows is "HyperTerminal" (Start → Programs → Accessories → Communications → HyperTerminal).

To connect to the modem from a computer equipped with HyperTerminal, observe the following steps:

1. Launch HyperTerminal via Start → Programs → Accessories → Communications → HyperTerminal.
2. Supply a connection name (e.g., Raven CDMA) and press OK.

3. Specify the communication port (e.g., COM1) on the computer the modem is connected to and press OK.

4. Set the Bits per second to the highest value the computer COM port and the modem support (e.g., 115200). Leave the remaining values alone and press OK.

5. Connect the modem to the computer COM port via a standard DB 9-pin extension cable (e.g., DB 9-pin Male to DB 9-pin Female). Alternatively, a DB 9-pin Female to DB 9-pin Female cable can be used in conjunction with a DB 9-pin Male to DB 9-pin Male Null Modem adapter.

Additional discussion about this process can be found (usually in Section 3.1 Local Configuration) in the printed User Guide that accompanied the modem or on-line at http://www.airlink.com/support/modems/ravenCDMA.asp.

---

**Power-up Time**

From the time power is supplied to the Raven CDMA modem, it should be fully registered and functional on the wireless data network within 35 seconds. This can be confirmed visually when the following lights are lit on the modem:

- Pwr
- Chan
- Link
- Reg
- RSSI (blinking or steadily lit)

Within 5 seconds of initial power-up, the modem enters into the default communication protocol (usually UDP mode), unless this mode is bypassed via other means.

**Bypassing Default Start-up Mode**

1. With a HyperTerminal session running as described in *HyperTerminal on page 311*, connect the CDMA modem to the COM port on the computer.

2. Power on the modem.
You should see \( \propto \) followed by OK in the HyperTerminal window.

3. **Within 5 seconds of the OK notification, type ATMD0 or atmd0 and press the Enter key on your computer keyboard.**

   This places the modem into normal (AT command) mode. The modem should respond to the command with another OK prompt in the HyperTerminal window.

If you are/were unable to initiate the normal command mode within 5 seconds, power-cycle the modem or reset it using the Reset button located on the front of the unit.

✓ **Be sure to re-establish the default startup mode with ATMD3&W prior to exiting your HyperTerminal session.**

---

**Querying Current Settings**

Once a local HyperTerminal session with the modem has been established, the values of the current modem can be extracted/listed for troubleshooting purposes.

---

**Sending Settings to an External File**

1. From the HyperTerminal Transfer menu, choose Capture Text.

2. **Supply the name of a file you wish to create (e.g., C:\MyValues.txt) and press the Start button.**

   Notice the Capture item in the HyperTerminal status line.

3. **Type AT&V in the HyperTerminal window and press Enter.**

   The list of current modem settings is written to the named file.

4. From the HyperTerminal Transfer menu, choose Capture Text → Stop when you no longer wish to write information to the external file.

---

**Listing Settings to the HyperTerminal Window**

Type AT&V in the HyperTerminal window and press Enter.

The list of current modem settings is written to the HyperTerminal window. Specific/individual values can be listed by supplying a question mark after the variable name. Common examples include:
ATS53? Returns the remote modem IP address/port.
ATAIP? Returns the Allow IP value (0=only S53, 1=allow all).
ATS82? Returns UDP\(^1\) Auto Answer (typically, should be 2).
ATS211? Returns Ignore DTR\(^2\) (typically, should be 1).
ATMD? Returns Default Start-up Mode (typically, should be 3).
ATMLIST? Returns ModBus\(^3\) List for one-to-many scenarios.

**Script Files**

In a concept similar to Sending Settings to an External File, modem settings can be placed into a file and then sent/loaded into the modem in a group. Sending this group of commands as a script file can dramatically reduce the amount of typing needed when programming more than one modem and lessens the chance for errors.

It is strongly recommended that an ASCII file editor (such as Notepad) be used when creating script files as the native file formats of other word-processing applications (e.g., Word, Word Perfect, etc.) can introduce undesired characters into the file that may cause abnormal results.

**Activation**

As part of the service Eagle Point provides when purchasing the CDMA cellular modem solution, each unit has already been activated for you prior to it being shipped from Eagle Point. However, should a modem be delivered to you that is not activated, a script file can be sent to the modem via a local HyperTerminal session.

The script file given below is for use with the Verizon Data Network and assumes the ESN number of the modem has been assigned to a wireless cell phone number. When using the script, replace

---

\(^1\) UDP – User Datagram Protocol. A protocol within TCP/IP which converts data from an application into IP packets but does not verify that the packets were delivered correctly.

\(^2\) DTR – Data Terminal Ready.

\(^3\) Modbus – MODBUS® Protocol is a messaging structure developed by Modicon in 1979, used to establish master-slave/client-server communication between intelligent devices. See [http://www.modbus.org/default.htm](http://www.modbus.org/default.htm) for related information.
PhoneNumber with the 10-digit phone number assigned to the modem without any additional characters. For example, the first line of the script file would resemble:

AT*NETUID=5635551212@vzw3g.com
AT*NETUID=PhoneNumber@vzw3g.com
AT*NETPW=vzw
AT&W
AT\APASSTHRU
AT~NAMLCK=000000
AT~NAMVAL=0,PhoneNumber,1740,65535
AT$QCMIPNAI=PhoneNumber@vzw3g.com,1
AT$QCMIP=1
AT~NAMVAL=0
AT&W

**Single Base/Single Rover**

The following script files can be used when configuring a pair of cellular modems:

<table>
<thead>
<tr>
<th>Modem1</th>
<th>Modem2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS53=PModem2IP/12345</td>
<td>ATS53=PModem1IP/12345</td>
</tr>
<tr>
<td>ATS82=2</td>
<td>ATS82=2</td>
</tr>
<tr>
<td>ATS211=1</td>
<td>ATS211=1</td>
</tr>
<tr>
<td>ATAIP=0</td>
<td>ATAIP=0</td>
</tr>
<tr>
<td>AT\Q0</td>
<td>AT\Q0</td>
</tr>
<tr>
<td>ATMD3</td>
<td>ATMD3</td>
</tr>
<tr>
<td>AT&amp;W</td>
<td>AT&amp;W</td>
</tr>
</tbody>
</table>
**Single Base/Multiple Rovers**

The following script files can be used when configuring a single base modem to communicate to one or more rover modems:

<table>
<thead>
<tr>
<th>Base Modem1</th>
<th>Rover Modem2, Modem3, Modem4, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS53=Modem2IP/12345</td>
<td>ATS53=Modem1IP/12345</td>
</tr>
<tr>
<td>ATS82=2</td>
<td>ATS82=2</td>
</tr>
<tr>
<td>ATS211=1</td>
<td>ATS211=1</td>
</tr>
<tr>
<td>ATAIP=1</td>
<td>ATAIP=0</td>
</tr>
<tr>
<td>AT\Q0</td>
<td>AT\Q0</td>
</tr>
<tr>
<td>ATMLIST01=Modem2IP</td>
<td>ATMD3</td>
</tr>
<tr>
<td>ATMLIST02=Modem3IP</td>
<td>AT&amp;W</td>
</tr>
<tr>
<td>ATMLIST03=Modem4IP</td>
<td></td>
</tr>
<tr>
<td>ATMLISTxx=etc.</td>
<td></td>
</tr>
<tr>
<td>ATMD83</td>
<td></td>
</tr>
<tr>
<td>AT&amp;W</td>
<td></td>
</tr>
</tbody>
</table>

The Rover script given above is identical to that of the Single Base/Single Rover scenario. Also note the base specific settings for AIP, MLISTxx, and MD.

**Noteworthy Items**

**Friends Mode**

Friends Mode (FM=1) instructs the modem to only accept packets from modems found in the Friends list. Up to 10 unique friend addresses/ranges can be specified. For example:

- **FM=1** Enables Friends mode.
- **F1=166.129.2.1** Allows access by specific IP address.
- **F2=166.129.2.255** Allows access by all IPs in the range 166.129.2.0–166.129.2.255.

**Firmware Upgrading**

Over-the-air firmware upgrading can be enabled (OPRG=1) if periodic firmware updates from AirLink communications is desired.
SATEL RADIO SETTINGS

In this chapter:

SATEL External Radio Setup Procedure ......................... 318
Basic Configuration and Installation .............................. 319

CHAPTER 5
This chapter explains the functionality of the SATEL external radios as they pertain to the *SMI Flex GPS* system and *SMI* Field Surveying solutions. For more information on the SATEL external radios, refer to the documentation that came with the radios.

---

**SETEL External Radio Setup Procedure**

- **Always have the antennas attached to the radios before turning them on to prevent damage to the radios.**

**EPIC Base Radio (the large radio with two antenna ports)**

1. Thread the Gainflex (12") antenna onto the left side of the radio.
2. Thread the Miniflex (Stub) antenna onto the right side of the radio.
3. Attach the EPIC radio to the base tripod.
4. Connect the large battery to the red and black cable.
5. Connect the 15-pin cable end to the EPIC radio.
6. Check the battery strength on the radio display. It should be five bars or better.
7. Connect the remaining end to the NavCom port labeled COM1.
8. When finished, charge the large battery overnight.

**3AS Rover Radio (the smaller radio with one antenna port)**

1. Thread the Gainflex (12") antenna onto the radio.
2. Attach the battery and switch to the "ON" position.
3. Make sure the battery strength is four bars or better on the display (1-5 bars possible).
4. Put the battery in the bag and attach it to the pole.
5. Connect the coiled cable between the radio and NavCom port labeled COM1.
6. Charge the battery overnight at the office.

⚠️ The battery switch must be in the "ON" position to charge.
Basic Configuration and Installation

The radio modem is shipped with the following default settings (unless specifically ordered with settings other than those listed below):

**Fixed Settings Defined at the Time of Order**

- **Radio Frequency Range**: According to customer order, between 380–470 MHz or 869.5 MHz; takes into account the regulations set by local authorities.
- **Channel Spacing**: 12.5 kHz or 25 kHz; 869.5 MHz only available as 25 kHz version.
- **Serial Interface Type**: RS-232 or RS-422 and RS-485.

**Adjustable Settings**

- **Radio Settings**: 500 mW (3) / -112 dBm (25 kHz) or -114 dBm (12.5 kHz) apart from the Epic, which ranges from 1W to 10W.
- **Addressing**: RX Address OFF / TX Address OFF.
- **Serial Port 1**: ON / 19200 / 8 bit data / None / 1 stop bit for 12.5 kHz channel spacing the default data speed is 9600 bps.
- **Serial Port 2**: OFF / 19200 / 8 bit data / None / 1 stop bit for 12.5 kHz channel spacing the default data speed is 9600 bps.
- **Handshaking**: CTS Clear to send / CD RSSI-threshold / RTS Ignored.
- **Additional settings**: Error Correction OFF / Error check OFF / Repeater OFF / SL-Commands OFF / Priority TX.
- **Routing**: OFF
- **Tests**: OFF.
- **Message Routing**: OFF.

Connect the power cables (+V and GND) to a power supply with an output voltage of 9 – 30 VDC and with a minimum output current of 1 A (in case of the SATELLINE-3AS EPIC, the minimum output current or the power supply is 5A). Connect the DTR–pin of the serial line connector to a positive voltage.
Changing Parameters Using the LCD Display

SATELLINE-3ASd contains an LCD display that facilitates the modification of the configuration settings of the radio modem without the use of an external terminal device. This is especially convenient when modifying or reinstalling radio modems in the field. The radio modem is switched into Programming Mode by pressing the SETUP button (■). First, the LCD displays the model of the radio modem and the software revision information, after which it automatically displays the main menu, which is a list of the modifiable configuration settings.

Below is the display in Data Transfer mode. Serial port PORT 1 settings are 19200,N,8,1. Frequency is set to 468.5000 MHz. Signal strength is displayed in the upper left corner and battery level in the upper right corner.

![Figure 5-1 Radio Modem Model Display](image1)

![Figure 5-2 Software Revision Display](image2)

![Figure 5-3 Main Menu](image3)

The main menu is used to select the desired submenus and the actual modifications are performed using these submenus. It is possible to jump back at any time to the previous (higher) level in the menu hierarchy by just pressing the CANCEL button (or in some cases the BACK button). Pressing the ▲ or ▼ button:

button modifies parameters with numerical values consisting of digits. Use until the said digit (with the cursor blinking under it) has reached the desired value. In the case of numerical values, the NEXT button is used to move on to the next digit in the numerical value and then the process described above is used to modify it. The process is repeated until all digits in the value have been edited. Toggle-type parameters (typically with ON/OFF choices modifications have to be confirmed by pressing the SELECT or SET button.

**Changing the Frequency of the Active Radio Channel**

1. Press ▲ or ▼ until the cursor points to RF frequency and press SELECT to move onto the next submenu.

2. Press CHANGE if the frequency is to be modified.

   ✓ **If you want to check possible frequency band limits and the center frequency (factory set values), press ▼ and follow instructions given in Checking the Center Frequency on page 322.**

3. To move onto the next digit, press NEXT.
4. Press ▲ or ▼ until the said digit has reached the desired value. Press NEXT to move on to the next digit and repeat the above steps. The previous steps are repeated four (4) times.

5. Press ▲ or ▼ until the last changeable digit has the desired value and confirm changes by pressing SET.

The radio modem acknowledges the changes if they are within acceptable limits (± 1 MHz from the center frequency and within optional band limits) with a similar message as shown below (frequency value depends on entered value) and automatically returns to the Main menu (if the entered frequency is not acceptable an error message is displayed).

Checking the Center Frequency

1. Press ▲ or ▼ until the cursor points to RF frequency and then press SELECT to move to a submenu which can be used to check (or modify) the frequency.
The current active channel frequency setting is shown in the display.

2. To check other related values press ▼. To change the active channel frequencies, press CHANGE.

If you pressed ▼, the display shows the lower and higher limits of frequency Band 1 (these values cannot be changed). To change the active channel frequency value, press CHANGE.

3. Press ▼ again.

The display shows the lower and higher limits of frequency Band 2 (these values cannot be changed). To change the active channel frequency value, press CHANGE.
4. Press ▼ again.

The display shows the center frequency (this value cannot be changed). To change the active channel frequency value press, CHANGE.

```
Center freq.
Cf 468.2000 MHz
BACK ▲▼ CHANGE
```

**Changing Radio Settings (Transmitter Power and Receiver Sensitivity)**

1. Press ▲ or ▼ until the cursor points to Radio settings and press SELECT to move to the submenu.

```
RF frequency
Radio settings
Addressing
Port 1
Port 2
Handshaking
Additional
Tests
Factory setup
Contrast
EXIT ▲▼ SELECT
```

2. Press ▲ or ▼ until the cursor points to the setting to be modified and press CHANGE.

```
TX level
Sig. Threshold
TX start delay
BACK ▼ Change
```
Modifying Transmitter Output Power

The displayed list consists of all possible values of transmitter output power. Press ▲ or ▼ until the cursor points to the desired value and press SET.

The starting position of the cursor indicates the previously set value.

```
10mW
20mW
50mW
100mW
200mW
500mW
1000mW
CANCEL ▼ SET
```

Modifying Receiver Sensitivity

The displayed list consists of all possible values of receiver sensitivity. Press ▲ or ▼ until the cursor points to the desired value and press SET.

The starting position of the cursor indicates the previously set value.

```
min
-118 dBm
-117 dBm

-81 dBm
-80 dBm
max
CANCEL ▲▼ SET
```

Modifying the Transmit Start Delay

1. The display shows the current value of the delay. Press SET to modify the value.
TX start delay
Current value:
0 ms
CANCEL ▲▼ SET

2. Press ▲ or ▼ until the first digit of the value has reached the desired value and then press NEXT to move on to the next digit.

TX start delay
00000
▲
CANCEL ▲▼ Next

3. Repeat the previous steps five times.

4. Press ▲ or ▼ until the last changeable digit has the desired value and confirm the changes by pressing SET.

TX start delay
01234
▲
CANCEL ▲▼ Next

**Changing Addressing**

1. Press ▲ or ▼ until the cursor points to Addressing and press SETUP to move to the submenu.

RF frequency
Radio settings
Addressing
Port 1
Port 2
Handshaking
Additional
Tests
Factory setup
Contrast
EXIT ▲▼ SELECT
2. Select the desired submenu (RX or TX address) by pressing ▲ or ▼ and then press CHANGE.

```
RX addr OFF
TX addr OFF
BACK ▼ Change
```

3. Press ▲ or ▼ until the first digit of the address has reached the desired value and move to the next digit by pressing NEXT.

```
RX address
0000 0000 OFF
∧
CANCEL ▲ ▼ Next
```

4. Repeat the above steps eight times.

5. Press NEXT again to jump to the toggle field (ON/OFF) and change the status to the desired value by pressing ▲ and ▼ until correct status is reached. Confirm the new address and status (ON/OFF state) by pressing SET.

The display returns to the previous (higher) level submenu.

```
RX address
0123 0123 ON
∧
CANCEL ▲ ▼ SET
```

Both RX and TX address modifications may be done using the above steps.

**Changing Serial Port Settings (Port 1 and Port 2)**

1. Press ▲ or ▼ until the cursor points to the desired port (in this example to Port 1) and move to the submenu by pressing SELECT.
2. Press ▲ or ▼ until the cursor points to the setting to be modified and then press CHANGE.

Modification of Port Status

Press ▲ or ▼ until the cursor points to the desired port status. Confirm selection by pressing SET. The display returns to the previous (higher) level submenu.

« The starting position of the cursor indicates the previously set value.

Modification of Data Transfer Speed

Press ▲ or ▼ until the cursor points to the desired data transfer speed value (X bit/s). Confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

« The starting position of the cursor indicates the previously set value.
Modification of the Number of Data Bits

Press ▲ or ▼ until the cursor points to the desired number of data bits (7 or 8 or 9 bit data length). Confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

* The starting position of the cursor indicates the previously set value.

Modification of Parity Bits

Press ▲ and ▼ until the cursor points to the desired parity bit status. Confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

* The starting position of the cursor indicates the previously set value.

* If the number of data bits is set to 9, the value of parity bits must be set to NONE (no parity).
Modification of the Number of Stop Bits

Press ▲ or ▼ until the cursor points to the desired number of STOP bits. Confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

- The starting position of the cursor indicates the previously set value.
- Port 2 settings are modified correspondingly.

| 1 stop bit | 2 stop bits | CANCEL ▲▼ SET |

Modification of Handshaking Functions

1. Press ▲ or ▼ until the cursor points to Handshaking and move to the submenu by pressing SELECT.

<table>
<thead>
<tr>
<th>RF frequency</th>
<th>Radio settings</th>
<th>Addressing</th>
<th>Port 1</th>
<th>Port 2</th>
<th>Handshaking</th>
<th>Additional</th>
<th>Tests</th>
<th>Factory setup</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXIT ▲▼ SELECT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There are three (3) submenus relating to handshaking parameters.

<table>
<thead>
<tr>
<th>CTS Clr to send</th>
<th>CD RSSI</th>
<th>RTS Ignored</th>
<th>BACK ▼ Change</th>
</tr>
</thead>
</table>

2. Press ▲ and ▼ until the cursor points to the desired submenu selection and press CHANGE.
Defining CTS-Line Functions

Press ▲ and ▼ until the desired function is indicated by the cursor and confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

```
CTS Clr to send
Buf state
CANCEL ▲▼ SET
```

Defining CD-Line Function

Press ▲ and ▼ until the desired function is indicated by the cursor and confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

```
RSSI
Data
Always ON
RD
CANCEL ▲▼ SET
```

Defining RTS-Line Status

Press ▲ and ▼ until the desired function is indicated by the cursor and confirm the selection by pressing SET. The display returns to the previous (higher) level submenu.

```
Ignored
Flow Cont.
Recept ctrl
CANCEL ▲▼ SET
```

Selecting Special Functions

1. Press ▲ or ▼ until the cursor points to Additional and press SELECT to move to the submenu.
2. Press ▲ or ▼ until the cursor points to the setting to be modified. Press CHANGE to toggle the status of the said parameter from ON to OFF and vice versa. Press CHANGE until the parameter has the desired status. Repeat for all special functions to be modified.

3. Confirm all changes by pressing BACK.

   The display returns to the previous (higher) level submenu.
Activating Tests

1. Press ▲ or ▼ until cursor points to Tests and press SELECT to move to the submenu.

   RF frequency
   Radio settings
   Addressing
   Port 1
   Port 2
   Handshaking
   Additional
   Tests
   Factory setup
   Contrast

   EXIT ▲▼ SELECT

2. Press ▲ or ▼ until cursor points to the test that is to be initiated. Press CHANGE to toggle the status of the selected test from ON to OFF and vice versa. Press CHANGE until the parameter has the desired status.

   Short Block OFF
   Long Block OFF
   BACK ▲▼ Change

3. After the tests have been set to desired states confirm all changes by pressing BACK.

   The display returns to the previous (higher) level submenu.
Restoring Factory Settings

1. Press ▲ or ▼ to move cursor to point to Factory setup and press SELECT to move to the submenu.

   RF frequency
   Radio settings
   Addressing
   Port 1
   Port 2
   Handshaking
   Additional
   Tests
   Factory setup
   Contrast

   EXIT ▲▼ SELECT

2. Press YES.

   Do you want to restore factory settings?
   NO       YES

All radio modem configuration settings return to factory settings.

   The display shows the question two (2) times to make sure that restoring factory settings is actually intended.

Saving Modified Values into the Internal Memory

After all desired modifications have been performed they have to be saved in order to make them permanent (until next modification). This is accomplished by choosing EXIT from the main menu. The display then shows a message asking a confirmation of the performed modifications.

   Do you want to make changes permanent?
   NO       YES

If you choose YES, all modifications are saved into the non-volatile memory inside the radio modem. If you choose NO, all modifications performed are cancelled and the previous settings remain in the non-volatile memory.
SECO Instrument/Technical Tips

In this chapter:

SECO GPS Tripod Length Test - All Models..................336
Calibrating the SECO 5001-10 Rod Level.....................337
Setting Up a SECO Precise GPS Antenna Tripod..........338
Calibrating Your Prism Pole’s 45-minute Vial.............340
Setting Up a SECO GPS Optical Plummet..................342
This chapter explains the functionality of the SECO instruments as they pertain to the *SMI Flex GPS* system and *SMI* Field Surveying solutions. For more information on SECO instruments, refer to the documentation that came with the instrument.

**SECO GPS Tripod Length Test - All Models**

To verify the actual length of the GPS tripod center pole:

1. **Pick a good level concrete floor, mark an x, and set up the GPS tripod.**

   Make sure the legs don't slip by either chipping the concrete or use a #5610 tripod stabilizer.

2. **Confirm and adjust the circular vial if necessary.**

   ![Figure 6-1 Tripod](image)

3. **Place a straightedge across the top flat surface of the brass, rotating stud.**

4. **With an accurate pocket tape measurer, measure from the floor to the bottom of the straight edge. Keeping the tape plumb, measure at three places and average.**

   This assumes that the floor is level enough not to cause a sizeable error.
The following can alter the length of the center pole:

- Worn point. New point length is 3.375”. The Surloc on the center pole can loosen due to use and cause the pole length to be longer. Be careful when extending the section that the impact does not knock the Surloc loose when you come to the stop. A 5/32 allen wrench fits the Surloc mount screw.

- In older models that have black lock handle to prevent the rotation of the center pole, the center pole tube is pressed into the head bearing and can come out. Unscrew the black lock and visually look to determine if the painted tubing is flush with the brass housing. This causes the length to be longer.

---

**Calibrating the SECO 5001-10 Rod Level**

**Method 1**

This method uses a calibrated Tribrach, #2070 Tribrach adapter, and a site [ole.

1. Level the circular vial on the Tribrach and install the #2070 Tribrach adapter and site pole.

2. Hold the rod level against the site pole and observe the bubble centering. If not centered, move the three adjusting screws until centered.

   Use the #2002 to test and calibrate Tribrach.
Method 2
This method uses a calibrated prism pole and prism pole bipod.

1. Plumb up the prism pole with the bipod.

2. Next hold the rod level next to the prism pole and simply adjust the bubble to center (with the 3 adjusting screws) if not already centered.

   If possible, use the #5195 Pole Pegger to test calibration of Prism Poles.

Setting Up a SECO Precise GPS Antenna Tripod

1. Carry the tripod by the carrying handle to the point you want to set up over.

2. Hold the handle in the left hand and with the right hand pop open the center pole Surloc and extend the center pole to its stop and then lock Surloc.
If this is difficult to do standing, lay the tripod on the ground. The objective is to extend the center pole with minimal stress. For proper calibration the arrow must line up with the split in the Surloc. If desired, install lock pin in its hole to guarantee no slipping.

3. Now with center pole extended and locked, held horizontal and balanced slowly, raise the tripod horizontally until you can turn it vertical and set the point down, with control, on the ground point.

Now it is balanced and easy to work with. The objective is not to bend or hit the center pole in any fashion. The straightness of the center pole is critical for accuracy.

4. Extend one leg at a time, starting with the Surloc, unlock and fully extend then lock. Then use the quick release. Walking around the tripod, extend each leg and spread as necessary. On the third leg do not lock the lock knob until final leveling is complete.

The Surlocs are always fully extended and locked.

5. To level, stand between the two quick release legs, hold the quick release handles, squeeze and move the legs, watching the circular vial until it is centered or close to centered.

6. Final leveling can be achieved by moving, one at a time, the quick release legs. This gives you more fine movement control. This is done by holding the quick release with one hand and holding the tube that comes out with the other hand. Now looking at the circular vial, move the leg up or down until the vial is centered or is in line with the other leg. Go to the other leg and repeat until centered.

7. After centering is complete, lock the third leg with the lock knob.

You are now level and over the point.

Circular vial adjustment can be checked after leveling by simply rotating the center pole 180 degrees. If bubble does not stay within the circle, adjustment is necessary. See Adjustment of the Circular Vial on page 340.

Figure 6-5  Setup
**Breakdown Instructions**

1. Grab any leg first and collapse the upper section fully and lock.

2. Next, unlock the Surloc on the lower section, lift the outer leg up and place in hole in keeper plate, rotate leg until foot cleat is close to the center pole and lock Surloc.
   
   This leg should now be held firmly in place.

3. Repeat steps 1 and 2 with the other two legs.
   
   Remember to let the center pole and balance help you manage the weight.

4. Now lift the tripod straight up and carefully turn horizontal. Now you can lay the tripod on the ground and collapse the center pole. Or standing you can collapse the center pole. Again the objective is not to bend the center pole.

**Adjustment of the Circular Vial**

1. Set up and center bubble as precisely as possible.

2. Rotate center pole 180 degrees.
   
   If bubble goes out of the black circle adjustment is necessary.

3. Move quick release legs until bubble is half way between position one and position two.

4. With a 2.5 mm allen wrench, turn adjusting screws until bubble is centered. Recommended procedure is to tighten the screw that is most in line with the bubble.

   * Very small movements work best.

5. Repeat until bubble stays within circle.

**Calibrating Your Prism Pole's 45-minute Vial**

Calibrating your prism pole's 45-minute vial is simple with the help of a SECO pole peg adjusting jig.

1. Mount your SECO pole peg adjusting jig (#5195) to a wall in your office.
2. Place the prism pole tip in bottom shoe. Lean the pole against the C screw assembly. Now turn the C screws in the direction needed to center bubble in the bull’s eye.

3. Rotate or spin prism pole 180 degrees.

   Bubble shows the amount of error.

4. Adjust C screws until bubble moves half way back towards center.

5. Adjust vial adjustment screws until bubble is centered.

6. Repeat steps 2 - 5 at least twice, or until bubble remains centered in a full 360-degree rotation.
Setting Up a SECO GPS Optical Plummet

The SECO 2154-02 GPS Optical Plummet sets up over the point using the same procedure as an optical plummet tribrach or a total station instrument. The prismatic vial allows you to do a high setup. The rotating axis allows you to check adjustment of the vial and optical plummet.

Setting Up the Tripod

1. Loosen quick clamps or twist locks on legs.
2. With tripod closed, raise the tripod head to about chin level.
3. Tighten leg locks.
4. Spread the tripod legs so that the three shoes form an equilateral triangle and are fixed firmly in the ground, and the tripod head is approximately level and positioned directly over the surveying point.

Figure 6-8 Survey Point

Centering the GPS Optical Plummet by Adjusting the Leg Length

1. Mount the 2154-02 on the tripod head. Tighten the tripod's centering screw.
2. Turn the optical plummet eyepiece to focus on the reticle. Then push or pull the eyepiece to focus on the surveying point.
3. Turn the foot screws to center the surveying point in the reticle.
4. Now look at the circular vial. Observe the off-center direction of the bubble. Shorten a leg nearest to the direction, or extend a leg farthest from the direction. Generally, two legs have to be adjusted to center the bubble.
5. Final leveling can be completed by adjusting legs and/or turning the leveling screws to complete centering of vial.

![Optical Plummet Diagram](image)

*Figure 6-9 Centering*

6. Look thru the optical plummet again. If the surveying point is off center, loosen the (tripod) centering screw and move the 2154-02 to center the surveying point on the reticle. Then tighten the center screw. Recheck leveling of the vial.

![Optical Plummet Diagram](image)

*Figure 6-10 Optical Plummet*
TROUBLESHOOTING

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General Rules to Remember

Entering Data
If you are prompted for input (as indicated by a flashing cursor on the command line), key in the desired information and press \( \text{Enter} \).

If you want to clear an entry before entering data within Classic SMI, tap or press \( \text{Esc} \). Tap or press \( \text{Esc} \) again to cancel the current command. Tapping or pressing \( \text{Esc} \) a third time clears the data in the stack.

Alpha Entry
When you are keying in alpha data, the Alpha mode must be on. When Alpha mode is on, the Greek alpha character is be shown at the top of the display.

Normally, Alpha mode is automatically be turned on when it is needed in the program. However, there are a few exceptions. One occurs when you first assign the keyboard.

When you exit the SMI program, you need to reload the SMI surveying functions by executing the K program: press \( \text{ALPHA} \) (Allegro Ins key, Titan key) \( \text{K} \).

Reassigning keys erases any custom key assignments or routines you may have programmed within SMI.

Problems

1. The data collector seems unusually slow.

   The problem may be that your memory is close to full.

   First, check the amount of points available in your storage file by pressing \( \text{VIEW} \) (the C key) \( \text{mem} \). This tells you how much space is available for storage of points. If the available points is 100 or less, backup older jobs to your PC and/or delete unwanted jobs.

   Second, check the available memory on the data collector itself. While running SMI, tap the Start button and select Setting Control Panel. Double-tap the System icon. Tap on the Memory tab. There should be some memory available for both Storage Memory and Program Memory. If you
have less than 1000 Kb left of free memory, you may need to remove some files from the device. These could be backup files created within *SMI* or other application files.

You may also try performing a reset on the device.

2. **Distance error occurs when staking points.**

   This generally occurs if you are working in one job (with a specific range of coordinates) and then switch to a different job (with different coordinates).

   Unless you tell it otherwise, the program assumes that you are still working from the coordinates of the first job, and the last point that you occupied in that job. Therefore, it reflects distances and angles accordingly.

   To prevent such distance errors, simply reoccupy the point your instrument is on and enter the backsight number in the new job before you begin staking points.

   Note that there may be times when you want to incorporate multiple jobs and data during a project. *SMI* software gives you that flexibility and control; you can occupy a point in one job, backsight a point in another job, and actually begin staking in a third job.

3. **Cannot store notes with my job.**

   Make sure that the NOTES key is turned on (the N flag should appear at the top of the display). If the N flag does not appear at the top of the display, turn on Notes using the Change menu.

4. **I have an * (asterisk) before my distances.**

   An * indicates that a scale factor is being applied to the distance. If this was unintentional, tap `<change>` `<NeXT>` `<ADJST>` and `<SCALE>`. Set the scale factor to 1 and the distances should correctly display.

---

**Cable Trouble**

If you are experiencing problems or receiving error messages, it would not be surprising if the problem lies within your cable. Check the following:

- If the pins on your data collector are slightly misaligned, they will not properly connect with your TFR cable.

- An internal problem in your cable is a little more difficult to see. However, the following IO-Loop Back Test is a test you can run to verify that the data collector is sending (and/or receiving) data correctly through the cable.
**IO Loop-Back Test**

**KEYSTROKES:** \([\text{ALPHA}]\) (Allegro Ins key, Titan key), type \(\text{IO}\), and press !.

**SMI** has a built-in serial loop-back test that can be run to determine if the instrument or PC cable is working properly.

1. Connect the data collector to the transfer serial cable.

2. On the other end of the transfer serial cable, locate the Send and Receive pins. On the PC cable, these are pins 2 and 3. See *Instrument Configuration, which begins on page 364*, for instrument cable diagrams.

   On a PC cable, these pins should be marked with tiny numerals. When looking at the face of the cable reading the numerals, there is a row of five holes on top and a row of four holes on the bottom. Pin 1 is usually the first pin on the top right, with pins 2 and 3 adjacent to it moving across the top to the left.

   ![Figure 7-1 PC Cable Female End](image)

3. Take a paper clip and bend it into a U-shape. Use the paper clip to connect the Send and Receive pins or holes.

4. Turn the data collector on and start **SMI**.

5. Press \(\text{ALPHA}\) (Allegro Ins key, Titan key), type \(\text{IO}\) (for input-output), and press !.

   You should hear a rapid beeping sound coming from the data collector. If you remove the paper clip and the beeps continue, but at a slower rate (about one beep per second), then the data collector/cable passes the test. If the rate of the beeps is the same whether or not the clip is in the pins, you may have a problem with either the cable or the port connection on the data collector.

6. Tap or press \(\text{Esc}\) to cancel the test.

   If the cable test fails, the problem could be in the hard case or the data collector. You can eliminate the cable as a possibility by removing the cable and repeating the test on the pins of the hard case or the pins of the data collector.
Figure 7-2 Allegro Male Pins

Figure 7-3 Allegro to PC Cable Wiring Diagram

For more information and pin diagrams on specific instrument cables, refer to Instrument Reference, which begins on page 364.
Allegro-Specific Troubleshooting

If you are experiencing problems with your Allegro with SMI, here are some solutions to common problems and some general guidelines to enhanced success with your SMI product.

Common Allegro Questions

Q. What is ActiveSync® used for?

A. With regard to SMI, ActiveSync® is currently only used for installation and updates of SMI software.

Q. How do I transfer job files to my PC?

A. A number of methods exist:

- **SMI Transfer** (you can also use SMI Transfer or another PC program and use the PC COM Cable).

  ✓ ActiveSync® must not be reserving the serial COM port while using SMI Transfer to transfer job files. To make sure ActiveSync® is not using the COM port, do the following:

  1. Right click your mouse on the round ActiveSync® icon in the tool tray located in the lower right-hand corner of your screen.

  2. Left click on Connection Settings in the pop-up menu.

     Make sure Allow serial cable or infrared connection to this COM port is not toggled on.
3. Click on OK to close the window.

- The ActiveSync® program can also be used to transfer job files. You must first export the job files using the built-in SMI transfer on the data collector to export the job files to your My Documents directory on the field device. These files are then automatically transferred to your PC the next time an ActiveSync connection is established.

**Starting SMI from a Preinstalled Storage Card**

When Allegro is shipped from SMI, it should already be preinstalled and preauthorized.

1. Tap START > Programs > Windows Explorer on the Allegro.
2. Tap C_Drive > SMI (‘SMI Allegro’ folder was used for version 7 only).

3. Scroll down and double tap on Setup.

Figure 7-5  Windows Explorer

Figure 7-6  C_Drive - SMI

Figure 7-7  Setup
When a Reset Might Help

There are times when a Reset function is necessary to clear up problems that can arise when working with SMI on the Allegro. The reset options are explained in the following sections.

Reset Classic SMI

If SMI appears to lock up or the hourglass displays for a long period of time, select File > Reset Classic SMI. The reset generally fixes any problems that might occur in the Classic SMI program.

Clear Classic SMI

If you tried File > Reset Classic SMI and you still are experiencing problems with the job you are working in, select File > Clear Classic SMI. When you use this command, the Classic SMI screen prompts Try to Recover Memory?, Select NO to clear the memory on the device. Selecting YES may only save information that can continue to cause the problem you are experiencing.

If you appear to have lost any job data as a result of clearing Classic SMI, this information was already unrecoverable prior to running this command. Clearing Classic SMI results in no lost job data.

After clearing Classic SMI, you will need to re-establish your occupied point, backsight point, instrument driver, notes toggle, units (if in Metric mode), or similar settings. The Clear Classic SMI command reverts Classic SMI to the original default flags and settings.

Reset Device

A soft reset generally clears up communication problems with ActiveSync® or if the problem was not fixed using the Reset Classic SMI or Clear Classic SMI command.

Allegro CE & CX Devices

Press and hold the ON/OFF key for about 8 (eight) seconds to reset the device. You are not at risk of losing any job information unless SMI has not been properly closed.

Refer to your Allegro documentation for additional information on performing a Reset System.

A hard reset on the Allegro is used as a last resort and should not be performed until after contacting SMI technical support at 800-477-0909.

1. Press and hold the ON/OFF key with the SHIFT key for 8 seconds (until the screen goes blank), then release the ON/OFF key.
2. If the shortcut to SMI doesn’t exist on the desktop, You may need to update the registry on the field device by running the Setup.exe program in the SMI program directory. To do this, double click on the My Computer icon on the desktop, then on the C_Drive device folder, and then on the SMI Allegro folder. Double click on the SETUP.EXE program.

Setup.exe restores the SMI program to the registry of the device and the Classic SMI icons should now be displayed on both the icon tray and desktop.

3. Click on the icon to start the program.

✓ If you have other applications installed to your Allegro device that do not have a registry updating program like SMI, you may need to reinstall these programs.

Titan DAP Device

Clearing the Titan memory should only be used as a last resort and should not be performed before contacting SMI technical support at (800) 477-0909.

1. Press the F1, 0, and 9 keys at the same time and hold for about five seconds until the screen goes blank.

2. Press ESC as soon as the screen goes blank.

You are prompted for a password.

3. Enter YIWT (Yes I Want To) as the password.

4. Select option I - Erase WCE Data & Object Store.

5. Select option 8 – Soft Reset.

6. Do stylus calibration by holding the stylus on the plus symbol until it moves.

7. Select Supervisor Mode in the Style menu.

The password is YIWT.

8. Double click on the STORAGE CARD folder, then on the SMI folder.

9. Double click on the SETUP.EXE program.

10. Click on the OK button in the User Name window.

The Titan reboots and puts the Classic SMI icon in the icon tray.

11. Click on the icon to start the program.
Adjusting the Memory Settings of the Allegro

If you are using an Allegro CE in particular, many of these units can benefit from having more memory configured for use of the SMI program as opposed to storage on the device.

✔ Before committing this change to the device, be sure to back up any job files.

1. Select Start > Settings > Control Panel.
2. Double tap on the System icon.
3. Tap on the Memory tab.

   If the SMI program is currently running, you can get an idea of how much memory is required to run it and how much space is available. If it appears that most all of the program memory is in use, it is a good idea to increase the amount of memory available to the program.

4. To increase the amount of memory available to the program, move the memory slider to the left either by tapping on the left side of the slider or grabbing it with your stylus and dragging it towards the right.

   As an example, many Allegro CE units have 20,000 KB of memory available for programs and storage. If this is the case, move the slider bar so that you have about 5000 KB for Storage Memory and about 15,000 KB for Program Memory. Allegro CX units may have more memory available for program allocation.

5. Tap the OK button in the upper right corner of the screen.

   ✔ Be sure to double check that your modification has held by checking the communication settings again. This is a good idea since it is easy to accidentally tap on the X button.

   To make the memory change ‘permanent,’ you need to commit this change to the registry of the device.

6. Tap Start > Programs > Utilities > Save System.
**General Tips**

- If you are using the COM port on the Allegro to ActiveSync, exit **SMI** before attaching the Allegro to the PC, as this may interfere with ActiveSync® or transferring data between **SMI** and the PC.

- The Allegro responds to taps on the screen like a PC responds to left button mouse clicks. To select an item, use a single tap. To execute an item, use either a single tap or a double tap, depending on where the command is being used.

- If holding a stylus is not convenient, you can use a pen cap, the antennae of the radio/phone you may be holding, or even your finger/fingernail. There are also a large variety of styluses that may be used, from finger-attached to pen-based that can be secured to the Allegro using one of the strap loops.

**General Communications Problems**

Read this section first if you have just started using new or different hardware (computer, cable(s), and/or data collector), but are somewhat familiar with **SMI** or have used it before with a different computer, and are having communication problems.

**SMI Transfer** uses a serial port on your computer to transfer job files. Serial ports are male ports usually on the back of the computer. Older computers use one 9-pin and one 25-pin port. Newer computers use two 9-pin ports. Laptops usually have just one 9-pin serial port. Parallel ports (female 25-pin connectors on the computer) are not used with the **SMI Transfer** program. As a rule of thumb, "if it fits it should work."

Here is a checklist of things to verify when having communications problems:

- Make sure everything is wired properly. If the data collector is used with a total station and it collects data properly, this indicates that there should not be a problem with the pins in the data collector. If you try using a different data collector with the same computer and the transfer works, you have determined that the computer serial port is good and the transfer works properly.

- Check to see if the serial cable is connected to the wrong serial port either on the data collector or on the PC. If it is, verify the port setting on the Setup tab in the **SMI Transfer** program.

- Your data collector requires a certain amount of charge to generate a signal that can be recognized through the serial cable by your PC. If your battery is weak, it may still be strong enough to run your data collector, while not having the power needed to signal your PC.
• Verify all communication settings. If your data collector has options to set the communication parameters, they must match with the SMI Transfer program on the Setup tab.

✓ **Check the settings on the collector and verify they are set the same (baud 9600, data bits 8, no parity).** Refer to your data collector’s documentation for further assistance.

• Check to see if you have a serial or PS/2 mouse. A serial mouse needs a dedicated serial (COM) port to operate. If you have a serial mouse, you cannot boot your computer with a serial mouse (or digitizer) plugged in, and then swap cables or use a switch box to transfer data with your data collector. This generally worked in a DOS environment. Windows, however, "captures" the device on start up and reserves that port setting for that device until the machine is rebooted. Keyboard and touch pad controls normally should not cause a conflict. However, there have been instances where the computer needs to be reconfigured to get the serial port to work.

• The serial port can be tested by turning off the computer, plugging in a serial mouse (disconnect other mice), and booting up the computer. If the mouse works, you know that the port is functioning properly. If it does not work, consult the computer manufacturer or a hardware technician.

• If you have an internal or external modem, verify your modem settings. To check, click on Start > Settings > Control Panels > Modems. Check the COM port and interrupt request setting (IRQ). It is common for an internal modem to be pre-configured to use COM 3. By default, COM 3 uses the same interrupt as COM 1, so you may need to either reconfigure the modem to a different IRQ or change the modem to a different COM port setting (2 or 4 is good if you are attempting to transfer to COM 1 or vice versa). When making COM port and IRQ changes, be sure to avoid a conflict with yet a different device, card, or board. If you have several devices, do some checking of the settings that already exist for these devices.

• Verify the BIOS settings on your computer to see if the port is enabled or to see if there may be an interrupt request conflict (IRQ). You can view your BIOS settings by pressing a keystroke while your machine is beginning to start up. One most machines, this may be the F1, F2, F8, or Delete key. Check your computer’s documentation for more information.

• Remove any recently installed devices (e.g., camera, modem, PDA, digitizer, or even sound/video cards, etc.). This may require you to physically remove the device/card from the inside of the PC. Restart your machine and retry the transfer.

• Low batteries on the collector are a problem if only a portion of the file transfers.

• Swap cables if you have recently replaced cables.

• Ideally, internal modems use virtual ports (using the resources, but not using a physical port on the back of the computer) 3 or 4 on the computer. Some manufacturers assign the modem to use the resources of ports 1 or 2, thus rendering a physical port unusable. This may or may not be
Switchboxes are not recommended, but they typically are used for swapping a plotter and the data collector. They add more cabling to the system, thus leaving it open to more connector/cabling problems. If you are having difficulty transferring, bypass the switchbox until the problem is resolved.

If you have a USB port, buy a USB to serial adapter through SMI. Typically, a USB port is included in computers made in 1998 or later. If you are not sure whether you have a USB port, refer to the computer manual or manufacturer.

A local computer vendor may be able to install an additional COM port in your computer.

If you become frustrated, please contact technical support. As with any problem, you must identify exactly where the problem is realized before you can solve it.

Our support personnel provide fast, friendly answers to your product questions. You can call, fax, or e-mail your product questions to us. When calling for technical support, please use our toll free number at (800) 477-0909 or our standard business line at (563) 556-8392. The fax service is available 24 hours a day, five days a week at (563) 556-5321. If you prefer to e-mail your question, please include the state you are contacting us from so we can route your request to the support personnel in your area. You can e-mail your question to support@eaglepoint.com.

### Windows-Specific Settings

#### Windows 95, Windows 98, or Windows ME Operating Systems

*For changes to take effect, you will need to restart your computer after making the change.*

Remove and reinstall your COM port with the default settings.

1. Click on Start > Settings > Control Panel > System > Device Manager.
2. Toggle on the View Devices by Connection option.
3. Expand the Plug and Play BIOS option to reveal the desired COM port.
4. Highlight the desired COM port and click on the Remove button.
5. Reboot the computer and retry the transfer.
Without Plug and Play you can still manually remove the device, reinstall the device through Control Panel > Add New Hardware, and restart your computer.

Add a line to your computer’s autoexec.bat file.

1. Click Start > Find > Files or Folders.
2. Type autoexec.bat in the Name edit field and set Look in to your C:\ drive.
3. When it displays, highlight the file and select Find > File > Edit.
4. Add this line to the bottom of the file:
   mode com1: baud=96 parity=n data=8 stop=1 retry=p
   or
   mode com1:96,n,8,1,p
5. Restart your machine and retry the transfer.

**Windows NT, Windows 2000, or Windows XP Operating Systems**

ş For any changes to take effect, you should restart your computer after making the change.

Verify the serial device has been started.

1. Click on Start > Settings > Control Panel > Devices.
2. Scroll down to the device named Serial and start the device if the status shows it has not already been started.

Verify that there is a COM port added to your list of ports. Make sure the port that you are adding is for the serial port that you want to transfer data through.

1. To add a port, click on Start > Settings > Control Panel > Ports.
2. Review the settings.
The default settings for a COM port are found in the table below.

**Default Settings for COM Port**

<table>
<thead>
<tr>
<th>Settings</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>9600</td>
</tr>
<tr>
<td>Data Bits</td>
<td>8</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
</tr>
<tr>
<td>Stop Bits</td>
<td>1</td>
</tr>
<tr>
<td>Flow Control</td>
<td>None</td>
</tr>
</tbody>
</table>

**Advanced Settings for COM Ports**

<table>
<thead>
<tr>
<th>Advanced Settings</th>
<th>COM Port 1</th>
<th>COM Port 2</th>
<th>COM Port 3</th>
<th>COM Port 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base I/O Port Address</td>
<td>3f8</td>
<td>2f8</td>
<td>3e8</td>
<td>2e8</td>
</tr>
<tr>
<td>FIFO Enabled</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Error Messages**

"No Response" or "Failed to Start Shot Stream" Error Message

The message displays if the data collector was not able to communicate at all with the receiver. Try running 3: POS (Allegro Esc key, JETT J key, Titan SP key) after each of the following steps to see if communications are working.

1. Check the cable. Make sure the cable is plugged into the COM2 on the receiver and COM1 on the data collector.

2. Reselect the NavCom driver by pressing <GPS> (the Z key) <INST> <nCT>.

3. Check the baud rate by selecting File > Settings. Make sure Wire is set to COM1 and Force baud rate to and Flow Control are not turned on (unless you have reconfigured the NavCom receivers to a different baud rate using starutil.exe).
5. Run the PORTS command by pressing a INFN (Allegro Esc key, JETT J key, Titan SP key).

6. Run the RESET command by pressing a INFN. After running the RESET command the receiver needs to download a new GPS Almanac. This process could take up to 13 minutes. After a reset the second Com port will be configured for 19,200 baud, the default baud rate for the NCT and NCTG drivers.

7. Try a different COM port on the receiver. Usually COM2 is used on the receiver. Switch the cable to COM1 on the receiver. Switch back to COM2 if COM1 does not work.

8. Try a different COM port on the data collector (if available). Usually COM1 is used on the data collector. Connect the cable to the COM2 port and select File > Settings. Make sure Wire is set to COM2. Make sure Force baud rate to and Flow Control are not turned on. Switch back to COM1 if COM2 does not work.

9. Test the cable by pressing ALPHA (Allegro Ins key, Titan key), typing |Q, and pressing !. The data collector will start beeping and instruct you to connect the send and receive pins. Until you do so, the message SERIAL TEST FAILED displays. With the cable plugged into COM1 on the data collector, connect pins 2 and 3 of the cable end that plugs into the NavCom receiver with a piece of metal as shown in the figure below. If everything is working, you will hear the beeping speed up and see the message SERIAL TEST OK. If the serial test does not work, remove the cable from the data collector and connect the middle pin and the pin to the left of it on the top row of COM1. If the test fails for COM1 as well, the COM port may be bad.

![Figure 7-8 Test the NavCom Cable](image-url)
"Q:0 Unrecognized Error Code" in GPS Instrument Status Window

An unrecognized error code message usually means the cable is plugged into the wrong COM port on the NavCom receiver. Either switch to the other COM port or tap \texttt{rover} in the GPS menu (the Z key). The \texttt{ROVER} function reconfigures the COM ports so that the COM port is the data collector port.

"Position Not Valid" Error Message

Run the GPS Instrument Status command by pressing \texttt{c POS} (Allegro \texttt{Esc} key, JETT J key, Titan SP key). Troubleshoot based on the error message or status message that displays in the GPS Instrument Status screen.

Link LEDs on Base Receiver Are Not All Blank

If, after setting up both the base and rover to use the internal radios, the link LEDs on the base receiver are not all blank, there is probably another \textit{SMI Flex GPS} base radio within radio range. To avoid conflicts, put each of your receivers on a new network ID. Connect the data collector to the receiver, press \texttt{a INFN} (Allegro \texttt{Esc} key, JETT J key, Titan SP key), and tap \texttt{n ETID}. The current network ID displays and you are prompted to enter a new one. Enter a number between 1 and 255 that is different than the current network ID. Repeat and use the same network ID for all your receivers.

Rover Not in Q5 RTK Fixed Mode

There are several conditions that must be met for the rover to be able to obtain RTK Fixed mode. The GPS Diagnostics window contains a checklist of the conditions.
Assign GPS Diagnostics to a Command Key

Tap the Command Keys Properties icon in the lower right corner of the screen. Tap the GPS Setup menu and tap the OK button in the Current Commands window. GPS Diagnostics is now assigned to the F2 Command Key with the label GPSD.

![GPSD Command Key Assignment](image)

**Figure 7-10 GPSD Command Key Assignment**

See GPS Diagnostics (SMI Flex System) on page 120 for information on how to run the GPS Diagnostics command while connected to the rover and base.

Receiving RTK Corrections

When running the GPS Diagnostics command while connected to the rover, this box will be checked if any corrections from the base are being received. They should be received once a second. If this box is not checked, try the following:

If using internal radios:

1. Make sure at least the red link LED is on and steady, which indicates that there is enough signal strength to receive the corrections. If the signal strength is good, then the base may not be transmitting (see Sending RTK Corrections for 5 Satellites on page 120). If all three link LEDs are blinking in sequence, then the signal has been lost completely.

2. Either take the rover closer to the base or check the link LEDs on the base to make sure they are all off, which indicates that the base radio has a connection. Another less common problem is that the network IDs of the internal radios do not match.
3. Press ❡ INFN (Allegro Esc key, JETT J key, Titan SP key) NeXT nETID to see the network ID number.

4. Tap or press Esc to cancel without changing the value. Do the same thing while connected to the base to compare the network ID numbers.

If using SATEL external radios:

1. Check the red RD LED on the rover radio. It should be blinking once per second. If it is blinking, press GPS (the Z key) ROVER, answer YES and enter the baud rate shown on the display of the rover radio. Check the cable going from the radio to COM1 on the receiver. To check that the radio cable is working, remove the cable from the receiver and connect pins 2 and 3 as shown in Figure 7-8 on page 361. When the pins are connected, the TD LED blinks once a second like the RD LED if the cable is good.

2. If the rover radio red RD LED is not blinking, compare the frequencies shown on the base and rover displays to make sure they match. Check to see that the base radio TD LED is blinking. If it is not, see Sending RTK Corrections for 5 Satellites on page 120.

---

### Charging Indicator LEDs for Battery Not Coming On

When a battery gets overcharged, it turns off an internal switch to prevent damage. The charger does not recognize a battery in this state. To correct the problem, simply put the battery in a receiver and turn it on for 10-15 minutes to slightly discharge the battery.

---

### What to Do After Rebooting

If there was a problem that caused the software to close without saving the current state, there are a few things that should be done to make sure the current GPS setup is valid. The settings will probably be what they were the last time Classic SMI was closed correctly. Press SETUP (Allegro F key, JETT J key, Titan G key) to make sure the correct job is current, that the M flag is showing if you should be in meters mode, that the occupied point and backsight angle are correct, and that the HI and HROD are set correctly. After correcting the settings, shoot a known point to verify the setup.
INSTRUMENT REFERENCE

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Each instrument driver is categorized by the current manufacturer or owner of that instrument line. In some cases intellectual property rights to certain instruments has switched corporate ownership—therefore the instruments are grouped by the current owner of that technology.

To select an instrument, use the soft key that corresponds to the particular model (refer to Instruments on page 140). The soft key installs the driver for the selected instrument. A driver is the software on the data collector that controls the instrument.

Some of the instrument drivers can measure a distance in Fine or Coarse mode. This is selected using the <CRS> / <FINE> key in the <INST> or <ROBOT> menu. Because of the limitations of some instruments, some instrument functions may not be available. When an instrument function is not supported, you will usually see a message to do it manually or that it is not supported in the current driver.

It is important that the baud rate, parity, data bits, and stop bits be set correctly on the instrument. In most cases, these settings are unchangeable on the data collector, so the instrument must be set to match the settings shown in this chapter. In the description of each driver, the communication settings are shown as baud-parity-data bits-stop bits. For example 9600-None-8-1 indicates 9600 baud, no parity, 8 data bits, and 1 stop bit.

If you suspect that the instrument cable may be bad, use the cable diagrams in this chapter and the instructions in IO Loop-Back Test on page 348 to test the Send and Receive wires of the cable.

Instrument drivers that are only available in the Robotic version are indicated with (Robotic). A detailed description of using the GPS and Robotic drivers is found in the SMI Version 8 User Guide.

The following sections give detailed instructions on using each of the supported surveying devices with the SMI field survey software.

See Instruments on page 140 for more information about the Instruments command.

---

**Geodimeter**

**KEYSTROKES:** | SETUP (Allegro F key, JETT J key, Titan G key) | NeXT | NeXT | INST | NeXT | NeXT | GeO
---|---|---|---|---|---|---|---

**Supported Geotronics (Geodimeter) Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO</td>
<td>400 and 500, 610</td>
<td>Variable-None-8-1</td>
</tr>
<tr>
<td>gEO4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Geodimeter drivers, except for the GEO driver, prompt for a baud rate. Usually, 4800 baud works the best on the GEO4 driver and 9600 baud on the other drivers.

The G420 driver has two additional options. It prompts for a delay time. This time is how long for the data collector should wait between asking the instrument to measure and asking the instrument for the results of the measurement.

The G420 driver also prompts USING TRACK/AIM KEY?. If you press YES, the driver does not try to cause the instrument to measure. Instead, you are expected to press the AIM key or to have the instrument in Track mode so that the distance is automatically sent by the instrument. The delay time is not used when this option is on.

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>G420</td>
<td>400, 420, 422, old style 440, 440LR, 620</td>
<td>Variable-None-8-1</td>
</tr>
<tr>
<td>RPU</td>
<td>For certain 600 series RPU models</td>
<td>Variable-Even-7-1</td>
</tr>
<tr>
<td>G600</td>
<td>(ROBOTIC only) Robotic capable 600 series</td>
<td>Variable-None-8-1</td>
</tr>
</tbody>
</table>

The Geodimeter/Trimble Custom Instrument Functions Menu

### Geodimeter/Trimble Custom Instrument Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>Prepares the Geodimeter to receive commands from the data collector. The Geodimeter must be in RPU mode for this to work.</td>
</tr>
<tr>
<td>OFF</td>
<td>Turns the Geodimeter off, but leaves the radio for the Geodimeter on. The radio the data collector is connected to can be turned off manually. To turn the Geodimeter back on, turn the radio for the data collector back on and press ON. To turn off the Geodimeter and its radio, tap rOFF.</td>
</tr>
<tr>
<td>FOLL</td>
<td>Sets the Geodimeter in Follow mode immediately. If needed, a search is performed before starting Follow mode. This is useful when AIM and FLW flags are turned off and you want the instrument to follow the prism.</td>
</tr>
<tr>
<td>Option</td>
<td>Function</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| **DIST** | Sets the Distance mode immediately. If the **CRS | FINE** toggle is set to **CRS** (Coarse) the future shots use this Distance mode. You can enter 0-3 to select one of the following:  
- 0: Standard 4s  
- 1: Track 0.4s  
- 2: Repeated Standard 4s  
- 3: Fast Standard 2s |
| **AIM** | Use this toggle key to select whether the Aim command is used before performing a Coarse mode shot. The Aim command adds about 4 seconds to the shot. |
| **FLW** | Use this toggle key to select whether the Follow command is used after performing a Coarse mode shot. If the Aim command is used, Follow must be executed before the instrument will follow the prism again. |
| **SRHA** | Changes the horizontal search range. |
| **SRZA** | Changes the zenith angle search range. |
| **SOUN** | Sets the sound level of the instrument. Enter a value between 0 and 99. |
| **LEVEL** | Enables the level compensator. |
| **ROFF** | Turns both the instrument and its radio off. To turn the Geodimeter on again, the Geodimeter must be manually turned on and put in the RPU mode again. To turn the Geodimeter off but leave the radio on, use the **OFF** key in the Custom Instrument Functions menu instead of the **ROFF** key. This is so it can be turned on again from the data collector. |
| **CHAN** | Changes the default radio channel. The default is 1. The value should match the radio channel setting on the instrument. |
| **IADD** | Changes the default instrument address. The default is 1. The value should match the “Station Address” setting on the instrument. |
| **CUADD** | Changes the default control unit (data collector) address. The default is 2. The value should match the “Remote Address” setting on the instrument. |
**Instrument Setup**

1. Press MNU 4 1 (select device) 2 (Serial) YES 1.8.0.4800 ENT. If using a baud rate other than 4800, replace 4800 in this step with the correct baud rate.

2. If prompted U.D.S.?, answer NO.

3. Set the table number to 0 and press ENT.

4. If prompted Request?, answer YES.

5. If prompted REG.key?, answer NO.

6. If prompted slave?, answer NO.

**Setting Up the Geodimeter 600/Trimble 5600 Instrument**

To control the Geodimeter 600/Trimble 5600 series instruments via radios, you must have the Command and Control (C&C) option or have an instrument firmware version later than 696-03.00. If the C&C module is not installed on your instrument, it can be purchased from and installed by your dealer.

To prepare the instrument to communicate with the SMI data collector, set the following parameters on the instrument:

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station address</td>
<td>1</td>
</tr>
<tr>
<td>Remote address/control unit address</td>
<td>2</td>
</tr>
<tr>
<td>Radio channel</td>
<td>1</td>
</tr>
</tbody>
</table>

Perform the following steps on the instrument to set these values:

1. Press MNU 1 (Set) 5 (Radio) “Channel=1?” YES “Station address” 1 ENT “Remote address” 2 ENT.

   The communications of the instrument and both radios should be set to 9600 baud and no parity.

2. Press MNU 4 (Data com) 1 (Select Device) 2 (Serial) “Serial ON?” YES 1.8.0.9600 ENT.

3. Set the table number to 0 and press ENT.
4. If prompted `REG.key?`, answer **NO**.

5. If prompted `slave?`, answer **NO**.

To put the instrument in RPU mode:

1. Tap `<rPU>` and choose Remote mode.

2. If prompted `Set sector?`, tap `<NO>`.

3. If prompted `Measure Ref obj?`, tap `<NO>`.

4. When prompted to press any key, do so.

   It is not necessary to remove the keyboard. After tapping the key, the instrument turns off and is ready to accept commands through the radio.

You may also set these values on the SMI data collector to match the settings on the instrument. Select the Custom Instrument Functions menu by pressing `<INFN>` (Allegro `<Esc>` key, JETT Titan SP key). Use `<CHAN>` to change the radio channel, `<IADD>` to change the Instrument Address, and `<CUADD>` to change the Control Unit Address.

### Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO RESPONSE FROM RADIO</strong></td>
<td>Check connection to radio. Try turning the radio off and back on.</td>
</tr>
<tr>
<td><strong>GEO: NOT RESPONDING</strong></td>
<td>Turn radio off and back on. Tap <code>&lt;ON&gt;</code> in the Custom Instruments menu. It may be necessary to press <code>&lt;ON&gt;</code> a second time. If this does not work, restart Geodimeter 600 RPU mode.</td>
</tr>
<tr>
<td><strong>NOT LEVEL</strong></td>
<td>Instrument is not level.</td>
</tr>
<tr>
<td><strong>SCOPE FLOPPED</strong></td>
<td>Geodimeter cannot measure a distance or track the prism while flopped.</td>
</tr>
<tr>
<td><strong>NO DISTANCE</strong></td>
<td>Make sure of tracking prism and try again.</td>
</tr>
<tr>
<td><strong>BATT LOW</strong></td>
<td>Battery on Geodimeter is low.</td>
</tr>
<tr>
<td><strong>SERIAL ERROR</strong></td>
<td>Check cable connections.</td>
</tr>
</tbody>
</table>
### Error Message Procedure

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIME OUT</td>
<td>Try again.</td>
</tr>
<tr>
<td>WRONG MODE</td>
<td>Try again.</td>
</tr>
<tr>
<td>TARGET NOT FOUND</td>
<td>Point instrument toward prism and search again.</td>
</tr>
<tr>
<td>TARGET LOST</td>
<td>Search for prism.</td>
</tr>
<tr>
<td>ZA TOO STEEP</td>
<td>Data collector attempted to move to an invalid Zenith Angle.</td>
</tr>
<tr>
<td>TRY AGAIN</td>
<td>Previous operation interrupted, try again.</td>
</tr>
</tbody>
</table>

### Notes on Using the G600 Driver or 5600 Driver

- While in reverse face, the instrument only measures if it is already on the prism. It cannot search while in reverse face. It first gets a distance from the prism, then moves down to the LED to get the angles and calculate the Zenith Angle to the prism. As implemented, it is assumed that all reverse face distances will be measured to prisms that are farther away than 20 feet. It will not zero or set angle in reverse face.

- To connect the data collector directly to the instrument, select the `<GEO4>` driver instead of the `<G600>` driver (`SETUP` (Allegro F key, Titan G key) `NeXT` `NeXT` `INST` `NeXT` `Geo g` `E04`). A baud rate of 4800 works better when using a cable instead of the radios.

- A shot in Coarse mode takes about 3 seconds if in Track mode and `<AIM>` and `<FLW>` flags are turned off. A shot in Fine mode takes about 10-15 seconds. The default setting is Fine. The mode is changed by using the `<CRS`/`FINE` toggle key in the Instrument menu.

- In addition to the standard cable, a Y cable that connects the data collector and an external battery to the Geodimeter is also available.

- If the instrument has a servo motor and the `<GEO4>` driver has been selected, the data collector will turn the instrument to the foresight point when FSPT is used. To turn this feature on and off, use the `<FS>` toggle key in the Servo menu. See Servo Menu (SRVO) on page 209 for more information.

- The Geodimeter 422 works faster in Coarse mode (@ 10 seconds) than Fine mode (@ 20 seconds). You can switch between Coarse and Fine in the Instrument menu. See Instruments Menu on page 141 for more information.
Wiring Diagrams for Geodimeter Instruments

Figure 8-1 Allegro to Geodimeter 9-pin Wiring Diagram

Figure 8-2 Allegro to Geodimeter RPU Wiring Diagram

Figure 8-3 Allegro to Geodimeter 600 Wiring Diagram

Figure 8-4 Allegro to Geodimeter 600Y Wiring Diagram
**Hewlett Packard**

KEYSTROKES:  
<table>
<thead>
<tr>
<th>SETUP</th>
<th>Allegro F key, Titan G key</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER</td>
<td>3820</td>
</tr>
</tbody>
</table>

**Supported Hewlett Packard Model**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3820</td>
<td>HP 3820 Total Station</td>
<td>9600-None-8-1</td>
</tr>
</tbody>
</table>

**Instrument Setup**

Set baud rate and parity.

**Comments**

A special cable from Ingenuity is required for this instrument. When the data collector needs a measurement from the instrument, you must press certain keys on the instrument. The data collector tells you which keys to press. You can press the MULTI key when measuring a distance to lessen the number of keys pressed.

---

**Kern**

KEYSTROKES:  
<table>
<thead>
<tr>
<th>SETUP</th>
<th>Allegro F key, Titan G key</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTHER</td>
<td>kern</td>
</tr>
</tbody>
</table>

**Supported Kern Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>KERN</td>
<td>Any model that uses the Kern ASB system</td>
<td>1200-Even-7-1</td>
</tr>
</tbody>
</table>

**Instrument Setup**

None
### Laser Atlanta

**KEYSTROKES:** ![SETUP](Allegro F key, Titan G key) ![NEXT](NeXT) ![NEXT](NeXT) ![INST](INST) ![NEXT](NeXT)

**OTHER LASER**

**Supported Laser Atlanta Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>LASER</td>
<td>ProSurvey 1000 Laser Rangefinder</td>
<td>4800-None-8-1</td>
</tr>
</tbody>
</table>

**Instrument Setup**

None

**Comments**

After pressing the key to measure on the data collector, press the trigger on the Rangefinder to send the data to the data collector.

### LaserCraft

**KEYSTROKES:** ![SETUP](Allegro F key, Titan G key) ![NEXT](NeXT) ![NEXT](NeXT) ![INST](INST) ![NEXT](NeXT)

**OTHER CRAFT**

**Supported LaserCraft Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRAFT</td>
<td>XLR, XLRM, XLRi, or XLRic</td>
<td>19200-None-8-1</td>
</tr>
</tbody>
</table>

**Instrument Setup**

When you press ![SIDS](Allegro J key, Titan K key) on the SMI data collector, you are instructed to fire the laser and release the trigger. The instrument then sends the distance and angles to the data collector and the point is stored.
Comments
Directions sent from the laser are azimuths from an internal compass instead of an angle right from a backsight.

Laser Technologies

KEYSTROKES: 

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRIT</td>
<td>Criterion</td>
<td>4800-None-8-1</td>
</tr>
</tbody>
</table>

Supported Laser Technologies Models

Instrument Setup
None

Comments
After pressing the key to measure on the data collector, press the trigger on the Criterion to send the data to the data collector.

Leica/Wild

KEYSTROKES: 

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>WILD1</td>
<td>T1000, TC1000</td>
<td>2400-Even-7-1</td>
</tr>
<tr>
<td>WILD2</td>
<td>T1000, TC1000, T2000, TC2000, T1600</td>
<td>2400-Even-7-1</td>
</tr>
</tbody>
</table>
### Driver Models Settings

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>T2002, TC1600</td>
<td>2400-Even-7-1</td>
</tr>
<tr>
<td>OLDTC</td>
<td>C800, Reflectorless</td>
<td>2400-Even-7-1</td>
</tr>
<tr>
<td>TC</td>
<td>T1010, T/TC1600 T/TC1610, TC1700, TC1800, 500's, TC605, TC600, TC800, TC805L</td>
<td>2400-Even-7-1</td>
</tr>
<tr>
<td>TCM</td>
<td>Motorized TCM's, TC1700</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>TCA</td>
<td>(ROBOTIC only) TCA, TDM 5000's</td>
<td>9600-None-8-1</td>
</tr>
</tbody>
</table>

### Leica TC/TCM Instrument Functions Menu

**KEYSTROKES:** `a` INFN (Allegro Esc key, Titan SP key)

#### Leica TC/TCM Instrument Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLR</td>
<td>Stops the instrument from tracking a prism. This can be useful if the instrument appears non-responsive or if it displays an @W100 error message (instrument busy). You can also run this command by pressing <code>cCLR</code> (the 8 key).</td>
</tr>
<tr>
<td>prism</td>
<td>Sends the prism constant to the instrument.</td>
</tr>
<tr>
<td>Dist</td>
<td>Toggles between having you control the Course/Fine mode in the instrument settings ((\text{SETUP}) (Allegro F key, Titan G key) (\text{NeXT} \text{ NeXT} \text{ NST} \text{ crs} \text{ fine})) and having the instrument govern this setting. When you tap this key, the screen displays \text{WILL USE DIST MODE ON LEICA} or \text{WON’T USE DIST MODE ON LEICA}.</td>
</tr>
<tr>
<td>off</td>
<td>Turns the instrument ON and OFF.</td>
</tr>
<tr>
<td>set</td>
<td>Sets an ID and value on the instrument. First, type the ID and the corresponding value separated by a space. Then, tap this key to set the ID and value.</td>
</tr>
<tr>
<td>conf</td>
<td>Allows you to see what the current value of an ID is on the instrument. Type the ID and then tap this key.</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>get</strong></td>
<td>Allows you to get a value from an entered WI number from the instrument. Type the WI number and then tap this key.</td>
</tr>
</tbody>
</table>

---

**Leica TCA Instrument Functions Menu**

**KEYSTROKES:** a INFN (Allegro Esc key, Titan SP key)

**Leica TCA Instrument Functions Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>show</strong></td>
<td>Displays the current ATR, LOCK, and LOCKED status of the instrument.</td>
</tr>
<tr>
<td><strong>Atr</strong></td>
<td>Toggles the ATR mode. Turning on ATR turns off the LOCK mode.</td>
</tr>
<tr>
<td><strong>lock</strong></td>
<td>Toggles the LOCK mode. Turning on LOCK mode turns on ATR mode. Turning off LOCK mode turns off ATR mode.</td>
</tr>
<tr>
<td><strong>CLR</strong></td>
<td>Stops the instrument from tracking a prism. This can be useful if the instrument appears non-responsive or if it displays an @W100 error message (instrument busy). You can also run this command by pressing c CLR (the 8 key).</td>
</tr>
<tr>
<td><strong>prism</strong></td>
<td>Sends the prism constant to the instrument.</td>
</tr>
<tr>
<td><strong>srha</strong></td>
<td>Changes the horizontal search range.</td>
</tr>
<tr>
<td><strong>srza</strong></td>
<td>Changes the zenith angle search range.</td>
</tr>
<tr>
<td><strong>off</strong></td>
<td>Turns the instrument ON and OFF.</td>
</tr>
<tr>
<td><strong>set</strong></td>
<td>Sets an ID and value on the instrument. First, type the ID and the corresponding value separated by a space. Then, tap this key to set the ID and value.</td>
</tr>
<tr>
<td><strong>conf</strong></td>
<td>Allows you to see what the current value of an ID is on the instrument. Type the ID and then tap this key.</td>
</tr>
<tr>
<td><strong>get</strong></td>
<td>Allows you to get a value from an entered WI number from the instrument. Type the WI number and then tap this key.</td>
</tr>
</tbody>
</table>
Option | Function
--- | ---
Dist | Toggles between having you control the Course/Fine mode in the instrument settings (SETUP (Allegro F key, Titan G key) NeXT NeXT INST crs / fine) and having the instrument govern this setting. When you tap this key, the screen displays WILL USE DIST MODE ON LEICA or WON’T USE DIST MODE ON LEICA.

**Leica GPS Instrument Functions Menu**

**KEYSTROKES:** a INFN (Allegro Esc key, Titan SP key)

**Leica GPS Instrument Functions Menu Soft Key Definitions**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>on</td>
<td>Turns on the receiver.</td>
</tr>
<tr>
<td>off</td>
<td>Turns off the receiver.</td>
</tr>
<tr>
<td>reset</td>
<td>Resets the receiver. After reset, the receiver has to reacquire the satellites.</td>
</tr>
<tr>
<td>ant</td>
<td>Allows you to select the type of antenna you are using. After you select it, the data collector tells the receiver, and the offsets of that antenna will be used in calculating the positions. This allows you to measure the height to the base of the antenna or to the height hook if selecting one of the Tripod antennae.</td>
</tr>
</tbody>
</table>

**Instrument Setup**

Make sure baud rate and parity are set correctly.

Models listed under WILD1 WILD2 2002: Press SET REC 99 RUN REC. Set mode 78. Set mode 76 to 0 (GRE). Set mode 73 to 0 (CR). If using the WILD2 or 2002 driver, set mode 74 to 1 (T2000 Emulation mode). If using the WILD1 driver, set mode 74 to 0 (T1000 Emulation mode).

**Setting up the Leica Instrument**

To prepare the Leica to communicate with the data collector, set the GSI baud rate to 9600, the protocol to GSI, parity to NONE, Terminator to CRLF, and 8 data bits.
**TCA1100**

On the TCA1100, the following keys are used to set the communications: Get in the Main menu and press Setup to set the following:

<table>
<thead>
<tr>
<th><strong>Option</strong></th>
<th><strong>Settings</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rec. Device</td>
<td>RS232</td>
</tr>
<tr>
<td>Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>Protocol</td>
<td>GSI</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE</td>
</tr>
<tr>
<td>Terminator</td>
<td>CR LF</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bit</td>
<td>1</td>
</tr>
</tbody>
</table>

Make sure that Remote Control (RCS) is turned off in the Extra menu.

The instrument must be in the Measure mode screen to work with the data collector. From the Main menu, press the MEAS key.

If the data collector is used to turn on the instrument, it should start up ready to use GSI. To do this on the TCA1100, from the main menu, press CONF and set the “autoexec-application” to “Meas & Rec (GSI).”

**TCA1103**

On the TCA1103, the following keys are used to set the communications:

1. Get in the Main menu, then press Setup and set “Meas Job:” to “RS232.”
2. Press ESC to get back to the Main menu.
3. Press 5 for Configuration and select 2 Communication mode.
4. Press 1 GSI Parameters and set the following:
<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>Protocol</td>
<td>GSI</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE</td>
</tr>
<tr>
<td>Terminator</td>
<td>CR LF</td>
</tr>
<tr>
<td>Data bits</td>
<td>8</td>
</tr>
<tr>
<td>Stop bit</td>
<td>1</td>
</tr>
</tbody>
</table>

- RCS mode must be turned off. On the Leica, press PROG (Program) RCS to turn it off.
- The instrument must be in the Measure mode screen to work with the data collector. From the Main menu, press the MEAS key.

**TC Driver**

On the TC Driver make sure the following settings are set to the corresponding values.

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA OUT</td>
<td>RS232</td>
</tr>
<tr>
<td>Format</td>
<td>8 or 16</td>
</tr>
<tr>
<td>RS232</td>
<td>Mask: 1</td>
</tr>
<tr>
<td>Baud</td>
<td>2400</td>
</tr>
<tr>
<td>Parity</td>
<td>EVEN</td>
</tr>
<tr>
<td>End Mark</td>
<td>CR</td>
</tr>
</tbody>
</table>

**Setting up the Leica Base Station Receiver**

1. Put the GPS antenna on a tripod in a spot where there is a wide view of the sky. If using State Plane Coordinates, it must be on a point for which you have the State Plane Coordinates. If using local coordinates, it can be on a known point or an unknown point.
You will also need to acquire a cable from Leica that will connect the collector to the receiver. This is part # 560-254 and can be purchased from your Leica dealer or directly from Leica through their website.

2. Connect the GPS antenna to the receiver.
3. Connect the battery to the PWR port or put a battery pack in the receiver.
4. If a Leica controller is connected to the receiver, remove it from the receiver.
5. Connect the cable from the data collector to the receiver’s TERMINAL port.
6. Connect the base radio cable to the receiver’s PORT 1 port.
7. Connect the power to the base radio.
8. Connect the radio antenna to the base radio. Put the radio antenna as high as possible.
9. Press the receiver’s ON/OFF button to turn on the receiver. An alternate way to turn on and off the receiver is to use the ON and OFF soft keys in the Leica Instrument Functions menu (INFN key, Titan SP key).
10. Wait until the Tracking LED light is green and steady, indicating that enough satellites are being tracked to calculate a position.
11. Press POS (Allegro Esc key, Titan SP key) to see the GPS Status screen. If you see the message POSITION DATA NOT AVAILABLE, there could be a problem with the cable connection, or the receiver may not have a position yet. Check the cables and make sure the receiver’s Tracking LED light is steady and green.
   The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the base, the quality will be 1, the link will be 999, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3. The RMS values shown are error estimates in feet or meters, depending on the current mode. The RMS values will be high at the base receiver. If the HDOP and VDOP values are high, they may get lower after a few minutes. If they do not get low enough, you can still proceed, but accuracy may not be very good unless more satellites come into view.
12. Press INFN (Allegro Esc key, Titan SP key) . Select the type of antenna you have at the base and press .
   The data collector tells the receiver which antenna you selected and the offsets for that antenna will be part of the calculations of the elevation.
13. Tap SETUP to enter the distance from the ground to the base of the antenna.
If you are using the Leica Tripod hook, you should select one of the tripod antenna options and measure to the height hook instead of the base of the antenna.

If you are using 2PFS or BM to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

14. Press BASE in the GPS menu. Enter the point number occupied by the base station or 0 if the base is on an unknown location.

You are prompted for the radio port number.

15. Press 1 and !.

You are prompted for the radio baud rate. The default radio baud rate is 38400.

16. Type 38400 and press !.

The data collector then initializes the receiver as a base station. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

17. Turn on the base radio.

The Transmit light (TX) should blink once per second. If the Receive light (RX) is blinking, there is radio interference. If the TX light is not blinking, make sure the radio port and baud rate entered using the BASE key are correct.

18. Disconnect the data collector from the base receiver.

Setting Up the Leica Rover Receiver

1. Follow the directions for setting up the Leica base receiver.

2. Put the GPS antenna on the pole.

3. Put the battery pack in the receiver.

4. Put the receiver on the pole if mounting to a pole.

5. Connect the GPS antenna to the receiver.

6. If the Leica controller is connected to the receiver, remove it from the receiver.

7. Connect the cable from the data collector to the receiver's TERMINAL port.
8. Connect the rover radio to the receiver’s PORT 1 or PORT 3 port.

9. Connect the radio antenna to the rover radio.

10. Press the receiver’s ON/OFF button to turn on the receiver. An alternate way to turn on and off the receiver is to use the ON and OFF soft keys in the Leica Instrument Functions menu (Allegro Esc key, Titan SP key).

11. The radio Power LED should be on. If not, check the connection.

12. The radio Receive LED should be blinking once per second. It may be difficult to see in direct sunlight. If it is flickering, there may be radio interference.

13. Whether you are using a local coordinates or state plane coordinates, you will need to verify your setup.

   Please refer to Guide to GPS in the SMI Version 8 User Guide for finishing the setup. Certain actions need to be performed based on your type of setup (i.e., Assumed Coordinates with Geodetic Backsight; Starting with two known state plane monuments; Using multiple rovers with one base; etc.).

   Wait until the receiver’s Tracking LED light is green and steady, indicating that enough satellites are being tracked to calculate a position.

14. Press a INFN (Allegro Esc key, Titan SP key) aNT. Select the type of antenna you have at the rover and press !.

   The data collector tells the receiver which antenna you selected, and the offsets for that antenna will be part of the calculations of the elevation.

15. Tap SETUP HROD to enter the distance from the ground to the base of the antenna. If you are using the AT502 pole or AT501 pole, enter a height of 2m using the HROD key.

   Note that if you are using 2PFS or BM to establish your elevations, it does not matter what the height of the base and rover antennae are.

16. Tap ROVER in the GPS menu.

   You are prompted for the radio port number.

17. If the rover radio is on PORT 1, press 1; if it is on PORT 3, press 3 and !.

   You are prompted for the radio baud rate. The default radio baud rate is 38400.

18. Type 38400 and press !.
The data collector initializes the receiver as a rover. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

Checking the Status of the Rover

1. Press C POS (Allegro Esc key, Titan SP key) to see the GPS status screen.

   If you see the message POSITION DATA NOT AVAILABLE, there could be a problem with the cable connection or the receiver may not have a position yet.

2. Check the cables and make sure the receiver’s Tracking LED light is steady and green.

   The GPS status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the rover, the quality should be 5, the link should be less than 1, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3.

   If the link value in the GPS status screen is higher than 1, there is a problem with radio communication. The link value shows how long it has been since the last data was received from the radio. Without good radio communication, the quality will not get up to 5 and RMS error estimates will be large.

   High HDOP and VDOP values are caused by a poor arrangement of satellites or not enough satellites. Try moving to a location where more of the sky is visible. Sometimes the arrangement of satellites in the sky will be poor even if the entire sky is visible.

3. If the rover radio Receive LED is flashing once per second, check the port and baud rate entered using the ROVER key.

Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD QUALITY = 1</td>
<td>The rover is not getting data from the base. Check connections and send and receive lights on the radios. Check radio serial port and baud rate settings on the data collector.</td>
</tr>
<tr>
<td>BAD HDOP = 6</td>
<td>The HDOP for the last shot exceeded the HDOP tolerance set using the gPs, OPT, TOL, and HDOP keys.</td>
</tr>
<tr>
<td>BAD VDOP = 6</td>
<td>The VDOP for the last shot exceeded the VDOP tolerance set using the gPs, OPT, TOL, and VDOP keys.</td>
</tr>
</tbody>
</table>
**GSI Errors**

The `OLDTC`, `TC`, `TCM`, and `TCA` drivers will sometimes report a “GSI Error” followed by a warning or error code. This code comes from the Leica instrument to indicate a particular problem. The following is a list of error codes from Leica’s documentation.

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Cause</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>@E103</td>
<td>Invalid value</td>
<td>On data collector, press <code>CLR</code></td>
</tr>
<tr>
<td>@E105</td>
<td>Wrong sequence</td>
<td>On data collector, press <code>CLR</code></td>
</tr>
<tr>
<td>@E112</td>
<td>Battery low</td>
<td>Press F5.</td>
</tr>
<tr>
<td>@E114</td>
<td>Invalid command</td>
<td>On data collector, press <code>CLR</code></td>
</tr>
<tr>
<td>@E117</td>
<td>Initialization error</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E119</td>
<td>Internal temperature</td>
<td>Warm/cool instrument.</td>
</tr>
<tr>
<td>@E121</td>
<td>Parity error</td>
<td>Try again/check parity setting on instrument.</td>
</tr>
<tr>
<td>@E122</td>
<td>Time out</td>
<td>On data collector, press <code>CLR</code></td>
</tr>
<tr>
<td>@E124</td>
<td>Input buffer overflow</td>
<td>On data collector, press <code>CLR</code></td>
</tr>
<tr>
<td>@E139</td>
<td>General EDM error</td>
<td>Check prism, battery, etc.</td>
</tr>
<tr>
<td>@E144</td>
<td>V or Hz collim. Error</td>
<td>Check calibration data.</td>
</tr>
<tr>
<td>@E145</td>
<td>V or Hz collim. Error</td>
<td>Check calibration data.</td>
</tr>
<tr>
<td>@E150</td>
<td>Angle error</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E151</td>
<td>Compensator error</td>
<td>Level instrument/turn off compensator/call service.</td>
</tr>
<tr>
<td>@E155</td>
<td>EDM intensity</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E156</td>
<td>EDM system error</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E158</td>
<td>Instrument not level</td>
<td>Press F5 in instrument.</td>
</tr>
<tr>
<td>@E182</td>
<td>Telescope position</td>
<td>Angle too steep.</td>
</tr>
<tr>
<td>Error Message</td>
<td>Cause</td>
<td>Procedure</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>@E190</td>
<td>Motorization error</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E191</td>
<td>Data error</td>
<td>Check record mask, Point ID.</td>
</tr>
<tr>
<td>@E194</td>
<td>General error</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@E197</td>
<td>Calibration data fault</td>
<td>Call Leica service.</td>
</tr>
<tr>
<td>@W100</td>
<td>Instrument busy</td>
<td>On data collector, press CLR.</td>
</tr>
<tr>
<td>@W101</td>
<td>External error</td>
<td>On data collector, press CLR.</td>
</tr>
<tr>
<td>@W127</td>
<td>Unknown command</td>
<td>On data collector, press CLR.</td>
</tr>
<tr>
<td>Input buffer overflow</td>
<td></td>
<td>On data collector, press CLR.</td>
</tr>
</tbody>
</table>

**Common Leica (Wild) Problems**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Communicating</td>
<td>Make sure you have a version after 5.1r.</td>
</tr>
<tr>
<td>TCM1100 Not Communicating with version 5.2</td>
<td>Only uses FINE mode in Change menu. Use GSI driver.</td>
</tr>
<tr>
<td>Zero works but SIDS &amp; TRAV don’t (&quot;Invalid raw data&quot;)</td>
<td></td>
</tr>
<tr>
<td>Waits 30 seconds before getting shot, data messed up.</td>
<td>Press the following buttons on the WILD: SET REC 99 RUN REC</td>
</tr>
<tr>
<td>TC(S) 500 and TC800 only work in fine mode (INST menu FINE/CRS).</td>
<td>These models don't support coarse mode.</td>
</tr>
<tr>
<td>Motorized model returns @W100 error message.</td>
<td>@W100 means the instrument is busy. To interrupt the current operation, press CLR.</td>
</tr>
<tr>
<td>Motorized models not turning to foresight point.</td>
<td>Must first zero or start a side shot after selecting driver to set baud rate.</td>
</tr>
</tbody>
</table>
Problem
Version 5 - Invalid Raw Data on newer instruments - TC600, TC605.

Slope distances in raw data are slightly different than what is shown in display of the instrument.

Solution
Format should be set to 8 instead of 16. On the instrument, hold Menu for long time to get options. Choose option 4. Rec data. Set DATA OUT FORMAT to 8 or set type to 1.

Older versions of Leica's firmware does not apply the prism constant to slope distance when in Coarse (CRS) mode. Get the latest version of firmware from your Leica dealer or do not set Coarse mode in the data collector.

Comments
When a Wild driver is selected, you are prompted for a delay time. Normally the 1.5 second default is sufficient. You are also asked if the instrument should be left on. If you answer no, whenever the data collector uses an instrument routine, it will turn on the instrument, perform the function, and then turn off the instrument. The delay time is necessary to let the instrument initialize when it is first turned on. The delay time is also used in the angles part of the <WILD2> and <2002> drivers.

The only difference between the <WILD2> and <2002> drivers is the Angles Only routine. If you are having trouble with the Angles Only routine (e.g., ZHA in the <SDA> menu), try the other driver.

All Wild/Leica instruments turn on when a signal is received on the cable, even if the baud rate and parity are wrong. It is a good way to verify that the send wire of the cable works.

If the slope distances in the raw data file are slightly different than what is shown in the display of the instrument, you need to update the instrument’s firmware. Older versions of Leica's firmware do not apply the prism constant to Slope Distance when the data collector is in Coarse (CRS) mode. Get the latest version of firmware from your Leica dealer or do not set Coarse mode in the collector.

Some of the instruments listed under the <TC> driver work better at 9600 baud. To try using 9600 baud and no parity, select the <TCM> driver and then tap INST and setup to clear the motorized flag.

The TC(S) 500 and TC800 only work in Fine mode (INST menu FINE / CRS).
Notes

Using the GSI Driver

- If you see **W100** (instrument busy), try turning off the **ATR** or tapping **CLR**.
- Toggling the instrument off and back on can help you get out of error situations.
- See the Wild Instrument's Online manual for valid values to use in the **SET**, **GET**, and **CONF** commands and learn what the various GSI error numbers mean.

Using the TCA Drivers

- The message **E182** can mean that an invalid target has been found. Try pointing closer to the prism and try again.
- To use the arrow keys to move the instrument while in the Instrument Positioning (**c POS** (Allegro **Esc** key, Titan SP key)) menu, the instrument should not be locked on the prism (LCKD = 1). First, tap the **STOP** key to exit Lock mode and then press the arrow keys.
- When tracking the prism, the TCA scope may not be pointing exactly to the prism, but the exact angle to the prism is shown and sent to the data collector. Coarse mode does not apply the correction to the center of the prism.
- When using the **AUTO SHOTS** routine in traffic, setting a narrow search range helps to overcome problems when the prism is temporarily obstructed. It is recommended that you use 5° for both **SRHA** and **SRZA** in the Instrument Functions menu (**INFN** (Allegro **Esc** key, Titan SP key)).

Using the Leica GPS Driver

Programming the radios using Pacific Crest's radio program may be necessary. This program is included on the **SMI** Installation CD.
Wiring Diagram for Leica Instruments

Allegro to Leica/Wild

Red Dot

Allegro (female)

Leica/Wild Limo Connector (male)

1
2 (To Allegro )
3 (From Allegro )
4
5 (Ground )

1
2
3 (Ground )
4 (From Allegro )
5 (To Allegro )

Figure 8-5 Allegro to Leica/Wild Wiring Diagram

MDL

KEYSTROKES: SETUP (Allegro F key, Titan G key) NeXT NeXT INST NeXT NeXT

Supported MDL Models

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDL</td>
<td>Most</td>
<td>4800-None-8-1</td>
</tr>
</tbody>
</table>

Instrument Setup

None

Comments
After pressing the key to measure on the data collector, press the trigger on the MDL to send the data to the data collector.

NavCom
There are two different NavCom GPS drivers at this time – the NavCom NCT GPS driver and the NTG GPS driver. This section focuses on the NavCom NCT GPS receivers (using either RTK or StarFire corrections).

Custom Instrument Functions Menu
KEYSTROKES: a INFN (Allegro Esc key, Titan SP key)

Custom Instrument Functions Menu Soft Key Definition

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET</td>
<td>This option resets the receiver. After reset, the receiver has to reacquire the satellites.</td>
</tr>
</tbody>
</table>

Instrument Setup

Setting Up the SMI Flex GPS System

1. Select an appropriate location for the base receiver.

   Make sure the base receiver has a full view of the sky. Since the base receiver will be transmitting corrections, put it in a location that will allow good radio communications with the areas where the rover will be used. If using State Plane Coordinates, or if you do not want to do a two-point free station, you should put the base receiver over a known control point.

2. Attach the short radio antennas to each receiver, even if using external radios.

   ✓ *Having the radio turned on while not having an antenna connected can damage any radio.*

3. Install batteries in both receivers.
Make sure you hear two clicks, as both battery tabs lock when inserting the batteries. If both battery tabs are not engaged, the battery may fall out onto the ground when the receiver is put on the pole.

4. Set up the base tripod. If the tripod has a quick release mechanism, screw it onto a receiver before inserting it into the top of the tripod.

![Indicator Panel]

**Figure 8-6 Indicator Panel**

5. Set up the rover bipod.

   It is recommended that you orient the rover bipod with the legs pointed away from you so that the rod does not fall over as you are pushing the buttons on the data collector.

6. Put a receiver on the tripod and bipod. Turn on both receivers by holding the power button (labeled I/O) for four seconds.

   All the LED lights will turn on briefly when the power comes on.

7. Connect the NavCom data collector cables to the ports on the NavCom receivers labeled “COM2”.

   The cables are attached to the receiver by lining up the red dots and pushing them in. See GPS Setup in the SMI Version 8 User Guide for detailed instructions on when to attach the data collector.

   *It is recommended that you do not use the thumbscrews on the cable to attach the cable to the Allegro. If the Allegro is dropped while the cable is screwed in, it could pull down the whole pole and receiver. Instead of using the thumbscrews, push the thumbscrews into the cable housing so they do not prevent the cable from being fully plugged into the Allegro.*

**Setting Up the NCT Base Station Receiver**

1. Put the GPS antenna on the tripod in a spot where there is a wide view of the sky. If you are using State Plane Coordinates, it should be on a point for which you have the State Plane Coordinates. If using local coordinates, it can be on a known point or an unknown point.
2. Connect the GPS antenna to the receiver.

3. Connect the power to the receiver.

4. Connect the cable from the data collector to the receiver’s control port.
   The port should be preset to 9600 baud.

5. Connect the base radio cable to the receiver’s data port.
   The port should be set to match the baud rate of the radio.

6. Connect the power to the base radio.

7. Connect the radio antenna to the base radio. Put the radio antenna as high as possible.

8. Press the receiver’s ON/OFF button to turn on the receiver.

9. Wait until the Tracking LED light is green and steady, indicating that enough satellites are being tracked to calculate a position.

10. Press ⌁ POS (Allegro Esc key, Titan SP key) to see the GPS Status screen.
    If you see the message POSITION DATA NOT AVAILABLE, there could be a problem with the cable connection, or the receiver may not have a position yet.

11. Check the cables and make sure the receiver’s GPS LED light is alternating between green and yellow (if you are using a StarFire-enabled system, the GPS LED lights may flash green only).
    The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the base, the quality is 3 (4 if using a StarFire-enabled system), there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3. The RMS values shown are error estimates in feet or meters, depending on the current mode. The RMS values are high at the base receiver. If the HDOP and VDOP values are high, they may get lower after a few minutes. If they do not get low enough, you can still proceed, but accuracy may not be very good unless more satellites come into view.

12. Tap ⌃ SETUP ⌅ to enter the distance from the ground to the base of the antenna.
    If you are using 2PFS or BM to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

13. Tap ⌃ BASE in the GPS menu and enter the point number occupied by the base station or 0 if the base is on an unknown location.
You are prompted for the radio baud rate. The default radio baud rate is 38400.

14. **Type 38400 and press Enter.**

The data collector then initializes the receiver as a base station. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

15. **Turn on the base radio.**

The Transmit light (TX) should blink once per second. If the Receive light (RX) is blinking, there is radio interference. If the TX light is not blinking, make sure the radio port and baud rate entered are correct.

16. **Disconnect the data collector from the base receiver.**

**Setting Up the NCT Rover Receiver**

1. Follow directions for setting up the NCT base receiver first.
2. Put the GPS antenna on the pole.
3. Put the battery pack in the receiver.
4. Put the receiver on the pole if mounting to a pole.
5. Connect the GPS antenna to the receiver.
6. Connect the cable from the data collector to the receiver’s control port.
   The port should be preset to 9600 baud.
7. Connect the rover radio cable to the receiver’s data port.
   The port should be set to match the baud rate of the radio.
8. Connect the radio antenna to the rover radio.
9. Press the receiver’s ON/OFF button to turn on the receiver.
   The radio Receive LED should be blinking once per second. If it is flickering, there may be radio interference.
10. Wait until the receiver’s Tracking LED light is green and steady, indicating that enough satellites are being tracked to calculate a position.
11. Tap \texttt{SETUP | HROD} to enter the distance from the ground to the base of the antenna.

   \textit{If you are using \texttt{2PFS} or \texttt{BM} to establish your elevations, it does not matter if the height of the base and rover antennae are entered.}

12. Tap \texttt{ROVER} in the GPS menu.

   You are prompted for the radio baud rate. The default radio baud rate is 38400.

13. Type 38400 and press \texttt{RETURN}.

   The data collector then initializes the receiver as a rover. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

14. Press \texttt{C | POS} (Allegro \texttt{Esc} key, Titan SP key) to see the GPS Status screen.

   If you see the message \texttt{POSITION DATA NOT AVAILABLE}, there could be a problem with the cable connection, or the receiver may not have a position yet. Check the cables and make sure the receiver’s Tracking LED light is steady and green.

   The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the rover, the quality should be 5, the link should be 1 or less, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3.

   If the link value in the GPS status screen is higher than 1, there is a problem with radio communication. The link value shows how long it has been since the last data was received from the radio. Without good radio communication, the quality will not get up to 5 and RMS error estimates will be large. If the rover radio Receive LED is flashing once per second, then check the port and baud rate entered using the \texttt{ROVER} key.

   High HDOP and VDOP values are caused by a poor arrangement of satellites or not enough satellites. Try moving to a location where more of the sky is visible. Sometimes the arrangement of satellites in the sky will be poor even if the entire sky is visible.

15. Whether you are using a local coordinates or state plane coordinates, you need to verify your setup.

   \textit{Please refer to Guide to GPS in the SMI Version 8 User Guide for finishing the setup. Certain actions need to be performed based on your type of setup (i.e., Assumed Coordinates with Geodetic Backsight; Starting with two know state plane monuments; Using multiple rovers with one base; etc.).}
**Error Messages**

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD QUALITY = 1-4</td>
<td>The rover is not getting data from the base. Check connections and Send and Receive lights on the radios. Check the radio serial port and baud rate settings on the data collector.</td>
</tr>
<tr>
<td>BAD HDOP = 3.1</td>
<td>The HDOP for the last shot exceeded the HDOP tolerance set using the [gPS] [OPT] [TOL], and [HDOP] keys.</td>
</tr>
<tr>
<td>BAD VDOP = 4.5</td>
<td>The VDOP for the last shot exceeded the VDOP tolerance set using the [gPS] [OPT] [TOL], and [VDOP] keys.</td>
</tr>
</tbody>
</table>

**Indicator Lights on the NavCom Receiver**

**Indicator Panel**

![RT-3010S Indicator Panel](image)

*Figure 8-7 RT-3010S Indicator Panel*

The Indicator Panel provides the on/off (I/O) switch and a quick view of the status of the RT-3010S GPS sensor, corrections source, and batteries. Each of the five indicators has three LEDs, which depict status as detailed in the following tables.

To power the unit on or off, the on/off (I/O) switch must be depressed for more than 3 seconds. During power-up of the GPS sensor, all LEDs will be on for a period of 3-5 seconds.

**Link LEDs**

In the following tables, a white, or blank, LED square indicates that the light is not on. Shading in the left LED square indicates that the green LED is on. Shading in the center square indicates the amber LED is on, and shading in the right square indicates the red LED is on.
**Link Light Indication**

<table>
<thead>
<tr>
<th>Link</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Red to amber to green]</td>
<td>Command mode.</td>
</tr>
<tr>
<td>![Red to amber to green]</td>
<td>Rapidly repeating red to amber to green indicates that it is searching for the base radio signal.</td>
</tr>
<tr>
<td>![Green]</td>
<td>Strong signal strength from the base radio.</td>
</tr>
<tr>
<td>![Yellow]</td>
<td>Medium signal strength from the base radio.</td>
</tr>
<tr>
<td>![Red]</td>
<td>Weak signal strength from the base radio.</td>
</tr>
</tbody>
</table>

**Base LEDs**

If the RT-3010 has been configured as a base station, the LEDs indicates the type of RTK corrections being produced. Where the color of the LED indicates the format of the correction, the blink rate indicates specifically which message is being sent. The table below illustrates the color, format, message, and blink rate of the LEDs for the type of corrections being output.

**Base Station Indication**

<table>
<thead>
<tr>
<th>Base</th>
<th>Status</th>
<th>Blink Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Red]</td>
<td>Rover mode</td>
<td>N/A</td>
</tr>
<tr>
<td>![Green]</td>
<td>NCT Proprietary</td>
<td>5e=2 Hz, 5b=1 Hz, Both=5 Hz</td>
</tr>
<tr>
<td>![Yellow]</td>
<td>CMR</td>
<td>1 Hz</td>
</tr>
<tr>
<td>![Red]</td>
<td>RTCM</td>
<td>20, 21=5Hz, 18, 19=1 Hz</td>
</tr>
</tbody>
</table>
**GPS LEDs**
The GPS LEDs blink at the positioning rate selected (1, 2, 5, 10 and 25 Hz).

**GPS Light Indication**

<table>
<thead>
<tr>
<th>GPS Status</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power is off.</td>
</tr>
<tr>
<td></td>
<td>Power is on. No satellites tracked.</td>
</tr>
<tr>
<td></td>
<td>Tracking satellites, position not available yet. Non-differential positioning. Code based differential positioning (the best base positioning possible with RT units). Dual frequency phase positioning (RTK Fixed mode is the best rover positioning possible, RTG is the best Base mode possible with SF units).</td>
</tr>
</tbody>
</table>

**Battery LEDs**
A fully-charged battery is indicated by a green light, and an extremely low battery is indicated by a red light. Different combinations of the three LED colors indicate various battery levels. The table below illustrates the possible scenarios and the estimated voltage level (as a percentage) remaining in the battery. The battery LEDs blink at 5Hz for the battery in use, and 1Hz for the battery in reserve (see the blink rate in the table below).

The indicator panel has a Battery Test button, indicated by a \( \checkmark \). Depressing this button gives an indication of the battery status, as per the table below, typically for the duration of 20 to 30 seconds.

Battery Status LED Indicator

<table>
<thead>
<tr>
<th>Battery Status</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Battery not installed, or battery installed but drained.</td>
</tr>
<tr>
<td>Green</td>
<td>Greater than 80% remaining.</td>
</tr>
</tbody>
</table>

Batteries are NOT charged in the unit. If external power is applied, the battery light indicates the status of the batteries and NOT the external power source.
<table>
<thead>
<tr>
<th>Battery</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image]</td>
<td>60% - 80% remaining.</td>
</tr>
<tr>
<td>![Image]</td>
<td>40% - 60% remaining.</td>
</tr>
<tr>
<td>![Image]</td>
<td>20% - 40% remaining.</td>
</tr>
<tr>
<td>![Image]</td>
<td>Less than 20%.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In Use</th>
<th>LED(s) blink rate at 5 Hz.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not in Use</td>
<td>LED(s) blink rate at 1 Hz.</td>
</tr>
</tbody>
</table>

**Notes**

The **SMI Flex GPS** system can use any GPS receiver produced by NavCom Technologies (a division of John Deere). Benefits of using the **SMI Flex GPS** system include:

- Sub meter Autonomous mode accuracy on RT models (compared to 3-7 meters with all other systems).
- Sub decimeter (4") autonomous mode accuracy on the SF models.
- Fixed height system (no need to measure antenna heights at the base or rover).
- 25 positions per second update rate (50 Hz Raw). Up to 5 Hz standard. 10 Hz and higher require a license upgrade.
- 4 mm RMS Horizontal RTK accuracy (short base lines).
- 1 second reacquisition time (compare to 30-45 seconds).
- 100% designed and built in the USA.
- 64 MB of internal ram for collection of static data. You also have the ability to perform static and RTK simultaneously with only one controller.
- Super-rugged design for construction use and operation in extreme environments.
- 9+ hours of continuous operation without battery change.
• Elevation masking from 5-7 degrees, gains you 2 – 3 additional satellites all day!

• Ability to run with RTK accuracies for 20 – 30 minutes (yes, minutes!) with a complete loss of RTK corrections (requires SF-equipped units), compared to 15 – 30 seconds with other systems.

• Ability to run with RTK accuracies with a complete loss of the L2 signal for approximately 10 minutes from each satellite, compared to 0 seconds from other systems.

• High precision pole lightweight rover pole system. The system is also available in a backpack option (rover pole weight is under 2 pounds).

---

**Wiring Diagrams for NavCom Instruments**

**Allegro to NavCom**

![Wiring Diagram](image)

**Figure 8-8 Allegro to NavCom Wiring Diagram**
**Figure 8-9 SATEL 3ASd Radio to NavCom Wiring Diagram**

**Nikon**

**KEYSTROKES:** <SETUP> (Allegro F key, Titan G key) NeXT NeXT INST NeXT NIKN.

**Supported Nikon Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIKN</td>
<td>Topgun 100's, A series, C-100, D-50, DTM</td>
<td>4800-None-8-1</td>
</tr>
<tr>
<td>SET</td>
<td>DTM models set to emulate Lietz SET</td>
<td>1200-None-8-1</td>
</tr>
</tbody>
</table>
**Instrument Setup**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Setup Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A series</td>
<td>Turn on the main power while depressing the [2nd] key. Tilt the scope once through the horizon. Press the [1] key until the selection option toggles to NkRS or RS-232. Press the [0] key.</td>
</tr>
<tr>
<td>C-100</td>
<td>Turn on the main power while depressing the [RST] key. Press the [HOLD] key until prompted for DATA RECORDER. Press the [S-H-V] key until NIKON is selected. Press the [HOLD] key. Press the [TRIK] key.</td>
</tr>
<tr>
<td>DTM 420</td>
<td>Press [FUNCTION] 5 (Settings) 6 (System) 3 (Communication) Baud: 4800 Parity: None COM1, and use the NIKN driver on the collector. Or, press [FUNCTION] 5 (Settings) 6 (Others) Baud: 4800 Data recorder: Nikon, and use the NIKN driver on the collector.</td>
</tr>
<tr>
<td>DTM 430</td>
<td>Press [FUNCTION] 5 (Settings) 6 (Others) ENTER ENTER Baud: 4800 Parity NONE Data recorder: Nikon, and use the NIKN driver on the collector. Or, press [FUNCTION] 5 (Settings) 6 (Others) ENTER ENTER Baud: 1200 Data recorder: SET, and use the SET driver on the collector.</td>
</tr>
<tr>
<td>DTM 20/750/830</td>
<td>Press [FUNCTION] 3 (Simple Total Station). Set Baud Rate to 1200. Use the SET driver on the collector. Does not support Angles Only mode. Must have AP700, AP800, or TS application card.</td>
</tr>
</tbody>
</table>

If you have the TDS application card with either a 700 or 800 series instrument, it may not support an external data collector.

**Common Problems**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting instrument to use Vertical Angle instead of Zenith Angle results in an elevation difference showing up as the horizontal distance in the data collector.</td>
<td>Nikon should be set to use Zenith Angles, not Vertical Angles. Do this by pressing [FUNCTION] 5 (Settings) (angles) and the Up arrow to select 0.</td>
</tr>
</tbody>
</table>
**Problem**
Recorded distances are far too small.

**Solution**
Nikon is setting output as a vertical angle and it should be set to use zenith angles. Do this by pressing [FUNCTION 5] (Settings) (angles) and the up arrow 0 selection.

No response

Make sure you are using a Nikon cable. The Nikon cable looks just like the Topcon/Lietz cable but is wired differently.

**Comments**
The Nikon cable looks just like the Topcon and Lietz cables but is wired differently inside.

**Wiring Diagram for Nikon Instruments**

![Wiring Diagram for Nikon Instruments](image)

*Figure 8-10 Allegro to Nikon Wiring Diagram*
NMEA LLQ GPS Driver/Allen Osborne

The NEMA LLQ message contains local coordinates instead of latitude and longitude. The LLQ driver can be used with GPS receivers that output LLQ messages.

**Instrument Setup**

**Setting Up the SMI Data Collector**

To install the LLQ driver on the SMI data collector, press \( <\text{GPS}\text{ INST } \text{ LLQ} > \) (the Z key). You can also press \( <\text{SETUP} \text{ NeXT} \text{ NeXT} \text{ INST} \text{ NeXT} \text{ NeXT} \text{ GPS} > \) (the Z key). A tolerance value for the coordinate quality can be set by pressing \( <\text{GPS} \text{ TOLM} \text{ HDOP} > \). If the coordinate quality exceeds the value set in HDOP, the coordinate is not used.

**Setting Up the GPS Receiver**

To prepare the GPS receiver to communicate with the data collector, set the baud rate to 9600, parity to NONE, and protocol to NEMA LLQ. If there is an output frequency option, set it to 1 record per second.

**Setting Up the Allen Osborne Associates Rascal Receiver**

First, ensure that your GPS setup is complete and that you have a real-time solution. Once you have obtained a solution on your Rascal rover receiver (viewed on the Survey Point Navigation screen), follow these steps to prepare the rover receiver to send LLQ messages to the data collector.

1. From the rover Rascal's main menu, select TurboKinematic Setup (5).
2. Toggle option 5 so that the NMEA output is on.
3. Plug the SMI RS-232 cable into the AUX port of the Rascal.

**Notes**

**Using the LLQ Driver**

- Setting the base station as the occupied point gives a good orientation for the go/come, left/right values in the Stake menu.
If you want to manually type in the coordinates and elevation instead of getting them electronically, choose the MAN3 option in the Instruments menu (<INST><mAN3>).

When raw data is turned on, a comment record precedes shot information as follows: CM GPS northeast elevation Hrod Geoid Satellites Coordinate Quality.

---

**Pentax**

**KEYSTROKES:**<SETUP> (Allegro F key, Titan G key) NeXT NeXT <NeXT> <NeXT> <INST> NeXT NeXT NeXT

Supported Pentax Models

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>PENT</td>
<td>PTS-III, 305, 310, PTS 10, PCS-1, some PCS-2's, 500 Series, PTS V5</td>
<td>1200-None-8-1</td>
</tr>
<tr>
<td>PNT2</td>
<td>Single shot PCS-2</td>
<td>1200-None-8-1</td>
</tr>
<tr>
<td>2Way</td>
<td>Two-way PTS V3</td>
<td>1200-None-8-1</td>
</tr>
</tbody>
</table>

* The Pentax 205 is not supported.

---

**Instrument Setup**

* The Pentax must be put in Measure mode by pressing the H/D/Z or AIM key.

- **PTS-III:** There are three rows of dip switches on the side. The four dip switches farthest to the right on the bottom row control communications. They all should be set to the OFF position (push them downward).

- **ATS Setup:** Turn on and plunge the scope. Hold down the S key and press F5 for Remote. The serial port is now active. To cancel Remote mode, press F1 for Quit.

- **PTS V5:** Set the baud rate in the Special Functions menu. To get into the Special Functions menu, hold down the double circle button while pressing the ON button.
**Common Problem**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTS 10 doesn't work</td>
<td>Toggle Coarse/Fine mode in the Change menu.</td>
</tr>
</tbody>
</table>

**Wiring Diagram for Pentax Instruments**

*Figure 8-11 Allegro to Pentax Wiring Diagram*
Sokkia/Lietz

KEYSTROKES: [SETUP] (Allegro F key, Titan G key) [NeXT] [NeXT] [INST] [NeXT] [sokkI]

Supported Sokkia/Lietz Models

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIETZ</td>
<td>SET’s: SET2, SET3, SET4, SET5, SET6, SET10</td>
<td>1200-None-8-1</td>
</tr>
<tr>
<td>SOKKI</td>
<td>SETsB: SET2B, SET3B, SET4B, SET5B</td>
<td>1200-None-8-1</td>
</tr>
<tr>
<td>Motr</td>
<td>SET 110M series instruments</td>
<td>1200-None-8-1</td>
</tr>
</tbody>
</table>

Sokkia Instrument Functions Menu

KEYSTROKES: [a] [INFN] (Allegro [Esc] key, Titan SP key)

Sokkia Instrument Functions Menu Soft Key Definition

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Srhz</td>
<td>Adjusts the prism search settings and searches for the prism. You are prompted for the following options: SEARCH WINDOW 1=SMALL; 2=LARGE; 3=TALL; 4=WIDE</td>
</tr>
</tbody>
</table>

Instrument Setup

1. Turn the instrument on, then pass the scope through the horizontal.
2. Press the [CE-CA] key.
3. Press 1 to enter the MENU mode.
4. Press 2 to select the Config display.
5. Press +/- until the RS-232C format parameter is displayed.
6. If the baud rate, parity, or Checksum are not set correctly, press [ENT] to change the settings.

7. Make sure that Checksum (CSUM) is turned off.

   When using the LIETZ driver, the instrument must be in Distance mode before taking a shot from the data collector. Press the measure button (CE-CA) on the instrument before pressing the key on the data collector.

   SOKKI works with instruments using two-way communication; it does not require that you put the instrument in Distance-Measuring mode. The SOKKI driver automatically selects Fine or Coarse mode based on the [CRS] / [FINE] key in the Instrument menu.

   LIETZ 4A: The yellow keys model has two-way communication.

   SET10: SOKKIA must be selected as the output format in the System menu.

---

**Common Problems**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invalid Raw Data message after flashing angles on screen.</td>
<td>Sokkia must be put in measurement mode. Older models do not allow external data collectors to change the mode. Press the measure button on the Sokkia.</td>
</tr>
<tr>
<td>Instrument shoots, but SMI still says measuring.</td>
<td>Turn checksum off.</td>
</tr>
</tbody>
</table>
Wiring Diagram for Sokkia/Lietz Instruments

Allegro to Topcon/Sokkia/Lietz

Thales/Ashtech

Instructions using the Ashtech Z GPS driver are specific to the Ashtech Z and Z Extreme receiver families.

Custom Instrument Functions Menu

KEYSTROKES: a [INFN] (Allegro Esc key, Titan SP key)
### Custom Instrument Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Sleep&gt;</td>
<td>Puts the receiver in power-saving Sleep mode.</td>
</tr>
<tr>
<td>&lt;Init&gt;</td>
<td>Initializes the receiver. After INIT, the receiver has to reacquire the satellites.</td>
</tr>
<tr>
<td>&lt;Reset&gt;</td>
<td>Resets the receiver. After reset, the receiver has to reacquire the satellites. You need to set the Base and Rover modes again.</td>
</tr>
<tr>
<td>&lt;RELIA&gt;</td>
<td>Sets the RTK reliability of the receiver. The higher the reliability setting, the longer it takes to achieve a fixed RTK solution. Tap the button to see the options. Refer to your GPS manual for more details.</td>
</tr>
<tr>
<td>&lt;Multi&gt;</td>
<td>Sets the multi-path setting of the receiver. Tap the button to see the options. Refer to your GPS manual for more details.</td>
</tr>
</tbody>
</table>

### Instrument Setup

**Setting Up the Ashtech Z Base Station Receiver**

1. Verify that the Force Baud Rate Setting is toggled off. To see this setting, select File > Settings.

2. On the data collector, select the Ashtech Z driver by pressing `c <GPS>` (the Z key).

3. Put the GPS antenna on a tripod in a spot where there is a wide view of the sky. If using State Plane Coordinates, it must be on a point for which you have the State Plane Coordinates. If using local coordinates, it can be on a known point or an unknown point.

4. Connect the GPS antenna to the receiver.

5. Make sure the battery is installed in the receiver.

6. Connect the cable from the data collector to the receiver’s Serial A port.

7. Connect the base radio cable to the receiver’s Serial B port.

8. Connect the radio antenna to the base radio. Put the radio antenna as high as possible.
9. Press the power button to turn on the receiver. Push one of the arrow keys on the receiver to get past any warning messages.

10. Press $\text{INFN}$ (Allegro Esc key, Titan SP key) to see the Ashtech Instrument Functions screen. Tap the $\text{INIT}$ soft key to set the receiver back to the default settings. Any warning messages that appear when turning on the power will appear again. Press one of the arrow keys to dismiss them.

11. Press $\text{POS}$ (Allegro Esc key, Titan SP key) to see the GPS Status screen.

If you see the message POSITION DATA NOT AVAILABLE, there could be a problem with the baud rate or cable connection. Check the cables and try again. If the receiver has not calculated a position yet, the latitude and longitude will be zero.

The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the base, the quality should be 1, the link should be 999, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3. The RMS values shown are error estimates in feet or meters, depending on the current mode. The RMS values will be high at the base receiver. If the HDOP and VDOP values are high, they may get lower after a few minutes. If they do not get low enough, you can still proceed, but accuracy may not be very good unless more satellites come into view.

12. Tap $\text{SETUP}$ $\text{HI}$ to enter the distance from the ground to the base of the antenna.

If you plan to use $\text{2PFS}$ or $\text{BM}$ to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

13. Tap $\text{BASE}$ in the GPS menu and enter the point number occupied by the base station or 0 if the base is on an unknown location.

You are prompted for the radio port number.

14. Usually, you should enter 1 to use port B.

You are prompted for the radio baud rate. The default radio baud rate is 9600 if you are using the Pacific Crest RFM96W radios, or 38400 if you are using the Pacific Crest PDL radios.

15. Type the baud rate and press $\text{!}$.

The data collector then initializes the receiver as a base station. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.
The base GPS receiver compares the position it computes for its location to the position you enter as the base position. If the two sets of coordinates differ by more than 500 meters, the base receiver will not output RTK base data.

16. Turn on the base radio.

The Transmit light (TX) should blink once per second. If the Receive light (RX) is blinking, there is radio interference. If the TX light is not blinking, make sure the radio port and baud rate entered are correct.

17. Disconnect the data collector from the base receiver.

Setting up the Ashtech Z Rover Receiver

Make sure the data collector is either set to 9600 or the Force Baud Rate toggle is turned OFF.

1. Follow the directions for setting up the Ashtech Z base receiver first.
2. Put the GPS antenna on the pole.
3. Connect the GPS antenna to the receiver.
4. Make sure the battery is installed in the receiver.
5. Connect the cable from the data collector to the receiver's Serial A port.
6. Connect the rover radio cable to the receiver's Serial B port.
7. Connect the radio antenna to the rover radio.
8. Press the power button to turn on the receiver. Press one of the arrow keys on the receiver to bypass any warning messages.
9. Press $\text{INFN}$ (Allegro $\text{Esc}$ key, Titan SP key) to see the Ashtech Instrument Functions screen. Tap the $\text{INIT}$ soft key to set the receiver back to the default settings. Any warning messages that appear when turning on the power will appear again. Press one of the arrow keys to dismiss them.
10. Tap $\text{SETUP} \uparrow \text{HROD}$ to enter the distance from the ground to the base of the antenna.

If you are using $\text{2PFS}$ or $\text{BM}$ to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

11. Tap $\text{ROVER}$ in the GPS menu.
You are prompted for the radio port number.

12. Usually, you should enter 1 to use port B.

You are prompted for the radio baud rate. The default radio baud rate is 9600 if you are using the Pacific Crest RFM96W radios, or 38400 if you are using the Pacific Crest PDL radios.

13. Type the baud rate and press ![Enter].

The data collector then initializes the receiver as a rover. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

14. Whether you are using a local coordinates or state plane coordinates, you need to verify your setup.

Please refer to Guide to GPS in the SMI Version 8 User Guide for finishing the setup. Certain actions need to be performed based on your type of setup (i.e., Assumed Coordinates with Geodetic Backsight; Starting with two know state plane monuments; Using multiple rovers with one base; etc.).

Checking the Status of the Rover

1. Press ![Alt] + ![Esc] (Allegro Esc key, Titan SP key) to see the GPS Status screen.

   If you see the message POSITION DATA NOT AVAILABLE, there could be a problem with the baud rate, cable connection, or the receiver may not have a position yet. Check the cables and try again.

   The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the rover, the quality should be 5, the link should be 1 or less, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3.

   If the link value in the GPS status screen is higher than 1, there is a problem with radio communication. The link value shows how long it has been since the last data was received from the radio. Without good radio communication, the quality will not get up to 5 and errors will be large.

2. If the rover radio’s Receive LED is flashing once per second, check the radio port and baud rate entered.

   High HDOP and VDOP values are caused by a poor arrangement of satellites or not enough satellites. Try moving to a location where more of the sky is visible. Sometimes the arrangement of satellites in the sky will be poor even if the entire sky is visible.
Error Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD QUALITY = 1</td>
<td>The rover is not getting data from the base. Check connections and Send and Receive lights on the radios. Check the radio serial port and baud rate settings on the data collector.</td>
</tr>
<tr>
<td>BAD HDOP = 6</td>
<td>The HDOP for the last shot exceeded the HDOP tolerance set using the (&lt;\text{GPS}), (&lt;\text{OPT}), (&lt;\text{TOL}), and (&lt;\text{HDOP}) keys.</td>
</tr>
<tr>
<td>BAD VDOP = 6</td>
<td>The VDOP for the last shot exceeded the VDOP tolerance set using the (&lt;\text{GPS}), (&lt;\text{OPT}), (&lt;\text{TOL}), and (&lt;\text{VDOP}) keys.</td>
</tr>
</tbody>
</table>

Topcon/Javad

KEYSTROKES: \[\text{SETUP}\] (Allegro F key, Titan G key) \[\text{NeXT}\] \[\text{NeXT}\] \[\text{INST}\] \[\text{NeXT}\] \[\text{TOPCO}\] for Total Stations) or \[\text{GPS}\] (the Z key) \[\text{INST}\] \[\text{JAVAD}\] for GPS.

Supported Topcon Models

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTS3</td>
<td>GTS 200's</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>GTS3</td>
<td>GTS3B, C; 300's</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>GTS4</td>
<td>GTS-4, GTS 400's</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>GTS5</td>
<td>GTS 500's</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>GTS6</td>
<td>GTS 600's</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>ET-1</td>
<td>ET-1</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>ET-2</td>
<td>ET-2</td>
<td>1200-Even-7-1</td>
</tr>
</tbody>
</table>
### Driver Models Settings

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTS-1</td>
<td>CTS-1. GTS3, ET-2</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>GMT1</td>
<td>GMT-100</td>
<td>1200-Even-7-1</td>
</tr>
<tr>
<td>800</td>
<td>(ROBOTIC only) GTS-800’s, 8200 series</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>APL1A</td>
<td>(ROBOTIC only) AP-L1A</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>APL1</td>
<td>(ROBOTIC only) AP-L1</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>JAVAD</td>
<td>(ROBOTIC only) Topcon GPS</td>
<td>9600-None-8-1</td>
</tr>
</tbody>
</table>

---

### Topcon AP-L1A Instrument Functions Menu

**KEYSTROKES:**

- a [INFN] (Allegro Esc key, Titan SP key)

#### Topcon AP-L1A Instrument Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>opt</strong></td>
<td>Displays the current settings from the instrument on the data collector. These settings include SRCH HA: Horizontal Angle range for searches. SRCH ZA: Zenith Angle range for searches. SCAN: “NARROW” “MIDDLE” “WIDE” SPEED: “LOW” “MIDDLE” “HIGH” WAIT: Time in seconds</td>
</tr>
<tr>
<td><strong>srzha</strong></td>
<td>Allows you to enter the Horizontal and Zenith Angle search ranges.</td>
</tr>
<tr>
<td><strong>scan</strong></td>
<td>Allows you to enter the scan range (1-3).</td>
</tr>
<tr>
<td><strong>speed</strong></td>
<td>Allows you to enter the tracking speed (0-2).</td>
</tr>
</tbody>
</table>
### Option Function

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>wait</td>
<td>Allows you to enter a wait time. This represents the time lag the instrument waits before searching again when the lock on the prism is lost.</td>
</tr>
<tr>
<td>sens</td>
<td>Allows you to enter the tracking sensitivity (0-2).</td>
</tr>
<tr>
<td>ptrn</td>
<td>Allows you to enter a normal or high search pattern (0-1).</td>
</tr>
<tr>
<td>ch2as</td>
<td>Allows you to enter the radio channel for the SATEL 2ASx radio (0-9 or A-F).</td>
</tr>
<tr>
<td>ch3as</td>
<td>Allows you to enter the radio channel for the SATEL 3ASd radio (0-9 or A-F).</td>
</tr>
</tbody>
</table>

---

**Topcon 800 Series Instrument Functions Menu**

**KEYSTROKES:**

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>opt</td>
<td>Displays the current settings from the instrument on the data collector. These settings include SRCH HA: Horizontal Angle range for searches. SRCH ZA: Zenith Angle range for searches. SCAN: “NARROW” “MIDDLE” “WIDE” SPEED: “LOW” “MIDDLE” “HIGH” WAIT: Time in seconds</td>
</tr>
<tr>
<td>srzha</td>
<td>Allows you to enter the Horizontal and Zenith Angle search ranges.</td>
</tr>
<tr>
<td>scan</td>
<td>Allows you to enter the scan range (1-3).</td>
</tr>
<tr>
<td>speed</td>
<td>Allows you to enter the tracking speed (0-2).</td>
</tr>
<tr>
<td>wait</td>
<td>Allows you to enter a wait time. This represents the time lag the instrument waits before searching again when the lock on the prism is lost.</td>
</tr>
</tbody>
</table>
Option | Function
--- | ---
sens | Allows you to enter the tracking sensitivity (0-2).
rc2y | Toggles between using the RC-2R to search for the prism and using a search pattern.
rc20 | Toggles between using the RC-2R for optical communication with the instrument or not.
mach | Allows you to enter the instrument to Machine Control mode.
surv | Allows you to enter the instrument to Survey Control mode.
ch2as | Allows you to enter the radio channel for the SATEL 2ASx radio (0-9 or A-F).
ch3as | Allows you to enter the radio channel for the SATEL 3ASd radio (0-9 or A-F).

Custom Instrument Functions Menu

KEYSTROKES: a [INFN] (Allegro Esc key, Titan SP key)

Custom Instrument Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RESET</td>
<td>Resets the receiver. After reset, the receiver has to reacquire the satellites.</td>
</tr>
<tr>
<td>OFF</td>
<td>Turns off the receiver.</td>
</tr>
</tbody>
</table>

Instrument Setup

See your instrument's manual to set the baud rate and parity. If it cannot be changed, the selected instrument driver will be using the correct baud rate.

Setting Up the AP-L1A Instrument

1. Turn on the AP-L1A and press the MENU key.
2. Press F1: PARAMETERS.
3. Press F3: COM.
5. Press F1: BIT FORMAT.
7. Press F2: TRANS SPEED.
9. Press F3: TERMINATE.
11. Press the ESC key to get back to the COM menu.
13. Select Radio channel (B is default) and press F4.
14. Press MENU to exit the menu.

Putting the AP-L1A in Remote Mode
1. Attach antennas to the radios.
2. Connect the data collector to the radio.
3. Attach the radio battery to the radio.
   The CTS light should be on and steady.
4. Turn on the AP-L1A and press the MENU key.
5. Press F3: REMOTE.
6. Press F1: REMOTE.

Setting Up the GTS-800A/GTS-802A Instrument
The GTS-800A can be set up to communicate with the data collector in three different ways. The methods are through a cable, through the 2Asx or 3ASd radios, or through the RC-2R using optical communications.
Cable Connection

1. Turn on the GTS-800A and let the self-check finish.
5. Press F3 to select RS232C.
6. Press F1: SET and answer YES.
7. Press F2: Set RS232C.
8. Set B. Rate to 1200, Data.L to 7, and Parity to even, press F1:SET, and answer YES.
9. Press ESC to go back to the main menu.
10. Select STD to see horizontal and vertical angles.
11. Connect the data collector to the instrument with the cable.
12. On the data collector, press SETUP (Allegro F key, Titan G key) NeXT NeXT INST NeXT TOPCO NeXT 800. When prompted Using Cable to 800?, tap YES. When prompted Use Search?, answer YES if you want the instrument to automatically search for and track the prism.

The next time the instrument is turned on, the only steps needed are 1 and 10-12.

Radio Connection

1. If you are using a Y cable, make sure the dip switch 3 on the RC-2R is set to the ON position. Dip switches are located behind the batteries of the RC-2R. More detailed information is available in the RC-2R manual.
2. Attach the antennas and batteries to radios. The CTS light should be on and steady.
3. Connect the data collector (and RC-2R if using a Y cable) to one radio and the GTS-800A to the other radio.
4. Turn on the GTS-800A and let the self-check finish.
5. Press F1: Prog.
6. Press F6: MORE.
7. Press F3: EXT. LINK.
10. Select the type of radio modem you have, either 2ASx or 3ASd and press F1: SET.
12. Press F1: SELECT PARAMETERS.
13. If you are using 2ASx, select the desired radio channel, and press F1: SET.
14. Select REC-B and press F1: SET.
15. If you are using 3ASd, press F4: PARAMETER(RADIO MODEM).
16. If you are using 3ASd, press F3: SET CHANNEL(3ASd).
17. If you are using 3ASd, select the desired radio channel, and press F1: SET and F6: OK.
18. Press the ESC key to get back to the EXTERNAL LINK menu.

   The message Remote control is being done from the controller displays.

20. If the message is Failed Initialize, check the connection to the radio and radio battery.

21. On the data collector, press [SETUP] (Allegro F key, Titan G key) [NeXT] [NeXT] [INST] [NeXT] [TOPCO] [800]. When prompted Using Cable to 800?, tap NO. When prompted Using RC-2R Optical Communication?, answer NO. When prompted Using RC2 Y cable?, answer YES if using the RC2 Y cable to connect the radio, data collector, and RC-2R. The RC-2R can also be used without the Y cable, but the trigger button on the RC-2R must be pressed manually.

   The next time, the only steps needed are 1-7 and 19-21.
RC-2R Optical Connection

1. Make sure the dip switch 3 on the RC-2R is set to the OFF position. Dip switches are located behind the batteries of the RC-2R. More detailed information is available in the RC-2R manual.

2. Turn on the GTS-800A and let the self-check finish.

3. Press F1: Prog.

4. Press F6: MORE.

5. Press F3: EXT. LINK.


8. Select the RC-2 option and press F1: SET.

9. Press the ESC key to get back to the EXTERNAL LINK menu.


   The message Remote control is being done from the controller displays.

11. On the data collector, press SETUP (Allegro F key, Titan G key) <NeXT> NeXT INST <NeXT> TOPCO 800. When prompted Using Cable to 800?, tap NO. When prompted Using RC-2R Optical Communication?, answer YES.

   The next time, the only steps needed are 1-5 and 9-10.

Setting Up the Topcon (Javad) GPS Base Station Receiver

1. Select the Javad driver by pressing GPS (the Z key) INST JAVAD.

2. Put the GPS antenna on a tripod in a spot where there is a wide view of the sky. If using State Plane Coordinates, it must be on a point for which you have the State Plane Coordinates. If using local coordinates, it can be on a known point or an unknown point.

3. Connect the GPS antenna to the receiver.

4. Connect the battery to the receiver’s Power port.
5. Connect the cable from the data collector to the receiver’s Serial A port.

6. Connect the base radio cable to the receiver’s Serial C port.

7. Connect the power to the base radio.

8. Connect the radio antenna to the base radio. Put the radio antenna as high as possible.

9. Press the large I button to turn on the receiver.

10. Hold down the FN button until the REC light turns from red to green and back to red.

   This sets port Serial A to 9600 baud.

   The STAT light flashes green once for each GPS satellite and orange once for each GLONASS satellite. If the green and orange flashes are followed by a red flash, the receiver has not been able to get a position yet. Wait until the red flashing has stopped before going to the next step.

11. Press \texttt{C POS} (Allegro <Esc key, Titan SP key) to see the GPS Status screen.

   If you see the message \texttt{POSITION DATA NOT AVAILABLE}, there could be a problem with the baud rate, cable connection, or the receiver may not have a position yet. Check the cables, make sure the receiver’s STAT light does not have a red flash, and repeat step 9.

   The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the base, the quality should be 1, the link should be 999, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3. The RMS values shown are error estimates in feet or meters, depending on the current mode. The RMS values will be high at the base receiver. If the HDOP and VDOP values are high, they may get lower after a few minutes. If they do not get low enough, you can still proceed, but accuracy may not be very good unless more satellites come into view.

12. Tap \texttt{SETUP HI} to enter the distance from the ground to the base of the antenna.

   If you are using \texttt{2PFS} or \texttt{BM} to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

13. Tap \texttt{BASE} in the GPS menu and enter the point number occupied by the base station or 0 if the base is on an unknown location.

   You are prompted for the radio baud rate. The default radio baud rate is 38400.

14. Type 38400 and press \texttt{}. You are prompted for the radio port number.
15. If you are connected to a Legacy or Hyper receiver, you should enter 2 for port C. If you have an Odyssey receiver that has a built-in radio, you should enter 0 for Auto.

The data collector then initializes the receiver as a base station. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

16. Turn on the base radio.

The Transmit light (TX) should blink once per second. If the Receive light (RX) is blinking, there is radio interference. If the TX light is not blinking, make sure the radio port and baud rate entered are correct.

17. Disconnect the data collector from the base receiver.

**Setting Up the Topcon (Javad) GPS Rover Receiver**

1. Follow directions for setting up the Javad base receiver first.

2. Put the antennae on the pole.

3. Connect the GPS antenna to the receiver.

4. Connect the battery to the receiver's Power port.

5. Connect the cable from the data collector to the receiver's Serial A port.

6. Connect the rover radio cable to the receiver's Serial C port.

   Hyper and Odyssey receivers may have the radio built-in.

7. Connect the power to the rover radio; this is not necessary if the radio is built-in.

8. Press the large I button to turn on the receiver.

9. Hold down the FN button until the REC light turns from red to green and back to red.

   This sets port Serial A to 9600 baud.

   The STAT light flashes green once for each GPS satellite and orange once for each GLONASS satellite. If a red flash follows the green and orange flashes, the receiver has not been able to get a position yet. Wait until the red flash has stopped before going to the next step.

10. Tap **SETUP** **HROD** to enter the distance from the ground to the base of the antenna.
If you are using `<2PFS>` or `<BM>` to establish your elevations, it does not matter if the height of the base and rover antennae are entered.

11. Tap `<ROVER>` in the GPS menu.

You are prompted for the radio baud rate. The default radio baud rate is 38400.

12. Type `38400` and press `Enter`.

You are prompted for the radio port number.

13. If you are connected to a Legacy receiver, you should enter `2` for port C. If you have a Hyper or Odyssey receiver that has a built-in radio, you should enter `0` for Auto.

The data collector then initializes the receiver as a rover. If there is an error communicating with the receiver, it beeps and displays an error message. If it is successful, it returns to the GPS menu.

14. Whether you are using a local coordinates or state plane coordinates, you need to verify your setup.

   Please refer to Guide to GPS in the SMI Version 8 User Guide for finishing the setup. Certain actions need to be performed based on your type of setup (i.e., Assumed Coordinates with Geodetic Backsight; Starting with two know state plane monuments; Using multiple rovers with one base; etc.).

Checking the Status of the Rover

1. Press `C POS` (Allegro `<Esc>` key, Titan SP key) to see the GPS Status screen.

   If you see the message `POSITION DATA NOT AVAILABLE`, there could be a problem with the baud rate, cable connection, or the receiver may not have a position yet. Check the cables, make sure the receiver’s STAT light does not have a red flash, and repeat step 8 from above.

   The GPS Status screen shows a live update of position and other useful information about the accuracy of the position. When connected to the rover, the quality should be 5, the link should be 1 or less, there should be at least 5 satellites, the HDOP should be lower than 2, and the VDOP should be lower than 3.

   If the link value in the GPS status screen is higher than 1, there is a problem with radio communication. The link value shows how long since the last data was received from the radio. Without good radio communication, the quality will not get up to 5 and errors will be large.
2. If the rover radio Receive LED is flashing once per second, then check the port and baud rate entered.

High HDOP and VDOP values are caused by a poor arrangement of satellites or not enough satellites. Try moving to a location where more of the sky is visible. Sometimes the arrangement of satellites in the sky will be poor even if the entire sky is visible.

---

### Error Messages

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD QUALITY = 1</td>
<td>The rover is not getting data from the base. Check connections and Send and Receive lights on the radios. Check the radio serial port and baud rate settings on the data collector.</td>
</tr>
<tr>
<td>BAD HDOP = 4</td>
<td>The HDOP for the last shot exceeded the HDOP tolerance set using the \texttt{GPS}, \texttt{OPT}, \texttt{TOL}, and \texttt{HDOP} keys.</td>
</tr>
<tr>
<td>BAD VDOP = 6</td>
<td>The VDOP for the last shot exceeded the VDOP tolerance set using the \texttt{GPS}, \texttt{OPT}, \texttt{TOL}, and \texttt{VDOP} keys.</td>
</tr>
</tbody>
</table>

---

### Notes

**Using the APL Driver**

- See the AP-L1A manual for optimum settings for \texttt{SCAN}, \texttt{SPEED}, \texttt{WAIT}, and \texttt{SENS}.
- If the CD light on the radio indicates a poor signal, check the antennae and batteries.
- The radio may not work well when within 5 feet of the instrument radio.
- Several lights flashing on the radio when the data collector is not in use indicate radio interference. Change the radio channel at the instrument and data collector.
- Older models of the Satel Radio Modem may only support channel B.

**Using the GTS-800A Driver**

- See the GTS-800A manual for optimum settings for SCAN, SPEED, PTRN, WAIT, SENS, MACH, and SURV.
• The CD light on the radio indicates a poor signal. Check the antennae and batteries on both radios.

• The data collector radio may not work well when within 5 feet of the instrument radio.

• Several lights flashing on the radio when the data collector is not in use indicates radio interference. Change the radio channel at the instrument and at the data collector.

• Older models of the SATEL Radio Modem may only support channel B.

• The LIVE update in the Instrument Positioning (POS) menu is not available when connecting directly to the instrument and using the Topcon STD screen.

• If using the External Link cable connection option, the data collector behaves just like it does when connected through the radios.

• If you are using a RC-2R and it does not turn the instrument, follow the RC-2R setup instructions to match the RC-2R's channel to the instrument.

**Using the Topcon RC-2R**

• Tracking mode is necessary for the RC-2R to optically communicate with the 802-A. Because of this, the angle turning functions, such as TOPT, ◄, ►, ▲, and ▼ keys, are deactivated.

• When using the RC-2R closer than 10m to the instrument, the RC-2R should be in low power mode. Activate low power mode by holding the ESC key down on the RC-2R while pressing the RC-2R power key. You will hear two beeps as the RC-2R turns on to indicate low power mode instead of one beep for full power mode.

• RC-2R beeps once when starting a search and twice when a link is established.

• The NO RESPONSE message when using optical communications is referring to no response from the instrument. When there is no response from the RC-2R, the message RC2 NOT RESPONDING is displayed instead.

**Comments**

• The old-style GTS3B instrument uses a special cable built by a company known as Ingenuity. This cable plugs into the battery port of the instrument. The only difference between the GTS3 and GTS4 drivers is the Angles Only routine.
Some Topcon instruments work better in GTS3, others in GTS4. If you get an error message using one driver, try the other.

The CTS-1 instrument must be manually put in Distance or Angles mode.

Wiring Diagram for Topcon Instruments
For the wiring diagram for Topcon total stations, see Wiring Diagram for Sokkia/Lietz Instruments on page 409.

### Trimble

**KEYSTROKES:**
- **SETUP** (Allegro F key, Titan G key)
- **NeXT**
- **INST**
- **NeXT**
- **NeXT**
- **TRIM**

**Supported Trimble Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTS</td>
<td>Trimble 300 and 500 series</td>
<td>1200-None-8-1</td>
</tr>
<tr>
<td>3300</td>
<td>3300 series instrument</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>3600</td>
<td>3600 series instrument</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>5600</td>
<td>(ROBOTIC only) 5600 series</td>
<td>Variable-None-8-1</td>
</tr>
<tr>
<td>GGA</td>
<td>(ROBOTIC only) 5700/5800 series GPS</td>
<td>Variable</td>
</tr>
</tbody>
</table>

**Instrument Setup**

**Setting Up the Trimble TTS 300 or 500 Series Instruments**

1. Turn the instrument on, then pass the scope through the horizontal.
2. Press the **CE-CA** key.
3. Press 1 to enter the Menu mode.
4. Press 2 to select the Config display.
5. Press +/- until the RS-232C format parameter is displayed.
6. If the baud rate, parity, or checksum are not set correctly, press +/- to change the settings.
7. Make sure that Checksum (CSUM) is turned off.

**Setting Up the Trimble 3300**

1. Hold down the On button and press Menu.
2. Select Setting Interface from the menu and press YES.
3. Use the MOD key to match the following settings:

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leave Recording</td>
<td>OFF</td>
</tr>
<tr>
<td>Format</td>
<td>R4</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE</td>
</tr>
<tr>
<td>Baud Rate</td>
<td>9600</td>
</tr>
<tr>
<td>Protocol</td>
<td>Xon/Xoff</td>
</tr>
<tr>
<td>Position C</td>
<td>11</td>
</tr>
<tr>
<td>Position P</td>
<td>16</td>
</tr>
<tr>
<td>Position I</td>
<td>1</td>
</tr>
<tr>
<td>T-O Rec On</td>
<td>NO</td>
</tr>
<tr>
<td>PC-DEMO</td>
<td>OFF</td>
</tr>
</tbody>
</table>

4. Press ESC twice to get back to the angle display.
Setting Up the Trimble 3600

The Trimble 3600 can come with either a 600 CU faceplate (Geodimeter-style) or an Elta faceplate (Zeiss-style). When \textbf{3600} is tapped, you are asked if you are using a 600 CU faceplate. Answer NO if you have the Elta faceplate.

If your 3600 uses the Elta faceplate, simply plug the \textit{SMI} data collector in and turn the instrument on. You are now ready to begin recording information. If you do not have \textit{SMI} installed on the Trimble 3600 instrument, please contact technical support for more information on getting the \textit{SMI} software installed. The instrument may need to be shipped to have the program installed.

If using the 600 CU faceplate, it is like using the Geodimeter \textbf{G420} driver.

Setting Up the Trimble 5600

Refer to Setting Up the Geodimeter 600/Trimble 5600 Instrument on page 369 for more information.

Setting Up a Trimble 5700/5800 GPS Receiver as an SMI Rover

The following information was produced by \textit{SMI} and Trimble and is available from Trimble as a "Technical Tip" document. The Trimble GPS receiver is not an officially supported device by \textit{SMI}.

What Equipment is Needed?

To successfully allow communication between the Allegro (or any standard 9-pin equipped data collector) running the \textit{SMI} software to a Trimble GPS Rover you need:

- Either a DB9 (9PIN) Serial to Zero Shell (7PIN) Lemo cable (either Part No: 32345-00 or the recommended 32960 REV B). This is the same cable that you would use communicating with Port 2 on a Trimble 5800 GPS Receiver use a DB9 to DB9 (9 PIN to 9 PIN) Serial Cable (Pt No# 18532). This is the 9-pin PC Sync cable supplied with the Titan and Allegro data collectors.

- If you are using a DAP Titan, it requires a custom-built cable to communicate with COM 1 on the 5800 GPS receiver or the use of a 9-pin gender changer between either of the two cables above and the Titan PC Sync cable.

- If you are using an iPAQ or a Pocket PC device, this usually requires a short cable adapter.

Setting Up the Devices

The Trimble GPS Rover receivers need to output a GGA NMEA string (from any Port) at 1Hz output to communicate with an \textit{SMI} data collector.
The simplest way to activate a GGA NMEA string is to provide a simple application file that can be loaded to the Trimble GPS Rover Receiver.

To generate and install the Application file, use the Trimble freeware software Configuration Toolbox located at http://www.trimble.com/support_trl.asp?Nav=Collection-3597

When generating the Application file, you should make sure that the File option is switched to Auto Power Up. This ensures that each time your power on the receiver it outputs the GGA NMEA string on every occasion. See the figure below.

**Figure 8-13 Setting the File to Auto Power Up**

To set up the desired GGA NMEA output string select the Output option in the Available window and then select the Message type NMEA from the list.

The NMEA output allows you to choose the Port and Frequency of Output. The Frequency of output should be 1Hz. See the figure below.
Figure 8-14  Setting GGA NEMA Outputs

To set up the receiver so that it can receive the correct radio frequency from the base you desire to use you should also add to the Contents the CMR Input option.

Set the CMR Input option to Use any station for any available signal or dedicate your frequency to a Station ID that you have entered at your base.

Figure 8-15  Setting CMR Input

You should then press the Transmit button to transmit the data from your PC to the GPS receiver.
Setting the Port

You must set the SMI collector’s COM port to receive the GGA NMEA string from the GPS device. To do so, run the SMI program and select File > Settings. Set the port to Force the Baud Rate to 38400.

You may also want to check to see if the receiver’s port is enabled using Trimble WinFlash.

Setting the Input Message Type

To set up SMI to communicate with the GGA NMEA string from the Trimble receiver you need to press GPS (the Z key on the Allegro and Titan). Then press INST gGA.

To verify that the connection has been made successfully, start the Instrument Position command by pressing POS (Allegro Esc key, Titan SP key).

If the screen reports NO POSITION DATA you are not successfully connected to the Trimble GPS Rover. Check the baud rate, power, and cables of the devices.

If successful, the current Lat/Long should be displayed and the LINK field (indicating radio link) should be 1.

Also, the Quality field indicates the solution type:

- If the value is 0, you have an Unknown solution. (Check your GPS antenna)
- If the value is 1, you have a GPS Fix solution. (Check Radio link)
- If the value is 4, you have an RTK Fixed solution.
- If the value is 5, you have an RTK Float solution.

Setting the Correct Antenna Height

To set or check your antenna height at any time, press SETUP (F key on the Allegro, G key on the Titan).

To set your Base Height, select HI. To set your Rover Height, select H ROD.

Antenna heights must be entered as complete Antenna Phase Center heights (in other words the rod height + the APC antenna offset).

Entering the Base Coordinates
For vectors to be correctly measured from the Base Antenna Phase Center to the Rover Antenna Phase Center you must also verify the correct latitude, longitude, and ellipsoidal height you have entered or will be using for the base location.

To enter the correct base coordinate use the <BASE> soft key. You must be in manual mode (<INST><MAN5>).

✓ The manual mode driver temporarily disables the GGA driver.

Tapping the <BASE> soft key while the data collector is set to a State Plane coordinate system results in the prompt, BASE POINT (0 TO GET POS HERE). If you have a point stored with the coordinates of the base, type it in and press . If you prefer to enter the latitude, longitude, and ellipsoid height instead of a point number, type in 0, and press . You are then prompted for the latitude, longitude, and ellipsoidal height.

Tapping the <BASE> soft key while the data collector is set to a Local coordinate system results in the prompt, BASE POINT (0 TO USE 2PFS). Type in the point number of the base and press . You are then prompted for the latitude, longitude, and ellipsoidal height. Follow the instructions in the previous paragraph for entering those values.

To set the current GPS driver back to GGA, press <INST><GGA>.

! You need to use Trimble software running on the field device or some other field device to control the Trimble GPS receivers to set them up, and then switch to the SMI software to collect or stake the points. If you create an App file for the GPS receiver, this can simplify this process quite a bit.

! Instead of just pressing <BASE> in the SMI software to set up the base, you need to connect the Trimble software to the receiver and follow whatever steps they have for setting up the base. You must then write down the latitude, longitude, and ellipsoid height, put the SMI software in manual mode <MAN5>, type the latitude, longitude, and ellipsoid height into the <Base> command, and then switch back to the <GGA> driver.

! The quality tolerance does not work properly with the Trimble 5800 receiver. You need to ensure that quality is set to “4” for RTK Fixed solutions. The Trimble receivers identify a quality of 4 for RTK Fixed mode in the GGA message and a quality of 5 for RTK Float mode. This means that when the position solution slips from RTK Fixed mode to RTK Float mode, the data collector does not know that it is an inaccurate solution because it assumes the industry standard that quality 5 is RTK Fixed mode and quality 4 is RTK Float mode. The end result is that you will be unaware that you are storing inaccurate results. What you should do to help reduce the chances of this happening are to always run with an H & V SDEV and H & V ERR tolerance set.
**Comments**

When using the total station with SMI, be sure the instrument is in Distance mode before attempting to record a shot with the SMI data collector. On the instrument, press the Measure button (CE-CA) on the instrument before pressing the key on the data collector.

---

**Zeiss**

KEYSTROKES:  

```
SETUP <NeXT> <NeXT> <INST> <Zeiss>
```

**Supported Zeiss Models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Models</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELT50</td>
<td>Rec Elta 50/55</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>ELTRAC</td>
<td>Elta C20/C30</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>S20</td>
<td>(ROBOTIC only) Elta S20 direct connect</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>S20R</td>
<td>(ROBOTIC only) Elta S20 radio</td>
<td>19200-None-8-1</td>
</tr>
<tr>
<td>S20Q</td>
<td>(ROBOTIC only) S20, S10 using QL radios</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>S20Q</td>
<td>(ROBOTIC only) Elta S20 Georadio QL</td>
<td>9600-None-8-1</td>
</tr>
<tr>
<td>Z46R</td>
<td>Z46R</td>
<td>1200-Odd-7-1</td>
</tr>
<tr>
<td>ELTA3</td>
<td>Rec Elta 3</td>
<td>1200-Odd-7-1</td>
</tr>
<tr>
<td>ELTA4</td>
<td>Rec Elta 4</td>
<td>1200-Odd-7-1</td>
</tr>
<tr>
<td>ELTRL</td>
<td>Rec Elta 15/RL</td>
<td>9600-None-8-1</td>
</tr>
</tbody>
</table>
Zeiss Elta S20Q (Georadio QL) Functions Menu

KEYSTROKES: a INFN (Allegro Esc key, Titan SP key)

Zeiss Elta S20Q (Georadio QL) Functions Menu Soft Key Definitions

<table>
<thead>
<tr>
<th>Option</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHOW</td>
<td>Displays the current radio channel, Control unit ID, and instrument address.</td>
</tr>
<tr>
<td>CHAN</td>
<td>Changes the radio channel at the data collector's radio. Change the channel at the instrument to match by following steps 1 through 11 in Setting Up the Zeiss Elta S20 (Georadio QL) on page 438. The default is 1.</td>
</tr>
<tr>
<td>CUADD</td>
<td>Changes the control unit (data collector) address. Change the radio number at the instrument to match by following steps 14 through 16 in Setting Up the Zeiss Elta S20 (Georadio QL) on page 438. The default is 2.</td>
</tr>
<tr>
<td>IADD</td>
<td>Changes the instrument address. Change the instrument address at the instrument to match by following steps 1 through 11 in Setting Up the Zeiss Elta S20 (Georadio QL) on page 438. The default is 1.</td>
</tr>
<tr>
<td>LEVEL</td>
<td>Displays the current level status at the instrument.</td>
</tr>
<tr>
<td>PRISM</td>
<td>Changes the prism offset setting on the instrument.</td>
</tr>
</tbody>
</table>

Instrument Setup

Setting Up the Zeiss ELTAC

Simply plug in the SMI data collector and turn on the instrument. You are now ready to begin recording information. If you do not have SMI installed on the Elta C instrument, please contact technical support for more information on getting the SMI software installed. The instrument may need to be shipped to have the program installed.

Setting Up the Elta R50/R55

1. Hold down the On button and press Menu.

2. Select Setting Interface from the menu and press YES.
3. Use the MOD key to match the following settings.

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording</td>
<td>OFF</td>
</tr>
<tr>
<td>Format</td>
<td>R4</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE</td>
</tr>
<tr>
<td>Baud Rate</td>
<td>9600</td>
</tr>
<tr>
<td>Protocol</td>
<td>Xon/Xoff</td>
</tr>
<tr>
<td>Position C</td>
<td>11</td>
</tr>
<tr>
<td>Position P</td>
<td>16</td>
</tr>
<tr>
<td>Position I</td>
<td>1</td>
</tr>
<tr>
<td>T-O Rec On</td>
<td>NO</td>
</tr>
<tr>
<td>PC-DEMO</td>
<td>OFF</td>
</tr>
</tbody>
</table>

4. Press ESC twice to get back to the angle display.

Setting Up the Elta RL

1. Select DATA TRANSFER from the menu.
2. Select RECORDING from the menu.
3. Select RECORDING until the option says EXTERNAL (RS232-C).
4. Select PARAMETERS from the menu.
5. Set the options as follows:

<table>
<thead>
<tr>
<th>Option</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud Rate</td>
<td>9600</td>
</tr>
<tr>
<td>Stop</td>
<td>1</td>
</tr>
<tr>
<td>Format</td>
<td>REC500</td>
</tr>
<tr>
<td>Option</td>
<td>Setting</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>Protocol</td>
<td>REC500</td>
</tr>
<tr>
<td>Parity</td>
<td>NONE</td>
</tr>
<tr>
<td>LF</td>
<td>YES</td>
</tr>
</tbody>
</table>

Shots can be taken from any menu, but angles are only visible in the Measure menu.

**Setting Up the Zeiss Elta S20R (DLS 70 Radio)**

1. Put the SMI interface for the S10/S20 PCMCIA card into the PCMCIA slot in the Zeiss instrument.

2. Turn on the instrument by pressing the PWR button.

3. Use the left and right arrow keys to select S_SMIxxx (xxx is the version number) and press ENTER (the blue arrow key on the lower right side of the keyboard).

4. Press F9 (SETUP). Steps 5 through 10 are only necessary if the current setting is wrong.

5. Press F1 (RADIO) to enter the radio serial number.

6. Press F2 (RDIO/RDIO*) to toggle Using Radio to YES.

7. Press F3 (BAUD) to toggle the baud rate at the serial port.
   
   This is not necessary if using the data collector at the radio.

8. Press F4 (PRISM) to change the prism constant.

9. Press F5 (CRS1/CRS2) to toggle Coarse mode to Fast (No Finelock) or Accurate (2 second Finelock).


11. When finished setting the options, press F10 (EXIT). To exit the Setup menu without saving changes, press the ESC key.
Setting Up the Zeiss Elta S20 (Georadio QL)

Setting Up the Data Collector for Connection to a Serial Port on S20

Connect the data collector to the serial port on the Zeiss S20 using the standard or Y cable. Press \texttt{SETUP} (Allegro F key, Titan G key) \texttt{NeXT NeXT INST ZEISS s20}.

Setting Up the Data Collector for Connection to Georadio QL

1. Connect the data collector to the serial port labeled A on the Georadio QL.
2. Connect the Quicklock sensor cable to the port labeled B on the Georadio QL.
3. On the data collector, press \texttt{SETUP} (Allegro F key, Titan G key) \texttt{NeXT NeXT INST ZEISS s20Q}.
4. Turn on the Georadio QL.
5. Press \texttt{INFN} (Allegro Esc key, Titan SP key) to start the Instrument Functions menu.
6. Tap \texttt{show}.

The data collector gets the current settings from the Georadio QL. \texttt{NO RESPONSE} means the data collector was unable to communicate with the Georadio QL. Check the cables and batteries.

7. The default settings on the Show screen are CHAN: 1, CUADD: 2, IADD:1. Use the \texttt{CHAN}, \texttt{CUADD}, and \texttt{IADD} soft keys to change the settings on the radio.

\begin{itemize}
  \item These settings must match what is set in the S20.
\end{itemize}

Setting Up the Zeiss Elta S20 (Georadio QL)

1. Put the \texttt{SMI} Interface for S10/S20 PCMCIA card into the PCMCIA slot in the Zeiss instrument.
2. Turn on the instrument by pressing the PWR button.
3. If the \texttt{SMI} Interface program starts automatically, press the ESC button.
4. Use the up and down arrow keys to select \texttt{S_{SMI}xxx.EXE} (xxx represents the version number) and press the Space key to the left of the blue arrow keys. This makes the \texttt{SMI} Interface the default application.
5. Use the blue up and down arrow keys to select System Software.
6. Press ENTER to get past the leveling screen and press 9 (Configuration).

7. Press 1 (Instrument), 3 (Switches), and 9 (Data Radio).

   If there is no data radio option, then this version of the S20 firmware uses the DLS 70 radio. Please see the instructions in Zeiss ELTA S20 (DLS 70 Radio) on page 437.

8. Press 1 (Configuration). Make sure the Module selected is Georadio QL. Press the SPACE key to toggle.

9. Make sure the Installation selected is Internal.

10. Press ESC to return to the Data Radio Switch screen.

11. Press 2 (Parameter). There will be a long pause while the internal radio parameters are checked. The Address field defaults to 1 and should match IADD on the data collector. The Channel field defaults to 1 and should match CHAN on the data collector. Protocol is fixed at 23.

12. Press the ESC key several times until prompted to exit. Select Yes and press ENTER.

   The instrument turns off.

13. Turn the data collector's radio on.

   The instrument tries to connect when the program is started.

14. Turn the instrument back on. The SMI program should start automatically. If it does not, use the up and down arrow keys to select S_SMlxxx.EXE and press ENTER.

15. Press F9 (SETUP).

   Steps 16 through 21 are only necessary if the current setting is wrong.

16. Press F1 (RADIO) to enter the data collector's radio number.

   This should match CUADD on the data collector. The default is 2.

17. Press F2 (RDIO/RDIO*) to toggle Using Radio to YES.

18. Press F3 (BAUD) to toggle the baud rate at the serial port. This is not necessary if you are using the data collector at the radio.

19. Press F4 (PRISM) to change the prism constant.
20. Press F5 (CRS1/CRS2) to toggle Coarse mode to Fast (No Finelock) or Accurate (2 second Finelock).


22. When finished setting the options, press F10 (EXIT). To exit the Setup menu without saving changes, press the ESC key.

The instrument tries to connect with the radio using the new settings when exiting Setup.

Notes

Using S20 and S20R Drivers

- When in Coarse mode (<crs> in <inst> menu), Finelock mode is not used unless the Coarse mode in the Zeiss SETUP menu is set to Accurate. When using the Accurate Coarse mode, Finelock takes two seconds. When in Fine mode, Finelock adds about five seconds to the shot.

- If the reflector is hidden while the S20 is searching horizontally, the instrument makes two complete revolutions and then stops. If it is hidden while the S20 is searching vertically, the instrument scope will point straight up or down. Put the reflector in view and try again.

- The Zeiss 360 prism has an offset of 3 mm.

Using S20 & S20Q Drivers

- When in Coarse mode (<crs> in <inst> menu), Finelock mode is not used unless the Coarse mode in the Zeiss Setup menu is set to “Accurate.” When using the Accurate Coarse mode, Finelock takes two seconds. When in Fine mode, Finelock adds about five seconds to the shot.

- If the Quicklock sensor is hidden while the S20 is searching horizontally, the instrument makes two complete revolutions and then stops. If it is hidden while the S20 is searching vertically, the instrument points straight up or down. Put the Quicklock sensor in view and try again.

- The Zeiss 360 prism has an offset of 3 mm.

- To use more than one radio with the same instrument at the same time, set a unique Control Unit Address (CUADD) on each radio. Set them all on the same channel as the instrument. When a search is started from a particular radio, the Quicklock only finds the sensor attached to the radio that started the search.
Wiring Diagram for Zeiss Instruments

Figure 8-16 Allegro to Zeiss Wiring Diagram