Trimble Survey Controller(TM)

Help

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Trimble.

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General Operations

Welcome

Welcome to the Trimble Survey Controller software version 10.5 Help.

This help system makes it easy to find the information you need to effectively use the full power and capabilities of Trimble Survey Controller.

For information that extends or updates this Help, refer to the Trimble Survey Controller Getting Started Guide and Release Notes. Alternatively, visit the Trimble website (www.trimble.com) or contact your local Trimble dealer.

The Trimble Survey Controller Screen

For an explanation of the buttons and icons on the Trimble Survey Controller screen, see:

Status Bar

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Files Menu

Use this menu to view and manage jobs, and transfer data between the office computer and external devices.

For more information, see:

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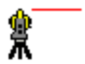
Status Bar

The status bar is located on the top right side of the Trimble Survey Controller screen. Which icons it displays depends on the equipment that is connected to the controller. Tap an icon to view more information about that equipment.

The following table describes the status bar icons.

Icon	What it shows
	Controller is connected to and drawing power from an external supply.
	Controller is connected to an external power supply and is recharging the internal battery.
100% or 50%	Power level is 100% or 50%. If this icon is on the top right, it refers to the controller internal battery. If it is below the internal battery, it refers to the power level of an external device.
	A 5800 receiver is in use.
	A GPS Total Station 5700 receiver is in use.
	A GPS Total Station 4800 receiver is in use.
	A GPS Total Station 4700 receiver is in use.
1.000	A GPS Total Station 4800 receiver is in use. The antenna height is shown to the right of the icon.
	An external antenna is in use. The antenna height is shown to the right of the icon.
1.500	A conventional instrument is in use. If a station setup is completed, the instrument height is shown to the right of the icon.
	A conventional instrument is being used to measure a point.
*	A conventional instrument is receiving an EDM signal back from the prism.
	A conventional instrument is locked on to the target (prism).
	A conventional instrument is locked and measuring to the target (prism).
F	A conventional instrument in FastStandard (FSTD) mode averages the angles while a fast standard measurement is taken.
S	A conventional instrument in Standard (STD) mode averages the angles while a standard distance measurement is taken.

	A conventional instrument in Tracking (TRK) mode constantly measures distances and updates in the status link. (TRK is commonly used in stakeout and continuous topo.)
	The laser pointer is on (DR mode only).
	The height of a conventional target is shown to the right of the icon. "1" indicates that target 1 is in use.
	The prism is locked by the robotic instrument. The prism constant (in millimeters) and target height are shown to the right of the icon."1" indicates that target 1 is in use.
	The target icon changes to a DR icon to show that the instrument is in Direct Reflex mode.
	The target icon rotates to show that the conventional instrument has Autolock enabled but is not currently locked on to a target.
	A static point is being measured.
	Radio signals are being received.
	Cellular modem signals are being received.
	WAAS signals are being received.
	Continuous points are being measured.
	If no survey is running, the number of satellites being tracked is shown to the right of the icon. If a survey is running, the number of satellites in the solution is shown to the right of the icon.

Status Line

The status line is displayed on the bottom of the screen. It displays a message when an event or action occurs, and when the Trimble Survey Controller software cannot start or continue with its present function.

When the controller is connected to a receiver, the status line displays the current survey mode. The following table explains these modes.

Survey mode	Explanation
No Survey	The receiver is connected but a survey has not been started.
RTK:Fixed	The current RTK survey is initialized, and the solution type is L1 fixed−centimeter−level.
RTK:Float	The current RTK survey is not initialized, and the solution type is L1 float.
RTK:Check	The current RTK survey is verifying the initialization.
RTK:Auto	The radio link is down in the current RTK survey, and the solution is an autonomous position.
RTK:WAAS	The radio link is down in the current RTK survey, and the solution is a WAAS position
FastStatic	The current survey type is FastStatic.
PPK:Fixed	The current postprocessed kinematic survey is initialized and, when postprocessed, should yield an L1 fixed or an iono−free (centimeter−level) solution.
PPK:Float	The current postprocessed kinematic survey is not initialized and, when postprocessed, should yield an L1 float solution.

PP differential	The current survey type is postprocessed differential.
RT differential	The current survey type is real−time differential.
Infill:Fixed	The current kinematic infill survey is initialized and, when postprocessed, should yield an L1 fixed or an iono−free (centimeter−level) solution.
Infill:Float	The current kinematic infill survey is not initialized and, when postprocessed, should yield an L1 float solution.
Infill	The current survey type is differential, and you are doing an infill session.
WAAS	The current survey type is differential, and using signals from the WAAS satellites.

The root mean square (RMS) indicator is displayed when you are in Fine mode in a real−time kinematic survey. It shows the RMS of the current position, expressed in millicycles.

ACU Function Keys

The following table describes the Trimble Survey Controller functions that are associated with the ACU icons.

On this instrument or receiver...	tap...	to...
Conventional or GPS		access the main Trimble Survey Controller menu
Conventional (with Autolock)		access the Trimble functions screen
		switch on Autolock and start a search
		switch on Autolock or switch it off
		take a measurement
Conventional (with servos)		turn the instrument horizontally to the current point name or stakeout location
		turn the instrument vertically to the current point name or stakeout location
		turn the instrument horizontally and vertically to the current point name or stakeout location
		change face
		take a measurement
Conventional (3600)		activate the first softkey (F1)
		activate the second softkey (F2)

		activate the third softkey (F3)
		activate the fourth softkey (F4)
		take a measurement
GPS		access the *Position* dialog
		access the *Satellites* dialog
		activate the first softkey (F1)
		activate the second softkey (F2)
		activate the third softkey (F3)
		activate the fourth softkey (F4)
		activate the **Enter** button

Survey Controller Buttons

Enter Measure	Tapping the Enter button on the controller is the same as tapping the Enter key on the controller keypad. The actions of the Enter button depend on the current screen. In some screens, the caption on the button changes to describe the action for the screen. For example, the Enter button changes to the Measure button when you are in the Measure points screen.
Map	Tap Map to display a background map of the current job.
Favorites	Tap Favorites to access a list of commonly used screens. See the Favorites menu below.
Switch to...	Tap this button to switch between active windows (screens).

Note − The up arrow softkey appears if there are more than four softkeys associated with a screen. Tap the arrow, or press the Shift key, to see the other softkeys.

Favorites menu

The Favorites menu provides quick access to commonly used screens. Access a screen from the Favorites list, or use the Switch button to access previously viewed screens.

To access a screen from the Favorites list, tap the Favorites button and select the screen you want.

To add a screen to the Favorites list, view it and select Favorites / Add to favorites.

To remove a screen, view it and select Favorites / Remove from favorites.

Softkeys

Softkeys are displayed on the bottom line of the Trimble Survey Controller screen as on−screen buttons. They relate to particular screens and change when the screens change.

Entering Quadrant Bearings

1. Make sure the system units are quadrant bearings.
   For more information, see System Units
2. Enter the bearing in any *Bearing* field.
3. Select NE, NW, SE, or SW from the popup list.
   The quadrant bearing is inserted in the field.

Example

To enter the quadrant bearing N25° 30' 30"E in a bearing field:

- Key in **25.3030 .**
- Select NE from the popup list.

In−Field Calculator

If the In−Field Calculator is available, use it to calculate a value in various software fields. For example, access the popup menu from the Azimuth field and tap Operator to see a list of available operators. Select = , and then enter the formula using the relevant operators. (With some operators you can calculate distances and azimuths between points.)
When you tap Enter to accept the formula, Trimble Survey Controller checks the syntax.

Tip − When calculating a distance between two points, select the List menu to select the points from the Trimble Survey Controller database.

Note − When keying in a point name that includes spaces, put double quotion marks around the name. To save time, use the List menu to select the point.

Time/Date

To set the time and date on a Trimble controller:

1. Do one of the following:
   - Double−tap the clock on the right of the taskbar.
   - From the Start menu, select Settings / Control Panel / Date/Time.
2. Change the date and time as required. Press the Enter key to accept the new settings or Esc to cancel.

To configure the time stamp interval and GPS time display setting:

1. From the main menu, select Configuration / Controller / Time/Date.
2. Enter a value in the Time stamp field.
3. In the Time display field, select the required time display format.

Sound Events

Sound events are prerecorded messages that notify you of an event or action that has occurred. They correspond with status line messages, and common error and warning messages.

Sound events are stored as .wav files. You can customize your own sound events by replacing or deleting the existing .wav files located in the Program Files\Survey Controller\Languages\English\ folder.

Tip − Use the Recorder application provided in the controller to record your own sound events. Alternatively, transfer .wav files from the office computer to the controller using Data Transfer.

To turn all sound events on or off:

1. From the main menu, select Configuration / Controller / Sound events.
2. Select the Play sound events check box to turn on sound events, or clear it to turn them off.

Language

To change the language of the Trimble Survey Controller software:

1. Use the Trimble Data Transfer utility to transfer a language file to the controller.
2. From the main menu of the Trimble Survey Controller software, select Configuration / Controller / Language.
3. Choose the required language from the list.
4. Restart the Trimble Survey Controller software.

Windows Explorer

Use Microsoft Windows CE Explorer to view and manage files stored in the controller. To do this, select Files / Windows Explorer from the Trimble Survey Controller main menu. For more information, refer to the Windows CE Help provided on the controller.

Deleting files

Warning − Files deleted in Windows CE Explorer cannot be recovered.

Use Files / Open job to copy and delete job files. If you delete job files, any associated GPS files are automatically deleted.

Power Indicators

The remaining battery power is displayed as a battery symbol along the top right corner of the status bar.

The symbol on the top represents the power remaining in the Trimble controller battery.

The symbol below the top battery symbol represents the remaining power in an external power supply, such as from a GPS receiver or conventional instrument. (This symbol only appears when an external power supply is connected.)

The level of shading in the symbol reduces as the power reduces.

Trimble Controller – General Operation

Use the links below to find out how to operate an ACU or TSCe controller:

Lighten or Darken the Display (TSCe only)

Calibrate the Touch Screen

Disable the Touch Screen

Use the keyboard to run programs

Perform a Soft Reset (Warm boot)

Perform a Hard Reset (Cold boot)

Switch on the controller or instrument

Change the speaker volume

Get rid of Out of Memory errors

Lighten or Darken the Display (TSCe only)

To adjust the Display Contrast hold down the **Alt** key and repeatedly press or hold down:

- the decimal key "." to lighten the display
- the comma key "," key to darken it.

Calibrate the Touch Screen

Open the Control Panel (**Ctrl** , **Esc** , **S** , **C**) and then follow the prompts, pressing the target as it moves from the center of the screen, to each corner. If the calibration is successful, you are prompted to press **Enter** to accept the new settings. If the calibration was not successful, the target returns to the center of the screen, and the process must be repeated. If you have trouble calibrating the screen with your finger, try using a pen, pencil, or stylus.

Disable the Touch Screen

To clean the ACU screen during a survey, press [Ctrl]+ (alpha key), then [1], [1], [1], [1] to disable it.

This locks the screen and keypad, except for the Esc key. To enable the touch screen and keypad again, press Esc.

To disable the TSCe screen, press [Ctrl]+[S].

Use the keypad to run programs

To do this...	**Use this keyboard shortcut...**
Access a pull−down menu	**Alt** − then the appropriate letter key of the menu item.
Move between fields	**Tab** , up and down **Arrow** keys
Move between buttons	**Arrow** keys
Click a check−box	**Space** Key
Close a screen	**Alt** then **F** then **C**
Switch between programs	**Alt** then **Tab** or **Alt** then **Esc**
Select an item from a list	**Space** key

Use the keyboard to run programs, as follows :

- To run a program from the desktop:

  If no desktop icons are highlighted, press the **Tab** key until one is selected. Then use the arrow keys to navigate to the icon for the program that you want to run. Press **Enter** to run the program.

- To run a program from the Start Menu:

  Press **Ctrl** then **Esc** to display the Start Menu, then use the arrow keys to select Programs. Press **Enter** to display a list of programs, then use the arrow keys to select the program that you want to run. Press **Enter** to run the program.

- If there is no icon or Start Menu listing:

  If there are no icons highlighted on the desktop, press the **Tab** key until one is selected, then use the arrow keys to select My Computer. In My Computer, use the arrow keys to highlight the Disk folder, then press **Enter** . Use the arrow keys to locate the program you want to run (it may be located in a sub folder), then press **Enter** to run the program.

Perform a Soft Reset (Warm boot)

You do not lose any data when you perform a soft reset. Hold down the **Shift** key and the **Ctrl** key, then press and release the **Trimble functions** key (ACU) or the **Power** key (TSCe). The Trimble controller resets to the default Windows desktop view.

Perform a Hard Reset (Cold boot)

You do not lose any data that is stored to the "Disk" when you perform a hard reset. However, the contents of the RAM memory are cleared, including any desktop shortcuts that you have created.

To perform a hard reset, hold down the **Power** key. After about five seconds, a countdown timer appears, indicating that the controller will reset. Continue to hold down the **Power** key for a further five seconds, then release it. The controller briefly displays the boot screen and then resets to the default Microsoft Windows desktop view.

Switch on the controller or instrument

If the controller is switched on before you connect it to an instrument:

- switch the controller off, connect it to the instrument, and then switch the controller on again to switch the instrument on.

- connect the controller to the instrument, and then press the button on the back of the instrument to switch the instrument on.

Change the speaker volume

Open the Windows CE Control Panel (**Ctrl** , **Esc** , **S** , **C**) then select the Volume and Sounds icon. Use the slider on the left of the dialog to increase or decrease the volume. You can also use this dialog to turn on or off individual sounds, such as tapping the screen.

Get rid of Out of Memory errors

Open the Control Panel (**Ctrl** , **Esc** , **S** , **C**) then select the System icon. In the System Properties dialog, select the Memory tab, then move the slider−bar to the left to increase the amount of RAM memory allocated to running programs.

If the problem persists, close all open programs except the one you are attempting to run. If the problem still persists, contact your local dealer for more assistance.

Registration

Please remember to register your Trimble Survey Controller software by selecting the Register Software option on the CD. Registration gives you access to:

- News about software updates and specials
- New product information

Registration gives Trimble information that is used to develop the product and improve customer support.

Trademarks

The Globe and Triangle logo, Trimble, Autolock, FastStatic, RoadLink, Trimble Geomatics Office, Trimble Survey Controller, TSCe, and Zephyr are trademarks of Trimble Navigation Limited.

Geodimeter, GPS Total Station, and Tracklight are trademarks of Trimble Navigation Limited registered in the United States Patent and Trademark Office.

Bluetooth is a trademark owned by Bluetooth SIG, Inc. and licensed to Trimble Navigation Limited. The Bluetooth trademarks are owned by its proprietor and used by Trimble Navigation Limited under license.

All other trademarks are the property of their respective owners.

The following U.S. patents cover the Trimble Survey Controller software: 6021376, 6016118, 5986604, 5969708, 5831573, 5614913, and other patents pending.

About

To access the About dialog, tap the Trimble icon in the top left corner.

The dialog displays program, copyright, and patent information, and the version and serial numbers for the Trimble Survey Controller software.

Troubleshooting

Conventional instrument behaving erratically
Set the HA VA status rate to Never if the instrument screen blinks erratically or has problems maintaining communication with the Trimble Survey Controller software. Some instruments cannot support a high status update rate.

Conventional instrument will not connect
Always select the correct survey style in the Trimble Survey Controller software before connecting the controller to a conventional instrument. Otherwise, they may fail to connect. If this occurs, reset the conventional instrument by switching it off and then on, and then try to connect again.

No communication between instrument and the Trimble Survey Controller software
Check the cables, connections and switches. Also check the power source to the receiver or conventional instrument.
Note − Make sure that you have selected an appropriate survey style.

No coordinates in Review
Check the Coordinate view setting. Tap the Options softkey to change the coordinate view.

To see grid coordinates in review, this setting must be grid. Also, to display grid coordinates, a projection and datum transformation must be defined.

In conventional surveys, check that the instrument and/or backsight point has been coordinated.

In conventional surveys, an observation is displayed with null coordinates until the observation to the backsight is stored.

No data recorded in receiver
Check the Base and Rover options in the survey style. Is the logging device set to Receiver? Is the antenna connected? Is power connected?

No grid coordinates
Check that a projection and datum transformation have been defined. Also check that the Coordinate view setting is Grid. To do this, select Files / Properties of current job / Units.

Not receiving radio
Check that all radio cables are connected to the correct ports and that the radio is switched on.

Check that the radios are configured correctly in the Survey Style.

Check that there are no obstructions (for example, trees or buildings). If there are, move to a place where the radio signals will not be obstructed.

Check that the base radio is switched on.

Receiver does not turn on
Check the cables, connections, and switches. Also check the power source.

RTK survey will not work
Check that you have selected an RTK Survey Style. Check that it is configured for RTK in the Type field in both the Base and Rover options. Check that the antenna is configured correctly in the Antenna Type field in Base and Rover options. Check that the radio is working and that it has been configured correctly.

RTK precisions are too high
Is RTK mode Fixed? If it is not, initialize the survey.

If the mode is Fixed, remain stationary on the point for a while and wait for the precisions to decrease. If you are in stakeout, tap the Fine softkey to go into fine mode.

Satellite/s not being tracked
Check that there are no obstructions − look at the azimuth and elevation of the SV in the GPS / Satellites screen. Check the GPS antenna connections. Check the elevation mask setting. Check that the satellite is not disabled − tap the Info softkey in the Satellites screen. Are there any transmitting antennas nearby? If there are, reposition the GPS antenna.

Job Operations

Job

A job can contain several different surveys. Select a job before you measure any points or make any calculations.

To create a new job:

1. From the main menu, select Files / New job.
2. Enter a name for the new job.
3. Tap the Coord. sys. button and choose a coordinate system for the job. Tap Next.
4. Configure the coordinate system settings required for the job and tap Store.
5. Tap the Units button to specify the units and various other settings for the job. Tap Accept.
6. Tap the Linked files button to select a linked file(s) for the job. Tap Accept.
7. Tap the Background files button to select a background file(s) for the job. Tap Accept.
8. Tap the Feature library button to associate a feature library with the job. Tap Accept.
9. Tap the Cogo settings button to set the cogo settings for the job. Tap Accept.
10. Optionally, tap the Page down button to enter Reference, Description and Operator details, and any Notes.
11. Tap Accept to save the job.

To open a job:

1. From the main menu, select Files / Open job.
2. Highlight the job name and tap Select.
   The job name appears in the title area of the main menu.

To delete a job:

1. From the main menu, select Files / Open job.

   If the job you want to delete is not highlighted, use the arrow keys to highlight it, or tap and hold it with the sylus.

   Note − If you tap with the stylus without holding, the job that you highlight opens automatically.

2. Tap Delete.
3. Tap Yes to confirm deletion, or No to cancel.

To copy a job:

1. From the main menu, select Files / Open job.
2. Highlight the name of the job to be copied and tap the Copy softkey.
3. Enter a name for the new job in the *To name* field and tap the Copy softkey. The complete job is copied.

Tip − You can also use Windows Explorer to copy, rename, or delete a file.

Properties of Current Job

Use this menu to configure settings for the current job.

For more information, see:

Coordinate system

Units

Linked files

Background files

Feature library

Cogo settings

Each button displays the current settings. When you create a new job, settings from the previous job are used as the defaults. Tap a button to change the settings.

Tap Accept to save any changes.

Review Current Job

To see the records stored in the job database:

1. From the main menu, select Files / Review current job. The screen displays details of the first entry in the database.
2. Use the arrow keys, stylus, or softkeys to navigate the database.

   Tip − To move to the end of the database quickly, highlight the first record and press the up arrow key.

   Tip − To highlight a field without selecting it, tap and hold briefly with the stylus.

3. To see more information about an item, tap the record. Certain fields, for example, Code and Antenna height, can be edited.

   Note − Offset points stored as coordinates are not updated when you change an antenna or target height record in the database. Also, the change in antenna height does not affect any postprocessed points that will be processed using the Trimble Geomatics Office software.
   Verify the antenna or target height information when you transfer the data to the office computer. Do

the same if you transfer postprocessed points directly from the receiver to the office software. When you change an antenna or target height record in the database, Stakeout deltas, Cogo points, calibrations, resections, and traverse results are not automatically updated. Staked out points should be re−observed and Cogo points, calibrations, resections, and traverses be re−calculated.

To search for a particular item, tap the Search softkey and select an option.

For details of road information stored in a job, see Reviewing a road.

Tip − To review features from the *Map of current job* screen, select the required feature(s), tap and hold on the screen and choose *Review* from the shortcut menu.

Inserting notes

To store a note in the database:

1. Highlight a record.
2. Tap Insert. The Note screen appears.
3. Enter the note and tap Store. The note is stored immediately before the record you highlighted in step 1.

   To close the Note screen, tap Esc. Alternatively, tap Store when there is no text on the screen.

Inserting target/antenna records

If you highlight an antenna or target height record and tap Insert, you can choose to insert a note (see above), or an antenna or target record.

To insert a target/antenna record:

1. Highlight the record.
2. Tap Insert. A popup appears with Target 1 or Target 2 (conventional survey) or Antenna (GPSurvey).
3. Enter the new details.
4. The new record is stored immediately before the record you highlighted in step 1, and applies to all subsequent observations that used the updated record.

   A timestamp is also applied to an updated height record.

To delete a point, line, or arc in the Trimble Survey Controller database:

1. From the main menu, select Files / Review current job.
2. Highlight the point, line, or arc to be deleted and tap Details.
3. Tap the Delete softkey. For points, the search class changes to Deleted (normal), Deleted (control), Deleted (staked), Deleted (backsight), or Deleted (check), depending on the original search classification.
4. Tap Back. Trimble Survey Controller records a note after the original point, line, or arc record, showing the time it was deleted.

When you delete a point, line, or arc, the point symbol changes. For example, for a topo point, the ⊘ symbol replaces the × symbol.

When you delete a face 1 or face 2 observation that contributes to a matched pair record, the matched pair record is also deleted. The same applies to mean turned angle records.

Tip − To delete features from the *Map of current job* screen, select the required feature(s), tap and hold on the screen and choose *Delete* from the shortcut menu. Select the features you want to delete and tap the Enter softkey.

To restore a point, line, or arc in the Trimble Survey Controller software database:

1. From the main menu select Files / Review current job.
2. Highlight the point, line, or arc to be restored and tap Back.
3. Tap the Undelete softkey.

Deleted points

A deleted point, line, or arc is not used in calculations, but it is still in the database. Deleting points, lines, or arcs does not make a job file smaller.

When you transfer a file that contains deleted points, the deleted points are not transferred to the office software. If you transfer a file using the Trimble Data Transfer utility, however, the deleted points are recorded in the Data Collector (.dc) file. They have a classification of Deleted.

Some points, such as continuous offset points and some intersection and offset points, are stored as vectors from a source point. If you delete a source point, any point stored as a vector from that point has null (?) coordinates when you review the database point record.

Storing Points

How you record a point determines how it is stored in the Trimble Survey Controller software. Points are stored either as vectors or as positions. For example, RTK points and conventionally observed points are stored as vectors, while keyed−in points, real−time differential points, and postprocessed points are stored as positions.

To review details about a stored point, from the main menu, select Files / Review current job. A point record contains information about the point, such as the point name, the code, the method, the coordinates, and the GPS data file name. The *Method* field describes how the point was created.

The coordinates are expressed as WGS−84, local, or grid coordinates, depending on the setting in the *Coordinate view* field. To change a *Coordinate view* setting, do one of the following:

- Select Files / Properties of current job / Units.
- Select Files / Review current job. Access the point record, and tap Options.

Note − Define a datum transformation and/or a projection if you want to display local or grid coordinates for a GPS point. Alternatively, calibrate the job.

Each point record uses the antenna height given in the previous antenna height record. From this, the Trimble Survey Controller software generates a ground height (elevation) for the point.

The following table shows how the point is stored in the *Stored as* field.

Value	What the point is stored as
Grid	Grid coordinates
Local	Local geodetic coordinates
WGS−84	WGS−84 geodetic coordinates
ECEF	WGS−84 Earth−Centered−EarthFixed *X* , *Y* , *Z* coordinates
ECEF deltas	WGS−84 Earth−Centered−EarthFixed *X* , *Y* , *Z* vector
Polar	Azimuth, horizontal distance, and vertical distance. This is a vector.
HA VA SD	A horizontal circle reading, vertical circle reading (a zenith angle), and slope distance. This is a vector.
HA VA SD (raw)	A horizontal circle reading, vertical circle reading (a zenith angle), and slope distance with no corrections applied. This is a vector.
Mag.Az VA SD	A magnetic azimuth, vertical (zenith) angle, and slope distance vector.
MHA MVA MSD	A meaned horizontal angle from the backsight, meaned vertical angle (a zenith angle), and meaned slope distance. This is a vector.
MHA MHD MVD	A meaned horizontal angle from the backsight, meaned horizontal distance, and meaned vertical distance. This is a vector.

Read the *Stored as* field in conjunction with the *Method* field.

For points calculated using Cogo/Compute point, you can choose how to store that point. The available options depend on the selected coordinate system and the type of observation used in computing the point.

Note − Points stored as vectors are updated if the calibration or coordinate system of the job changes, or the antenna height of one of the source points is changed. Points stored as WGS−84 coordinates (for example, an offset point calculated using the *From a baseline* method) are not updated.

For GPS points, Quality Control (QC) records are stored at the end of the point record.

Point Classification

When points are stored they have either one or two classifications:

- Points that have been measured using GPS have an observation class and a search class.
- Points that have been keyed in, computed, or measured with a conventional instrument or laser rangefinder have only a search class.

Observation class

For real−time surveys, the observation class is L1 Fixed, L1 Float, WA Fixed, WA Float, or L1 Code, and precisions are recorded. For postprocessed surveys, the observation class is autonomous and no precisions are recorded.

The following table lists the observation classes and resulting solutions.

Observation class	Result
L1 Fixed	An L1 fixed real−time kinematic solution.
L1 Float	An L1 float real−time kinematic solution.
L1 Code	An L1 code real−time differential solution.
Autonomous	A postprocessed solution.
WAAS	A position that has been differentially corrected using WAAS signals.
WA Fixed	A fixed solution using Wide Area processing.
WA Float	A float solution using Wide Area processing.

Search class

A search class is applied to a point when it is measured, keyed in, or computed. The search class is used by the Trimble Survey Controller software when details of a point are required for stakeout or calculations (for example, for Cogo calculations).

When you select a point name, the database is searched from the start down. The first search is for a control class point. If no point is found, the next search is for a normal class point, then an as−staked point, then a backsight class point. If still no point is found, the final search is for a check class point. The following table describes the different search classes.

Search class	Description
Control	The highest order of search class. A control class point can only be overwritten by another control class point. Key in or upload control points. Points that are adjusted in a traverse are stored as control points.
Normal	Most points are usually measured as normal class. A normal class point can only be overwritten by another normal class point later in the database, or by a control class point.
As−staked	If a point was staked out and then measured, it has an asstaked classification.
Backsight	If a point was observed as a backsight or a resection target in a conventional survey, it has a backsight classification.
Check	Check class is the lowest order of search class that will be found by the Trimble Survey Controller software search rules. Check class points can be overwritten by any class of point except deleted points. A check point can only be measured; it cannot be keyed in.
Deleted	When points are deleted in the Trimble Survey Controller software, the original class is given the prefix Deleted. Deleted class points are not displayed in lists, used in calculations, or found by database searches.

Note – Measured points have a search class of normal or lower.

For more information, see Database search rules.

Reviewing and Editing a Road or Template Defintition

Reviewing a Definition

To view the details of an existing road definition select Key in / Roads. From the list of roads, highlight the road name and tap the Review softkey. To return to the list tap the Esc softkey or, to view details of other roads in the list, tap the Prev or Next softkey.

Use the same process to review a template.

You can also review the details of a road or template component at any time. For more information, see Reviewing the Database . Alternatively, select Key in / Roads or Key in / Templates (as if to edit the record).

Editing a Definition

Notes – You can not edit a road or template during a survey.
When you edit a road or template definition, a new definition is stored. The original definition stays in the Trimble Survey Controller database, but the deleted symbol (⊘) indicates that it is no longer available.

To edit a road or template definition that was imported from the Trimble RoadLink software or partially keyed in, select Key in / Roads or Key in / Templates.

To select a road definition for editing, do one of the following:

- Select it from a list
- Enter the name of the road definition
  The name must match an existing road name.

Use the same process to edit a template definition.

Map of Current Job

The Map of current job screen is a graphical representation of the features (points, lines, and arcs) in the database. You can move around the map and select features for common tasks . You can also display a background map .

To access the Map of current job screen:

1. Tap Map. The current position of the GPS antenna is displayed as a vertical/horizontal cross. The current orientation of a conventional instrument is shown by a dotted line extending from the instrument to the end of the screen. The location of the prism is shown as a cross when a distance is

measured.
2. Use the map softkeys to navigate around the map.

Note − Only grid coordinates are displayed. If you have not defined a projection, only points stored as grid coordinates appear. For a road, only the centerline and stationing are displayed.

If there is a point with the same name as another point in the database, the point with the higher search class is displayed. For more information about how the Trimble Survey Controller software uses search classes, see Database search rules.

Note − If the Grid coords field in the Cogo settings screen is set to Increase South−West or Increase South−East, this screen is rotated by 180°. The letter N on the north arrow denotes Grid 0°.

Map Softkeys

Use the map softkeys to:

- navigate around the map
- change the map display options

Some softkeys can operate in an "active" mode. The effect of tapping on the map depends on the active softkey selected.

The functions are described in the following table:

Softkey	Function
+	Tap this softkey to zoom in. Tap and hold the softkey to make it active. Tap the area of the map to zoom in on, or drag to create a box around the area of interest.
−	Tap this softkey to zoom out. Tap and hold the softkey to make it active. Tap the area of the map to zoom out from.
Pan	Tap this softkey to shift the center of the map area to another part of the map. Tap the softkey to make it active. Tap an area of the map to center on, or tap and drag the map area to where you want to pan.
	Tap this softkey to show all features on the screen. Tap the softkey to make it active.

Click the Up arrow to access more softkey functions. The additional functions are described in the following table.

Filter	Shows a legend for the feature symbols and lets you choose which features are displayed.
Pan to	Displays the Pan to point screen. Enter a point name and scale value.
Options	In the screen that appears, you can: • Change the labels that are displayed next to the points.

		• Display point symbols, coded features, and stakeout list points. • Select the Automatic pan to your current position check box. • Choose whether to display the points symbols and coded features for each point. If the Display coded features check box ic selected, Trimble Survey Controller draws lines between points that have feature codes with certain display properties. When you vreate or edit a feature code, use the Display softkey to specify the display features of the fetaure code. • Choose to have the points displayed in the stakeout list. To do this, set the Display stakeout list points field to Yes.

Filter

Use the Filter softkey to control:

- points to select. For example, tap Stakeout / Points / Add / Select from list / Filter.
- features to display. For example, tap Map / Filter.

Tap an item to select it. Tap it again to clear it. A check mark beside an item shows that it is selected.

Use the All and None softkeys to aid selection.

Using the Map for Common Tasks

You can use the Map of current job screen to select features (points, lines, arcs) for various tasks.

To select a feature from the map, do one of the following:

- Tap the required feature(s) from the map area. The selected features are highlighted and displayed in reverse video (white on black). If there is more than one feature within the highlighted area, a list of features within this area appears. Select the features as required. Tap OK or tap off the list to return to the map.
- Drag a box around the features you want to select.

To deselect a feature from the map, do one of the following:

- Tap the selected feature to deselect it. If there is more than one feature within the highlighted area, a list of features within this area appears. Deselect the features as required. Tap OK or tap off the list to return to the map.
- Tap and hold on the map and select List selection from the shortcut menu. A list of the selected features appears. Deselect the features as required.
- To clear the entire selection, double−tap off the selected features. Alternatively, tap and hold on the map and select Clear selection from the shortcut menu.

To carry out a task using the selected feature(s), do one of the following:

- Measure / Stakeout. When you have no features selected, tap Measure to measure the current position. Tap Stakeout to stake out the selected features. If more than one point is selected, the points are added to the Stake out points list where they can be selected for stakeout.

  Alternatively, double−tap a feature to stake out. If there is more than one feature within the highlighted area, a list of features within this area appears. Select the feature to stake out.

  If the selection contains different feature types (points, lines, arcs), only features of the first type selected can be staked out from the map. To stake out other feature types, clear the selection then reselect the other features.

- Shortcut menu. Tap and hold on the map area to access a shortcut menu. The shortcut menu provides quick access to common tasks. The tasks depend on the number and type of features selected.

In the following table, the * symbol against a task shows that you can access it through the shortcut menu for the feature at the top of that column.

Task	Feature					
	No Features	One point	Two points	Three or more points	Line	Arc
Review	–	*	*	*	*	*
List section	–	*	*	*	*	*
Clear section	–	*	*	*	*	*
Delete	–	*	*	*	*	*
Stakeout	–	*	*	*	*	*
Navigate to point	–	*	–	–	–	–
Turn to point	–	*	–	–	–	–
Compute inverse	–	–	*	*	–	–
Compute area	–	–	–	*	–	–
Subdivide a line	–	–	–	–	*	–
Subdivide an arc	–	–	–	–	–	*
Key in point	*	–	–	–	–	–
Key in line	–	–	*	–	–	–

Note − If you select a point with the same name as another point in the database, then select the *Review* or *Delete* option from the shortcut menu, a list of the duplicate points appears. Select the point you want to review or delete.

- Field fill−in. Enter feature names into fields by selecting from the map. Select the feature(s) from the map then select a survey function, such as Cogo or Stakeout. The selected feature(s) are automatically entered into the appropriate fields.
- Map selection list. The Map selections option is available on the right side of the feature name field when you have selected features from the map. Tap it to access the list of the selected features. Only features that are specific to the field are shown.

Autopan

The Autopan function automatically centers the map using the current position. Autopan only operates when the current position appears within the selected map view.

To automatically view your current position:

1. In the Map of current job screen, tap the Up arrow.
2. Tap Options.
3. Select the Automatic pan to current position check box.
4. Tap Enter.

Units

You can specify the units, such as degrees and meters, used by the Trimble Survey Controller software.

You can also specify the order of the displayed coordinates, the type of coordinates, the way a slope grade is displayed, and how stationing values are displayed.

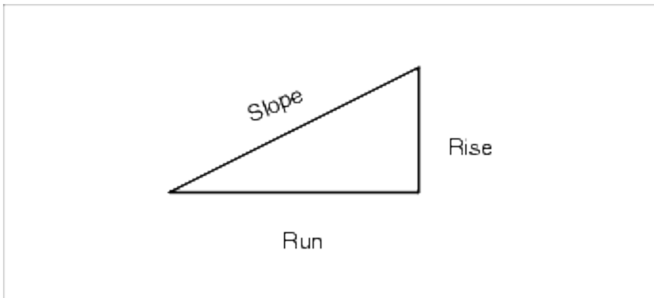
To configure the units display, select Files / Properties of current job / Units and change the fields as required.

The following table describes the coordinate view options.

Option	Description
WGS−84	View as WGS−84 Latitude, Longitude, and Height
Local	View as local ellipsoidal Latitude, Longitude, and Height
Grid	View as Northing, Easting, and Elevation
Station and Offset	View as station, offset, vertical distance relative to a line, arc or road
ECEF (WGS−84)	View as Earth−Centered−Earth−Fixed WGS−84 X, Y, Z coordinates
Az VA SD	View as azimuth, vertical angle, and slope distance
HA VA SD (raw)	View as horizontal angle, vertical angle, and slope distance
Az HD VD	View as azimuth, horizontal distance, and vertical distance
HA HD VD	View as horizontal angle, horizontal distance, and vertical distance
”Grid	View as differences in Northing, Easting, and Elevation from the instrument point

In some fields (for example, Azimuth), you can enter a value in units other than the system units. The Units softkey appears in these fields. When you tap Enter to accept the field, the value is converted to the system units.

The grade of a slope can be displayed in one of the following formats: angle, percent, or ratio.
The ratio can be displayed as *Rise:Run* or *Run:Rise.*



The setting in the *Laser VA display* field determines whether the laser measurements are displayed as vertical angles measured from the zenith, or inclinations measured from horizontal.

Linked Files

You can link Comma Delimited files (.csv, or .txt) to your current job to provide easy access to additional data.

Use a linked file to access points that do not exist in the current job, or that you do not want to import into the current job. Linked CSV points appear as a comma (,). All linked points appear blue. You can use points from a linked file for:

- staking out without having the design points in the job
- entering values into Point name fields, such as for COGO functions
- navigating to control or check shots from previous surveys

Notes – You can only review points in a linked file from the map. Once you select a linked point and copy it into the current job, it appears as a "c" in the map.
If two points in one or more linked files have the same name, only the first point is used. If there is a point with the same name in the database, the point in a linked file is not used.

Transferring linked files

You can transfer linked CSV files from the office computer, transfer files between controllers, or export points to a CSV file from a previous job.

Before you transfer a CSV file, make sure the data in the file is in the format: Point name, First ordinate (Northing or Easting), Second ordinate (Northing or Easting), Elevation, Point code.

Note – The coordinate order (Northing and Easting ordinates) in the comma delimited file must be the same as the setting in the *Coordinate order* field in the *Units* screen.

To transfer a CSV file from the office computer to the \Trimble Data folder on the Trimble controller, use Data Transfer or Microsoft ActiveSync. For more information, see Data transfer.

To transfer files between controllers, use Windows Explorer. Select File / Send to / File Transfer.

Use the Data Transfer utility or Microsoft ActiveSync to transfer the file from the office computer to the \Trimble Data folder on the Trimble controller. For more information, see Data transfer.

To select linked files:

1. From the Trimble Survey Controller main menu, select Files / Properties of current job and tap the Linked files button. The Linked files screen appears.
2. Tap the file(s) that you want to use for the current job or tap the All softkey to select all files.

To import points from a linked file to the current job, select Files / Import/Export / Receive data.

When using points from linked files, make sure that they use the same coordinate system as the job that they are being brought into. Points in a different coordinate system, are not transferred.

Staking out points from a linked file

To stake out a point from a linked file, do one of the following:

- From the map , select a point to stake out.
- Add a point to the Stake out points list using the Select from file option.

Entering point name fields

To enter a point from a linked file into a Point name field, access the field and key in the point name. A linked point entered into a point name field is copied into the current job database.

Background Map

To select a map to display in the background layer of the Map of current job screen, select Files / Properties of current job / Background files.

Use Data Transfer to transfer background map files to Trimble Survey Controller.

If you display more than one map at a time, the features are visible but cannot be selected, edited, or deleted.

Trimble Survey Controller supports AutoCAD (ASCII) files (*.dxf). Supported entities are 3D FACE, ARC, CIRCLE, INSERT, LINE, LWPOLYLINE, POINT, POLYLINE, and TEXT.

Using a Feature and Attribute Library

To select a code in a survey, first select the library that you want to use:

1. From the main menu, select Files / Properties of current job.
2. Tap the Feature library button and select the library that you want to use.

To choose a code from the library:

1. In the Code field, enter the first character of the required feature code. The feature code list is filtered to display all codes beginning with that character.
2. Enter additional characters to further filter the feature code list.
3. When the required code is highlighted, tap Enter.

   You can enter one or more feature codes in any *Code* field in the Trimble Survey Controller software. The maximum number of characters in these fields is 42. To enter a code, key it in or select it from a predefined library.

   Note − You cannot select a different feature and attribute library for the current job once a point with attributes is stored.

To see the whole feature code list, tap the arrow next to the Code field or press the Space key on the keypad when you enter the Code field.

Tip − On the ACU, you can also use numeric characters to filter an alphanumeric feature code list. For example, enter 2 to display all codes beginning with 2 (and associated keypad characters t, u, and v). Enter additional numeric characters to further filter the code list. For example, to display the code "Tree" in the list, enter 2,1,9,9.

When you use a feature code that has attributes, the Trimble Survey Controller software prompts you to enter the attribute data.

Using Feature Codes with Predefined Attributes

You can use feature and attribute libraries that were created using the Trimble Geomatics Office software, the Feature and Attribute Editor or Data Dictionary Editor utilities, to store additional attribute information for feature codes. In the Trimble Survey Controller software, these feature codes have an attribute icon (Ⓐ) next to the feature code in the library.

Note − Feature codes created using the Trimble Survey Controller software do not have attributes asociated with them.

Note − Feature classifications defined in feature and attribute libraries as Point, Line, or Area in the office software all appear as Point features in the Trimble Survey Controller software.

Tip − To capture attribute data more efficiently, use the office software to predefine default values, minimum and maximum ranges, auto−generated times and dates, and well−structured menu options. If you use auto−generated times, make sure that the time is set correctly on your Trimble Controller. For information on setting the Trimble Controller time and date, refer to: Time and date.

Note − If you specify in the office software that field entry is not permitted for an attribute, you cannot use the Trimble Survey Controller software to enter that attribute data.

To enter attributes before measuring a point:

1. Enter the feature code and tap the Attrib softkey. A screen with the feature code and attribute fields appears.
2. Enter values in the attribute fields.

   The maximum number of characters in text attribute fields is usually 100. Your definition of a feature and attribute library can specify fewer.

Tip – Use the Repeat softkey to repeat the last stored set of attributes for the current feature.

The Prev, and Next softkeys appear when there are multiple feature codes with attributes in the *Code* field. Use them to swap between attributes.

To enter attributes while measuring a point:

1. Enter the feature code. The Attrib softkey appears.
2. Tap the Measure softkey to start measuring the point.

   A screen with the feature code and attribute fields is displayed.
3. Enter values in the attribute fields. Tap the Store softkey to accept the attributes.

Tip – The Trimble Survey Controller software can automatically store the point while you are still entering attribute data. To enable this, select the *Auto store point* check box in the survey style.

Entering attributes for a point using feature codes without predefined attributes

You can enter several attributes for one point. For a point that has a feature code of Tree, for example, you can enter its type, height, girth, and spread as attributes.

To enter attributes for a point using the colon (:) key:

1. Measure, key in, or compute the point.
2. Tap the Favorites softkey and select Key in note.
3. Enter the first attribute and press the colon (:) key. Enter the data and press : again.
   If a feature code and attribute library is selected for the job, it appears when you type the first letter of a code that is in the library.
4. Enter the next attribute and press the colon (:) key. The attributes for a tree, for example, could be:
   Type:Oak:Girth:1.0:Height:15:Spread:12
5. Repeat step 4 until all attributes are entered, then tap the Enter softkey.

Tip – Use the Switch to softkey to return to the screen where you stored the point without closing this window.

Note – Attributes collected using note records with ":" separators are processed as note records in the Trimble Geomatics Office software. For more flexibility in the office software, collect attributes using attribute subrecords or features from the feature and attribute libraries created in the office software.

To edit a Code once a point has been measured:

1. Select Files / Review current job.
2. Edit the code field for the point.

You can also enter feature and attribute data when you key in a Note .

Resurveying points that already have attributes

To stake out and re−measure points for which you already have attribute data:

1. If the job is not yet in the Trimble Survey Controller software, transfer it from the Trimble Geomatics Office software.

   Note − Transfer relevant features and attributes as well as the points.

2. From the main menu, select Survey / Survey style / Stakeout.
3. Set the as−staked point details:
   - Set the As−staked name field to Design name
   - Set the As−staked code field to Design code
4. Stake out the points.
5. Measure the as−staked point.

   The attribute data displayed for the point is the attribute data that you entered previously. The defaults in the feature and attribute library are not used. Update the values as required.

Copy Between Jobs

To copy a calibration, control points, roads, or points from another job in the database:

1. Select Files / Copy between jobs.
2. Select each of these items:
   - a job name in the Job to copy from field.
   - a job name in the Job to copy to field.
   - the items to be copied in the Copy field.

     If you select the Copy duplicate points check box, the option to Overwrite appears.

3. If you want to copy duplicate points, and overwrite and delete the duplicate points in the job you are copying to, select the appropriate check boxes.
4. When the Copy field is set to Points, various point selection options become available in the Select Point menu. Select the appropriate option.

When copying points between jobs, make sure that the points you are copying use the same coordinate system as the job that the files are being brought into. Points in a different coordinate system are not transferred.

Key In

Key in Menu

This menu lets you enter data into the Trimble Survey Controller software from the keypad. You can key in points, lines, arcs, boundaries, roads, templates, and notes.

For more information, see:

Points

Lines

Arcs

Boundary

Roads

Templates

Notes

Key in – Points

Use this function to define a new point by entering coordinates or by using Cogo functions to compute the new point.

To do this:

1. From the main menu, select Key in / Points.
2. Enter the point name.
3. Enter the values.
4. Tap Store to calculate or store the point.

To enter a point from the map:

1. Make sure the current selection is cleared.
2. Tap and hold on the area of the map to which you want to add the point.
3. From the shortcut menu, select Key in point. The Key in points screen appears.
4. Complete the fields as required.

Key in − Lines

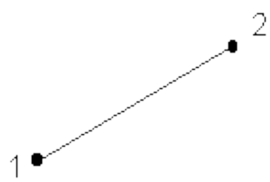
Use this function to define a new line by one of the following methods:

Two points

Brng−dist from a point

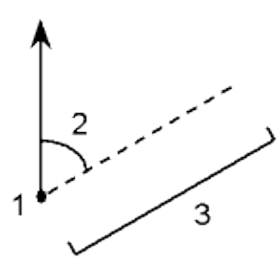
To define a new line by the Two points method:

1. Do one of the following:
    - From the map, select the Start point (1) and the End point (2). (See the diagram below.) Tap and hold on the map and select Key in line from the shortcut menu.
    - Select Key in / Line from the main menu. In the Method field, select Two points. Enter the names of the Start point, and the End point.
2. Use the Options softkey to specify ground, grid, or sea level distances.
3. Enter the name of the line.
4. Specify the Grade between the start and end points.
5. For stationing, enter a value for the Start station and the Station interval.



To define a new line by the Brng−dist from a point method:

1. From the main menu, select Key in / Line.
2. Use the Options softkey to specify ground, grid or sea level distances.
3. Enter the name of the line.
4. In the Method field, select Brng−dist from a point.
5. Enter the name of the Start point (1), the azimuth (2), and the length of line (3). See the diagram below.
6. Specify the Grade between the start and end points.
7. For stationing, enter a value for the Start station and the Station interval.



Key in – Arcs

Use this function to define a new arc by one of the following methods:

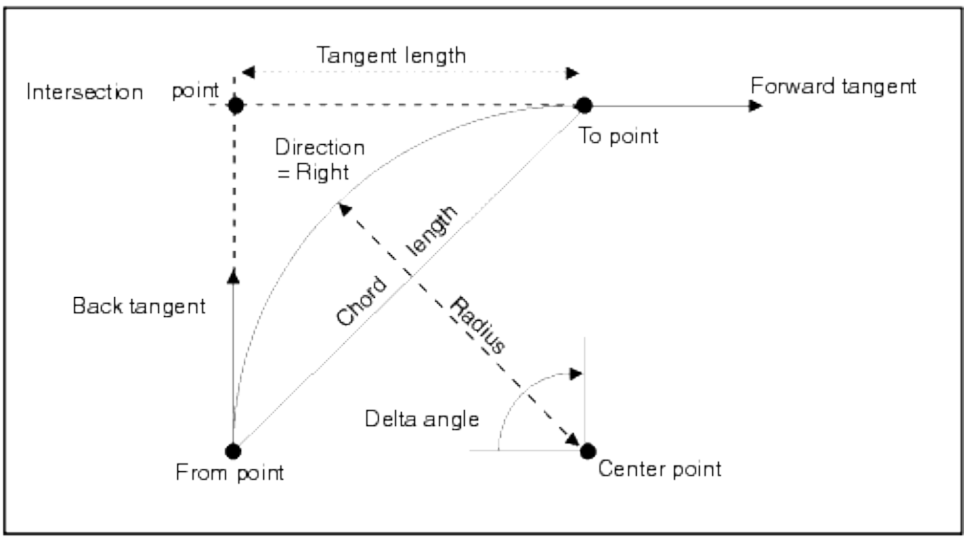
Two points and radius

Arc length and radius

Delta angle and radius

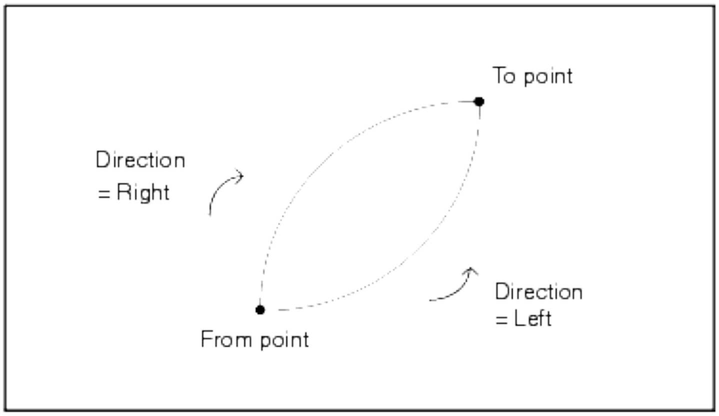
Intersect point and tangents

The following diagram explains the terms used to define features of an arc.



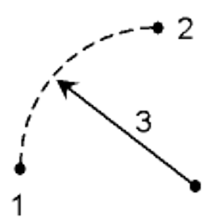
The back tangent value is related to the direction in which the stationing or chainage increases. For example, when you stand at the intersection point looking in the direction of increasing stationing or chainage, the forward tangent is in front of you and the back tangent is behind you.

The direction field defines whether the arc turns to the left (counterclockwise) or right (clockwise) from the start point. The following diagram shows both a left and right arc.



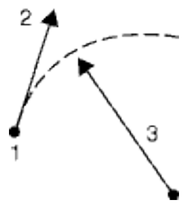
To define an arc using the Two points and radius method:

1. From the main menu, select Key in / Arc.
2. Use the Options softkey to specify ground, grid, or sea level distances.
3. Enter the name of the arc.
4. In the Method field, select Two points and radius.
5. As shown in the diagram below, enter the name of the start point (1), the name of the end point (2), and the radius (3) of the arc.
6. Specify the direction of the arc.
7. For stationing, enter a value for the start station and the station interval.



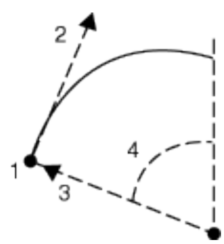
To define an arc using the Arc length and radius method:

1. From the main menu, select Key in / Arc.
2. Use the Options softkey to specify ground, grid, or sea level distances and the grade entry method.
3. Enter the name of the arc.
4. In the Method field, select Arc length and radius.
5. As shown in the diagram below, enter the name of the start point (1), the back tangent (2), the radius (3)and the length of the arc.
6. Specify the direction of the arc and the grade between the start and end points.
7. For stationing, enter a value for the start station and the station interval.



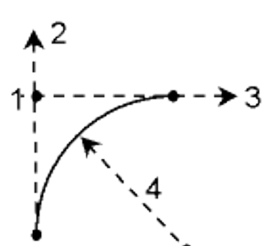
To define an arc using the Delta angle and radius method:

1. From the main menu, select Key in / Arc.
2. Use the Options softkey to specify ground, grid, or sea level distances and the grade entry method.
3. Enter the name of the arc.
4. In the Method field, select Delta angle and radius.
5. As shown in the diagram below, enter the name of the start point (1), the back tangent (2), the radius (3) and the turned angle (4) of the arc.
6. Specify the direction of the arc and the grade between the start and end points.
7. For stationing, enter a value for the start station and the station interval.



To define an arc using the Intersect point and tangents method:

1. From the main menu, select Key in / Arc.
2. Use the Options softkey to specify ground, grid or sea level distances.
3. Enter the name of the arc.
4. In the Method field, select Intersect point and tangents.
5. As shown in the diagram below, enter the name of the intersection point (1), the back tangent (2), the forward tangent (3) and the radius (4) of the arc.
6. Specify the direction of the arc.
7. For stationing, enter a value for the start station and the station interval.



Key in − Boundary

To calculate the coordinates of a new point:

1. From the main menu, select Key in / Boundary.
2. Enter the bearing and distance from an existing point.
3. Tap Calc to obtain the coordinates of the new point.
4. Tap Store to store the new point.

The Start point field is updated with the point name of the last point calculated.

Once one calculation has been made, the From point field is updated with the point name of the last point calculated.

To compute the misclosure of a loop of points:

1. Give the last point the same name as the first point.
2. Tap Calc for the point coordinates.
3. When you tap Store, the boundary misclosure appears on the screen. Store the last point as a check to avoid overwriting the first point.

Key in − Roads

To key in a road definition, or edit a definition already stored in the database:

1. From the main menu, select *Key in* / *Roads* .
2. In the *Name* field, enter a name for the new road definition. Tap the Enter softkey.
3. Do one of the following:
    - ♦ Copy an existing road definition into the current road.

      To do this, tap the Copy softkey. From the list of available road definitions that appears, highlight the one to be copied and tap the Enter softkey. This copies all components comprising that road definition into the current road.

      Tip − To view details of a road definition before copying it, highlight the road name and tap the Review softkey. Tap the Esc softkey to return to the list or, to view details of other roads in the list, tap the Prev or Next softkeys. For more information, see Reviewing a Definition .

    - ♦ Choose a component to key in, that is, horizontal alignment, vertical alignment, template positioning, or superelevation and widening.

Horizontal Alignment

Vertical Alignment

Template Positioning

Superelevation and Widening

Horizontal Alignment

To add a horizontal alignment to a new road definition, select *Horizontal alignment* and then follow these steps:

1. Tap the New softkey to enter the first element that defines the alignment. The *Element* field is set to *Start point* . You cannot change this.
2. For stationing along the road, enter the stationing value for this start point in the *Start station* field.
3. In the *Method* field, choose one of the following options:
   - Key in coordinates
   - Select point

   If you choose the *Key in coordinates* method, enter values in the *Start north* and *Start east* fields.

   If you choose the *Select point* method field , enter a value in the *Point name* field. The *Start north* and *Start east* fields will update with the values for the entered point.

   Tip − To edit the *Start north* and *Start east* values when they have been derived from a point, change the method to *Key in coordinates* .
4. Enter the distance between the stations in the *Station interval* field. Tap the Enter softkey to add the horizontal element.
5. Tap the New softkey to enter another horizontal alignment element (for example, a line) that defines the road.
6. Select an option from the *Element* field and enter the required information. For more information, see that appropriate section below. Then tap the Enter softkey to store the element.

   Line elements

   Arc elements

   Entry spiral/Exit spiral elements
7. When you have entered the last element, tap the Accept softkey.

   Tip − To delete an element, highlight it and tap the Delete softkey. When you add an element, it appears below the previous element that you added. To insert it at a particular place in the list, highlight the element that you want it to follow. Tap the New softkey and enter details of the element.
8. Enter the other road components or tap the Store softkey to store the road definition.

Line elements

If you select *Line* in the *Element* field , the *Start station* field displays the start station value for the line that you are defining. You cannot edit this.

In the *Azimuth* and *Length* fields, key in values that define the line. If this is not the first line to be defined, the *Azimuth* field displays an azimuth calculated from the previous element. If you edit this and then accept the definition, you are warned that the alignment has non−tangential transitions.

The *End north* and *End east* fields update to display the coordinates at the end of the element just added.

Arc elements

If you select *Arc* in the *Element* field, the *Start station* field displays the start station value for the arc that you are defining. You cannot edit this.

The *Start azimuth* field displays the azimuth as calculated from the previous element. If you edit this, when you accept the definition, you are warned that the alignment has non−tangential transitions.

The following table shows the available methods and the fields that appear when you select each one.

Method	Procedure
Arc length and radius	Specify arc direction.In the *Radius* and *Length* fields, enter values that define the arc.
Delta angle and radius	Specify arc direction.In the *Angle* and *Radius* fields, enter values that define the arc.
Deflection angle and length	Specify arc direction.In the *Angle* and *Length* fields, enter values that define the arc.

The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Entry spiral/Exit spiral elements

If you select *Entry spiral/Exit spiral* in the *Element* field, the *Start station* field displays the start station value for the entry spiral or exit spiral that you are defining. You cannot edit this.

The *Start azimuth* field displays the azimuth as calculated from the previous element. If you edit this, when you accept the definition, you are warned that the alignment has non−tangential transitions.

In the Arc direction field, select *Right* or *Left.* In the *Radius* field, enter the radius of the arc associated with the spiral. In the *Length* field, enter the length of the spiral.

The *End North* and *End East* fields update to display the coordinates at the end of the element just added.

Note − An exit spiral connecting two arcs is known as a hanging or combining spiral. The end coordinates of the spiral are incorrect until the second arc is added. If you select an entry spiral, the coordinates are correct.

Notes for Keying in and Editing Horizontal Alignments

If you enter non−tangential elements, a warning message appears. If this happens, do one of the following:

- Select *Yes* to adjust the current element to maintain tangency.

- Select *All* to adjust all elements to maintain tangency.
- Select *None* to accept non−tangency for all elements.
- Select *No* to accept non−tangency for the current element.

When you edit an element, the station and coordinate values for all subsequent elements update to reflect the change. All remaining values defining the subsequent elements are maintained. Exceptions to this are as follows:

- If you edit the radius of a spiral or arc, the Trimble Survey Controller software warns you that adjacent spiral/arc elements that define the arc will be updated with the same radius. If this happens, do one of the following:
  - Select *Yes* to adjust the adjacent elements.
  - Select *No* to discard the changes you have made.
- A spiral connecting two arcs (known as hanging or combining spirals) is referred to as an exit spiral when the radius of the second arc is greater than the radius of the first arc. If you edit the radius of the second arc so that it is smaller than the radius of the first arc, the Trimble Survey Controller software changes the spiral to an entry spiral with the radius of the second arc.
- Similarly, if you edit the radius of the first arc so that it is smaller than the radius of the second arc, the Trimble Survey Controller software changes the spiral to an exit spiral with the radius of the first arc.

Vertical Alignment

To add a vertical alignment to a new road definition, select *Vertical alignment* and then follow these steps:

1. Tap the New softkey to enter the first element that defines the alignment. The *Element* field is set to *Start point* . You cannot change this.
2. In the *Station* and *Elevation* fields, key in the values that define the first vertical point of intersection (VPI).
3. Tap the Enter softkey to add the vertical element record.
4. Tap the New softkey to enter another vertical alignment element (for example, a circular arc).
5. Select an option from the *Element* field and enter the required information. For more information, see the appropriate section below.

   Point elements

   Symmetric parabola elements

   Asymmetric parabola elements

   Circular arc elements

6. When you have entered the last element, tap the Abort softkey.

   Tip − To delete an element, highlight it and tap the Delete softkey.

7. Enter the other road components or tap the Store softkey to store the road definition.

Point elements

If you select *Point* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI.

Note − A vertical alignment must start and end with a point.

Tip − You can also use points between the start and end points if the alignment changes direction when no parabola or arc is required.

Symmetric parabola elements

If you select *Sym parabola* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. Enter the length of the parabola in the *Length* field.

Asymmetric parabola elements

If you select *Asymmetric parabola* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. Enter the In and Out lengths of the parabola.

Circular arc elements

If you select *Circular arc* in the *Element* field, use the *Station* and *Elevation* fields to key in values that define the VPI. Enter the radius of the circular arc in the *Radius* field.

Note − When you edit an element, only the selected element is updated. All adjoining elements remain unchanged.

Template Positioning

Define the position of templates in a road definition by specifying the station at which the Trimble Survey Controller software starts to apply each template. A template is applied at the start station and template element values are then interpolated linearly (applied on a pro rata basis) from that point to the station where the next template is applied.

To define the template positioning:

1. Select *Template positioning* .
2. Tap the New softkey.
3. In the *Start station* field, specify the start station for the template(s).
4. The options in the *Left template* and *Right template* fields are as follows:
    - User defined−allows you to select templates for the left side and the right side of the horizontal alignment.
    - <None>−no templates are assigned. Use this option to create a gap in the road definition.
    - <Interpolate>−the template for this station is interpolated from the previous and next templates in the road definition.
5. If you selected *<None>* or *<Interpolate>* , go to the next step. If you selected *User defined* , do one of the following:

- Select a template from the list.
  To do this, double tap the *Left template* (or *Right template*)field. Tap the List softkey to display the list of available templates. This list contains templates defined using the *Key in / Templates* command.
- Enter a template name.
  This name must match an existing template name. If the name is invalid, the Trimble Survey Controller software warns you.
  Tap the Enter softkey and use the screen that appears to key in details for the new template. For more information, see Templates .

6. Tap the Enter softkey to apply the templates.
7. Tap the New softkey to enter more templates at other positions.
8. When all template positions are entered tap the Accept softkey.

   Tip − To delete a highlighted entry, tap the Delete softkey.

9. Enter the other road components or tap the Store softkey to store the road definition.

Superelevation and Widening

Define where superelevation and widening values are applied in a road definition by specifying the station at which the Trimble Survey Controller software starts to apply them. Superelevation and widening values are applied at the start station, and values are then interpolated linearly (applied on a pro rata basis) from that point to the station where the next superelevation and widening values are applied.

To add superelevation and widening values to a new road definition:

1. Select Superelevation &widening and tap the New softkey.
2. In the *Start station* field, specify the station where the superelevation and widening starts.
3. In the *Left super* and *Right super* fields, enter superelevation values for the left and right sides of the horizontal alignment.

   Tip − To change the way a superelevation value is expressed, tap the Options softkey and change the *Grade* field as required.

4. In the *Pivot* field, specify the position about which the template rotates. The options are *Pivot left* , *Pivot crown* , and *Pivot right* .
5. In the *Left widening* field, enter the widening value to be applied.

   This value is applied to each element in the template that has the *Widening* check box selected.
6. Do the same for the *Right widening* field. Tap the Enter softkey to add these superelevation and widening values to the road definition.

   Note − Widening is expressed as a positive value.

7. To enter more superelevation and widening records tap the New softkey.
8. After entering the last superelevation and widening record, tap the Accept softkey.

   Tip − To delete an entry, highlight it and tap the Delete softkey.

9. Enter the other road components, or tap the Store softkey to store the road definition.

Key in − Templates

To enter a template:

1. From the main menu, select *Key in* / *Templates* .
2. In the *Name* field, enter a name for the new template and tap the Enter softkey.
3. Do one of the following:
    - Copy an existing template into the current template. To do this, tap the Copy softkey. A list of available template definitions appears. Highlight the one to be copied and tap the Enter softkey.

      Tip − To view details of a template before copying it, highlight the template name and tap the Review softkey. Tap the Esc softkey to return to the list or, to view details of other templates in the list, tap the Prev or Next softkey.

    - Manually key in the elements of the new template.

Keying In Elements

To manually key in the elements in a template:

1. Select *Key in* / *Templates* and name the new template as described above.
2. Tap the New softkey to enter the first element defining the template.
3. Select an option from the *Element* field and enter the required information. For more information, see the appropriate section below.

   Crossfall and offset

   Delta elevation and offset

   Delta elevation only

   Side slope

4. To add the template element, tap the Enter softkey.
5. To enter more elements that define this template, tap the New softkey.
6. When you have entered the last element, tap the Enter softkey.

   Tip − To delete an element, highlight it and tap the Delete softkey.

7. Tap the Store softkey to store the template.

Crossfall and offset

If you selected *Crossfall and Offset* in the *Element* field:

1. In the *Crossfall* and *Offset* fields, enter the values that define the element.

   Tip − To change the way a crossfall value is expressed, tap the Options softkey and change the *Grade* field as required.

2. Enter a value in the *Code* field (this step is optional).

Tip − The annotation entered in the *Code* field is assigned to the end of the element and is displayed during stakeout. (For example, the code `CL' is displayed in the Stakeout screen in Navigating to a non−side slope .

3. Select the *Apply superelevation* and *Apply Widening* check boxes as required.

Delta elevation and offset

If you selected *Delta elevation and Offset* in the *Element* field:

1. In the *Delta elevation* and *Offset* fields, enter the values that define the element.
2. Enter a value in the *Code* field (this step is optional).
3. Select the *Apply superelevation* and *Apply Widening* check boxes as required.

Delta elevation only

If you selected *Delta elevation only* in the *Element* field:

1. In the *Delta elevation* field, enter the value that defines the element.
2. Enter a value in the *Code* field (this step is optional).

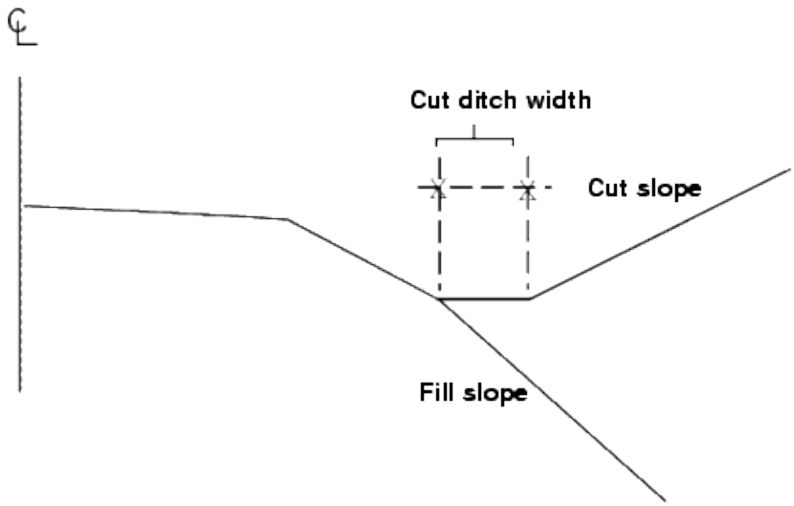
Side slope

If you selected *Side Slope* in the *Element* field:

1. In the *Cut slope* , *Fill slope* , and *Cut ditch width* fields, enter the values that define the element.

   Note − Cut and fill slopes are expressed as positive values.

The following diagram shows the cut ditch width.



2. Enter a value in the *Code* field (this step is optional).

Key in – Notes

You can enter a note in the Trimble Survey Controller database at any time. To do this:

1. From the main menu, select *Key in* / *Notes* .
2. Type in the details to be recorded. Alternatively tap the T/Stamp softkey to generate a record of the current time.
3. Tap Store to store the note in the database or Esc to discard it.
4. To exit *Key in notes* , tap Esc. Alternatively, if the *Note* form is empty, tap Store.

Note – If a feature code list is already selected for the job, you can use codes from the list when keying in a note. From the *Note* screen, press Space to display the feature code list. Select a code from the list or type the first few letters of the code.

In Review, tap the Insert softkey to insert a Note record into the job database at the current position.

Cogo

Cogo Menu

This menu lets you carry out Coordinate Geometry (Cogo) functions. You can use the menu options to calculate distances, azimuths, and point positions by various methods.

For some calculations, you must define a projection, or select a Scale factor−only coordinate system.

You can display ellipsoid, grid, or ground distances by changing the Distances field in the Cogo settings screen.

For more information, see:

Compute Inverse

Compute Point

Compute Area

Compute Azimuth

Compute Distance

Subdivide a Line

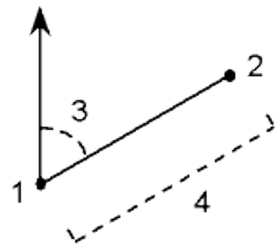
Subdivide an Arc

Traverse

Cogo − Compute Inverse

To calculate the azimuth, horizontal, vertical, and slope distances between two existing points:

1. From the map, select the From point (1) and To point (2), as shown in the diagram below.
2. Tap and hold on the map and select Compute inverse from the shortcut menu. Alternatively, select Cogo / Compute inverse from the main menu.
3. The azimuth (3), horizontal distance (4), change in elevation, slope distance and grade are shown.



Cogo − Compute Point

Use this Cogo function to calculate the coordinates of an intersection point from 1 or 2 existing points. You can store the results in the database.

Use the Options softkey to specify ground, grid, or sea level distances.

Note − When entering an existing point name you can select from the list, perform a fast fix or measure a point. Fast fix stores an automatic rapid point with a temporary point name.

Warning − In general, do not compute points and then change the coordinate system or perform a calibration. If you do, these points will be inconsistent with the new coordinate system. An exception to this is points computed using the *Brng−dist from a point* method.

Note − If you use the Four point intersection method or the From a baseline method and then change the antenna height record for one of the source points, the coordinates of the point will not be updated.

Note − If you are operating a robotic instrument remotely from the target, the left/right directions are reversed. However, the measurement is stored relative to the instrument position.

Note − If the measured points were measured using GPS, the coordinates of the point can only be displayed as grid values if a projection and a datum transformation are defined.

Note − For all methods when the point is stored use the Store as field to specify if the calculated point is to be stored as WGS84, Local or Grid coordinates values.

Calculate coordinates using one of the following methods:

Brng−dist from a point

Brng−dist intersect

Brng−brng intersect

Dist−dist intersect

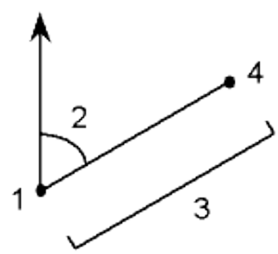
Four point intersection

From a baseline

Brng−dist from a point

To calculate the coordinates of an intersection using the Brng−dist from a point method:

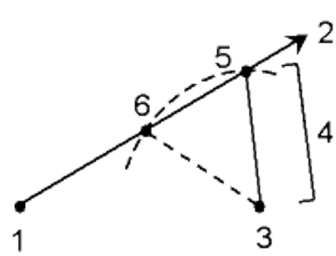
1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select Brng−dist from a point.
4. As shown in the diagram below, enter the name of the Start point (1), the azimuth (2) and the horizontal distance (3).
5. Tap Calc to calculate the intersection point (4).
6. Store the point in the database.



Brng−dist intersect

To calculate the coordinates of an intersection using the Brng−dist intersect method:

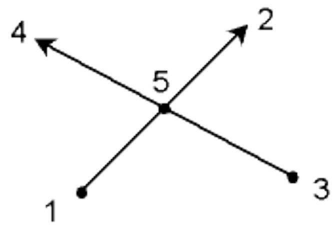
1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select Brng−dist intersection.
4. As shown in the diagram below, enter the name of Point 1 (1), the azimuth (2), the name of Point 2 (3) and the horizontal distance (4).
5. Tap Calc.
6. There are two solutions (5,6) for this calculation; tap the Other softkey to see the second solution.
7. Store the point in the database.



Brng−brng intersect

To calculate the coordinates of an intersection using the Brng−brng intersect method:

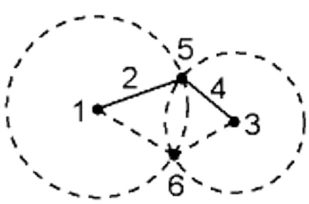
1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select Brng−brng intersect.
4. As shown in the diagram below, enter the name of Point 1 (1), the azimuth from point one (2), the name of Point 2 (3), and the azimuth from point two (4).
5. Tap Calc to calculate the intersection point (5).
6. Store the point in the database



Dist−dist intersect

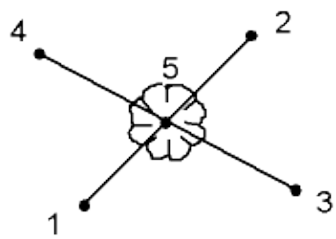
To calculate the coordinates of an intersection using the Dist−dist intersect method:

1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select Dist−dist intersect.
4. As shown in the diagram below, enter the name of Point 1 (1), the horizontal distance (2), the name of Point 2 (3) and the horizontal distance (4).
5. Tap Calc.
6. There are two solutions (5,6) for this calculation; tap the Other softkey to see the second solution.
7. Store the point in the database.

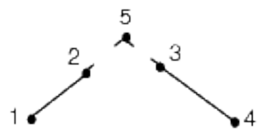


To record an offset using the Four point intersection method:

1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select Four point intersection.
4. As shown in the diagram below, enter the names of the start point of line 1 (1), the end point of line 1 (2), the start point of line 2 (3) and the end point of line 2 (4).
5. Enter any change in the vertical position as a vertical distance from the end of line 2.
6. Tap Calc to calculate the offset point (5).



Note − The two lines do not have to intersect, but they must converge at some point, as shown below.

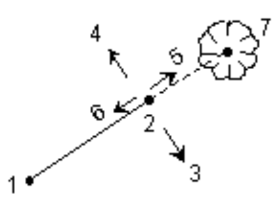


To record an offset using the From a baseline method:

1. From the main menu, select Cogo / Compute point.
2. Enter a point name.
3. In the Method field, select From a baseline.
4. As shown in the diagram below, enter the names of the start point (1) and the end point (2) of the baseline.
5. Enter a distance (5 or 6) and select the distance direction method, enter the offset left/right (3 or 4), and a vertical distance from the end of the line.

   Note: Enter a positive offset if the point is offset to the right (3) of the end point, or a negative offset if it is to the left (4). Enter 0 for either the distance or the offset if you do not want the point offset in that direction.

6. Tap Calc to calculate the offset point (7).



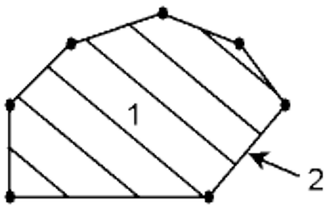
Cogo − Compute Area

To calculate an area enclosed by points in the database:

1. From the map, select the points on the perimeter of the area to be calculated. Use the order that they occur on the perimeter.
2. Tap and hold on the map and select Compute area from the shortcut menu. Alternatively, select Cogo / Compute area from the main menu.

Note − The computed area varies according to the Distance display setting.

The diagram below shows the calculated area (1) and perimeter (2).



Cogo − Compute Azimuth

You can use keyed−in data, and points stored in the database, to calculate an azimuth by various methods. You can also store the results in the database. For some methods, you have to tap Calc to display the results.

The data that you enter can have different units. For example, you can add an angle in degrees to an angle in radians−the answer is returned in whatever format you specified in the job configuration.

Calculate an azimuth using one of the following methods:

Between two points

Bisected azimuths

Bisected corner

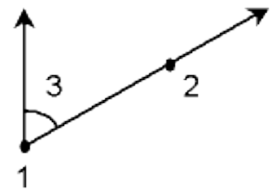
Azimuth plus angle

Azimuth to line offset

Between two points

To calculate the azimuth between two points:

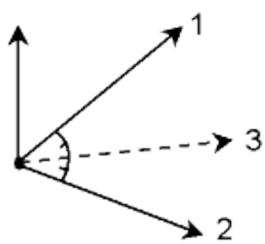
1. From the main menu, select Cogo / Compute azimuth.
2. In the Method field, select Between two points.
3. As shown in the diagram below, enter the name of the From point (1) and the To point (2).
4. The azimuth between them (3) is calculated.



Bisected azimuths

To calculate bisected azimuths:

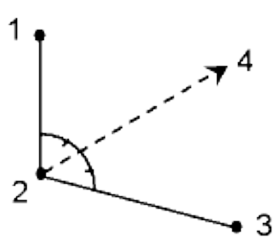
1. From the main menu, select Cogo / Compute azimuth.
2. In the Method field, select Bisected azimuths.
3. As shown in the diagram below, enter values for Azimuth 1 (1), and Azimuth 2 (2).
4. The azimuth halfway between them (3), is calculated.



Bisected corner

To calculate a bisected corner azimuth:

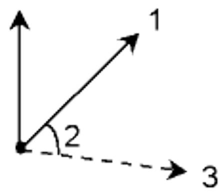
1. From the main menu, select Cogo / Compute azimuth.
2. In the Method field, select Bisected corner.
3. As shown in the diagram below, enter the names of the Side point 1 (1), the Corner point (2), and Side point 2 (3).
4. The azimuth (4), halfway between Side point 1 and Side point 2, from the Corner point, is calculated.



Azimuth plus angle

To calculate the azimuth plus angle:

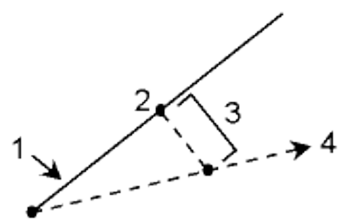
1. From the main menu, select Cogo / Compute azimuth.
2. In the Method field, select Azimuth plus angle.
3. As shown in the diagram below, enter the azimuth (1) and the turned angle (2).
4. The sum of the two (3) is calculated.



Azimuth to line offset

To calculate the azimuth to line offset:

1. From the main menu, select Cogo / Compute azimuth.
2. In the Method field, select Azimuth to line offset.
3. As shown in the diagram below, enter the name of the line (1), the stationing (2) and the horizontal offset (3).
4. The azimuth (4), from the start point of the line to the offset point is calculated.



Cogo − Compute Distance

You can use keyed−in data, and points stored in the database, to calculate a distance by various methods. You can also store the results in the database.

The data that you enter can have different units. For example, if you add a distance in meters to a distance in feet, the answer is returned in whatever format you specified in the job configuration.

For some methods you have to tap Calc to display the results.

Between two points

Between point and line

Between point and arc

Between two points

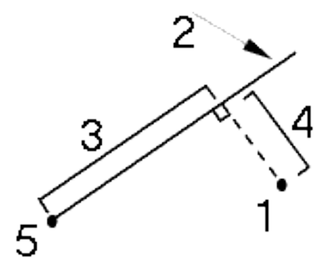
To compute the distance between two points:

1. From the main menu, select Cogo / Compute distance.
2. In the Method field, select Between two points.
3. Enter the From point and the To point.
4. The distance between the two points is calculated.

Between point and line

To compute the distance between a point and a line:

1. From the main menu, select Cogo / Compute distance.
2. In the Method field, select Between point and line.
3. As shown in the diagram below, enter the point name (1) and the line name (2).
4. The distance along the line (3) and the perpendicular distance (4) to the line is calculated. The distance along the line is from the point specified (5).



Between point and arc

To compute the distance between a point and an arc:

1. From the main menu, select Cogo / Compute distance.
2. In the Method field, select Between point and arc.
3. As shown in the diagram below, enter the point name (1) and the arc name (2).
4. The distance along the arc (3) and the perpendicular distance (4) to the arc is calculated. The distance along the arc is from the point specified (5).

Cogo – Subdivide a line

Use this function to subdivide a line into segments. The points created are automatically stored in the database and the point names are automatically incremented from the Start point name.

You can predefine the code of a subdivided point. For more information, see Subdivide Pts Code .

Subdivide a line using one of the following methods:

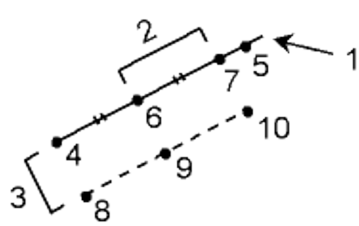
Fixed segment length

Fixed number of segments

Fixed segment length

To subdivide a line into segments of fixed length:

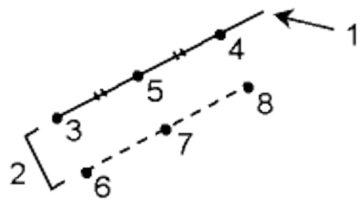
1. As shown in the diagram below, from the map, select the line to be subdivided (1).
2. Tap and hold on the map, and select Subdivide a line from the shortcut menu. Alternatively, select Cogo / Subdivide a line from the main menu.
3. In the Method field, select Fixed segment length.
4. Enter the segment length (2), and any horizontal offset (3) and vertical offset from the line.
5. Enter the names of the Start at station (4), the End at station (5), and the Start point.
6. Tap Start to calculate the new points (4, 6, 7, or 8, 9, 10).



Fixed number of segments

To subdivide a line into a fixed number of segments:

1. As shown in the diagram below, from the map, select the line to be subdivided(1).
2. Tap and hold on the map and select Subdivide a line from the shortcut menu. Alternatively, select Cogo / Subdivide a line from the main menu.
3. In the Method field, select Fixed number of segments.
4. Enter the number of segments, and any horizontal offset (2) and vertical offset from the line.
5. Enter the names of the Start at station (3), the End at station (4), and the Start point.
6. Tap Start to calculate the new points (3, 5, 4, or 6, 7, 8).



Cogo − Subdivide an arc

Use this function to subdivide an arc using one of the following methods:

Fixed segment length

Fixed number of segments

Fixed chord length

Fixed angle subtended

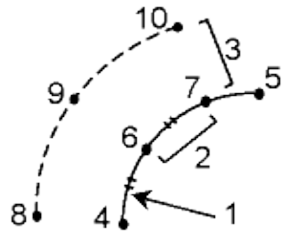
The points created are automatically stored in the database and the point names are incremented from the Start point name.

You can predefine the code of a subdivided point. For more information, see Subdivide Pts Code .

Fixed segment length

To subdivide an arc into segments of fixed length:

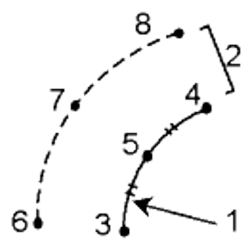
1. In the Method field, select Fixed segment length.
2. Do one of the following:
   - From the map, select the arc to be subdivided. Tap and hold on the screen and select the *Subdivide an arc* option from the shortcut menu.
   - From the main menu, select *Cogo* / *Subdivide an arc* . Enter the name of the defined arc.
3. In the Method field, select Fixed number of segments.
4. Enter the segment length (2), and any horizontal offset (3) and vertical offset from the arc.
5. Enter the names of the Start at station (4), the End at station (5), and the Start point.
6. Tap Start to calculate the new points (4, 6, 7, or 8, 9, 10).



Fixed number of segments

To subdivide an arc into a fixed number of segments:

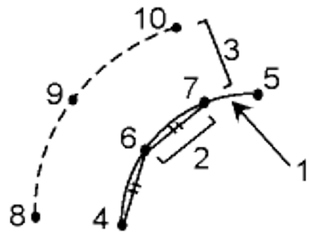
1. Do one of the following:
   - From the map, select the arc to be subdivided. Tap and hold on the screen and select the *Subdivide an arc* option from the shortcut menu.
   - From the main menu, select *Cogo* / *Subdivide an arc* . Enter the name of the defined arc.
2. In the Method field, select Fixed number of segments.
3. Enter the number of segments, and any horizontal offset (2) and vertical offset from the arc.
4. Enter the names of the Start at station (3), the End at station (4), and the Start point.
5. Tap Start to calculate the new points (3, 5, 4, or 6, 7, 8).



Fixed chord length

To subdivide an arc into segments of fixed chord length:

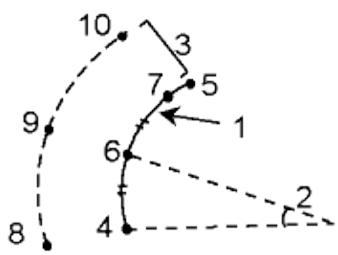
1. Do one of the following:
   - From the map, select the arc to be subdivided. Tap and hold on the screen and select the *Subdivide an arc* option from the shortcut menu.
   - From the main menu, select *Cogo* / *Subdivide an arc* . Enter the name of the defined arc.
2. In the Method field, select Fixed chord length.
3. Enter the chord length (2), and any horizontal offset (3) and vertical offset from the arc.
4. Enter the names of the Start at station (4), the End at station (5), and the Start point.
5. Tap Start to calculate the new points (4, 6, 7, or 8, 9, 10).



Fixed angle subtended

To subdivide an arc into fixed angle subtended segments:

1. Do one of the following:
   - From the map, select the arc to be subdivided. Tap and hold on the screen and select the *Subdivide an arc* option from the shortcut menu.
   - From the main menu, select *Cogo* / *Subdivide an arc* . Enter the name of the defined arc.
2. In the Method field, select Fixed angle subtended.
3. Enter the angle subtended (2), and any horizontal offset (3) and vertical offset from the arc.
4. Enter the names of the Start at station (4), the End at station (5), and the Start point.
5. Tap Start to calculate the new points (4, 6, 7, or 8, 9, 10).



Cogo − Traverse

Use this function to calculate a traverse misclosure, and adjust a conventional traverse. The software helps you select the points to be used, calculates the misclosure, and then lets you compute either a Compass or Transit adjustment.

Note − The Compass adjustment is sometimes known as the Bowditch adjustment.

You can calculate closed−loop traverses and closed traverses that start and end on pairs of known points.

To calculate a traverse:

1. Enter the traverse name.
2. In the Start station field, tap the List softkey.
3. Select a point from the list of valid traverse points that can be used as the start station. Tap Enter.

A valid traverse point has an observation to the previous point and an observation to the next point. When there is only one valid point, it is added automatically.

4. Tap Add to add the next point in the traverse.
5. Select the next station in the traverse.

   Note – To view the observed azimuth and distance between two points in the list, highlight the first point and tap the Info softkey.

6. Repeat steps 4 and 5 until all points in the traverse have been added.

   If you need to remove any points from the list, highlight the point and tap the Delete softkey. When you delete a point, all points after it are deleted as well.

7. Tap Close to compute the traverse misclosure.

   Note – You cannot add more points after selecting a control point.

   Note – To compute a traverse closure, there must be at least one distance measurement between successive points in the traverse list.

   Note – The Azimuth fields do not have to be completed.

   If the backsight azimuth is null:

   - the traverse cannot be oriented.
   - adjusted coordinates cannot be stored.
   - an angular adjustment cannot be computed on an open traverse. (A distance adjustment can be computed.)

     If the foresight azimuth is null in a loop traverse, and if all angles have been observed, you can compute an angular and distance adjustment.

The backsight and foresight points that provide the orientation for the traverse are shown.

If necessary, tap Enter to edit the fields as follows:

1. Inspect the results of the traverse and do one of the following:
   - To store the closure results, tap Store.
   - To adjust the traverse, go to the next step.
2. Tap Options to check the traverse settings. Make any changes as required, then tap Enter.
3. Tap Adj. Ang. to adjust the angular misclosure. The angular misclosure is distributed according to the setting in the Options screen.
4. Inspect the results of the traverse, then do one of the following:
   - To store the angular adjustment details, tap Store.
   - To adjust the distance misclosure, tap Adj. dist. The distance misclosure is distributed according to the setting in the Options screen and the traverse is stored.

When the traverse is stored, each point used in the traverse is stored as an adjusted traverse point with a search classification of control. If there are any previously adjusted traverse points of the same name, they are deleted.

Cogo Softkey

A Cogo option is available for some of the fields in some Cogo functions. It applies only to that particular field, and provides a shortcut from the field to a Cogo calculation. Use the option to calculate a value for a field in the current *Cogo* screen.

Example

To use the Cogo option to divide a line into segments of fixed length in the *Subdivide a line* option:

1. If the length is to be the same distance as between points A and B, access the Segment length (grnd) field and select Calculate / Cogo. The Compute distance screen appears.
2. Set *Method* to Between two points.
3. Enter the point name *A* in the *From point* field and the point name *B* in the *To point* field.

   The computed distance between *A* and *B* is displayed.

4. Tap Accept to return to the Subdivide a line screen. The distance just calculated is inserted into the Segment length (grnd) field.

Entering Feature (Points, Lines, Arcs) Names

When entering feature names into fields, select the feature(s) from the map then select the Cogo function. The selected feature(s) are automatically entered into the appropriate fields.

To enter another feature name, tap the:

- Map softkey, and select a feature as required. Tap the Esc softkey to return to the Cogo screen.
- Arrow for a pop−up list of the following menus:

List	select features from the database
Key in	key in details
Measure	measure a point
Fast fix	automatically measure a construction class point

Cogo Settings

Use this screen to configure the distance type (grid, ground, or ellipsoid), and the grid coordinate system orientation to be used by the Trimble Survey Controller software.

You can select a south azimuth, or set the grid coordinates to increase in north−east, south−west, north−west, or south−east directions.

For a GPS survey, specify an ellipsoid (in Datum transformation) if ground distances are to be displayed, otherwise the WGS−84 ellipsoid is used.

When you select Scale factor only in a conventional instrument only survey, grid and ground distances can be displayed.

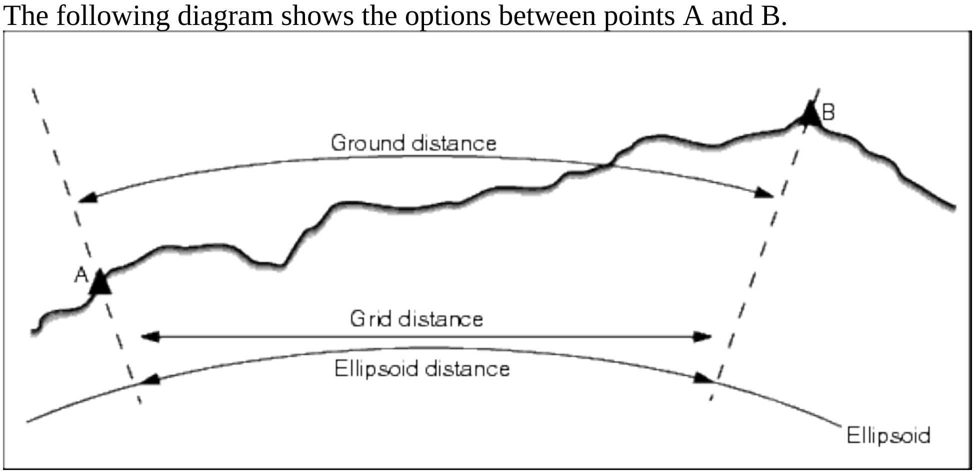
To configure the Cogo settings, select File / New job / Cogo settings when creating a new job. For an existing job select File / Properties of current job / Cogo settings.

Distance Display

The *Distances* field defines how distances are displayed and which distances are used for calculations in the Trimble Survey Controller software. Select one of the following options:

- Ground (the default setting)
- Ellipsoid
- Grid

The following diagram shows the options between points A and B.



Ground distance

A ground distance is the horizontal distance calculated between the two points at the mean elevation parallel to the chosen ellipsoid.

If an ellipsoid has been defined in the job and the *Distances* field is set to *Ground* , the distance is calculated parallel to that. If no ellipsoid has been defined, the WGS84 ellipsoid is used.

Ellipsoid distance

If the *Distances* field is set to *Ellipsoid* then a correction is applied and all distances are calculated as if on the local ellipsoid, which usually approximates to sea level. If no ellipsoid has been specified, the WGS84 ellipsoid is used.

Note − If the coordinate system for a job is defined as Scale factor only, ellipsoid distances cannot be displayed.

Grid distance

If the *Distances* field is set to *Grid* , the grid distance between two points is displayed. This is the simple trigonometrical distance between the two sets of two−dimensional coordinates. If the coordinate system for the job is defined as *Scale factor only* , and the *Distances* field is set to *Grid* , the Trimble Survey Controller software displays ground distances multiplied by the scale factor.

Note − A grid distance between two measured GPS points cannot be displayed unless you have specified a datum transformation and a projection, or performed a site calibration.

Curvature Correction

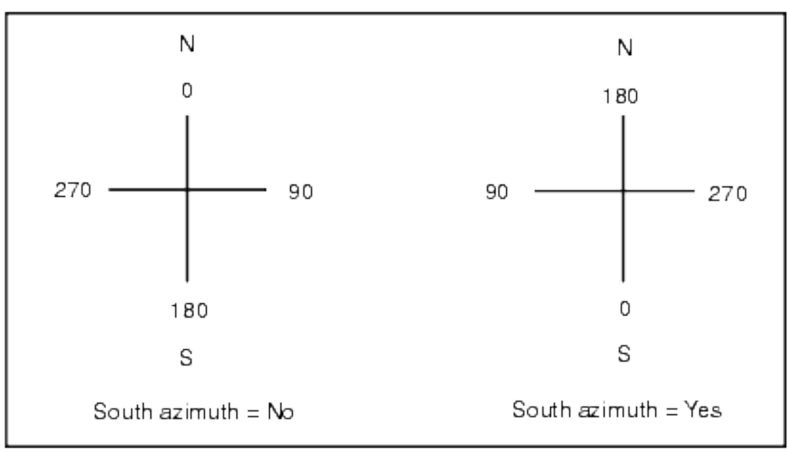
In the Trimble Survey Controller system, all ellipsoid and ground distances are parallel to the ellipsoid.

Azimuth Display

The azimuth displayed and used by the Trimble Survey Controller software depends on the coordinate system that you defined for the current job:

- If you defined both a datum transformation and a projection, or if you selected *Scale factor only* , the grid azimuth is displayed.
- If you defined no datum transformation and/or no projection, the best available azimuth is displayed. A grid azimuth is the first choice, then a local ellipsoidal azimuth, then the WGS84 ellipsoid azimuth.
- If you are using a laser rangefinder, the magnetic azimuth is displayed.

  If a south azimuth display is required, set the *South azimuth* field to *Yes* . All azimuths still increase clockwise. The following diagram shows the effect of setting the *South azimuth* fields to No or Yes.

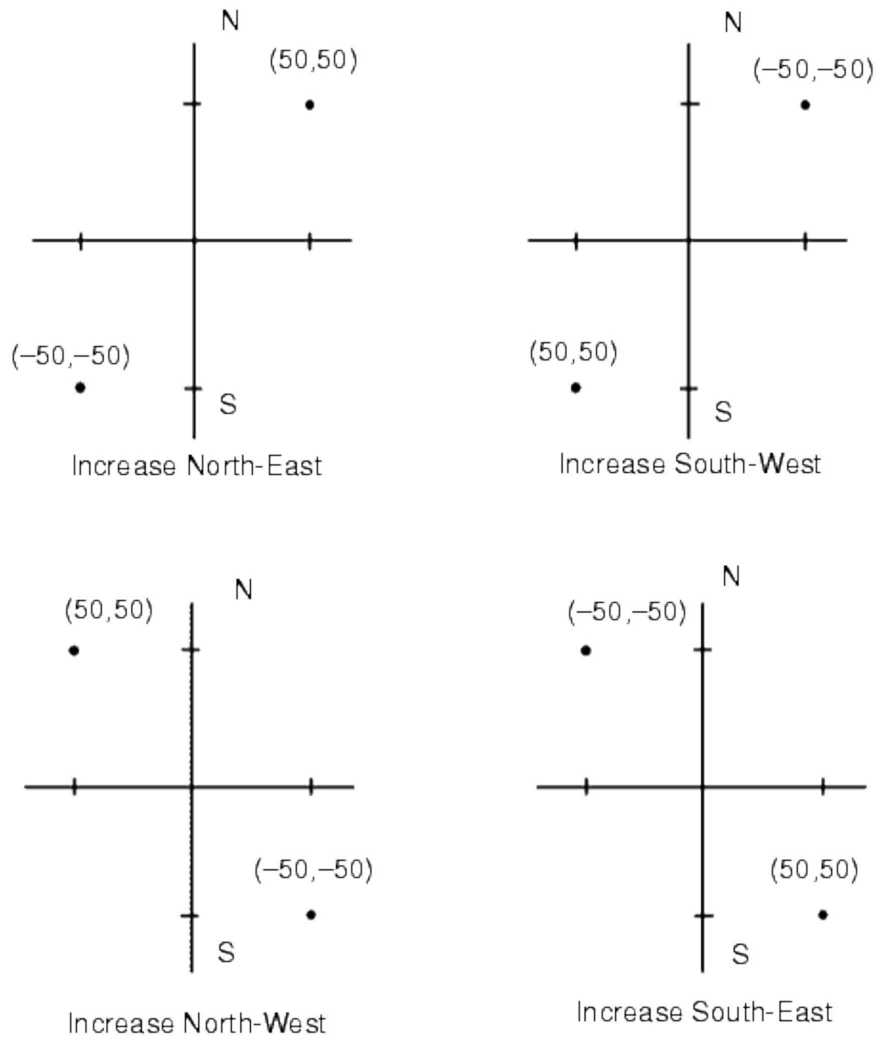


Grid Coordinates

Use the *Grid coords* field to set the grid coordinates to increase in one of the following sets of directions:

- north and east
- south and west
- north and west
- south and east

The following diagram shows the effect of each setting.



Magnetic Declination

Set the magnetic declination for the local area if magnetic bearings are being used in the Trimble Survey Controller software. You can use magnetic bearings if you choose the Cogo / Compute point using the Brng−dist from a point method.

Enter a negative value if magnetic north is west of true north. Enter a positive value if magnetic north is east of true north. For example, if the compass needle points 7° to the east of grid north, the declination is +7° or 7°E.

Note – Use the published declination values if available.

Survey

Survey Menu

Use this menu to measure and stake out points using the Survey Styles defined in the Trimble Survey Controller software.

For more information, see:

Conventional Surveys

FastStatic Surveys

PPK Surveys

RTK Surveys

RTK and Infill Surveys

Getting Started

When you begin a survey, you first need to set up a survey style (in the Configuration menu) for your equipment and survey preferences. You should only need to do this once for each type of survey.

After this, whenever you want to use a particular survey style, you can select it from the Survey menu .

For details on how to set up these two types of surveys, see Conventional Surveys , or Real−Time Kinematic Surveys .

For more information on other types of GPS surveys, see GPS Surveys .

Conventional Surveys

Note − If there is only one survey style, it is automatically selected when you choose Survey from the main menu. Otherwise, select a style from the list that apears.

The Trimble Survey Controller software provides a default style for use with a conventional instrument. Configure this type of survey when you create or edit a survey style, then follow these steps to carry out a conventional survey.

1. Configure your survey style.
2. Perform a station setup.
3. Begin the survey.

4. End the survey.

Configure your survey style

Trimble Survey Controller automatically connects to Trimble 5600 and 3600 instruments.You only need to configure the style if the defaults do not suit your needs.

To configure a survey style:

1. From the main menu, select Configuration / Survey styles / 5600 3600.
2. Select each of the options in turn, and set them to suit your equipment and survey preferences.
3. Once you configure all the settings, tap Store to save them, and then Esc to return to the main menu.

For more information, see:

Instrument

Laser rangefinder

Duplicate point tolerance

Traverse options

Preparing for a robotic survey

To survey using a 5600 robotic instrument:

1. From the main menu, select Instrument / Radio. Set the radio channel, station address and remote address and tap Accept.
2. From the main menu, select Survey / Start Robotic to prepare the 5600 for robotic connection.
3. Tap OK to suspend the 5600 and the ACU ready for robotic operation.
4. Remove the ACU from the 5600.
   Note − If the radio settings on the 5600 instrument are already set to match the ACU, and the instrument is level, press the trigger button on the back of the 5600 to turn on the instrument for a robotic connection.
5. Ensure that the ACU is turned off, and then attach it to the ACU holder.
6. Connect the ACU to Port A on the remote radio using the ACU holder or a 0.4m, 4 pin Hirose cable.
7. Turn on the active target or connect it to Port B on the remote radio.

   Once the ACU is attached to the holder, Trimble Survey Controller connects to the remote radio and then to the 5600. The 5600 is re−initialized to compensate for the earlier removal of the controller.

Perform a station setup

To do this:

1. From the main menu, select Survey / Station Setup.

Note − If you have only one style, it is automatically selected.

Set the corrections associated with the instrument.

If the corrections form does not appear set the corrections by selecting the Options softkey from the Station setup screen. To have the corrections form display on startup select the Show corrections on startup option.

For some instruments, Trimble Survey Controller automatically checks to see if various corrections (PPM, prism constant, and curvature and refraction) are being applied correctly. When you select Station setup, messages showing what has or has not been checked are displayed in the status line. If Trimble Survey Controller finds that the corrections are being applied twice, a warning message appears. When using the 5600 3600 instrument style, all corrections are applied in Trimble Survey Controller.

Note : When using a non−Trimble instrument, you must select the correct survey style **before** you connect the controller to the instrument. Otherwise, they may fail to connect.

2. Connect the data collector to the instrument.
3. Enter the instrument point name. If the point is not already in the database, it can be keyed in, resected, or left as null.
4. If necessary, enter an instrument height.

   Note − For a 2D or planimetric survey, leave the *Instrument height* field set to null (?). No elevations are calculated. A project height must be defined before the Trimble Survey Controller can coordinate 2D observations.

5. Enter the backsight point name. If the point is not already in the database, you can key it in. Alternatively, if there are no coordinates for the point, you must key in an azimuth.

   Note − If you do not know the azimuth at this stage, you can enter "0" and edit the azimuth record later in Review, or you can measure the backsight point using GPS.

6. Choose an option in the *Method* field. The options are:
   - Angles and distance − measure horizontal and vertical angles and slope distance
   - Angles only − measure horizontal and vertical angles
   - H. Angle only − measure horizontal angle only
7. If necessary, enter the target height for the backsight.
8. Sight the center of the backsight target and tap the Measure softkey.

   The horizontal and vertical distance deltas are the differences between the known position and the observed position of the backsight.

9. Store the observation.

Station Setup is complete.

Note : In 2D surveys where a projection has been defined, enter a value for the project elevation. You need this to reduce measured ground distances to ellipsoid distance, and to compute coordinates.

If your instrument is still correctly set up and oriented, you are satisfied that the last station setup is still valid, and you wish to continue observing points from this station, tap the Use last softkey to use the last completed station setup.

If the coordinates for the instrument point are not known, you can coordinate the point by performing a resection to known points.

If you cannot determine the coordinates for the instrument or backsight point, key them in or measure them later using GPS. Alternatively, provide the coordinates in the Trimble Geomatics Office software after transferring the job.

Note – When you enter the instrument point later, make sure you delete the original instrument point. The coordinates of any points measured from that station will then be computed.

Begin the survey

To do this:

1. From the main menu, select either Survey / Measure points, or Survey / Stakeout.

   If you chose Measure points:

   a. Enter a point name and code.
   b. Choose one of the methods of observation.
   c. Enter a target height, if required.
   d. Tap Measure to observe the point.
   e. Tap Store to save the observation to the database.
   f. Tap Check to measure check shots to any known points.
   g. Move to the next point and measure it.

   If you chose Stakeout:

   a. Tap Add to add the points you want to stake out to the stakeout list.
   b. Select the point to stake out now, and use the graphics and text to stake out the point.
   c. When the instrument is within the angular tolerance (as indicated by two hollow/outline arrows), tap Measure.
   d. Tap Accept to view the stakeout deltas.
   e. Tap Store to save the point.
   f. Continue until all points have been staked out.
   g. To make the instrument turn to the point when using a servo instrument, tap the Turn softkey. If Auto turn is set to Yes, the instrument automatically turns if it can compute the HA to the point.
   h. To review stored points, select Review current job from the Files menu.

End the survey

To do this:

1. From the main menu, select Survey / End survey.
2. Tap Yes to confirm.
3. Turn off the controller.

   If a survey is running, end it before editing the current survey style or changing survey styles. You must also end the survey before accessing job functions such as copying. For more information, see Job.

   If you are operating a robotic instrument remotely, the instrument can be powered down from the remote end (target) once you select *End survey* .

For more information, see:

Station Setup − Single backsights

Station Setup − Multiple backsights

Resection

Target

Prism constant

Measure Points

Measure a point in two faces

Measure Rounds

Station and offset

Stakeout

End Survey

Measuring Points in a Conventional Survey

To measure a topographic point using the Trimble Survey Controller software and a conventional instrument:

1. Enter a value in the *Point name* field.
2. If necessary, enter a feature code in the *Code* field.
3. In the *Method* field, select a measurement method.
4. Enter a value in the *Target height* field. Tap the Measure softkey.

If you selected the View before storage check box in the survey style, the measurement information appears on the screen. If necessary, edit the target height and code. Then do one of the following:

- Tap the Store softkey to store the point.
- Turn the instrument to the next point and tap the Read softkey. The last point is stored and a measurement is made to the next point.

If you did not select the View before storage check box, the point is stored automatically and the point name increments (based on the Auto point step size setting). The Trimble Survey Controller software stores the raw observations (HA, VA, and SD).

To change the settings for the current survey, tap the Options softkey. It is not possible to change the current survey style or the system settings.

If you are using a servo or robotic instrument to measure a known (coordinated) point, tap the Turn softkey or select the *Stakeout auto turn* check box in the survey style to automatically turn the instrument to the point.

Measurement Methods

For more information on the different measurement methods see the following:

H. Angle and Offset

Single distance

Dual Prism

Circular Object

You can also Measure a point on two faces.

Use the *Auto point step size* field to set the increment size for automatic point numbering. The default is *1* , but you can use larger step sizes and negative steps.

Select the *View before storage* check box to view observations before they are stored.

Station Setup

In a conventional survey, you must complete a station setup to orient the instrument.

To configure a station setup:

1. From the main menu, select Survey / Station setup.
2. Select *Station setup* .

   Set the corrections associated with the instrument.

If the corrections form does not appear set the corrections by selecting the Options softkey from the Station setup screen. To have the corrections form display on startup select the Show corrections on startup option.

3. Enter the instrument point name and the instrument height.

   Note − For a 2D or planimetric survey, leave the *Instrument height* field set to null (?). No elevations are calculated. A project height must be defined before the Trimble Survey Controller can coordinate 2D observations.

4. Enter the backsight point name and the target height. If the point is not already in the database, it may be keyed in. Alternatively, if there are no coordinates for the point, you can key in an azimuth.

   Note − If you do not know the azimuth at this stage, you can edit the azimuth record later in Review, or you can measure the backsight point using GPS. The coordinates of any points measured from that station will then be computed.

5. Choose an option in the *Method* field. The options are:
   - Angles and distance − measure horizontal and vertical angles and slope distance
   - Angles only − measure horizontal and vertical angles
   - H. Angle only − measure horizontal angle only

   Tip : If the point is available from a linked file , select the linked file for the job and enter the point name into the Instrument point name or Backsight point name field. The point is automatically copied to the job.

6. Sight the backsight target and measure the point.
7. Sight the center of the backsight target and tap the Measure softkey.

   The horizontal and vertical distance deltas are the differences between the calculated position and the observed position of the backsight.

8. If the observation is acceptable, tap Store.

If your instrument is still correctly set up and oriented, you are satisfied that the last station setup is still valid, and you wish to continue observing points from this station, tap the Use last softkey to use the last completed station setup.

If the coordinates for the instrument point are not known, you can coordinate the point by performing a resection − making observations to known points.

If you cannot determine the coordinates for the instrument or backsight point, key them in or measure them later using GPS. Alternatively, provide the coordinates in the Trimble Geomatics Office software after transferring the job.

Note − When you enter the instrument point later, make sure you delete the original instrument point. The coordinates of any points measured from that station will then be computed.

Conventional Instrument − Corrections

You can set the corrections associated with conventional observations.

Note − If you intend to perform a network adjustment in the Trimble Geomatics Office software using data from a conventional survey, make sure that you enter a pressure, temperature and, curvature and refraction correction.

Use the *PPM* (Parts Per Million) field to specify a PPM correction to be applied to electronic distance measurements. Key in the PPM correction, or enter the pressure and temperature of the surrounding environment and let the Trimble Survey Controller software compute the correction.

Use the Curvature and refraction field to specify the index of refraction value. This is used to compute the curvature and refraction correction that is applied to vertical angle observations. See the following table for a description of the curvature and refraction options.

Option	Description
0.142	for use during the day
0.2	for use at night
None	no correction applied

Note : Do not set corrections in both devices. To set them in the Trimble Survey Controller software, make sure the instrument settings are null.

For some instruments, the Trimble Survey Controller software automatically checks to see if various corrections (PPM, prism constant, and curvature and refraction) are being applied correctly. If it finds that the corrections are being applied twice, a warning message appears.

Multiple backsight station setup

In a conventional survey, you must complete a Station setup to orient the instrument. You can use more than one reference station to calculate an orientation correction and a local scale correction.

To configure a Multiple backsight station setup:

1. From the main menu, select Survey / Station setup.
2. Enter the instrument point name and the instrument height.
3. Enter the first backsight point name and the target height.
4. Select an observation method.

   Tip − If the point is available from a linked file, select the linked file for the job and enter the point name in the Instrument point name or Backsight point name field. The point is automatically copied to the job.

5. Sight the backsight target and measure the point.

6. Tap the Add softkey.
7. Enter the second backsight point name and measure the point.
8. In the residuals form that appears, choose which observations to include in the calculation.
9. To add another backsight point, tap the the Add softkey. Otherwise, tap the Store softkey to complete the station setup.

Target Details

You can configure the details of the target during a conventional survey.

To alternate between targets (Target 1/Target 2), or view the target heights, and the prism constant , tap the target icon on the status bar. The number next to the target icon indicates which target is currently in use. The target number is also shown next to the measured point symbol in job review. You can select which target to use by checking the appropriate radio button.

You can insert a Target record prior to any conventional data records when viewing the database.

To do this:

1. Select from the Survey Controller main menu, Files / Review current job.
2. Highlight a conventional data record.
3. Tap Insert and then Target.
4. Update the Target information and tap Accept.

All subsequent observations that use this Target record now use the new target details. To change the target information for just one observation insert another target record above the next observation with the original target details.

When connected to a DR instrument, target 2 can be used to define the DR target height and prism constant. Selecting target 2 will enable DR. Selecting target 1 will disable DR and return the instrument to its last state.

Prism Constant

The prism constant (distance offset) must be set for each prism that is used as a target in a conventional survey.

To configure the prism constant, tap the target icon on the status bar and set the Prism constant field as required. Enter a negative value if the prism constant is to be subtracted from measured distances. Enter the Prism constant in millimeters (mm).

When using a Trimble 3600 or 5600 instrument, all corrections are applied in Trimble Survey Controller.

For some non−Trimble instruments, Trimble Survey Controller checks to see if a prism constant has been applied by the instrument **and** the software. When you select Station setup, messages are displayed in the status line showing what has or has not been checked.

If the Trimble Survey Controller software cannot check the setting on the conventional instrument, do one of the following:

- If there is a prism constant set on the instrument, make sure that the prism constant in the Trimble Survey Controller software is set to 0.000.
- If there is a prism constant set in the Trimble Survey Controller software, make sure that the prism constant in the instrument is set to 0.000.

Measure Points

The process of recording GPS or conventional instrument data is known as measuring. To measure points, do one of the following:

- From the Favorites menu select, Survey / Measure points.
- From the Survey menu, select Measure points.

The types of points that you can measure depend on your survey style and the survey method used.

Conventional Surveys

In conventional surveys, you can measure the following types of points:

- Measure points
- Check points .

If a point is inaccessible, you can also measure horizontal angle and single distance offsets to the point.

To measure a point that cannot be observed directly with a pole in a plumb position use Dual prism measurement method.

To calculate a center point of a circular object such as a water tank or silo, use the Circular option option.

To measure multiple sets of observations, select Measure rounds from the Survey menu.

You can also Measure a point on two faces.

Tip − In Point name fields there is a Find softkey that lets you search for the next available point name. For example, if your job contains points numbered in the 1000s, 2000s and 3000s, and you want to find the next available point name after 1000:

1. In the Point name field, tap the Find softkey. The Find next free point name screen appears.
2. Enter the point name you want to start searching from (in this example, 1000) and tap the Enter softkey.

The Trimble Survey Controller software searches for the next available point name after 1000 and inserts it in the *Point name* field.

GPS Surveys

In GPS surveys, you can measure the following types of points:

- Topo point
- Observed control point
- Calibration point
- Rapid point
- FastStatic points . This is the only type possible in a FastStatic survey.

To measure a line of points at a fixed interval, select Continuous topo from the Survey menu.

Measuring a Point in Two Faces

The Trimble Survey Controller software lets you make face 1 and face 2 (direct and reverse) measurements at any time and in any order. It averages a pair of observations in a matched pair record. It then averages multiple matched pair records (rounds of observations) in a mean turned angle record.

For more information on checking Face 1 and Face 2 tolerances, see Duplicate Point Tolerance.

Notes − You can measure points using either face in any order (for example, BS FS FS BS or BS FS BS FS). However, if you observe the backsight only on face 1, only face 1 observations to points are coordinated. Points observed on face 2 are coordinated when the backsight is observed on face 2.
− Press and release the Trigger button to perform the same function as the Enter key. Use the Trigger button short press to perform a meaurement on face 2.
− When using a servo instrument, press and hold the Trigger button to change face. Use the Trigger button long press to return the instrument to face 1 after performing a measurement on face 2.
− When using a servo instrument, select the Auto matched pair (F1/F2) to automatically change face and retain the point name after the completion of the F1 measurement. Selecting the measure key on the back of the instrument will then perform a F2 measurement the same as the F1 measurement. Use a long key press to change the instrument back to face 1. If you do not require distances on face 2, clear the Measure distance on face 2 option.
− When using an instrument with Autolock and Remote Targets, the Auto matched pair (F1/F2) option will automatically change face, retain the point name and commence the F2 measurement. At the completion of the measurement the instrument will change back to face 1.

To measure a point using both faces:

1. Complete a station setup.
2. Measure a point. For more information, see Measuring a Topo Point .
3. Measure the same point again on the opposite face of the instrument. In the Point name field, use the same name as in step 2. Alternatively, use the Auto matched pair (F1/F2) option to measure automatically.

   The Trimble Survey Controller software writes a matched pair record immediately after the observation on the opposite face is stored. This matched pair record contains the mean horizontal angle, the mean vertical angle, and the mean slope distance from the two previous observations.

Immediately after a matched pair record, the Trimble Survey Controller software writes a mean turned angle record. This record contains the mean horizontal angle, the mean vertical angle, and the mean slope distance from all previous matched pairs observed from the current station setup.

The mean slope distance displayed in the mean turned angle record in the Trimble Survey Controller software has been reduced for PPM, curvature and refraction, and prism constant. The raw mean slope distance is exported to the DC file and reduced in the Trimble Geomatics Office software.

If you make another pair of face 1 and face 2 observations during the same station setup, another matched pair record is written to the database and a new updated mean turned angle record is written. The previous mean turned angle record disappears.

Note − If you change the target height between the two observations, the Trimble Survey Controller software reduces the face 1 and face 2 observations to HA HD VD, and produces a matched pair that is the mean HA HD VD. The same happens to the mean turned angle record when you change the target height between matched pair records.

If you observe a point using the Angles and distances method and then make a second (face 2) observation to it using the Angles only method, you must still observe to the center of the target. The Trimble Survey Controller software averages the vertical angle measurements in the matched pair record. Alternatively, use the H. Angle only method.

Backsight

When you observe points on both faces, remember to observe the backsight on both faces. Once the backsight has been observed on face 1 and face 2, a matched pair record is written for the backsight. The orientation correction for any foresight points with a matched pair record is then based on the backsight matched pair record.

Measure Rounds

This topic shows how to measure multiple sets (rounds) of observations with a conventional instrument and the Trimble Survey Controller software. A round consists of a set of both face 1 and face 2 observations.

With rounds, you measure the first face observations. The Trimble Survey Controller software builds the rounds list then guides you through a specified number of rounds of observations by:

- directing you to change face when required, or doing so automatically with servo−driven instruments.
- defaulting to the correct point details for each observed station
- displaying the results and letting you delete bad data

For further details see:

Building a rounds list

Measuring a point in a round of observations

Skipping observations

Viewing the results

Station details screen

Point details screen

Automated rounds

Building a rounds list

The rounds list contains the points used in the rounds observations. The Trimble Survey Controller software automatically builds this list during the first round of observations made on the first face (typically face 1). The backsight point observed during station setup is added to the list first. The last point is added when the first round of observations is completed on the first face.

The rounds list cannot be edited, so observe all points that are to be included in the rounds observations during the first round on the first face.

To add a point to the rounds list:

1. Complete a station setup. You can do this with a single backsight, multiple backsights, or a resection. With multiple backsights or a resection, the points are not included the rounds, but are used to calculate the mean turned angle.
   With a single backsight, the point is added to the rounds list first. For more information, see Station Setup .
2. From the *Survey* menu, select *Measure rounds.*

   The top of the *Measure rounds* screen shows which face the instrument is on, and the number of the current round (shown in brackets). For example, this screen shows that the instrument is on face 1 of the first round.
3. To change the settings for the current survey, tap the Options softkey.

   Select the target icon to specify the prism constant of the target for each observation in the rounds list. Enter a negative value if the prism constant is to be subtracted from measured distances.
4. To add a point to the rounds list, follow the same procedure for measuring a topo point. For more information, see Measuring a Topo Point .

   If you selected the View before storage check box in the survey style, the measurement information is displayed.

   If you did not select the View before storage check box, the point is stored automatically, and the point name increments according to the value in Auto point step size.

5. When the rounds list is complete, tap the End face softkey. The Trimble Survey Controller software prompts you for the next point to be measured in the rounds of observations.

Measuring a Point in a Round of Observations

Once the rounds list has been built, Trimble Survey Controller enters the default point name and target information for the next point in the rounds. To measure a point, tap the Measure softkey. Repeat this until all observations are completed on the face.

Note − When using servo or robotic instruments, check that the instrument has sighted the target accurately, and manually adjust it if necessary. Some instruments can perform accurate sighting automatically. For information on the instrument specifications, refer to the instrument manufacturer's documentation.

If the controller is connected to a servo or robotic instrument, and you selected the Auto turn check box in the survey style, Trimble Survey Controller automatically turns the instrument to the calculated horizontal and vertical angle.

When all observations are complete, the Trimble Survey Controller software displays the results for the round. For more information, see Viewing the Results.

If you cannot complete the observations, tap the End face softkey. The following warning message appears.

Please confirm: Not all points have been observed. End observations on this face?

Tap the Yes softkey to confirm that you want to end observations on this face and begin observing the next set of rounds.

If the controller is connected to a servo or robotic instrument, the Turn softkey is available. After a point is stored, tap Turn to automatically turn the instrument to the next target. If you selected the Auto turn check box in the survey style, the instrument automatically turns.

Note − If you tap the Esc softkey in the *Measure* rounds screen, the current rounds list is lost. A new station setup is required to start another round.

Use the *Observation order* field to specify the order in which the Trimble Survey Controller software prompts for observations in the rounds survey.

Select *Measure distance on face 2* to measure the distances on face 2 observations.

Skipping Observations

During rounds observations, if the current point cannot be measured, tap the Skip softkey to skip an observation. The Trimble Survey Controller software will then default to the next point in the rounds list.

You cannot skip observations:

- when building the rounds list
- if the observations are made to the first point (backsight) in the rounds list

When the Trimble Survey Controller software reaches the end of a rounds list in which points have been skipped, the following message appears:

Observe skipped points?

Tap the Yes softkey to observe the points that were skipped during that round. The observations can be skipped again if required. Tap No to end the round.

Points that are skipped on the first face are automatically skipped on the second face. Similarly, if a point is skipped on the second face, the first face observation will be ignored. If a point is skipped in one round, all subsequent rounds continue to prompt for observations to that point.

Viewing the Results

At the end of each round, the Rounds summary screen appears.

Use the *Rounds summary* screen to:

- continue (observe more rounds)
- view specific point/observation details
- end the current rounds session

The *Rounds summary* screen shows details of the rounds that have been completed. The maximum residuals are displayed for quick reference.

Note – In 2D surveys where the instrument or target heights are null, the observed vertical angle and slope distance residuals and standard deviation are displayed as N/A.

Do one of the following:

- To return to the *Measure rounds* screen and observe another round, tap the Continue softkey.
- To end the current rounds session, tap the End softkey.
- To view details of the observations, tap the Results softkey.
- To return to the *Rounds summary* screen, tap the Esc softkey.

Station details screen

Use the *Station details* screen to:

- view the observation details from the current station in the round
- view individual point residuals and remove bad observations from a round

The *Station details* screen shows the mean (turned) horizontal angle and standard deviation for all points observed from the station. To change the observation display view, do one of the following:

- Tap the VA softkey to display the mean vertical angle.
- Tap the SD softkey to display the mean slope distance.

To return to the mean horizontal angle view, tap the HA softkey.

To view individual point residuals for each round and remove bad observations, highlight the point and tap the Details softkey.

Point details screen

The *Point* details screen shows the residuals of the observed point for each round. The *Use* column shows the observations in use (displayed as *Yes*), and those that have been removed (displayed as *No*). If observations have been skipped in a round, *N/A* is displayed.

Use the HA, VA, or SD softkeys to change the residual display views.

If the residuals for an observation are high, it may be better to disable the observation from the round. To disable an observation component (HA, VA or SD), highlight it and tap the Use softkey.

If you select No in the *Use* field, the pairs of observations (face 1 and face 2) made to the point in the round are deleted. The mean observations, residuals, and standard deviations are recalculated.

The Use softkey is not available for backsight points. Observations to the backsight are used to orientate observations and cannot be deleted.

To accept the changes and return to the *Station* details screen, tap the Enter softkey.

Automate rounds

The Automate rounds option is available in a Trimble 5600 instrument with Autolock. When you select Automate rounds, the instrument automatically completes all rounds after the rounds list has been built. If required, specify a time delay between automated rounds.

Note − Observed targets are automatically skipped.

Station and offset

The Station and Offset option is available for both GPS and Conventional surveys enabling points to be measured or staked out relative to a line, arc or road.

1. Select from the Survey Controller main menu, Survey / Station and offset.
2. Select Measure or Stakeout.
3. From the Station and offset form select from the Type field the arc, line or road you want to measure or stakeout relative to.
4. Tap enter. You are taken to the appropriate stakeout forms as follows:
    - Select Station and Offset / Measure relative to a line and the stakeout line form appears and the stakeout method is set to To the line.
    - Select Station and Offset / Measure relative to an arc and the stakeout line form appears and

the stakeout method is set to To the arc.

- Select Station and Offset / Measure relative to a road and the stakeout line form appears and the stakeout method is set to Position on road.
- Select Station and Offset / Stakeout relative to a line and the stakeout line form appears and the stakeout method is set to Station/Offset from line.
- Select Station and Offset / Stakeout relative to an arc and the stakeout arc form appears and the stakeout method is set to Station/offset from arc.
- Select Station and Offset / Stakeout relative to a road and the Stakeout road form appears and the stakeout method is set to Station and offset.

Circular object

In a conventional survey, use this measurement method to calculate the center point of a circular object, such as a water tank or silo. To do this:

1. Start a conventional survey.
2. Use the Circular object method to measure an angle and distance to the front center face of the circular object.
3. Observe an angles only measurement to the side of the circular object.

From these two measurements Trimble Survey Controller calculates the center point of the the circular object and stores it as a raw HA VA SD observation. The radius is also calculated and stored as a note.

Resection

In a conventional survey, the resection function is used to determine coordinates for an unknown point by making observations to known points. You can also use Resection to determine the elevation of a point with known 2D coordinates.

Note − In a resection, only use points that can be viewed as grid coordinates. (The resection calculation is a grid calculation.)

A resection needs a minimum of the following:

- Three sets of angles
- Two observations with horizontal and vertical angles and slope distances

The Trimble Survey Controller software uses a least−squares algorithm to compute the resection. This uses all of the data collected and gives a statistically better result.

To do a resection:

1. From the main menu, select Survey / Resection.

   Set the corrections associated with the instrument.

If the Corrections form does not appear, select the Options softkey to set the corrections. To display the Corrections form on startup, select the Show this form on startup option.

2. Enter an instrument point name and instrument height, if applicable.

   Note – Once the resection is started you cannot enter a different instrument height.

3. Set the Calculate field and tap Accept.

   The *Calculate* field indicates what values will be calculated by resection.

4. Measure known points with the conventional instrument.
5. When there is enough data for the Trimble Survey Controller software to calculate a resected position, the Calc softkey appears. Tap Calc to calculate the resection. The resection solution appears. You can alter which observations are used in the calculation by tapping the Details softkey and selecting each observation.

Do one of the following:

- To store the results of the resection immediately, tap the Store softkey.
- To return to the Resection observation screen and observe more points, tap the Add softkey.
- To view details of the resection, tap the Details softkey.

Use the *Resection* details screen to:

- view individual point residuals
- delete observations from the resection
- change which observations are used to compute a solution

To delete an observation from the resection calculation, highlight it and tap the Delete softkey.

Warning – You cannot include an observation in a resection once the observation is deleted.
To see what a solution would be like if you deleted a particular observation, access the Resection point screen. In the Use field, select Off.

To change which components (horizontal/vertical) of an observation are used in the resection calculation, highlight the point and tap the Enter softkey.

The Resection point screen shows the residuals of the observed point. The Use field shows which components of the observation are used in the resection calculation. See the following table.

Option	Description
H (2D)	Use only the horizontal values for that point in the calculation
V (1D)	Use only the vertical values for that point in the calculation

H,V (3D)	Use both the horizontal and vertical values for that point in the calculation
Off	Do not use the point in the calculation

Note − If you change the *Use* field, the resection recomputes when you accept the screen.

To return to the Resection results screen and store the resected point, tap the Results softkey then Store.

H. Angle Offset

In a conventional survey, use this measurement method to observe a point that is inaccessible, for example, the center of a tree.

To measure a point using the H.Angle Offset method:

1. In the *Point name* field, enter the name of the point.
2. In the *Code* field, enter a feature code (optional).
3. In the *Method* field, select *H. Angle Offset* .
4. In the *Target height* field, enter the height of the target.
5. Place the target beside the object to be measured, sight the target, and tap the Measure softkey.

   The *Horizontal angle* field contains a null (?) value.
6. Turn the target to the center of the object and tap the Measure softkey. The Trimble Survey Controller software inserts the measured value in the *Horizontal angle* field and:
   - if you selected the View before storage check box in the survey style, the measurement values are displayed. Tap the Store softkey to store the point.
   - if you did not select the *View before storage* check box, the point is stored automatically.

NOTE : The observation is stored in the database as raw HA, VA, and SD records.

Single Distance Offset

In a conventional survey, use this observation method when a point is inaccessible but a horizontal distance from the target point to the object can be measured.

To measure a point using the Single distance offset method:

1. As shown in the diagram below, enter a code for the instrument station (1).
2. Change the Method field to Single dist. offset.
3. Enter a target height, if applicable.
4. Enter the horizontal distance (2) from the target (3) to the object (4, 5, 6, or 7) to be measured.
5. Specify the direction of measurement; right (4), left (5), out (6) or in (7).

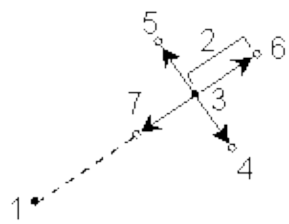
   If you are operating a robotic instrument remotely from the target, the left/right directions are reversed. However, the measurement is stored relative to the instrument position.

6. Tap the Measure softkey.

   If you selected the View before storage check box in the survey style, the observation adjusted for the offset distance appears. Tap the Store softkey to store the point.

   If you did not select the View before storage check box, the point is stored automatically.

   The Trimble Survey Controller software stores the adjusted horizontal angle, vertical angle, and slope distance in the point record, as well as an offset record with the offset measurement details.



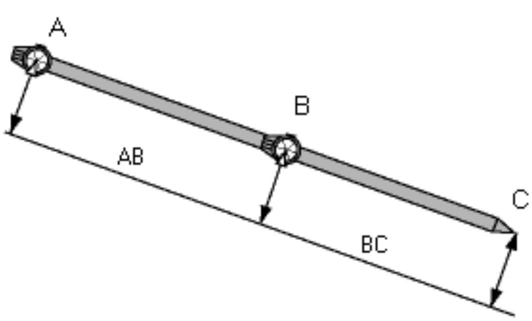
Dual−prism Offset

In a conventional survey, use this measurement method to coordinate a point that cannot be observed directly with a pole in a plumb position.

To measure a point using the dual−prism offset method:

1. As shown in the following diagram, space two prisms (A and B) apart on the range pole. The distance BC is known.
2. Take two measurements (tap Measure).

Trimble Survey Controller calculates the obscured position (C) and stores it as a raw HA VA SD observation.



Fast Fix

Tap the Fast fix softkey key to quickly measure and automatically store a construction point. Alternatively, select Fast fix from the popup in the Point name field.

Note − In a GPS survey, Fast fix uses the Rapid point method. In a conventional survey, it uses the FSTD measurement mode. To use a different method or measurement mode, select Measure from the popup in the Point name field.

Typically, a construction point is used in Cogo − compute points or Key in − lines and arcs.

Construction points are stored in the Trimble Survey Controller database with autopoint names that increment from Temp0000. They are classified higher than as−staked points and lower than normal points. For more information, see Database Search Rules .

To view construction points in a map or list, tap the Filter softkey and select them from the Select filter list.

Topo Point

This is a previously configured method of measuring and storing a point. Configure this type of point when you create or edit a Survey Style.

Use the *Auto point step size* field to set the increment size for automatic point numbering. The default is *1* , but you can use larger step sizes and negative steps.

Select the *View before storage* check box to view observations before they are stored.

You can store quality control information with each point measurement. The default is *QC1* . For real−time surveys, other options are *QC1 and QC1* .

Measuring a Topo Point in a GPS Survey

You can measure a topo point in every type of survey except a FastStatic survey.

To measure a topo point:

1. Do one of the following:
   - From the main menu, select *Survey* / *Measure points* .
   - Tap the Favorites softkey and select *Measure points* .
2. Enter values in the *Point name* and *Code* fields (the *Code* field entry is optional), and select Topo point in the *Type* field.
3. Enter a value in the *Antenna height* field and make sure that the setting in the *Measured to* field is set appropriately.
4. When the antenna is vertical and stationary, tap the Measure softkey to start recording data. The static icon appears in the status bar.
5. When the preset occupation time and precisions have been reached, tap the Store softkey.

Tip − In the survey style, select the *Auto store point* check box to automatically store the point when the preset occupation time and precisions have been met.

Check Point

GPS

In a GPS survey, measure a point twice. Give the second point the same name as the first point. If the duplicate point tolerances are set to zero, the Trimble Survey Controller software warns that the point is a duplicate when you try to store it. Select *Store as check* to store the second point as a check class point. For more information, see Duplicate point: Out of tolerance screen .

Conventional

In a conventional total station survey, tap the Check softkey to measure a check class point.

To measure a check point:

1. In the *Point name* field, enter the name of the point to check.
2. In the *Method* field, select a measurement method and enter the required information in the fields that appear.
3. In the Target height field, enter the height of the target. Tap the Measure sofkey.

   If you did not select the View before storage check box, the point is stored with a classification of Check. If you selected the View before storage check box, the check shot deltas appear on the Check shot screen.

   When you observe the point, if the station setup is the same as when you originally measured the point, the deltas are the difference in values between the original observation and the check observation. The deltas displayed are horizontal angle, vertical distance, horizontal distance, and slope distance.

   If the station setup is different from when you originally measured the point, the deltas are in terms of the best coordinates from the original point to the check point. The deltas displayed are azimuth, vertical distance, horizontal distance, and slope distance.
4. Tap the Enter softkey to store the check point. Tap the Esc softkey to abandon the measurement.

Tap the Chk BS softkey to display the *Check backsight* screen. This is similar to the *Check point* screen, but the *Point name* field shows the backsight of the current station setup. You cannot edit this field.

To observe a check shot to the backsight, use the same procedure as described above.

To return to the *Check point* screen, tap the Chk topo softkey.

Observed Control Point

This is a previously configured method of measuring and storing a point. Configure observed control points when you create or edit a Survey Style. The point is stored with a search classification of Normal.

The Trimble Survey Controller software can terminate observed control point measurements and store the results automatically if the *Auto store point* check box is selected and the occupation times are satisfied. For RTK surveys, the number of measurements and the horizontal and vertical precisions must also be satisfied. The default setting for the *Number of measurements* field is *180* . The extended occupation time suggests that this measurement type is ideally suited to points that will be used for control purposes.

Quality control information is automatically stored with each point:

- Real−time observed control points can store QC1, QC1 or QC1 records.
- Postprocessed observed control points only store QC1 records.

If the *Topo point* option is configured to perform 180 measurements, the positional result is similar to a point measured using the observed control point measurement type. Differences are:

- the default value in the *Quality control* field
- the observation class given by the office software when the point is downloaded

When the Trimble Survey Controller software measures an observed control point, it stores a point when the preset number of epochs has elapsed and the precisions have been attained.

To measure an observed control point:

1. Do one of the following:
    - ♦ From the main menu, select *Survey* / *Measure points* .
    - ♦ Tap the Favorites softkey and select *Measure points* .
2. Enter values in the *Point name* and *Code* fields (the *Code* field entry is optional), and select *Observed control point* in the *Type* field.
3. Enter a value in the *Antenna height* field and make sure that the setting in the *Measured to* field is set appropriately.
4. Tap the Measure softkey to start recording data.
5. When the preset number of epochs and precisions are reached, tap the Store softkey to store the point.

Note − For an RTK survey, initialize the survey before starting to measure the point. For a Postprocessed Kinematic survey, you can start measuring a point, but you cannot store it until you have initialized the survey.

Rapid Point

This is a method for measuring GPS points quickly. Configure this type of point when you create or edit a GPS Survey Style. The point is stored when the preset precisions have been satisfied. There is no minimum occupation time.

The Trimble Survey Controller software collects just one epoch of data when the preset precisions are reached, so the default precision values should ideally be higher than for other point measurement types. The software uses this single epoch of data to define the point, making Rapid point the least precise measurement method.

Alternatively, you can change the Type field to Rapid point in the Measure points screen, and tap the Options softkey.

To measure a Rapid point:

1. Do one of the following:
   - From the main menu, select *Survey* / *Measure points* .
   - Tap the Favorites softkey and select *Measure points* .
2. Enter values in the *Point name* and *Code* fields (the *Code* field entry is optional), and enter *Rapid point* in the *Type* field.
3. Enter a value in the *Antenna height* field and make sure that the setting in the *Measured to* field is set appropriately.
4. Tap the Measure softkey to start recording data. The point is automatically stored when the preset precisions are reached.

Note − When using WAAS positions in a survey, the only type of point you can store is a Rapid point.

Continuous Topo

Use this function to measure points continuously. A point is stored after a predefined time has elapsed, after a predefined distance has been exceeded, or both predefined time and distance settings have been met. The point is stored at the predefined interval when the preset precisions are reached. If you are doing a postprocessed survey, the time interval is the logging interval.

Set this interval in the *Logging interval* field of the *Rover options* screen.

Configure this type of point when creating or editing a Survey Style.

To measure Continuous topo points:

1. From the main menu, select Survey / Continuous points.
2. In the *Type* field, select *Fixed distance continuous* , *Fixed time continuous* , or *Time &distance continuous* .

   Note − For a postprocessed survey, you can only use the Fixed time continuous method. The time interval is set by default to the same value as the logging interval.

3. Enter a value in the *Antenna height* field and make sure that the setting in the *Measured to* field is set appropriately.
4. Enter a value in the *Horizontal distance* field and/or the *Time interval* field, depending on the method you are using.
5. Do one of the following:
   - If you are measuring *Fixed distance* or *Time &distance continuous* points, select *None* in the *Offset* field.
   - If you are measuring *Fixed distance* or *Time &distance continuous offset* points, select *One* or *Two* (the second line of offset points) in the *Offset* field.

6. Enter a value in the *Start point name* field (or enter a start point name for the center line when measuring offset points). This increments automatically.
7. If you are measuring an offset line, enter the offset distances and the start point name. To enter a left horizontal offset, enter a negative offset distance or use the Left or Right popup menus.
8. Tap the Measure softkey to start recording data, and then move along the feature to be surveyed.

   Note − To change the distance interval, time interval, or offset while measuring points, enter new values in the fields.

9. To stop measuring continuous points, tap the End softkey.

FastStatic Point

This type of point is measured in a FastStatic survey . Configure the preset times at which a FastStatic point is measured when you create or edit a FastStatic Survey Style − usually the default time is sufficient.

Note : If you do not record enough data, the points may not be successfully postprocessed.

The Trimble Survey Controller software terminates a FastStatic occupation automatically if the *Auto store point* check box is selected and the specified occupation time is satisfied.

The default occupation times are satisfactory for most users. If you change an occupation time, choose a setting according to the number of satellites being tracked by that receiver. Remember that both receivers must track the same satellite at the same time for the data to be useful.

Tip − Use a mobile phone or a walkie−talkie radio to verify that both receivers are tracking the same satellites.

Changing the occupation times directly affects the outcome of a FastStatic survey. Any changes should increase this time rather than decrease it.

You can only measure a FastStatic point in a FastStatic survey.

Note − FastStatic surveys are postprocessed and do not need to be initialized.

To measure a FastStatic point:

1. Do one of the following:
    - From the main menu, select *Survey* / *Measure points* .
    - Tap the Favorites softkey and select *Measure points* .
2. Enter values in the *Point name* and *Code* fields (the *Code* field entry is optional).
3. Enter a value in the *Antenna height* field and make sure that the setting in the *Measured to* field is set appropriately.
4. Tap the Measure softkey to start measuring the point.
5. When the preset occupation time is reached, as shown in the following table, tap the Store softkey to store the point.

Receiver type	4 SVs	5 SVs	6+ SVs
Single−frequency	30 min	25 min	20 min
Dual−frequency	20 min	15 min	8 min

Tip − No satellite tracking is necessary between measuring points. You can turn off the equipment.

Stakeout − Overview

In a real−time GPS survey, or a conventional survey, you can stake out points, lines, arcs, DTMs, and roads.

To stake out an item:

- Define the item to be staked out.
- From the map, or from Survey / Stakeout, select the item to be staked out.
- Navigate to the point, or direct the person holding the rod to the point.
- Mark the point.
- Measure the point (optional).

You can define the item to be staked out in the Key in menu, or you can use a linked file to add the points to the stakeout list. You can also add lines and arcs transferred in a DC file to the stakeout list.

To use GPS to stake out lines, arcs, Digital Terrain Models, and roads, you must define a projection and datum transformation.

Warning : Do not change the coordinate system or calibration after you have staked out points.

For more information, see:

Arcs

Lines

Points

DTMs

Roads

Stakeout − Display mode

Stakeout − Options

Using the Graphical display

Fine and Coarse Modes − GPS Stakeout

Choose either the fine or coarse mode when navigating to a point. Use the Fine or Coarse softkeys in the *Stakeout* graphical display to change from one to the other:

- The Fine softkey appears when the Trimble Survey Controller software is in coarse mode. Tap it to go into fine mode.

  The display updates at a rate of one position per second, and the precision of the position is higher.
- The Coarse softkey appears when the Trimble Survey Controller software is in fine mode. Tap it to go into coarse mode.

  The display updates at a rate of five positions per second, and the precision of the position is lower.

Note − When you tap the Fine softkey the graphical display screen zooms in and magnifies the display by the zoom factor specified in the survey style.

Note − When you get within 1 foot (0.3048) of the point, the stakeout mode will automatically change to fine mode. This can be disabled by unselecting the Auto change to Fine setting in the stakeout section of the RTK survey style.

Stakeout − Using the Graphical Display

The graphical display in Stakeout helps you to navigate to a point. The display orientation assumes you are moving forwards at all times. The display varies depending on whether you performing a Conventional or GPS survey.

Conventional

To use the graphical display in a conventional survey:

1. The first display shows which way the instrument should be turned, the angle that the instrument should display and the distance from the last point staked to the point currently being staked.

   If you are using a servo or robotic instrument, tap the Turn softkey to turn the instrument to the angle indicated on the screen. Alternatively, select the *Auto turn* check box in the survey style. If you are operating a robotic instrument remotely from the target, the graphical display is reversed and the arrows are shown from the target (prism) to the instrument.

2. Turn the instrument (two outline arrows will appear when it is on line), and direct the rod person on line.
3. Take a distance measurement.
4. The display shows how far the person holding the rod should move towards or away from the instrument.
5. Direct the person holding the rod, and take another distance measurement.

6. Repeat steps 2 − 5 until the point has been located (when four outline arrows are displayed), then mark the point.

   If you are operating a robotic instrument remotely, the instrument automatically tracks the prism as it moves and continuously updates the graphical display. If a measurement to the target is within the angular and distance tolerances, tap the Measure softkey.

GPS

To use the graphical display in a GPS survey:

1. Hold the display screen in front of you as you walk forwards in the direction that the arrow is pointing. The arrow points in the direction of the point.
2. Use the coarse navigation mode when you are some distance away from the point.
3. When you get to within 10 feet (3 meters) of the point, the arrow disappears and a bull's−eye target appears.
4. When you get even closer to the point, tap the Fine softkey to make the screen zoom in.
5. Continue moving forwards until the cross, representing your current position, covers the bull's−eye target, representing the point. Mark the point.

Stakeout − Options

Configure the stakeout settings when you create or edit a Survey Style.

Select Stakeout and set the As−staked point details and stakeout display mode .

Alternatively, tap Options from the Stakeout screen to configure the settings for the current survey.

As−Staked Point Details

Configure the As−staked point details either in the Stakeout option, when you create or edit a real−time survey style, or by tapping the Options softkey in the Stakeout screen.

If you want to see the differences between the design point and the as−staked point before you store the point, select the View before storage check box and then choose one of these options:

- To see the differences every time, set the Horizontal tolerance to 0.000 m.
- To see the differences only if the tolerance is exceeded, set the Horizontal tolerance to 0.100 m.

  Note − The *Stake delta* values are reported as differences ***from*** the measured/as−staked point ***to*** the design point.

You can set the name of the As−staked point to be the next auto point name, or the design point name. You can also set the code of the As−staked point to be the design point name, or the design point code.

Set the *Display grid deltas* check box. Do one of the following:

- Select the check box to display the change in northing and easting during stakeout.
- Clear the check box to display a bearing and distance.

Stakeout − Display Mode

The display varies depending on whether you performing a Conventional or GPS survey.

Conventional Surveys

For a conventional survey the Stakeout graphical display screen displays directions using the conventional instrument as a reference point.

To configure the display:

1. From the main menu, select Configuration / Survey Styles / Stakeout.
2. Choose a setting in the *Deltas* field. The options are:
    - Distances − navigate to a point using distances only
    - Angle and distance − navigate to a point using angle and distance
    - Station and offset − navigate to a point using station and offset when staking a line or arc.

      When staking To the line or arc the station and offset view displays the Station, H.offset, V.dist and the Grade.

      When staking to the Station on the line / arc or the Station/offset from line / arc the view displays the Station, H.offset, V.dist, delta Station and delta H.offset.
3. Use the *Distance tolerance* field to specify the allowable error in distance. If the target is within this distance from the point, the graphical stakeout display indicates that the distance(s) is correct.
4. Use the *Angle tolerance* field to specify the allowable error in angle. If the conventional instrument is turned away from the point by less than this angle, the graphical stakeout display indicates that the angle is correct.
5. If you define a DTM and select the *Display cut/fill to DTM* check box, the graphical display screen displays cut or fill relative to that DTM. Use the *DTM* field to specify the name of the DTM to be used.

Alternatively, tap Options from the Stakeout screen to configure the settings for the current survey.

GPS Surveys

For a GPS survey, you can set the mode of the Stakeout graphical display so that the point stays fixed in the center of the screen, or so that your position stays fixed in the center of the screen.

To configure the display:

1. From the main menu, select Configuration / Survey Styles / Stakeout.
2. In the Display mode, select either Target centered, or Surveyor centered.
3. You can enter a value in the *Zoom factor* field. This is the amount that the display zooms in when you switch from Coarse mode to Fine mode while navigating to a point. The default value is 4.0. When you zoom in by this amount, the width of the graphical display corresponds to approximately one meter (or three feet).
4. Select the Auto change to Fine option to automatically change to fine mode when you get within 1 foot (0.3048) of the point.
5. Choose a setting in the *Deltas* field. The options are:
   - Azimuth and distance − navigate to a point using azimuth and distance
   - Delta grid − navigate to a point using delta grid values
   - Station and offset − navigate to a point using station and offset

     When staking To the line or arc the station and offset view displays the Station, H.offset, V.dist and the Grade.

     When staking to the Station on the line or arc, or the Station/offset from line or arc the view displays the Station, H.offset, V.dist, delta Station and delta H.offset.
6. If you define a DTM and select the *Display cut/fill to DTM* check box, the graphical display screen displays cut or fill relative to that DTM. Use the *DTM* field to specify the name of the DTM to be used.

Alternatively, tap Options from the Stakeout screen to configure the settings for the current survey.

Stakeout − Points

To stake out a point:

1. From the map, select the point(s) to be staked out. Tap the Stakeout softkey.

   If you have selected more than one point from the map for staking out, the *Stake out points* screen appears. Go to the next step. If you have selected one point from the map, go to step 4.
2. The *Stake out points* screen lists all points selected for stakeout. To add more points to the list, do one of the following:
   - Tap the Map softkey and select the required points from the map. Tap the Esc softkey to return to the *Stake out points* screen.
   - Tap the Add softkey. Choose the method by which points are to be selected.

     Use the *Select from list* option to select from a list of all points in the Trimble Survey Controller database. Use the *Select from file* option to select points in a comma delimited file.

     Note − If two points have the same name, only the point with the higher class−or the first point in a linked file−is displayed.
3. To select a point for stakeout, highlight the point from the *Stake out points* screen and tap the

Stakeout softkey. The *Stake out point* screen appears.

4. In the *Stake* field, select one of the following methods for staking out the point:
    - *To the point* − stake out the point with directions from your current position.
    - *From fixed point* − stake out the point with cross−track information and directions from another point. Enter a point name in the *From point* field. Select from a list, key in, or measure this value.
    - *From start position* − stake out the point with cross−track information and directions from the current position when you start to navigate.
    - *From last point staked* − stake out the point with cross−track information and directions from the last point that was staked out and measured. The ***staked*** point is used, not the design point.

      To stake out from the current position, access the *From point* field and tap the Null softkey.

      Note − The cross−track function creates a line between the point to be staked out and one of the following: a fixed point, the start position, or the last point staked. The Trimble Survey Controller software displays this line, and an extra field in the graphical stakeout screen gives the offset to the line. The extra field is *Go left* or *Go right* .
5. In a GPS survey, enter a value in the Antenna/Target height field and make sure the setting in the Measured to field is set appropriately. The graphical display screen appears.

   In a conventional survey, tap the Target icon to change target details.
   The screen displays the angle to which you should turn the instrument and the distance from the instrument to the point, together with a graphical representation of this.
6. Locate the point using the graphical display, and then mark it.
7. When the point has been marked, you can measure it as an as−staked point by tapping Accept or Measure.

Stakeout − Lines

Use the *Slope left* field and the *Slope right* field to define the type of grade in one of the following ways:

- horizontal and vertical distance
- grade and slope distance
- grade and horizontal distance

  You can also enter a value in the *Grade* field (this is optional).

To stake out a line in an RTK or conventional survey:

1. Do one of the following:
    - From the map, select the line to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
    - From the main menu, select Survey / Stakeout / Lines. Enter the name of the line to be staked out.

2. In the Stake field, select one of the following options:

- To the line
- Station on the line
- Station/offset from line
- Slope from line

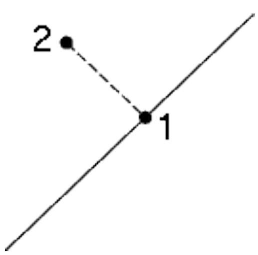
3. Enter the antenna/target height, the value of the station to be staked out (if any), and any further details, such as horizontal and vertical offsets and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point.
6. When the point has been marked, you can measure it as an as−staked point by tapping Enter to go into the Measure points screen.

To the line

Use this option, as shown in the diagram below, to stake out points on a defined line starting with the closest point (1) from your current position (2).

To stake out a line using the To the line method:

1. Do one of the following:
   - ♦ From the map, select the line to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - ♦ From the main menu, select Survey / Stakeout / Lines. Enter the line name.
2. In the Stake field, select To the line.
3. Enter the antenna/target height and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Measure to measure it.



Station on the line

Use this option, as shown in the diagram below, to stake out stations (1) on a defined line at the stationing intervals (2) along the line.

To stake out a line using the Station on the line method:

1. Do one of the following:

- ♦ From the map, select the line to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
- ♦ From the main menu, select Survey / Stakeout / Lines. Enter the line name.

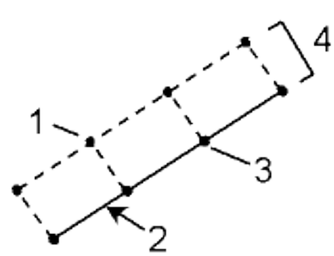
2. In the Stake field, select Station on the line.
3. Enter the antenna/target height and the station to be staked out and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Measure to measure it.

Station/offset from line

Use this option, as shown in the diagram below, to stake out points (1) perpendicular to stations (3) on a defined line (2) and offset to the left or right by a set distance (4).

To stake out a line using the Station/offset from line method:

1. Do one of the following:
   - ♦ From the map, select the line to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - ♦ From the main menu, select Survey / Stakeout / Lines. Enter the line name.
2. In the Stake field, select Station/offset from line.
3. Enter the antenna/target height and the station to be staked out.
4. Specify the Horizontal offset (a negative value is left of the line) and the Vertical offset and tap Start.
5. Use the graphical display to navigate to the point.
6. Mark the point and tap Measure to measure it.



Slope from line

Use this option, as shown in the diagram below, to stake out points on surfaces (2), at different defined grades (3), either side of the defined line (cross section =1). See the diagram below.

To stake out a line using the Slope from line method:

1. Do one of the following:
    - From the map, select the line to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
    - From the main menu, select Survey / Stakeout / Lines. Enter the line name.
2. In the Stake field, select Slope from line.

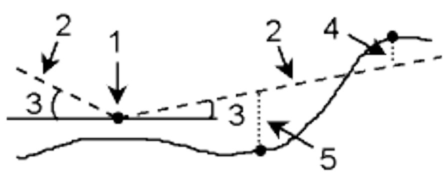
   Use the *Slope left* field and the *Slope right* field to define the type of grade in one of the following ways:

    - horizontal and vertical distance
    - grade and slope distance
    - grade and horizontal distance

   You can also enter a value in the *Grade* field (this is optional).

3. Enter the antenna or target height, specify the grade of the left and right slopes and tap Start.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Measure to measure it.

   At any point on the surface, the display shows the closest station, the Horizontal offset, and the Vertical distance as a cut (4) or a fill (5).



Stakeout – Arcs

Follow these steps to stake out an arc in an RTK or conventional survey:

1. Do one of the following:
    - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
    - From the main menu, select Survey / Stakeout / Arcs. Enter the name of the arc to be staked out.
2. In the Stake field, select one of the following options:
    - To the arc
    - Station on the arc
    - Station/offset from arc
    - Slope from arc
    - Intersect point of arc
    - Center point of arc
3. Enter the antenna/target height and the value of the station to be staked out (if any).

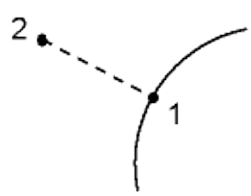
4. Enter any further details, such as horizontal and vertical offsets, and tap Enter.
5. Use the graphical display to navigate to the point.
6. Mark the point.
7. When the point has been marked, you can measure it as an as−staked point by tapping Enter to go into the Measure points screen.

To the arc

Use this option, as shown in the diagram below, to stake out points on a defined arc, starting with the closest point (1) from your current position (2).

To stake out an arc using the To the arc method:

1. Do one of the following:
    - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
    - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select To the arc.
3. Enter the antenna/target height and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Enter to measure it.



Station on the arc

Use this option, as shown in the diagram below, to stake out points (1) on a defined arc at the stationing intervals (2) along the arc.

To stake out an arc using the Station on the arc method:

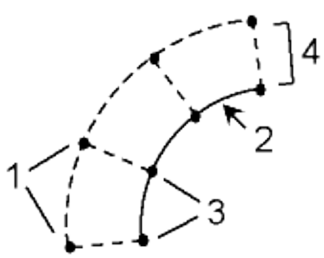
1. Do one of the following:
    - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
    - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select Station on the arc.
3. Enter the antenna/target height and the station to be staked out and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Enter to measure it.

Station/offset from arc

Use this option, as shown in the diagram below, to stake out points (1) perpendicular to stations (3) on a defined arc (2) and offset to the left or right by a specified distance (4).

To stakeout an arc using the Station/offset from arc method:

1. Do one of the following:
   - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select Station/offset from arc.
3. Enter the antenna/target height and the station to be staked out.
4. Specify the Horizontal offset (a negative value is left of the arc) and the Vertical offset and tap Enter.
5. Use the graphical display to navigate to the point.
6. Mark the point and tap Enter to measure it.



Slope from arc

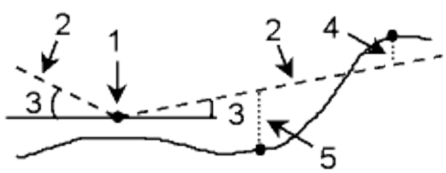
Use this option, as shown in the diagram below, to stake out points on surfaces (2), at different defined grades (3) either side of the defined arc (cross section=1).

To stake out an arc using the Slope from arc method:

1. Do one of the following:
   - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select Slope from arc.
3. Enter the antenna/target height and tap Enter.
4. Use the graphical display to navigate to the point.

5. Mark the point and tap Enter to measure it.

At any point on the surface the graphical display shows the closest station, the Horizontal offset and the Vertical distance as a cut (4) or a fill (5).

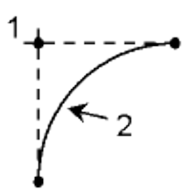


Intersect point of arc

Use this option as shown in the diagram below, to stake out the Intersection point (1) of an arc (2).

To stake out an arc using the Intersect point of arc method:

1. Do one of the following:
   - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select Intersect point of arc.
3. Enter the antenna/target height and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Enter to measure it.



Center point of arc

Use this option, as shown in the diagram below, to stake out the Center point (1) of a defined arc (2).

To stake out an arc using the Center point of arc method:

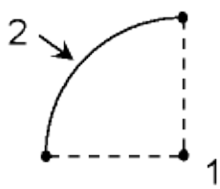
1. Do one of the following:
   - From the map, select the arc to be staked out. Tap Stakeout, or tap and hold on the map and select Stakeout from the shortcut menu.
   - From the main menu, select Survey / Stakeout / Arcs. Enter the arc name.
2. In the Stake field, select Center point of arc.

Use the *Slope left* field and the *Slope right* field to define the type of grade in one of the following ways:

- horizontal and vertical distance
- grade and slope distance
- grade and horizontal distance

You can also enter a value in the *Grade* field (this is optional).

3. Enter the antenna/target height and tap Enter.
4. Use the graphical display to navigate to the point.
5. Mark the point and tap Enter to measure it.



Stakeout − Digital Terrain Models (DTM)

A Digital Terrain Model is an electronic representation of a 3D surface. The Trimble Survey Controller software supports gridded and triangulated DTMs.

When you specify a DTM, you can view the cut and fill relative to the DTM. You must define a projection and datum transformation before you use a DTM in a GPS or conventional survey.

To stake out a DTM:

1. Transfer a DTM file into the Trimble Survey Controller software then select Survey / Stakeout / DTMs.
2. Select the file to be used.
3. If necessary, specify a vertical offset to raise or lower the DTM.
4. Enter a value in the *Antenna/Target height* field.
5. Tap the Start softkey. The stakeout graphical display screen appears, displaying the coordinates of the current position and the vertical distance above (cut) or below (fill) the DTM.

   Note: If you are using a conventional instrument the values only appear after you have taken a distance measurement.

When staking out the DTM, the cut/fill value will be null (?) when you are outside the extent of the DTM or in a "hole". To display the cut/fill to a DTM when staking out a point, line, arc, or road:

1. Tap the stakeout Options softkey.
2. Select the Display cut/fill to DTM check box and specify the model.

Note: This does not apply to the Slope from line or Slope from arc stake methods.

Stakeout − Roads

Before staking out a road or determining your position relative to a road, key in or transfer a road definition.

For information on how to do this, see Roads , and Templates .

To transfer a road definition, use Trimble's RoadLink software, which is a module of the Trimble Geomatics Office software. For more information about how to transfer files see, Data Transfer.

Each road is transferred as a job. To open a job, select *Files* / *Open job.*

Note − Once the files are transferred, you can copy several roads into a single job. For more information, see Copying a Job .

Each road transferred using the RoadLink software contains the coordinate system for the road. Roads always have grid coordinates.

Note − The Trimble Survey Controller software treats all road distances, including stationing and offset values, as grid distances. The value in the *Distances* field (accessed by selecting *Files* / *Properties of current job − Cogo settings*) has no effect on the road definition or the way road distances are displayed.
If a ground coordinate system is defined in either the Trimble Geomatics or Survey Controller software, then the grid coordinates are, in effect, also ground coordinates.

Note : You must specify a coordinate system before you can stake out roads with the Trimble Survey Controller software.

For more information, go directly to these topics in this section:

Stakeout road

Selecting a station

Selecting an offset

Specifying construction offsets

Go Forward/Go Backward directions

Target in the graphical display

Icons in the graphical display

Staked deltas

Staking out a road using the Position relative to road method

See also:

Catch point

Stakeout road

Warning − Do not stake out points and then change the coordinate system or perform a calibration. If you do, these points will be inconsistent with the new coordinate system and any points computed or staked out after the change.

To stake out a road in an RTK survey:

1. From the main menu, select *Survey* / *Stakeout* / *Roads.*
2. In the *Road name* field, select the road to be staked out. To select a road, access the Road name field and tap the List softkey to view a list of available roads, and highlight the required road.

   Tip − To review the selected road, tap the Review softkey now.
3. In the *Stake* field, select *Station and offset* .
4. Enter a value in the *Antenna/Target height.*
5. Choose the point to be staked out by entering values in the Stationing and Offset fields.

   The *Code* field displays the code of the offset to be staked out. The Trimble Survey Controller software uses the code from the template definition for the selected offset. When the offset is 0.000 m, the code defaults to CL.
6. If required, enter values in the Construction offsets fields. The Horizontal construction offset can be applied horizontally or at the slope of the previous template element.
7. Use the graphical display to navigate to the point.

   Note − When you navigate to a non−sideslope point with construction offsets, the bull'seye symbol represents the offset point.
8. If you are navigating to a catch point with construction offsets, navigate to the Catch point first then tap the Select>> softkey. Choose Add Constr. offsets to Catch pt and then navigate to the offset point.

   The graphical display also shows a dashed line that connects the sideslope catch position−the point where the sideslope intersects with the ground−to the sideslope hinge position.

   Note − For side slope offsets where the slope changes between templates, the Trimble Survey Controller software calculates the side slope for intermediate stations by interpolating the slope value.
9. Mark the point with a stake.
10. When the point has been marked, you can measure it as an As−staked point by tapping Enter to go into the Stakeout / Point screen.

Note − If a road has a horizontal and vertical alignment but no templates, all offset points display a null (?) value in the *V.Dist* field during stakeout. If a road definition is defined only as a horizontal alignment, you can only stake it out in two dimensions. The horizontal and vertical alignments of a road do not necessarily start and end at the same stationing. When they do not, you can only stake out points in three dimensions if their stations lie within the horizontal alignment.

Selecting a station

You can select a station by one of the following methods:

- Select from the map.
- Select from the list in the Stationing field popup.
- Key in a value.
- Tap the Sta+ or Sta− softkey to select the next/previous station.

The list contains the stations defined by the section interval, and the stations where the horizontal or vertical alignment changes. The following table lists the abbreviations that the Trimble Survey Controller software uses.

Abbreviation	Meaning	Abbreviation	Meaning
CS	Curve to spiral	SS	Spiral to spiral
PC	Point of curvature (Tangent to curve)	ST	Spiral to tangent
PI	Point of intersection	TS	Tangent to spiral
PT	Point of tangent (Curve to tangent)	VCE	Vertical curve end
RE	Road end	VCS	Vertical curve start
RS	Road start	VPI	Vertical point of intersection
SC	Spiral to curve	XS	Cross−section

Selecting an offset

You can select an offset by one of the following methods:

- In the Offset field, select List from the popup menu and then select from the list.
- Key in a value.

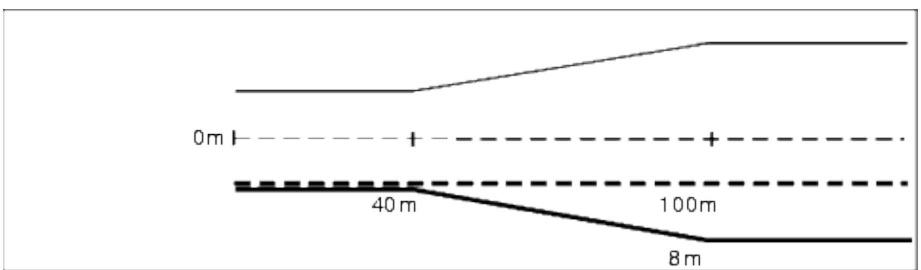
  A negative value for an offset to the left of the centerline; a positive value for an offset to the right. If you enter a value greater than the maximum offset in the template, a message appears. It warns that the offset is outside the range, and asks if you want to use the left side slope, or right, depending on the value entered. If you tap the No softkey, another message appears. It warns that point positions will be in two dimensions, and asks whether you want to continue. This option is useful if you need to stake out the 2D position of a feature not defined in the template (the position of a lamppost, for example).

- Tap the Offs>> softkey to select the next left/next right template element or the rightmost/leftmost element.

Tip – If you select an offset from the list, or by using the Offset softkey, for all subsequent station values, the offset value will be updated to reflect any widening or interpolation.

If you enter an offset value, that value will be maintained for all subsequent station values, even when the entered value corresponds to a value in the list.

Consider the following diagrm. If you select offset 5 m at station 0 m, the offset value will update to follow the solid line for subsequent stations, moving from offset 5 m to offset 8 m.
If you enter 5 m for the offset, the offset will follow the dashed line, maintaining offset 5 m for subsequent stations.



Specifying Construction Offsets

To offset a point horizontally enter a value *Construction H.offset* field. The Trimble Survey Controller software directs you to a point that is offset from the design point.

- A negative value offsets the point towards the centerline (in).
- A positive value offsets the point away from the centerline (out).

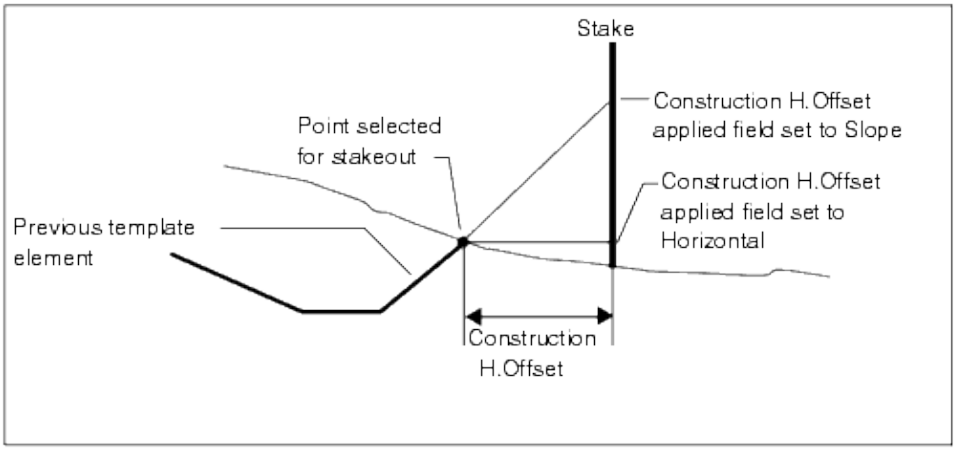
Note – If you enter a value for the Construction H.Offset on the centerline (at offset 0.00 m), a negative value offset is to the left.

To offset a point vertically enter a value *Construction V.offset* field. The Trimble Survey Controller software directs you to a point that is offset from the design point.

- A negative value offsets the point vertically down.
- A positive value offsets the point vertically up.

Note – Construction offsets are not automatically applied to a sideslope offset. For more information, see staking a Catch point. Construction offset values specified here are not applied to a DTM surface.

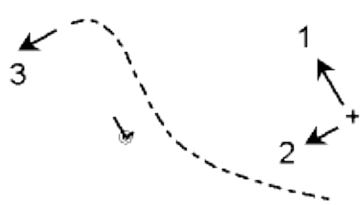
To apply the offset at the slope value of the previous template element, select *Slope.* The following diagram shows how the *Horizontal* and *Slope* options are used in the *Construction H.Offset applied* field. The construction V.Offset value in the diagram is 0.000.



You cannot apply construction horizontal offsets at the slope value of the previous template element for points with zero offset. *Construction V.offset* field, the Trimble Survey Controller software directs you to a point that is offset from the design point.

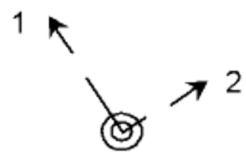
Go Forward/Go Backward directions

As shown in the diagram below, the values in the Go Forward/Go Backward (1) and Go Right/Go Left (2) fields in the graphical display are relative to the cross−section of the point that you are staking out. They are **not** relative to the current direction of travel, or to the current stationing. The direction of increasing stationing is shown by (3).



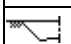
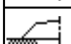
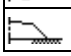
Target in the graphical display

As shown in the diagram below, the bull's−eye symbol in the graphical display also shows the road−space coordinate frame. The longer line (1) on the symbol shows the direction of increasing stationing and the shorter line (2) shows the direction of increasing offset (the right side of the road).



Icons in the graphical display screen

The following table lists the icons that appear in the top right of the graphical display screen when you stake out a point on a road.

Icon	Information about the point staked out
	The point is on the left side of the road and is in *cut.*
	The point is on the left side of the road and is in *fill.*
	The point is on the right side of the road and is in *cut.*
	The point is on the right side of the road and is in *fill* .

Note − Cut means that the elevation of the design point is lower than the current position. Fill means that the elevation of the design point is higher than the current position

Note − In addition, for sideslope positions the slope value is displayed below the icon. For non−sideslope positions the code (or offset value if no code is assigned) is displayed below the icon.

Staked deltas

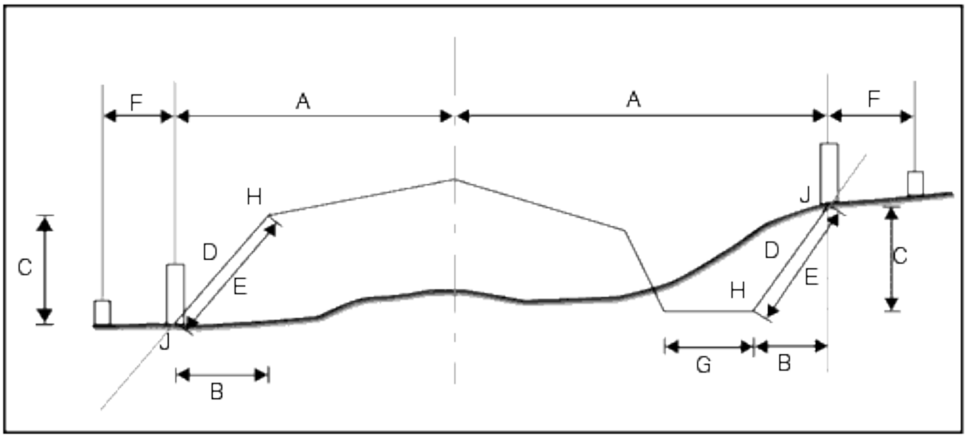
If you have the View before storage check box in the Stakeout options selected, the Confirm staked deltas screen appears before you store the point.

Note − The value in the S.dist to hinge + Constr off: field includes any construction offset values specified and reports the slope distance from the hinge to the as−staked position. The value is null (?) if there is no horizontal construction offset specified or the horizontal construction offset is applied horizontally.

Note − The value in the *Design elevation* field and the *H.Offset* field for the design road is null (?) for catch points.

Tip − Tap the Report softkey to view the *Stake template deltas* screen. It shows the horizontal offset and vertical distance from the catch point to the end of each template element, up to and including the centerline. If the template includes a cut ditch, the report will include the hinge position at the toe of the cut slope. The reported values exclude any construction offset specified.

The following diagram explains some of these fields.



Where:

A	=	Distance to center line
B	=	Horizontal distance to hinge point
C	=	Vertical distance to hinge point
D	=	Slope
E	=	Slope distance to hinge point
F	=	Construction horizontal offset
G	=	Ditch offset
H	=	Hinge point
J	=	Catch point

Position relative to road

To determine your current position relative to a road:

1. From the main menu, *Survey* / *Stakeout* / *Roads.*
2. In the *Road name* field, select the road to be staked out.
3. In the *Stake* field, select *Position on road* .
4. Enter a value in the *Antenna/Target height* field and make sure that the *Measured to* field is set correctly.
5. If there is a value in the *V.Offset* field, the Trimble Survey Controller software reports your position relative to the design, as adjusted by the specified vertical offset:
   - A negative value offsets the design vertically down, a positive value up.

     Note – The V.Offset value specified here is not applied to a DTM surface.

6. Tap the Start softkey. The graphical stakeout screen appears.

Note – If you are using a conventional instrument, the road values only appear after you take a distance measurement.

The graphical display shows your current position relative to the road. The right side of the screen reports your current position relative to the road in terms of Station, Offset and Vertical distance to the road surface.

If your current position is more than 30 meters from the road centerline, the graphical display navigates you to a position on the road centerline. This is calculated by projecting your current position at right angles to the centerline.

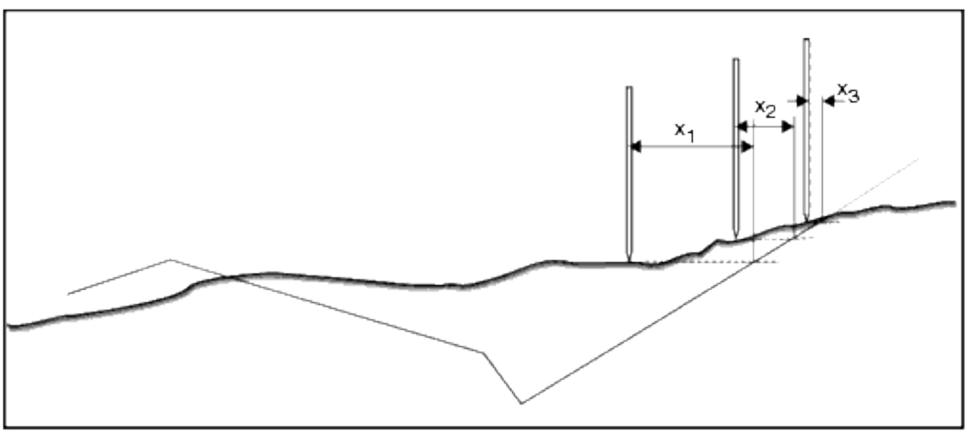
If your position is before the start, or beyond the end, of the road, the Station field will report Off road and the graphical screen will navigate you to the start of the road.

You can measure your current position as an As−staked point by tapping Enter to go into the Stake out point screen.

Catch Point

The catch point is the point where the design side slope intersects with the ground.

The actual intersection position of the side slope with the existing ground surface−the catch point−is determined iteratively (by repetition). The Trimble Survey Controller software calculates the intersection of a horizontal plane passing through the current position, and either the cut or fill side slope, as shown in the following diagram , where x_n is the Go Right/Left value.



The Select softkey

The following table explains the *Select* menu options for a side slope.

Option	Description
Catch point (Auto)	The Trimble Survey Controller software selects the side slope (cut or fill) to intersect with the ground. This is the default.
Catch point (Cut)	Fixes the side slope as a cut side slope.
Catch point (Fill)	Fixes the side slope as a fill side slope.

Add Constr. offsets to Catch pt	Applies the horizontal and vertical construction offsets specified to the catch point. Navigate to the catch point before selecting this option. The position of the offset point depends on the catch point, so make sure that you stake out the catch point precisely.
Hinge point	Stakes out the base of the side slope. This is the most direct way to select the hinge point if the template includes a ditch offset. **Note** : Construction offsets are not applied to the hinge point when you use this method to select the hinge point.

Note − Construction offsets are not automatically applied to a catch point. Navigate to the catch point and then tap the Select softkey. Select *Add Constr. offsets to Catch pt* and navigate to the offset point.

There is no need to tap the Select softkey when staking out a catch point with no construction offsets.

Roading

You can stake out, or measure your position relative to, roads transferred from the Trimble RoadLink software, or roads keyed directly into the Trimble Survey Controller software.

A road is made up of three basic components; the horizontal alignment, the vertical alignment, and cross−section templates. You can also apply superelevation and widening factors.

Each road is transferred as a separate job. You can copy several roads into one job on the Trimble Survey Controller software. When the road has been transferred, to review the road information, select Files / Review current job from the main menu.

For more information, see:

Key in − Roads

Key in − Templates .

Stakeout − Roads

GPS Surveys

Note − If there is only one survey style, it is automatically selected when you choose Survey from the main menu. Otherwise, select a style from the list that apears.

The Trimble Survey Controller software provides Survey Styles for the following GPS survey types:

FastStatic

Postprocessed Kinematic

Real−Time Kinematic

Real−Time Kinematic and Infill

To use one of the following survey types, you must create your own survey style.

Real−Time Kinematic and Data Logging

Real−Time Differential Survey

Real−Time Differential and Data Logging

For information on how to configure settings for GPS surveys, see the following topics:

Start Base Receiver

Measure Points

Continuous Topo Points

Swap Base Receiver

Stakeout

Initialization

Site Calibration

Calibration

A calibration calculates parameters for transforming WGS−84 coordinates into local grid coordinates (NEE). It either calculates a horizontal and vertical adjustment, or a transverse mercator projection and a 3−parameter datum transformation, depending on what has already been defined.

For accurate calibration, your site should be within at least four control points with known 3−D grid coordinates.

Warning : You must complete a calibration **before** you compute offset or intersection points, or stake out points. If you change the calibration after computing or staking out these points, they will not be consistent with the new coordinate system and any points computed or staked out after the change.

To calibrate point coordinates:

1. Enter the grid coordinates of your control points. Key these in, transfer them from your office computer, or measure them using a conventional total station.
2. Measure the points with GPS.
3. Perform either an automatic or a manual calibration.
4. To obtain the current list of points being used in the calibration, select Survey / Site calibration.

Notes and Recommendations

- You can perform a calibration using one of the real−time GPS survey styles in the Trimble Survey Controller software. Do this manually, or let the Trimble Survey Controller software do it automatically. If all the points have been measured, you do not need to connect the Trimble Controller to a receiver during a manual calibration.
- Multiple calibrations can be performed in one job. The last calibration performed and applied is used to convert the coordinates of all previously surveyed points in the database.
- You can use up to 20 points for a calibration. Trimble strongly recommends that you use a minimum of four 3D local grid coordinates (N, E, E) and four observed WGS84 coordinates, with the local projection and datum transformation parameters (the coordinate system). This should provide enough redundancy.

  Note − You can use a combination of 1D, 2D, and 3D local grid coordinates. If no projection and no datum transformation are defined, you must have at least one 2D grid point.

  If you did not specify the coordinate system, the Trimble Survey Controller software calculates a Transverse Mercator projection and a three−parameter datum transformation.

- Use the Trimble Geomatics Office software, Trimble's Data Transfer utility, or ASCII transfer to transfer control points.
- Be careful when naming points that are to be used in a calibration. Before you begin, familiarize yourself with the Database search rules.
- The set of WGS−84 coordinates must be independent of the set of grid coordinates.
- You select the grid coordinates. Select the vertical coordinates (elevation), the horizontal coordinates (northing and easting values), or all of these together.
- Place the calibration points around the perimeter of the site. Do not survey outside of the area enclosed by the calibration points, as the calibration is not valid beyond this perimeter.
- The origin of the horizontal adjustment in a calibration is the centroid of the measured calibration points. The origin of the vertical adjustment is the first point in the calibration with an elevation.
- When reviewing a calibration point in the database, notice that the WGS84 values are the ***measured*** coordinates. The grid values are derived from these, using the current calibration.

  The original keyed−in coordinates remain unchanged. (They are stored elsewhere in the database as a point with the *Type* field showing *Keyed in coordinates* and the *Stored as* field showing *Grid* .)
- When you are calibrating a no projection, no datum job, (where ground coordinates are required after calibration) you must define the project height (average site height). When the job is calibrated, the project height is used to compute a ground scale factor for the projection, using the inverse of the ellipsoid correction.
- When you have calibrated a scale−only job, the scale factor that you specified in the job is used as the scale factor in the projection.

Site Calibration

A calibration calculates parameters for transforming WGS−84 coordinates into local grid coordinates (NEE). Set the parameters for computing a calibration when you create or edit a Survey Style.

To set the parameters for computing a calibration, select the *Site calibration* survey style option from *Configuration / Survey styles*, selecting a real time survey, and do the following:

1. The *Fix H. scale field to 1.0:* check box details whether the calibration computation should compute a horizontal scale factor or not:
    - To compute the horizontal scale factor, make sure the check box is clear. (This is the default setting.) Use this option only if GPS measurements need to be scaled to fit the local control. (GPS measurements are usually more precise.)
    - To fix the horizontal scale factor to 1.0, select the check box. Select the check box to avoid distorting the geometry of the GPS network, but note that the calibration residuals will be higher.
2. Select an observation type appropriate to a calibration point. The options for a calibration point are Topo point or Observed control point.
3. For the Trimble Survey Controller software to automatically perform a calibration when you measure a calibration point, select the *Auto calibrate* check box. To switch automatic calibration off, clear the check box.
4. If necessary, set the tolerances for maximum horizontal and vertical residuals, and maximum and minimum horizontal scale settings. These settings only apply to automatic calibration and do not affect manual calibration.

    You can also specify the maximum slope of the vertical adjustment plane. The Trimble Survey Controller software warns you if the slope in the north direction or the slope in the east direction exceeds this. Generally the default settings are appropriate.
5. Specify how the calibration points you measure will be named:
    - In the *Method* field, choose one of the following options: *Add prefix* , *Add suffix* , or *Add constant* .
    - In the *Add* field, enter the prefix, suffix, or constant.

The table below shows the different options and gives an example of each.

Option	What the software does	Example value in the Add field	Grid point name	Calibration point name
Same	Gives the calibration point the same name as the grid point	–	100	100
Add prefix	Inserts a prefix before the grid point name	GPS_	100	GPS_100
Add suffix	Inserts a suffix after the grid point name	_GPS	100	100_GPS
Add constant	Adds a value to the grid point name	10	100	110

For more information, see:

- Calibration
- Calibration − Automatic
- Calibration − Manual

Calibration − Manual

Key in the grid coordinates of your control points. Alternatively, transfer them from your office computer, or use a conventional instrument to measure them. Then measure the points with GPS.

To carry out a manual calculation:

1. From the main menu, select Survey / Site calibration.
2. Use the Add softkey to add a point to the calibration.
3. Enter the name of the grid point and the WGS−84 point in the appropriate fields.

   The two point names do not have to be the same, but they should correspond to the same physical point.

4. Change the Use field as required and tap Enter.

   The residuals for each point are not displayed until at least three 3D points are included in the calibration to provide redundancy.

5. Tap the Results softkey to see the horizontal and vertical shifts that the calibration has calculated.
6. To add more points, tap the Esc softkey to return to the calibration screen.
7. Repeat steps 3 through 6 until all the points are added.
8. Do one of the following:
   - If the residuals are acceptable, tap the Apply softkey to store the calibration.
   - If the residuals are not acceptable, recalculate the calibration.

Recalculating a Calibration

Recalculate a calibration if the residuals are not acceptable, or if you want to add or delete points.

To recalculate a calibration:

1. From the *Survey* menu, choose *Site calibration* .
2. Do one of the following:
   - To remove (exclude) a point, highlight the point name and tap the Delete softkey.
   - To add a point, tap the Add softkey.
   - To change the components used for a point, highlight the point name and tap the Edit softkey. In the *Use* field, choose whether to use the vertical coordinate of the grid point, the horizontal coordinates, or both horizontal and vertical coordinates.
3. Tap the Apply softkey to apply the new calibration.

Note − Each calibration calculation is independent of the previous one. When a new calibration is applied, it overwrites any previously calculated calibration.

Calibration − Automatic

When you use this function to measure calibration points, the calibration calculations are performed and stored automatically.

Define a projection and datum transformation. Otherwise, a transverse mercator projection will be used and the datum will be WGS−84.

To use automatic calibration:

1. Select your RTK Survey Style.
2. Select Site calibration.
3. Select the Auto calibrate check box. Alternatively, tap the Options softkey when you measure a Calibration point.
4. Use the Options softkey to configure the naming relationship between the grid and WGS−84 points.
5. Enter the grid coordinates of your Calibration points. Key these in, transfer them from your office computer, or measure them using a conventional total station.

   For keyed in coordinates check that the coordinate fields are *North* , *East* , and *Elevation* . If they are not, tap the Options softkey and change the *Coordinate view* to Grid. Key in the known grid coordinates and tap the Enter softkey.

   Select the *Control point* check box. (This ensures that the point is not overwritten by a measured point.)

   For transferred coordinates make sure that these coordinates are:

   - transferred as grid coordinates (N, E, E), not as WGS84 coordinates (L, L, H)
   - control class points
6. Measure each point as a Calibration point.

   In the *Method* field, select Calibration point.

7. Enter the grid point name. The Trimble Survey Controller software names the GPS point automatically, using the naming relationship that you configured earlier. The Auto−calibrate function then matches the points (grid and WGS−84 values), and calculates and stores the calibration. The calibration is applied to all previously measured points in the database.
8. When you measure the next Calibration point, a new calibration is calculated using all of the Calibration points. It is stored and applied to all previously measured points.

   When one point has been calibrated, or a projection and datum transformation have been defined, the Find softkey softkey appears. You can use this to navigate to the next point.

The calibration residuals are only displayed if the calibration tolerances are exceeded.

If this happens, consider removing the point with the most extreme residuals. Do one of the following:

- If at least four points are left after removing that point, recalibrate using the remaining points.
- If not enough points are left after removing that point, measure it again and recalibrate.

It may be necessary to remove (re−measure) more than one point. To remove a point from the calibration calculations:

1. Highlight the point name and tap the Enter softkey.
2. In the *Use* field, select *Off* and tap Enter. The calibration is recalculated and the new residuals are displayed.
3. Tap the Apply softkey to accept the calibration.

To view the results of an automatic calibration:

1. From the *Survey* menu, choose *Site calibration* . The *Site calibration* screen appears.
2. Tap the Results softkey to see the *Calibration results.*

To change a calibration that has been calculated using the *Auto calibrate* function, select *Site calibration* from the *Survey* menu. Then proceed as described in Performing a Manual Site Calibration .

Starting the Base Receiver

This chapter describes how to start the base receiver for a GPS survey.

For more information, go directly to these topics in this section:

Base Station Coordinates

When you set up a base, it is important to know the WGS84 coordinates of the point as accurately as possible.

Note − Every 10 m of error in a base station coordinate can introduce up to 1 ppm scale error on every measured baseline.

The following recognized methods, listed in descending order of accuracy, are used to determine base station WGS−84 coordinates:

- Published or precisely−determined coordinates.
- Coordinates computed from published or precisely−determined grid coordinates.
- Coordinates derived using a reliable differential (RTCM) broadcast based on published or precisely−determined coordinates.
- A WAAS position generated by the receiver−use this method if no control exists for the location and you have a receiver that tracks WAAS satellites.
- An autonomous position generated by the receiver−use this method for real−time surveys in a location where no control exists. Trimble strongly recommends that you calibrate any jobs started by this method on a minimum of four local control points.

Tip − In the U.S.A., you can regard NAD83 geodetic coordinates as equivalent to WGS−84 coordinates.

Note − If the keyed in WGS−84 coordinates differ from the current autonomous position generated by the receiver by more than 500 m, a warning message appears.

For more information about entering base station coordinates, see Starting a Base Survey .

Survey Integrity

To preserve the integrity of a GPS survey, consider the following:

- When you start subsequent base receivers for a particular job, make sure that each new base coordinate is in the same terms as the initial base coordinate.

Note − Within a job, only use an autonomous position to start the ***first*** base receiver. An autonomous position is equivalent to an assumed coordinate in conventional surveying.

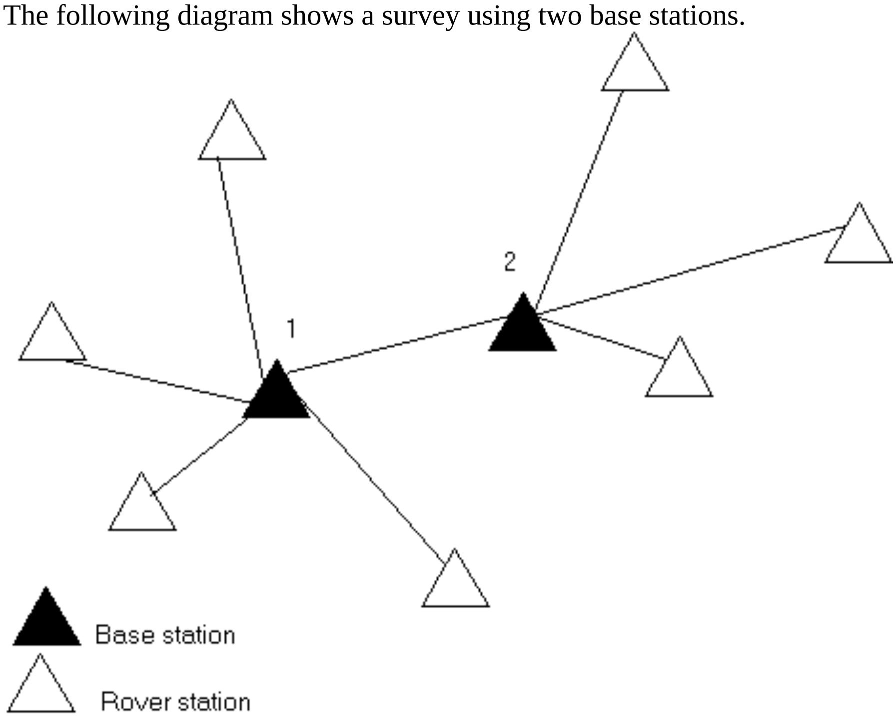
- Coordinates published by a reliable source and coordinates determined by control surveys should be in the same system.
- If subsequent base coordinates are not in the same terms, regard observations from each base as a separate job. Each needs a separate calibration.
- Because measured real−time kinematic points are stored as vectors from the base station, not as absolute positions, the origin of the survey must be an absolute WGS−84 position from which the vectors radiate.

  If other base stations are subsequently set up on points measured from the original base station, all vectors are resolved back to the original base station.
- It is possible to start the base on any kind of coordinates, for example, grid or local ellipsoid coordinates. However, in a realtime survey, the Trimble Survey Controller software must store a WGS−84 position for the base when a rover survey is started. It is this position that is held fixed as the origin of the network.

  When you start a rover survey, the Trimble Survey Controller software compares the WGS−84 position broadcast by the base receiver with points already in the database. If a broadcast point has the same name as a point in the database, but different coordinates, the Trimble Survey Controller software uses the coordinates that are in the database. These coordinates were keyed in or transferred by you, so it assumes that you want to use them.

If a point in the database has the same name as the one being broadcast by the base, but the coordinates are NEE or local LLH rather than WGS−84 coordinates, the Trimble Survey Controller software converts this point to WGS−84 coordinates using the current datum transformation and projection. It then uses these as the base coordinates. If no datum transformation and projection are defined, the broadcast WGS−84 point is automatically stored and used as the base.

The following diagram shows a survey using two base stations.



In this survey, Base station 2 was first surveyed as a roving point from Base station 1.

Note − Base stations 1 and 2 ***must*** be linked together by a measured baseline, and Base station 2 ***must*** be started with the same name that it had when it was surveyed as a roving point from Base station 1.

Setting up the Equipment for a Real−Time Survey

This section describes how to assemble the hardware components at the base receiver for a Real−time kinematic (RTK) or Real−time differential (RT differential) survey. Follow these steps if you are using a GPS Total Station 5700 receiver.

Using a GPS Total Station 5700 Receiver

To set up a base receiver for a real−time survey using a Trimble 5700 receiver:

1. Set the Zephyr antenna over the ground mark using a tripod, a tribrach, and a tribrach adaptor.
2. Use the tripod clip (part number 43961) to hang the 5700 receiver on the tripod.
3. Connect the Zephyr antenna to the yellow GPS receiver port labeled "GPS". Use the yellow GPS antenna cable (part number 41300−10).

Note − Instead of hanging the receiver on the tripod, you can place the receiver in its base case. Run the antenna cable out of the portal in the side of the base case to the antenna so that the case can stay closed while the receiver is running.

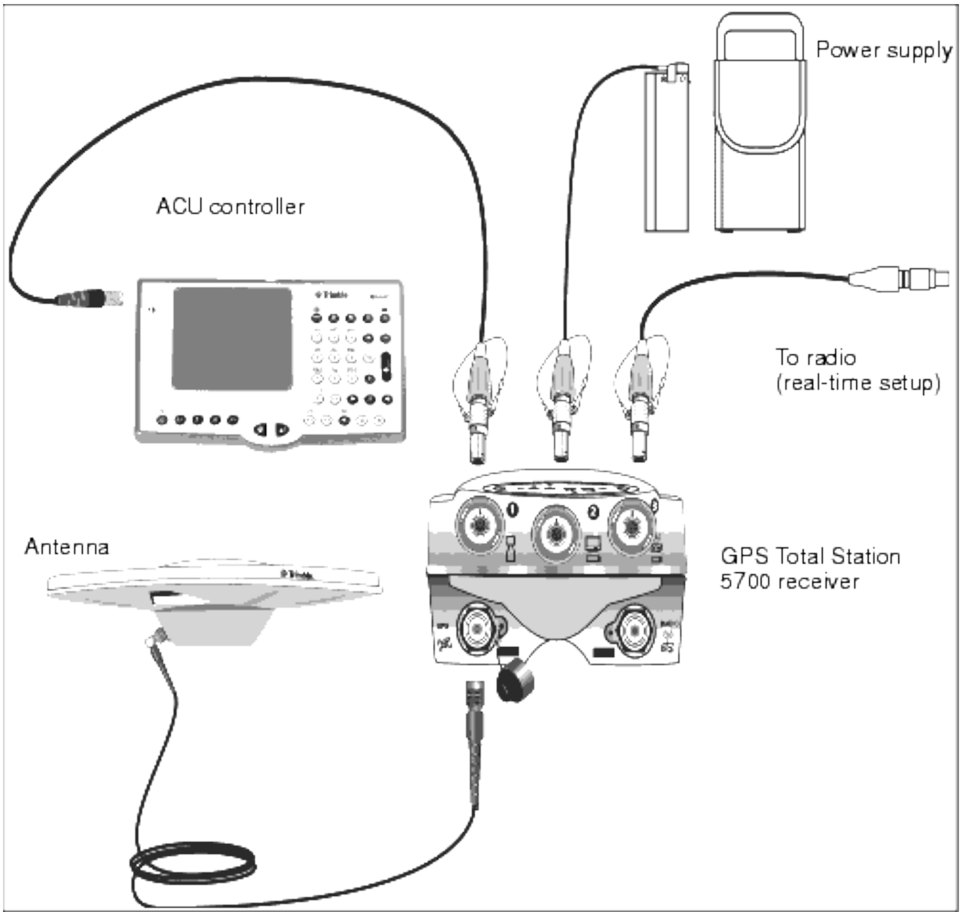
4. Assemble and erect the radio antenna.
5. Connect the radio antenna to the radio using the cable attached to the antenna.
6. Connect the radio to the GPS receiver port 3.
    - If using a Trimble radio, use the supplied cable.
    - If using a radio provided by a third party, use the appropriate cable.

Note − For some third−party radios, a separate power supply is needed for the radio.

Warning − Do not force plugs into the receiver ports. Align the red dot on the plug with the red line on the socket and then insert the plug carefully.

7. If external power is required, connect the power supply with a 0−shell Lemo connection to port 2 or port 3 on the receiver.
8. Connect the controller to the GPS receiver port 1 using the 0−shell Lemo−to−Hirose cable.
9. Turn on the controller, then follow the instructions in Starting a Base Survey .

The following diagram shows how to set up the base receiver for a real−time survey using a GPS Total Station 5700 receiver.



Radio Solutions

Trimble provides a comprehensive range of radio solutions that have been tested and proven. TRIMTALK radios are powered by the receiver's power supply using a common data/power cable. This configuration simplifies battery issues, as the receiver and the radio use the same power source. The GPS Total Station 5700, 4800 and 4700 receivers can use a TRIMMARK III, TRIMMARK IIe or a TRIMTALK 450S radio at the base, and an internal radio at the rover.

Cellular modems can be used at both the base and rover receivers.

Note − Cellular modems used with the Trimble Survey Controller software must support Hayes compatible AT commands.
Base receivers used with modems must support CTS flow control.

You can use the Trimble Survey Controller software to configure the radios. For more information, see Configuring a radio using the Trimble Survey Controller software .

Radio considerations

Real−time survey methods rely on trouble−free radio transmission.

Note − The precision of measured points is not affected by radio performance.

To reduce the effects of interference from other base stations operating on the same frequency, use a transmission delay for your base station that does not coincide with others on the same frequency. For more information, see Operating Several Base Stations on One Radio Frequency .

Sometimes the conditions or topography of a site adversely affect radio transmission, resulting in limited coverage.

To increase site coverage:

- Move the base stations to prominent points around the site.
- Erect the base radio antenna as high as possible.
- Use radio repeaters.

Tip − Double the height of the broadcast antenna to increase the coverage by approximately 40%. To achieve the same effect, it would be necessary to quadruple the radio broadcast power.

Radio Repeaters

Radio repeaters increase the broadcast range of a base radio by receiving the base transmission and then rebroadcasting it on the same frequency.

Trimble provides five radio solutions for use with the Trimble Survey Controller system.

You can use one repeater with the TRIMTALK 450S (12.5 kHz) radio, and one or two repeaters with the TRIMTALK 450S (25 kHz) radio. For details of the TRIMMARK 3, TRIMMARK II / IIe, TRIMCOMM, and Pacific Crest radios, please refer to the specific product documentation.

Note − To use any of these radios as repeaters, they must be configured as repeaters. For instructions on how to do this, see the next section.

Configuring a radio using the Trimble Survey Controller software

Use the Trimble Survey Controller software to:

- change the frequency of a radio.
- change the mode of a radio from a broadcasting/receiving radio to a repeater radio.
- change the wireless data rate.

Note − You can only change the frequency when configuring a Pacific Crest radio.

To configure a radio:

1. Connect the controller, receiver, power, and radio. For more information, see the diagram on setting up the base receiver.

   Alternatively, use a Y−cable to connect the power and the controller directly to the radio.

2. On the controller, highlight your survey style and tap Edit.
3. Select *Base radio* or *Rover radio* depending on which radio you are configuring.
4. Set the *Type* field and, if connecting directly, the *Controller port* field.

   If connecting through a receiver, set the *Receiver port* field.
5. Tap Connect.

Note − If the softkey is not displayed, you cannot configure the type of radio you have selected.

If you are configuring a radio other than the internal radio of a GPS Total Station 5800, 5700, 4800, or 4700 receiver, the following message appears:

Please confirm. Disconnect power from radio.

6. Disconnect the power from the radio and tap OK.

   The following message appears: Please confirm. Connect power to radio.
7. Reconnect the power to the radio and tap OK (There is no need to tap OK for a Pacific Crest radio.)

   The second *Base radio* / *Rover radio* screen appears.
8. Change the settings in the *Frequency* field and the *Base radio mode* field, as required.

   The radio firmware version is also displayed.
9. Tap Enter when the details are correct. (There is no need to tap Enter for a Pacific Crest radio.)

Note − In some countries it is illegal to change the frequency of a radio. The Trimble Survey Controller software uses the latest GPS position to see if you are in one of these countries. If you are, only the available frequencies are displayed in the *Frequency* field.

Setting up the Equipment for a Postprocessed Survey

This section shows how to assemble the hardware components at the base receiver for a postprocessed kinematic, a postprocessed differential or a FastStatic survey. Follow these steps when using a GPS Total Station 5700 receiver.

Using a GPS Total Station 5700 Receiver

To set up the base receiver for a postprocessed survey using a GPS Total Station 5700 receiver. For more information, see the diagram on setting up the base receiver. Then do the following:

1. Set the Zephyr antenna over the ground mark using a tripod, a tribrach, and a tribrach adaptor.
2. Use the tripod clip (Part Number 43961) to hang the 5700 receiver on the tripod.
3. Connect the Zephyr antenna to the yellow GPS receiver port labeled GPS. Use the yellow GPS antenna cable (part number 41300−10).

Note − Instead of hanging the receiver on the tripod, you can place the receiver in its base case. Run the antenna cable out of the portal in the side of the base case to the antenna so that the case can stay closed while the receiver is running.

Warning − Donot force plugs into the receiver ports. Align the red dot on the plug with the red line on the socket and then insert the plug carefully.

4. If external power is required, connect the power supply with a 0−shell Lemo connection to Port 2 or Port 3 on the receiver.
5. Connect the controller to the GPS receiver port 1 using the 0−shell Lemo to 0−shell Lemo cable.
6. Turn on the controller, then follow the instructions in Starting a Base Survey .

Setting up the Equipment for a Real−Time and Postprocessed Survey

To conduct a survey that uses both real−time and postprocessed techniques, follow the assembly instructions for real−time surveys. If the receiver has no memory (or has a limited memory), use a controller to store raw data at the base receiver.

Starting a Base Survey

To conduct a survey using a predefined survey style, make sure that the required job is open. The title of the main menu should be the current job name.

From the main menu, choose *Survey* and select a survey style from the list. To create or edit a survey style, see the help.

A *Survey* menu is generated. It displays items specific to the chosen survey style and includes the *Start base receiver* and *Start survey* items.

Warning − In a real−time survey, make sure that the radio antenna is connected to the radio before starting the base survey. If it is not, the radio will be damaged.

To start a base survey:

1. From the *Survey* menu, choose *Start base receiver* .
    - If the controller is connected to a receiver that was logging data, the data logging stops.
    - The first time that you use this survey style, the Style wizard prompts you to specify the equipment you are using.

   The Start base screen appears.

   Note − When you start a survey, the Trimble Survey Controller software automatically negotiates the highest possible baud rate for communicating with the connected receiver.

2. Enter the base station name and coordinates. Use one of the following methods.:
    - If WGS84 coordinates are known:

      Access the *Point name* field and enter the point name. Tap Key in.

      In the *Key in point* screen, set the *Method* field to *Keyed in coordinates* . Check that the coordinate fields are *Latitude* , *Longitude* , and *Height (WGS84)* . If they are not, tap Options and change the *Coordinate view* setting to *WGS84* . Key in the known WGS84 coordinates for the base station, and tap Store.

- If grid coordinates are known, and projection and datum transformation parameters are defined:

  Access the *Point name* field and enter the point name. Tap Key in. In the *Key in point* screen, set the *Method* field to *Keyed in coordinates* . Check that the coordinate fields are *Northing* , *Easting* , *Elevation* . If they are not, tap Options and change the *Coordinate view* setting to *Grid* . Key in the known grid coordinates for the base station, then tap Store.
- If local geodetic coordinates are known and a datum transformation is defined:

  Access the *Point name* field and enter the point name. Tap Key in. In the *Key in point* screen, set the *Method* field to *Keyed in coordinates* . Check that the coordinate fields are *Latitude* , *Longitude* , and *Height (Local)* . If not, press Options and change the *Coordinate view* setting to *Local* . Key in the known local coordinates for the base station, then tap Store. In a real−time survey, select either the current WAAS position, or the current autonomous position, derived by the GPS receiver. Then, access the *Point name* field and enter the point name. Tap Key in to access the *Key in point* screen. Tap Here and the current position is displayed. Tap Store to accept and Store this position.

Note − If you want a WAAS position, ensure the receiver is tracking a WAAS satellite by checking the WAAS icon is displayed on the status line when you tap Here. The receiver can take 120 seconds to lock on to WAAS. Alternatively, check the *Observation class* field before starting the base.

Warning − Within a job, only use an autonomous position (the here softkey) to start the first base receiver.

Note − If you carry out a real−time survey using RTCM corrections and use a base point name that is more than eight characters long, the name will be shortened to eight characters when it is broadcast.

3. The *Observation class* field shows the observation class of the base point. For more information, see Storing GPS points.
4. Enter values in the *Code* (optional) and *Antenna height* fields.
5. Set the *Measured to* field as appropriate .
6. In the *Station index* field, enter a value.

   This value is broadcast in the correction message, and must be in the range 0−31.

   Tip − Tap Scan to view a list of other base stations operating on the frequency you are using. The list shows the station index numbers of the other bases and the reliability of each. Choose a different station index number to those displayed.

7. If the receiver you are using supports transmission delays, the *Transmission delay* field appears. Choose a value depending on how many base stations you intend to use. For more information about transmission delays, see Operating Several Base Stations on One Radio Frequency .
8. Tap Start.

   The base receiver starts to record data.
9. Do one of the following:
   - If you are carrying out a real−time survey or are logging data in the receiver, the following message appears:

Base started
Disconnect controller from receiver

Disconnect the controller from the base receiver but **do not** turn off the receiver. You can now set up the rover receiver.

Note − For a real−time survey, check that the radio is working before leaving the equipment. The data light should be flashing.

- If you are logging data in the controller, the *Base* screen appears. It shows which point is being surveyed and the time that has elapsed since data logging started. Leave the Trimble Controller connected to the base receiver and set up the rover using another Trimble Controller.

Output additional code RTCM

For a real time survey, the base receiver can broadcast the RTK message and the RTCM−104 differential message at the same time. To do this, select the Output additional code RTCM check box. (The RTCM output option must be installed in your receiver.)

Note − When RTCM−104 code and CMR messages are being broadcast, the behavior of rover GPS receivers varies according to type. When you are broadcasting CMR with Output additional code RTCM enabled, only use GPS Total Station 5700 receivers, or GPS Total Station 4700 and 4800 receivers with firmware later than v1.2. Not all receivers will function correctly in this environment because their behavior is receiver− and manufacturer−dependent. Most RTCM−only receivers will work correctly. For more information, contact your local Trimble dealer.

Warning − Do not use the *Output additional code* RTCM option when using time delays for sharing the radio frequency.

Ending a Base Survey

After an RTK survey, or after logging data in the receiver, end the survey as follows:

1. Return to the equipment and select *Survey* / *End survey* . Tap Yes to confirm that you want to end the survey, and again to power down the receiver.
2. Turn off the controller.
3. Disconnect the equipment.

After logging base station data in the Trimble Controller, end the survey as follows:

1. Return to the equipment and tap Enter.
2. Tap Yes to confirm that you want to end the survey, and again to turn off the receiver.
3. Turn off the controller.
4. Disconnect the equipment.

Base Options

To configure the Base survey when you create or edit a Survey Style:

1. From the main menu, select Configuration / Survey Styles / <Selected GPS Survey Style> / Base options.
2. Choose a survey type.
3. Set the elevation mask.
4. Set the antenna type.

Output additional code RTCM

For real−time surveys, the base receiver can broadcast the RTK message and the RTCM−104 differential message at the same time. To do this, select the Output additional code RTCM check box. (The RTCM output option must be installed on your receiver.)

Note − When RTCM−104 code and CMR messages are being broadcast, the bahaviour of rover GPS receivers varies according to type. When you are broadcasting CMR with Output additional code RTCM enabled, only use GPS Total Station 5700 receivers, or GPS Total Station 4700 and 4800 receivers with firmware later than v1.2. Not all receivers will function correctly in this environment because their behaviour is receiver− and manufacturer−dependent. Most RTCM−only receivers will work correctly. For more information contact your local Trimble dealer.

Warning − Do not use the Output additional code RTCM option when using time delays for sharing the radio frequency.

Setting Up the Equipment for a Trimble GPS 5800 Total Station Survey

This section shows how to assemble the hardware at the rover receiver for a postprocessed kinematic (PP kinematic) survey. It describes the steps for a Trimble GPS Total Station 5800.

For more information, go directly to these topics in this section:

Setting up the equipment for a real−time survey

Setting up the equipment for a postprocessed survey

Setting up the equipment for a real−time and postprocessed survey

Starting a rover survey

Recommended RTK initialization procedure

Postprocessed initialization methods

Swapping bases during a real−time rover survey

Ending a rover survey

Setting Up the Equipment for a 'Real−Time' Survey

To set up a rover receiver for a real−time survey using a GPS Total Station 5800:

1. Mount the 5800 to a range pole. Power for the 5800 is supplied by the internal battery in the 5800.
2. Attach the lithium−ion batteries to the ACU holder.
3. Attach the controller to the ACU holder. See: Attaching the ACU Controller to the ACU Holder.
4. Connect the ACU holder to the range pole.
5. Turn on the 5800.
6. Turn on the controller.

Setting Up the Equipment for a 'Postprocessed' Survey

1. Mount the 5800 to a range pole. Power for the 5800 is supplied by the internal battery in the 5800.

   Note − It may be useful to use a bi−pole to hold the range pole while taking measurements.
2. Attach the lithium−ion batteries to the ACU holder.
3. Attach the controller to the ACU holder. See: Attaching the ACU Controller to the ACU Holder.
4. Start the survey.

Setting Up the Equipment for a Real−Time and Postprocessed Survey

To conduct this type of survey, assemble the rover exactly as for a real−time survey. The 5800 has no internal memory so leave the controller connected to the base receiver for data storage. Use another controller for the rover receiver.

Attaching the ACU Controller to the ACU Holder.

Warning − Switch off the ACU before attaching it to the holder or when changing the batteries in the holder with the ACU attached. Otherwise, the on/off status of the ACU and the holder may become unsynchronised.

To connect the ACU to the ACU holder or the Trimble Total Station 5600:

1. Hold the controller with both hands.
2. Fit the groove on the back of the controller over the lower lip on the front of the holder.
3. Press down and rest the back of the controller flat against the holder.
4. Gently release downward pressure and guide the controller so that the teeth on the front of the holder click into the notches on top of the controller.

Warning − If attaching to a Trimble Total Station 5600, ensure the instrument is well supported during each step.

Detaching the ACU Controller from the ACU Holder or 5600.

To detach the ACU from the ACU holder or the Trimble Total Station 5600:

1. Hold the ACU with both hands.
2. Press down gently and pull the controller towards you to release it from the teeth on front of the holder.
3. Release the downward pressure and lift the controller off the holder.

Warning − If detaching from a Trimble Total Station 5600, ensure the instrument is well supported during each step.

Starting a Rover Survey

Only start a survey after you have started the base receiver. For more information, see Starting the Base Receiver .

To conduct a survey:

1. Make sure that the required job is open. The title of the main menu should be the current job name.
2. From the main menu, choose *Survey* . Select a survey style from the list. This must be the same survey style that you use for the base survey.

Note − If you have only one survey style, it is automatically selected.

A *Survey* menu is generated. It displays items specific to the chosen survey style and includes the *Start base receiver* and *Start survey* items.

When you start a survey using a particular Trimble survey style for the first time, the Trimble Survey Controller software prompts you to customize the style for your specific hardware.

When the survey starts, the menu items *Start base receiver* and *Start survey* no longer appear. For kinematic surveys, a new item, *Initialization* , appears.

GPS Total Station 5800, 5700, 4800, or 4700 receiver

Warning − If the receiver as logging data, logging stops. If you start a survey that specifies data logging, logging restarts to a different file.

Note − When you start a survey, the Trimble Survey Controller software automatically negotiates the highest possible baud rate for communicating with the connected receiver.

Starting a Real−Time Rover Survey

To start the rover receiver for a real−time survey:

1. Select *Start survey* .
2. Make sure the rover is receiving radio corrections from the base.

   Note − An RTK survey needs radio corrections.

3. If the receiver you are using supports transmission delays and you select the *Prompt for station index* check box in the *Rover options* field, the *Select base station* screen appears. It shows all the base stations operating on the frequency you are using. The list shows the station index numbers of each base and the reliability of each. Highlight the base you want to use and tap Enter.

   For more information about using transmission delays, see Multiple bases on one frequency.

   Tip − If you want to check the point name of the base station being used in the rover survey, select *Files* / *Review current job* and inspect the Base point record.

4. If necessary, initialize the survey.

   Note − If you are carrying out an RTK survey but do not require centimeter−level results, select Survey / Initialization. Tap Init and set the Method field to No initialization.

   For an RTK survey, initialize before starting centimeter−level surveying. If you are using a dual−frequency receiver with the OTF option, the survey automatically starts to initialize using the OTF initialization method.

5. When the survey is initialized, you can perform a site calibration, measure points, or stakeout.

Starting an RTK &Infill Rover Survey

Note − If you are using postprocessed techniques, to process the data you must have the Baseline Processing module of the Trimble Geomatics Office software installed.

To start the rover receiver for an RTK &infill survey:

1. Select *Start Survey* .
2. Make sure the rover is receiving radio corrections from the base.

   Note − An RTK survey needs radio corrections.

3. If the receiver you are using supports transmission delays and the *Prompt for station index* check box in the *Rover options* option in the survey style is selected, the *Select base station* screen appears. It shows all the base stations operating on the frequency you are using. The list shows the station index numbers of each base and the reliability of each. Highlight the base you want to use and tap Enter.

   For more information about using transmission delays, see Multiple bases on one frequency.

   Tip − If you want to check the point name of the base station being used in the rover survey, select *Files / Review current job* and inspect the Base point record.

4. Initialize the survey using an RTK initialization method.
5. Measure points as usual.

Switching to PP infill

During periods when no base corrections are received, the following message flashes in the status line:

Radio link down

To continue surveying select *Start PP infill* from the *Survey* menu. When postprocessing infill starts, this item changes to *Stop PP infill* .

Raw data is logged at the rover during postprocessing (PP) infill. For successful baseline resolution, you must now use postprocessed kinematic observation techniques.

Note − Initialization cannot be transferred between the RTK survey and the PP infill survey. Initialize the PP infill survey like any other postprocessed kinematic survey. For more information, see Postprocessed Initialization Methods .

Only rely on the OTF (automatic) initialization if you are certain that the receiver will observe at least five satellites, without interruption, for the next 15 minutes. Otherwise, select *Initialization* from the *Survey* menu and perform an initialization.

Note − You cannot stake out points during a postprocessed survey.

When base corrections are received again, one of the following messages appears in the status line, depending on the initialization mode of the RTK survey:

- Radio link up (RTK=Fixed)
- Radio link up (RTK=Float)

The first message is displayed if the receiver has retained the RTK initialization during the PP infill survey. That is, if the number of satellites did not fall below four throughout the PP infill survey.

Select *Stop PP infill* from the *Survey* menu to stop data logging at the rover. When postprocessing infill stops, this item changes back to *Start PP infill* . Real−time measurements are resumed.

Starting a Postprocessed Rover Survey

To start the rover receiver for a postprocessed survey, select *Start survey* .

Note − If using postprocessed techniques, to process the data you must have the Baseline Processing module of the Trimble Geomatics Office software installed.

You can begin surveying immediately, you do not need to initialize a FastStatic or differential survey.

You must initialize a PP kinematic survey to achieve centimeter−level precisions when the data is processed. With dual−frequency receivers, the initialization process begins automatically if at least five L1/L2 satellites are being observed.

For more information about initializing a postprocessed survey, see Postprocessed Initialization Methods . For information about measuring points, see Measure Points.

Working in Float mode

Work in Float mode if you do not want to initialize a survey. Start the survey and select *Initialization* . When the *Initialization* screen appears, press Init. Set the *Method* field to *No initialization* and tap Enter.

Starting a Rover Survey

Starting a rover survey is the same as for a Real−time survey.

To start a survey using VRS or SAPOS FKP, you must send an approximate position for the rover receiver to the control station. When you start the survey, this position is automatically sent through your radio communications link in a standard NMEA position message. It is used to compute the RTK corrections your receiver will use.

Swapping Bases During a Real−Time Rover Survey

If you are using multiple bases on the same frequency, you can swap bases during the rover survey. For more information, see Multiple bases on one frequency .

To swap bases, do the following:

- From the *Survey* menu, select *Swap base receiver* .

  The *Select base station* screen appears. It shows all the base stations operating on the frequency you are using. The list shows the station index numbers of each base and the reliability of each. Tap the base you want to use.

Note − When you change to a different base, your OTF receiver automatically starts the initialization.

Ending a Rover Survey

When you have measured or staked out all points required, do the following:

1. From the *Survey* menu, choose *End survey* .

   The Trimble Survey Controller software asks if you want to power down the receiver. Tap Yes to confirm this.
2. Turn off the controller **before** disconnecting the equipment.
3. Return to the base station and end the base survey. For more information, see Ending a Base Survey .

Rover Options

To configure the Rover survey when you create or edit a Survey Style:

1. From the main menu, select Configuration / Survey Styles / <Selected GPS Survey Style> / Rover options.

2. Choose a survey type and set the associated parameters.

   Generally, when a GPS Total Station setup consists of one base and one rover receiver, make sure the survey type selected in the *Rover options* field and the *Base options* field is the same. However, when there are multiple rovers, you can have various configurations. The following table shows the rover survey types that are possible when the base survey type is RTK or PP Kinematic.

Base survey type	Possible rover survey types
RTK &infill or RTK &data logging	RTK RTK &infill PP Kinematic FastStatic
PP Kinematic	PP KinematicFastStatic

Broadcast format

For Realtime Kinematic surveys, the format of the broadcast message can be CMR, CMR +, or RTCM RTK 2.x. (CMR is Compact Measurement Record; RTCM is Radio Technical Commission for Maritime Services).

The default is CMR +, which is a format used by the modern Trimble receivers. It is a modified type of CMR record that improves the efficiency of a low bandwidth radio link in realtime surveys. Only use CMR + if all the receivers have the CMR + option installed. To check if this option is installed in the receiver, select *Instrument* / *Options* on a TSCe data collector that is connected to a receiver.

Note − If you want to operate several base stations on one frequency, use CMR+. For more information, see Operating several base stations on one radio frequency.

For wide−area RTK surveys, the broadcast message format can be from the following wide−area RTK solutions: SAPOS FKP, VRS (CMR), and VRS (RTCM 2.x). For more information, see Starting a wide area RTK survey.

The rover selection should always correspond to the broadcast message format generated by the base.

WAAS

When the radio link is down in a real−time survey, the receiver can track and use signals from the Wide Area Augmentation System (WAAS). This provides WAAS positions instead of autonomous GPS positions. To use WAAS positions for more accurate navigation when the radio link is down, set the *WAAS* field to On. When using WAAS signals, only Rapid points or postprocessed points can be measured.

Note − For WAAS surveys, you must use a receiver that can track WAAS satellites.

Use station index

If you want to use multiple base stations on one radio frequency, enter the station index number that you want to use first in the *Use station index* field.

If you do not want to use multiple base stations on one frequency, enter the same station index number that you enter in the *Base options* screen.

To use any base station operating on the frequency set in the rover radio, tap the Any softkey.

Warning – If you tap Any and there are other base stations operating on the frequency, your rover survey could receive corrections from the wrong base.

For information about using multiple bases, see Multiple bases on one frequency.

Prompt for station index

When you use a receiver that supports multiple base stations on one radio frequency, the Trimble Survey Controller software asks you to specify the base to use when you start the rover survey. You can stop this question from appearing by clearing the *Prompt for station index* check box. The station index number in the *Use station index* field is used.

Elevation mask

You must define an elevation mask below which satellites are not considered. For kinematic applications, the default of 13° is ideal for both the base and rover.

For differential surveys where the base and rover are separated by more than 100 kilometers, Trimble recommends that the base elevation mask be lower than the rover setting by 1° per 100 kilometers of separation between the base and rover. Generally, the base elevation mask should be no lower than 10°.

PDOP mask

For the rover option, define a PDOP mask. The Trimble Survey Controller software issues high PDOP warnings when the satellite geometry goes above this threshold. The default value is 6.

Logging device

With survey types that involve postprocessing, set the Logging device to be either the Receiver or Controller.

To define the logging interval, enter a value in the *Logging interval* field. The base and rover logging intervals must correspond to (or be multiples of) each other.

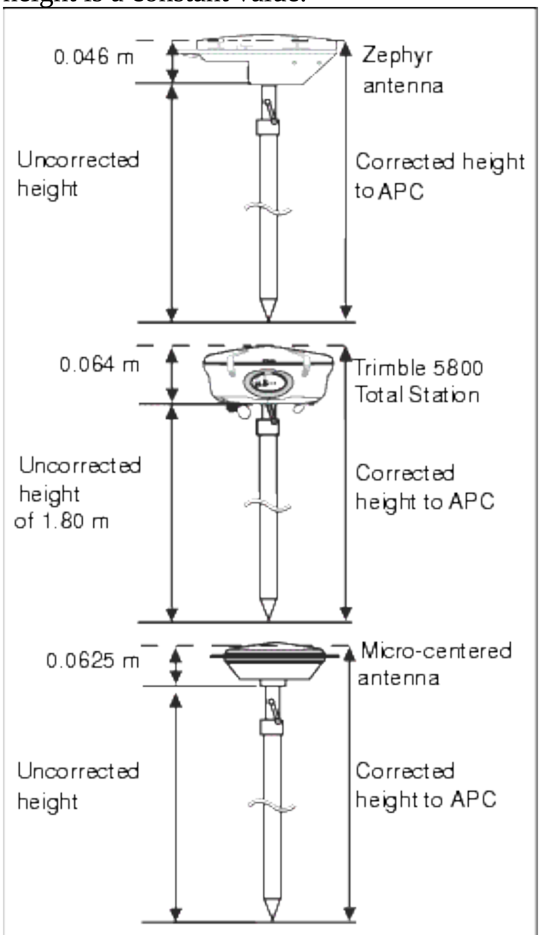
Antenna type

To set the default antenna height, enter a value in the *Antenna height* field.

To define the antenna details, access the *Type* field and select the correct antenna from the list of antennas. Access the *Measured to* field and select the correct measurement method for the equipment and type of survey. The field that displays the part number is automatically filled. Key in the serial number.

Measuring Antenna Heights

The diagram below shows how to measure the height of an antenna mounted on a range pole when the *Measured to* field is set to *Bottom of antenna* or *Bottom of antenna mount* . With a fixed height range pole, the height is a constant value.



Measuring the Height of an Antenna on a Tripod

The way to measure this depends on the equipment used.

Zephyr antenna

If this antenna is mounted on a tripod, measure the height to the top of the notch on the side of the antenna. See the diagram below.

Zephyr Geodetic antenna

If this antenna is mounted on a tripod, measure the height to the bottom of the notch on the side of the antenna. See the diagram below.

GPS Total Station 5800 receiver

If this receiver is mounted on a tripod, measure the uncorrected height to the base of the housing.

GPS Total Station 5700 receiver

If this receiver is mounted on a tripod, measure the uncorrected height to one of the eight protruding notches on the edge of the plastic antenna housing. These are located inside the external shock resistant housing ring. Use the special measuring tape provided by Trimble. Enter a value in the *Antenna height* field, and, in the *Measured to* field, select *Hook using 4800 tape* .

Tip − If you are using a fixed height tripod, you can measure the height to the bottom of the antenna housing and select *Bottom of antenna mount* in the *Measured to* field.

Micro−centered L1/L2 antenna

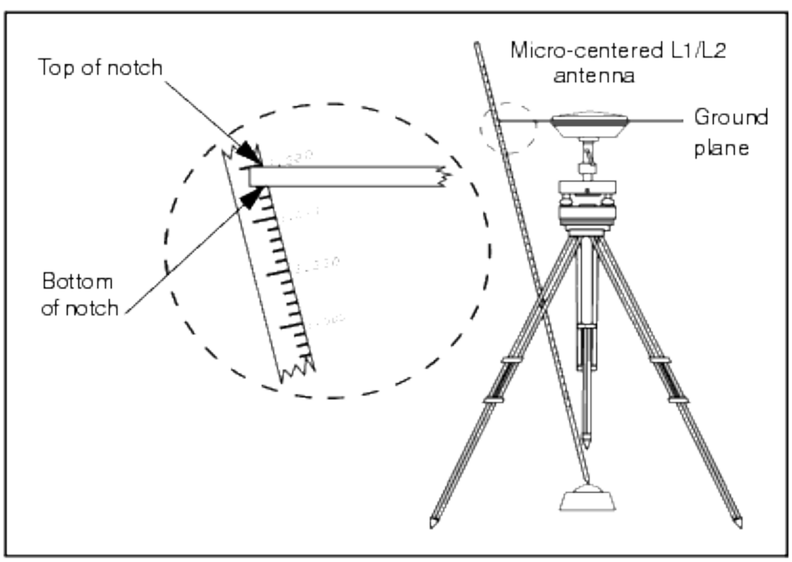
If this antenna is mounted on a tripod, measure the height to the bottom of the plastic housing. Enter this value in the *Antenna height* field and set the *Measured to* field to *Bottom of antenna* .

Ground plane

If you are using a ground plane, see the next section.

Measuring the Height of an Antenna When Using a Ground Plane

The following diagram shows how to measure the uncorrected height of a Micro−centered antenna (or a Compact L1/L2 antenna) that has a ground plane. Measure to the underside of the notch in the ground plane.



Tip − Measure the height to three different notches around the perimeter of the ground plane. Then record the average as the uncorrected antenna height.

Antenna.ini File

The Trimble Survey Controller software includes an integrated Antenna.inifile that contains a list of antennas that you can choose from when creating a survey style. You cannot edit this list in the Trimble Survey Controller software. However, if you want to shorten the list or add a new antenna type, you can edit and transfer a new Antenna.ini file.

To edit the antenna.ini file, use a text editor such as Microsoft Notepad. Edit the *Survey Controller* group, and transfer the new Antenna.ini file to the Trimble Survey Controller software, using Trimble's Data Transfer utility.

Note − When you transfer an Antenna.ini file, it overwrites any existing file of that name. The information in this file is also used in preference to the antenna information built into the Trimble Survey Controller software.

RTK Initialization Methods

If base corrections are being received and there are four or more satellites, the survey is initialized automatically when you start the survey. A survey must be initialized before centimeter−level surveying can begin.

Note − At least five L1/L2 satellites are required for OTF initialization. After initialization, at least four satellites must be tracked. If the number of satellites drops below four, the survey must be reinitialized.

The following table summarizes methods of initializing a realtime kinematic survey, and the time required for each method.

Survey and receiver type	Time required for each initialization method		Range (km)
	Known Point	OTF	
RTK	~15 s (5+ SVs)	~60 s, 5+ SVs	<10
Dualfrequency (OTF)	~30 s (4 SVs)	−	−

Note − Initialization must be maintained throughout the survey by continuously tracking a minimum of four satellites. If initialization is lost at any time, reinitialize and then continue the survey.

After initialization, the survey mode changes from Float to Fixed. The mode remains Fixed if the receiver continuously tracks at least four satellites. If the mode changes to Float, reinitialize the survey.

Multipath

Initialization reliability depends on the initialization method used and on whether or not multipath occurred during the initialization phase. Multipath occurs when GPS signals are reflected off objects, such as the ground or a building.

The occurrence of multipath at the GPS antenna adversely affects GPS initializations and solutions:

- If initialization is by the Known Point method, multipath can cause an initialization attempt to fail.
- During initialization by the OTF method, it is difficult to detect multipath, which may cause initialization to be lengthy or unsuccessful. For more information, see Recommended RTK Initialization Procedure .

The initialization process in Trimble receivers is very reliable, but if an incorrect initialization does occur, Trimble's RTK processing routines detect it within 15 minutes (if the mode has remained Fixed). When the error is detected, the receiver automatically discards the initialization and issues a warning.

Note – If you survey points with a bad initialization, you will get position errors. To minimize the effect of multipath during an OTF initialization, move around.

Known Point Initialization

To perform a Known Point initialization:

1. Position the rover antenna over a known point.
2. From the *Survey* menu, choose *Initialization* .
3. Set the *Method* field to *Known Point* .
4. Access the *Point name* field and tap List. Select the point from the list of known points.
5. Enter values in the *Antenna height* field, and make sure that the setting in the *Measured to* field is correct.
6. When the antenna is centered and vertical over the point, tap Start.

   The controller starts to record data, and the static icon ( ) appears in the status bar. Keep the antenna vertical and stationary while data is recorded.
7. When the receiver is initialized, the following message appears:

   Initialization change. Initialization has been gained. The results are displayed. Tap Enter to accept the initialization.
8. If the initialization fails, the results are displayed. The Trimble Survey Controller software asks if you want to retry. Tap Yes or No.

Recommended RTK Initialization Procedure

This section describes the procedure that Trimble recommends for performing a check on an OTF RTK initialization.

Minimize the chance of surveying with a bad initialization by adopting good survey techniques. A bad initialization occurs when the integer ambiguities are not correctly resolved. The Trimble Survey Controller software automatically reinitializes when this is detected, but cannot do so if you end the survey too soon. As a precaution, always perform the RTK initialization described below.

When initializing, always choose a site that has a clear view of the sky and is free of obstructions that could cause multipath.

Note − Known Point is the quickest method of initialization when known points exist.

To perform an On−The−Fly initialization:

1. Initialize the survey using the OTF method of initialization.

Tip − When performing an OTF initialization, move around to reduce the effect of multipath.

2. When the system is initialized, establish a mark about 9 meters (30 feet) from where the initialization occurred.
3. Conduct a static point measurement over the mark. Once this is done, discard the current initialization.
4. If you are using an adjustable height range pole, change the height of the antenna by approximately 8 inches.
5. Reoccupy the mark observed in step 2, and reinitialize the survey using either the OTF or Known Point method of initialization. Remember to enter the new antenna height details.

Follow this procedure to substantially improve the quality of an initialization.

Measuring a new point creates a known point on which the first initialization is tested. Changing the antenna height moves the GPS antenna from the environment in which the test point was initially surveyed. Always enter the new antenna height before starting the Known Point initialization.

Postprocessed Initialization Methods

In a postprocessed survey you must initialize to attain centimeter−level precisions.

Use one of the following methods to initialize dual−frequency postprocessed kinematic surveys in the field:

- On−The−Fly
- Known Point

Note − In a postprocessed survey, collect enough data during initialization so that the WAVE processor can successfully process it. The following table shows Trimble's recommended times.

Initialization method	4 SVs	5 SVs	6+ SVs
L1/L2 OTF initialization	N/A	15 min	8 min
Known Point initialization	at least four epochs		

After initialization, the survey mode changes from Float to Fixed. The mode remains Fixed if the receiver continuously tracks at least four satellites. If the mode changes to Float, reinitialize the survey.

Note − If you do an On−The−Fly initialization in a postprocessed kinematic survey, it is possible to measure points before initialization is gained. The Trimble Geomatics Office software can back−process the data later to give a fixed solution. If you do this but lose lock on the satellites while initializing, re−measure any one of the points that you surveyed before lock was lost.

To work without initializing the survey (in Float mode), start a survey and select *Initialization* . When the *Initialization* screen appears, tap Init. Set the *Method* field to *No initialization* and tap Enter.

Known Point Initialization

In a postprocessed survey you can initialize on:

- a point measured previously in the current job
- a point that you will provide coordinates for later (before the data is postprocessed)

See Known Point initialization for instructions.

RTK Survey

Real−time kinematic surveys use a radio to broadcast signals from the base station to the rover. The rover then calculates its position in real time. Configure this type of survey when you create or edit a Survey Style, then follow these steps to carry out an RTK survey:

1. Configure the survey style.
2. Configure the base receiver.
3. Configure the rover receiver.
4. Begin the survey.
5. End the survey.

Configure the survey style

To do this:

1. From the main menu, select Configuration / Survey styles / RTK.
2. Select each of the options in turn, and set them to suit your equipment and survey preferences.
3. When you have configured all the settings, tap Store to save them.

For more information, see:

Rover options

Base options

Radios

Laser rangefinder

Topo point

Observed control point

Rapid point

Continuous points

Stakeout

Site calibration

Duplicate Point Tolerance

Configure the base receiver

To do this:

1. Set up the base station and connect the data collector.
2. From the main menu, select Survey / RTK / Start base receiver. If you are using this Survey Style for the first time, the Style wizard prompts you to specify the type of equipment you are using.

   The style wizard customizes the chosen survey style, setting any parameters specific to the hardware.

   Tip − To correct a mistake when customizing a survey style, first complete the process and then edit the style.

   Note − With the GPS Total Station 5700, 4800 or 4700 receivers, use an external radio at the base even if you use the internal radio at the rover.

   Tip − You can use a Custom radio if the radio you have is not listed.
3. Enter the point name. If the WGS−84 point is not already in the database, the Key in / Point screen appears.
4. Enter values, or tap the Here softkey to use the current position. Only use the Here key once in a job.
5. Enter the code.
6. Enter the antenna height and tap Enter.
7. Disconnect the data collector from the base station.

   Note − The first time that you start the base or the rover receiver, you must select the type of antenna that you are using from a list. The following table shows some common choices.

Receiver and station	**GPS Total Station receivers**		
	5700	**4800**	**4700**
Base receiver	Zephyr Geodetic	4800 Internal	Micro−centered L1/L2 w/GP
Rover receiver	Zephyr	4800 Internal	Micro−centered L1/L2

Configure the rover receiver

To do this:

1. Set up the Rover receiver and connect the data collector.

2. From the main menu, select Survey / RTK / Start survey. Again, the Style wizard may prompt you to specify the type of equipment you are using.
3. Initialize the survey. If you have selected the On−The−Fly (OTF) option, initialization is automatic. Otherwise, the Initialization screen appears.
4. Once the rover is initialized, the survey mode in the status line shows as RTK:Fixed. You can then measure points.

Begin the survey

To do this:

1. From the main menu, select Survey / Measure points.
2. Enter the point name and code.
3. In the Type field, select Topo point.
4. Enter the antenna height.
5. Tap the Measure button. The antenna must remain stationary and vertical while you measure a point.
6. Tap the Store button to store the point.
7. Move to the next point and measure it.
8. To review stored points, select Review current job from the Files menu.

End the survey

To do this:

1. From the main menu, select Survey / Conventional / End survey.
2. Tap Yes to confirm.
3. Turn off the data collector.

For more information, see:

Start base receiver

Measure points

Continuous topo

Stakeout

Site calibration

Swap base receiver

Operating Several Base Stations on One Radio Frequency

In an RTK survey you can reduce the effects of radio interference from other base stations on the same frequency by operating your base station with a different transmission delay. This allows you to operate several base stations on one frequency. The general procedure is as follows:

1. Check that you have the correct hardware and firmware.
2. Set up the equipment and start a survey at each base station, specifying a transmission delay and a station index number.
3. Start a rover survey and specify which base to use.

Hardware and firmware requirements

To operate several base stations on one frequency, you must use receivers that support the CMR Plus correction record format.

All other base and rover receivers must be GPS Total Station 5700 receivers, or 4700 and 4800 receivers with firmware version 1.20 or later.

Note − Do not use transmission delays if you intend to use radio repeaters.

Starting the base with a transmission delay

When you use multiple base stations, you set the transmission delay for each base when you start the base survey. Each base must broadcast with a different transmission delay and station index number. The delays allow the rover to receive corrections from all of the base stations at once. The station index numbers let you select which base station to use at the rover.

Note − You can only set the base radio transmission delay when using a GPS Total Station 5700 receiver, or a GPS Total Station 4700 or 4800 receiver with firmware version 1.20 or later.
When you carry out surveys using different base stations in one job, make sure that the coordinates of the base stations are in the same coordinate system and are in terms of each other.

Before you start the base receiver, do the following:

1. Select the CMR Plus correction message format. Select this in the survey style for both the base and the rover.
2. Set the over air baud rate in the radio to at least 4800 baud.

Note − If you use a 4800 over air baud rate you can only use two base stations on one frequency. Increase the over air baud rate if you want to increase the number of base stations on one frequency.

When you start the base survey, do the following:

1. In the *Station index* field, enter a value within the range 0−31. This number is broadcast in the correction message.

   Tip − You can configure the default station index number in the survey style. For more information, refer to Station index.

2. If the receiver you are using supports transmission delays, the *Transmission delay* field appears. Choose a value, depending on how many base stations you want to use. See the following table.

No. of base stations	Use these delays (in ms) ...			
	Base 1	Base 2	Base 3	Base 4
One	0	−	−	−
Two	0	500	−	−
Three	0	350	700	−
Four	0	250	500	750

For more information about starting the base survey, see Starting a Base Survey .

For information about starting the rover and selecting which station index to use, see Starting a Rover Survey .

Starting a Wide−Area RTK Survey

Wide Area RTK (WA RTK) systems consist of a distributed network of reference stations communicating with a control center to calculate GPS error corrections over a wide area. Real−time correction data is transmitted by radio or cellular modem to the rover receiver within the network area.

The system improves reliability and operating range by significantly reducing systematic errors in the reference station data. This lets you increase the distance at which the rover receiver can be located from the physical reference stations, while improving on−the−fly (OTF) initialization times.

The Trimble Survey Controller software supports broadcast formats from the following WA RTK solutions:

- SAPOS FKP
- Virtual Reference Station (VRS)

To use a WA RTK system, first check that you have the necessary hardware and firmware.

Hardware Requirements

All rover receivers must have firmware that support WA RTK. For details of availability, check the Trimble website or contact your local dealer.

Real−time correction data is provided by radio or cellular modem. For details about the delivery option for your system, contact your local dealer.

Configuring the Survey Style

Before you start a survey using a WA RTK system, configure the RTK survey style.

To select a WA RTK broadcast format:

1. In the survey style, select *Rover options* .
2. In the *Broadcast format* field, select one of the following options from the list:
    - SAPOS FKP
    - VRS (RTCM 2.x)
    - VRS (CMR)

To select a radio solution:

1. In the survey style, select *Rover radio.*
2. In the *Type* field, select your radio from the list.

Note − If you are using a radio in a VRS system, you must select a two−way radio. You cannot use Trimble internal radios.

RTK and Infill Survey

This type of survey allows you to continue a kinematic survey when radio contact is lost. The infill data must be postprocessed.

Configure an RTK and Infill survey when you create or edit a Survey Style.

To do this:

1. From the main menu, select Configuration / Survey Styles / RTK &infill / Base options.
2. In the Survey type field, select RTK and infill.
3. Specify the logging device and logging interval.
4. Do the same for Rover options.

To receive WAAS positions instead of Autonomous positions when the radio is down, set the WAAS field to On.

The logging interval is for the infill session only and should be the same for each receiver, typically 5 seconds. The RTK interval remains at 1 second.

When radio contact is lost, the following message flashes in the status line: 'Radio link down'.

To start infill:

1. From the main menu, select Survey / RTK &infill / Start PP infill.
2. Initialize, and continue as for a postprocessed kinematic survey.

When the radio link returns, select Survey / Stop PP infill from the main menu and continue with your RTK survey.

For more information, see:

Rover Options

Base Options

Radio

Laser Rangefinder

Topo Point

Observed Control Point

Rapid Point

Continuous Points

Stakeout

Site Calibration

Duplicate Point Tolerance

RTK and Data Logging

This type of survey records raw GPS data during an RTK survey.

As this survey style is not provided by the Trimble Survey Controller software, you must create the style the first time that you want to use it.

To do this:

1. From the main menu, select Configuration / Survey Styles and tap New.
2. Type in RTK and data logging and tap Enter.
3. Select Base options.
4. In the Survey type field, select RTK and data logging.
5. Specify the logging device and the logging interval.
6. Repeat steps 4−6 for Rover options.

The logging interval should be the same for each receiver − typically 5 seconds. The RTK interval remains at 1 second.

For more information, see:

Rover Options

Base Options

Radio

Laser rangefinder

Topo Points

Observed Control Point

Rapid Point

Continuous Topo Points

Stakeout

Site Calibration

Duplicate Point Tolerance

FastStatic Survey

A FastStatic survey is a postprocessed survey using occupations of up to 20 minutes to collect raw GPS data. The data is postprocessed to achieve sub−centimeter precisions. Typically, the occupation times vary based on the number of satellites. A minimum of four satellites is required.

Configure a FastStatic survey when you create or edit a Survey Style.

To do this:

1. From the main menu, select Configuration / Survey Styles / FastStatic / Base options.
2. In the Survey Type field select FastStatic.
3. Do the same for Rover options.

For more information, see:

Rover Options

Base Options

Laser Rangefinder

FastStatic Point

Duplicate Point Tolerance

PPK Survey

Postprocessed Kinematic surveys store raw observations and process them later.

Configure a PPK survey when you create or edit a Survey Style.

When you use this type of survey, the default logging interval is five seconds. If your receiver is capable of storing data, the first time that you use this survey style, the Style wizard prompts you to specify where you want to store the data.

Before you measure points, initialize the survey using one of the following methods:

- Known point
- On−The−Fly (OTF)

When you are familiar with the equipment, you can configure the PP initialization times.

PP Initialization Times

Select the *PP initialization times* survey style option to define initialization times. Generally the default settings are appropriate.

Warning − Reducing any of these times can affect the outcome of a postprocessed survey. Increase these times rather than decrease them.

RT Differential Survey

This survey type uses a radio to broadcast a correction message (RTCM−104) from the base station to the rover which then calculates its position. A real−time differential survey gives sub meter level precisions.

Differential surveys require four satellites that are common to the base and the rover receivers. Differential surveys do not require initialization.

The two differential survey types are described in the following sections:

- RT differential − This survey uses the RTCM broadcast message and relies on a reliable radio for the duration of the survey. Alternatively, use WAAS signals to provide real−time positions instead of a radio.
- RT diff &data logging − This survey works in the same way as an RT differential survey, except that data is recorded for the entire survey both at the base and at the rover receivers. This method is useful if raw data is required for quality assurance purposes.

As this survey style is not provided by the Trimble Survey Controller software, you must create the style the first time that you want to use it.

To do this:

1. From the main menu, select Configuration / Survey Styles.
2. Tap New.
3. Enter a name in the *Style name* field.
4. In the *Style type* field, choose *GPS* and tap Accept.
5. Choose *Rover options* or *Base options* and make the appropriate changes to the *Type* field. In this case, change it to the differential method that you want to use. The survey type you select depends on whether the technique you choose is real−time or postprocessed.
6. For both real−time and postprocessed techniques, define an elevation mask and antenna for the base and the rover. For the rover options, define Broadcast format, the PDOP mask, and the RTCM age limit. In a differential survey you can choose to set the *Broadcast format* field to RTCM or WAAS.
7. For methods that involve data logging, specify whether the data is to be logged in the receiver or in the controller, and define the interval. For real−time techniques, the RTCM−SC104 version 2 broadcast message format is used. Real−time signals are generated at 1second intervals.
8. To use Wide Area Augmentation System positions when you do not have a radio, set the Broadcast format to WAAS.
9. To receive WAAS positions instead of Autonomous positions when the radio is down, set the broadcast format to RTCM and set the WAAS field to On.

   Note − For WAAS surveys, you must use a receiver that can track WAAS satellites.

   When using WAAS signals, only Rapid points or postprocessed points can be measured.

For more information, see:

Rover Options

Base Options

Radio

Laser rangefinder

Topo Points

Observed Control Point

Rapid Point

Continuous Topo Points

Stakeout

Site Calibration

Duplicate Point Tolerance

Wide Area Augmentation System (WAAS)

The satellite−based Wide Area Augmentation System (WAAS) provides real−time, differentially corrected positions without the need for a radio link.

WAAS can be used in real−time surveys when the ground based radio link is down. To do this, set WAAS to On in the Rover options screen of your Survey Style. In real−time differential surveys, the Broadcast format can be set to WAAS to always store WAAS positions without the need for a radio link.

When WAAS signals are being received, the radio icon changes to a WAAS icon, and in an RTK survey, RTK:WAAS is displayed on the status line.

Rapid point is the only measurement method that can be used to store a WAAS position.

The availability of WAAS signals depends on your location and the receiver you are using. See your Trimble dealer for details.

Note : The US term WAAS describes a satellite−based delivery system for differential positions. It is synonymous with the European Global Navigation Overlay Service (EGNOS) and MSAT.

End Survey

To end the current survey, select End survey from the Survey menu.

When you end a GPS survey, the software asks you if you want to power down the receiver.

When you end a Conventional survey with Robotic instruments, the software asks you if you want to power down the instrument. If the instrument is powered down this way, starting the survey again automatically starts the instrument.

Caution : The current station setup is lost when you select End Survey.

You must end a survey before you can make changes to the configuration of the current job or current Survey Style.

Survey Configuration

Configuration Menu

Use this menu to:

- Set or change settings related to the Trimble controller.
- Create and edit feature and attribute libraries.
- Create and edit survey styles.

For more information, see:

Controller

Feature and Attribute Library

Survey Styles

Options

Survey Styles

Survey Styles define the parameters for configuring and communicating with your instruments, and for measuring and storing points. In a GPS survey, the Survey Style instructs the base and rover receivers to perform the functions required for a specific survey type . This whole set of information is stored as a template that can be called up and re−used when necessary.

If there is only one survey style, it is automatically selected. Otherwise, choose one from the list that apears when you select Configuration / Survey styles.

You can use the styles supplied with the system without configuring them, but you can change default settings as required. The 5600 3600 style works with both the Trimble 5600 and Trimble 3600 instruments. Trimble Survey Controller detects the instrument that you are connected to and automatically configures the appropriate controls.

Set the appropriate Options to view and use Survey Styles.

To change the configuration of the Trimble Survey Controller software for different types of survey, select Configuration / Survey Styles from the main menu.

For more information, see:

Conventional Survey

FastStatic Survey

Postprocessed Kinematic Survey

Real−Time Kinematic and Infill Survey

Real−Time Kinematic Survey

Real−Time Kinematic and Data Logging

Software Options

To display a list of the available software options, select Configuration / Options from the main menu. Choose an option to enable one of the following:

- GPS surveying
- TS surveying
- Advanced Geodetic support

GPS surveying and TS surveying are selected by default. The corresponding survey files are created in the Trimble data dictionary and are displayed only when these options are enabled.

Note − GPS surveying or TS surveying are automatically enabled when connecting to a GPS receiver or conventional instrument respectively.

Select Advanced Geodetic support to calculate a network scale factor during multiple backsights or resection station setups.

Tap Upgrade to install a new option key for upgrading the software options.

Survey Types

Your GPS survey type will depend on available equipment, field conditions, and the results required. Configure the survey type when you create or edit a Survey Style.

To do this:

1. From the main menu, select Configuration / Survey Styles / <Selected Survey Style> / Base options.
2. Change the Type field as required.
3. Do the same for Rover options.

The Trimble Survey Controller software provides survey styles for the following survey types:

Conventional Survey

FastStatic Survey

Real−Time Kinematic Survey

Real−Time Kinematic and Infill Survey

Postprocessed Kinematic Survey

To use one of the following survey types, you must create your own survey style:

Real−Time Kinematic and Data Logging

Real−Time Differential Survey

Bluetooth

A Trimble controller (ACU, or TSCe with a BlueCap attachment) can be connected to a 5800 GPS receiver using Bluetooth.

To do this:

1. Switch on the receiver and the controller.
2. From the Windows Control Panel, select Bluetooth device properties and make sure that the Enable Bluetooth check box is selected.
3. Optionally, tap the Scan softkey to move the 5800 instrument into the Trusted device list.
4. Start Trimble Survey Controller and select Configuration / Controller / Bluetooth from the main menu.
5. Tap the Scan softkey.
   Trimble Survey Controller searches for other Bluetooth devices within range.
6. Once the scan is complete, select the 5800 receiver you wish to connect to.
7. Tap the Accept key.
   Trimble Survey Controller connects to the receiver.

Note − Unless you tap the Clear softkey, you do not need to use the scan function again. The controller connects to the receiver automatically when you switch on both devices.

Conventional Instrument − Configuration

Configure the conventional instrument type when you create or edit a Survey Style.

Select Instrument, choose the instrument type , and then set the associated parameters.

Baud rate and parity

Use the *Baud rate* field to configure the Trimble Survey Controller baud rate to match that of the conventional instrument.

Use the *Parity* field to configure the Trimble Survey Controller parity to match that of the conventional instrument.

When you change the instrument type, the baud rate and parity settings automatically change to the default settings for the selected instrument.

HA VA status rate

Use the *HA VA status rate* field to set how often the Trimble Survey Controller software updates the horizontal and vertical angle display in the status line with information from the conventional instrument.

Note − Some instruments beep when communicating with the Trimble Survey Controller software. You can turn off the beep in the instrument or set the *HA VA status rate* to Never.

Measurement mode

The Measurement mode field appears if the selected instrument type has more than one measurement mode that can be set by Trimble Survey Controller. Use this mode to specify how the EDM measures distances. Options vary according to the instrument type. Select Instr. default option to always use the setting on the instrument.

Set backsight

The *Set backsight* field appears if you can set the horizontal circle reading on the instrument when the backsight is observed. The options are *No* , *Zero*, and *Azimuth* . If you select the *Azimuth* option, when you observe the backsight the horizontal circle reading is set to the computed azimuth between the instrument point and the backsight point.

Auto turn and servo options

With a servo or robotic instrument, the Auto turn check box and the Servo options field appear. Select the check box to operate the servo instrument automatically during stakeout when you measure a known (coordinated) point.

In the Servo options field, choose HA only, or HA &VA.

Instrument precision

Use the *Instrument precision* fields to record the precisions of the instrument. Do one of the following:

- Leave them as null.
- Enter the manufacturer's values.
- Enter your own values based on your observing techniques.

If you leave the fields as null, the statistics are computed using Trimble Geomatics Office default values. If you enter values, they are used to weight observations in the calculation of the Mean orientation and Scale factor for Multiple backsights and Resections, as well as the Resected position. They are also used in Trimble Geomatics Office to compute the standard error statistics for an observation.

Conventional Instrument − Type

In a conventional survey style, you need to specify the type of instrument being used.

Choose a model made by one of the following manufacturers:

- Trimble
- Leica
- Nikon
- Pentax
- Sokkia
- Spectra Precision
- Topcon
- Zeiss

Choose Manual when you want to key in the measurements.

Choose one of the following SET types:

- SET (Basic), when using a Nikon instrument (if your instrument does not support a Nikon survey style). Make sure that the units on the instrument are the same as the units in Trimble Survey Controller.
- SET (Extended), when using any Sokkia instrument.

Laser Rangefinder

To measure points or distances using a laser rangefinder connected to the controller, first configure the laser rangefinder in your Survey Style.

1. From the main menu, select Configuration / Survey styles. Highlight a survey style and tap the Edit softkey.
2. Select *Laser rangefinder* .
3. Select one of the instruments in the *Type* field.
4. If necessary, configure the Controller port and Baud rate fields.
   The default value in the Baud rate field is the manufacturer's recommended setting. If the laser is a model with which Trimble Survey Controller can automatically take a measurement when you tap the Measure softkey, edit the Auto measure field.
5. If required, select the Auto store point check box.
6. Tap Enter. The precision fields contain the manufacturer's precision values for the laser. They are for information only.

> Laser measurements can be displayed as vertical angles measured from the zenith or inclinations measured from horizontal. Select a display option in the Laser VA display field of the Units screen. For more information, see System units.

Before using the laser with the controller, configure the laser options. The following table shows the configuration for each laser that is supported by Trimble Survey Controller.

Laser	Laser setting
LTI Criterion 300 or LTI Criterion 400	From the main menu, press the down arrow or up arrow key until the Survey menu appears, then tap the Enter softkey. Select Basic measurements and tap Enter. A screen showing the fields HD and AZ appears.
LTI Impulse	Set up the laser to operate in CR 400D format. Make sure that a small "d" is displayed on the screen. (If necessary, press the Fire2 button on the laser).
Laser Atlanta Advantage	Set the *Range/Mode* option to *Standard (Averaged)* and the *Serial/Format* option to *Trimble Pro XL* .
Leica Disto memo/pro	Set the unit to meters or feet, not feet and inches.
MDL Generation II	No special settings are required.
MDL LaserAce	Set the *Data record* format to *Mode 1* . When using the angle encoder, set the magnetic declination to zero in the Trimble Survey Controller software. The angle encoder in the LaserAce corrects for the magnetic declination.

Note – You must configure the laser rangefinder to update the inclinometer and slope distance readings after each measurement.

Measuring laser points

During a survey, select Measure laser points from the Survey menu to measure laser points as offsets from a known point. Alternatively, to insert a distance into an H.Dist or an S.Dist field, tap the Laser softkey and measure the distance with the laser.

If the Auto measure field in the survey style Laser rangefinder option is set to Yes, Trimble Survey Controller instructs the laser to take a measurement when you tap the Laser softkey.

If the Trimble Survey Controller software receives only a distance measurement from the laser, another screen is displayed with the measured distance in a *Slope distance* field. Enter a vertical angle if the measured distance was not horizontal.

Note – If you are using a laser without a compass, you must key in a magnetic azimuth before the Trimble Survey Controller software can store the point.

Note – Allow the laser to settle for a few seconds before you take a measurement with it. If you enter a value for magnetic declination in the laser, make sure the Cogo setting in Trimble Survey Controller is null.

Radios − for GPS

Radios are used for real−time surveys.

A radio icon is displayed in the status bar when there is a radio link between the base and rover receivers. If there are fewer than 4 satellites, no position is computed and the radio icon disappears. If there is a problem, various messages appear in the status line to give you extra information about the radio.

Configure the Rover radio or Base radio type when you create or edit the Survey Style.

To change the frequency or the mode of a radio using the Trimble Survey Controller software:

1. Connect the radio to the controller directly or through a receiver.
2. In a real−time Survey Style, select Base radio.
3. Set the Controller port field or Receiver port field, depending on your connection.
4. Tap the Connect softkey and follow the prompts.
5. Do the same for the Rover radio option.

If your radio does not appear on the list, select Custom radio and define the receiver port, baud rate, and parity. **Note** − You can use a cellular modem.

If you select *Base radio* and set the *Type* field to *Custom radio* or *Cellular modem* , you can also enable *Clear To Send (CTS)* .

Warning − Do not enable CTS unless the receiver is connected to a radio that supports CTS.

The GPS Total Station 5700, 4800, and 4700 receivers support RTS/CTS flow control when you enable CTS. If you are using a GPS Total Station 4700 or 4800 receiver, use receiver firmware version 1.20 or later.

For more information on CTS support, refer to the documentation supplied with your receiver.

Cellular Modem

You can use cellular modems at both the base and rover receivers, but the modems must support Hayes compatible AT commands.

Configure the Cellular modem when you create or edit a Survey Style.

To configure the rover radio for use with a cellular modem:

1. Select Configuration / <Selected Survey Style> / Rover radio.
2. In the Type field, select Cellular modem.
3. In the Hang up field, enter the command that the Trimble Survey Controller software sends to the modem to instruct it to end communication.
4. In the Dial prefix field, enter the command that the Trimble Survey Controller software sends to the modem to instruct it to dial a number.

5. In the Number to dial field, enter the phone number of the base station modem.

To configure the base radio for use with a cellular modem:

1. In the Survey Style, select Base radio.
2. In the Type field, select Cellular modem.
3. In the Init string field, enter the command that the Trimble Survey Controller software sends to the modem to instruct it to start communication.
4. In the Hang up field, enter the command that the Trimble Survey Controller software sends to the modem to instruct it to end communication.

Note − In the Init string field for the base radio, the command must leave the modem in auto−answer mode. Alternatively, set the auto−answer mode separately.

The following table shows cellular modem commands and information.

Field	Information required	Function of command
Init string (optional)	Command **Tip −** For some cellular modems you must enter a Personal Identification Number (PIN). Usually the command is as follows: **AT+CPIN="****"** (where **** is the PIN) If you use a PIN, add the command to the end of the value in the Init string field.	Starts communication
Hang up	Command	Ends communication
Dial prefix	Command	Dials a number
Number to dial	Phone number of the base station modem. **Note** − Use a comma (,) to send a short delay, for example, to separate the area code from the number.	
Dial suffix (optional)	Command	Software sends to the modem after it has dialled the number.
Note − The *Dial prefix* , *Number to dial* , and *Dial suffix* values are concatenated to send to the modem.		
Post connect (optional)	Information sent from rover to base once connection is confirmed (for example, log−in name and password). **Note** − Use a carat (^) to send a carriage return and a 3−second delay to the base system, for example, to separate a log−in name from a password.	

Duplicate Point Tolerance

In a conventional survey, when you attempt to add a point name that already exists, no message appears to warn you that the point already exists. This is because you may want to regularly measure points on both faces.

In a GPS survey, when you attempt to add a point name, Trimble Survey Controller warns you if a point of the same name already exists.

In a real−time GPS survey or conventional survey, you can set the tolerance for a duplicate point warning. Specify the maximum distance that a new point can be from an existing point. A duplicate point warning appears when you try to store a new point only if it is a duplicate point outside the tolerance set. If the new point has the same name as an existing point, and is closer to the existing point than the tolerance specified, the point is stored as a new point, and does not overwrite the existing point.

If the new point is further from the original point than the tolerance specified, you can choose what to do with the new point when you store it.
The options are:

- Discard
- Rename
- Overwrite − Overwrite and delete the original point, and all other points of the same name and the same (or lower) search class.
- Store as check − Store with a lower classification.
- Store another − Store the point, which can then be averaged in the office software. The original point is used in preference to this point.

To configure the Duplicate point tolerance:

1. Select the Survey Style.
2. Select Duplicate point tolerance.
3. Specify the horizontal and vertical tolerances. If you set these distances to zero, a warning is always given.

Face 1 and Face 2 observations

When you carry out two−face observations in a conventional survey, Trimble Survey Controller checks that the Face 1 and the Face 2 observations to a point are within a preset tolerance. If they are, a Matched pair record and Mean turned angle record is stored.

If the observations are out of tolerance, the Observation: Out of tolerance screen appears.
The options are:

- Discard − discard the observation without storing.
- Rename − rename to a different point name.
- Store as check − store with a classification of Check.
- Store another − store the observation and the matched pair.
- Store and reorient − (This option only appears if you are observing a backsight point.) Store another observation that will provide a new orientation for subsequent points measured in the current station setup. Previous observations are not changed.

Note − If the target height changed between the Face 1 and Face 2 observations, Trimble Survey Controller reduces both observations to HA HD VD, and produces a matched pair that is the mean HA HD VD.

When you make the next observation to the same point, the Trimble Survey Controller software performs a duplicate point tolerance check using the best point in the database and the point just measured:

- If it is within tolerance, the new observation is stored.
- If it is out of tolerance, the Duplicate point: Out of tolerance screen appears.

Feature and Attribute Library

Use a predefined feature and attribute library in a survey, transfer one from Trimble Geomatics Office, or create a feature code list in Trimble Survey Controller. You can also transfer a data dictionary (.ddf) file using Data Transfer.

To create a new feature code list:

1. From the main menu, select Configuration / Feature and attribute libraries.
2. Tap the New softkey.
3. Enter the name of the list.
4. Tap Edit to add, delete, or edit codes.

   Note – Feature codes can not contain more than 20 characters.

5. To set the display properties for the feature code, tap the Display softkey. If the Display coded features option is selected in the map options, Trimble Survey Controller draws lines between points based on the specified display properties.

   Note – To copy or delete a feature and attribute library, use Windows Explorer. For more information, see Windows Explorer.

   Feature code names that contain spaces appear in the Trimble Survey Controller software with a small dot between the words, for example, Fire·Hydrant. These dots do not appear in the office software.

   Some symbols are not supported in feature and attribute libraries, for example ! and [ ]. If you use unsupported symbols when creating a library in the office software, the Trimble Survey Controller software converts them to the underscore symbol "_" when they are transferred.

Control Commands

With feature codes, points that have the same code can be joined by lines or represented by symbols on a plan. In a topographical survey, for example, survey the center line of a road and give it the code CL. Then set up the office software that processes the feature codes so that all points with the code CL are joined together.

However, if you survey the centerline of two different roads, and the points all use the code CL, the two centerlines will be joined together. To prevent this, use the code CL START for the first point on the first center line. Observe a succession of points with the code CL, then use the code CL END for the final point on the first center line.

Set up the feature code library for the office software to recognize these start and end codes as control commands.

Instruments

Instrument Menu

This menu provides information about the instrument connected to the Trimble Controller, and is used configure the settings.
Available options depend on the instrument that is connected.

For more information on GPS instrument controls, see the following topics:

Satellites

Receiver Files

Position

Receiver Status

Options

Navigate to Point

For more information on conventional instrument controls, see the following topics:

Station Setup Details

Target Details

Electronic Level

Direct Reflex

Instrument Controls

Tracklight

Autolock

Instrument Settings

Radio Settings

Adjust

Survey Controller Basic

Satellites

To see information about the satellites currently being tracked by the receiver, tap the satellite icon on the staus bar, or select Instrument / Satellites from the main menu. The satellite number is displayed, along with its azimuth, elevation, signal−to−noise ratios, and flags.

In the list of satellites, each horizontal line of data relates to one satellite. A satellite is identified by the space vehicle number in the *SV* column. Azimuth (*Az*) and elevation (*Elev*) define a satellite's position in the sky. The signal−to−noise ratios (*SNRL1* and *SNRL2*) indicate the strength of the respective GPS signals. The greater the number, the better the signal. If L1 or L2 are not being tracked, then a dashed line (−−−−−) appears in the appropriate column.

The check mark on the left of the screen indicates whether that satellite is in the current solution, as shown in the following table.

Situation	What a check mark indicates
No survey is running	Satellite is being used in the current position solution
RTK survey is active	Satellite is common to the base and rover receivers
Postprocessed survey is running	Satellite for which one or more epochs of data have been collected

You can also select the following options:

- To see more information about a particular satellite, tap the appropriate line.
- To stop the receiver tracking a satellite, tap the Disable softkey.

  Note − If you disable a satellite, it remains disabled until you enable it again. Even when the receiver is switched off, it stores that a satellite is disabled. WAAS satellites cannot be disabled.

- To see a sky plot, tap the Plot softkey. The plot screen can be oriented towards the sun or towards North. Double−tap a satellite to view more information about it.
  - The outside circle represents the horizon or 0° elevation.
  - The inner dashed circle represents the elevation mask setting.
  - The SV numbers on the diagram are placed in the position of that particular satellite.
  - The zenith (90° elevation) is the center of the circle.
  - Satellites that are tracked but not in the solution appear in reverse video (white on black).
- To see the list of satellites, tap the List softkey.
- To change the elevation mask and the PDOP mask for the current survey, tap the Options softkey.
- In a real−time survey, tap the Base softkey to see which satellites are being tracked by the base receiver. No values appear in the *Az* and *Elev* columns, as this information is not included in the correction message broadcast by the base.
- In a postprocessed survey, the L1 softkey appears in the Satellites dialog. Tap it to display a list of cycles tracked on the L1 frequency for each satellite.

The value in the *CntL1* column is the number of cycles on the L1 frequency that have been tracked continuously for that satellite. The value in the *TotL1* column is the total number of cycles that have been tracked for that satellite since the start of the survey.

- With a dual−frequency receiver, the L2 softkey appears in the Satellites dialog. Tap it to display a list of cycles tracked on the L2 frequency for each satellite.
  The SNR softkey appears. Tap it to return to the original screen and view information about the signal−to−noise ratio for each satellite.

Receiver Files

This option is available when a GPS Total Station 5700, 4800, or 4700 receiver is in use. Use it to copy and delete files in the connected receiver.

If the controller is connected to a 5700 receiver that supports this function, you can transfer files to and from the Trimble controller to the survey data card on the receiver.

To transer files from the receiver to the controller:

1. From the main menu, select Instrument / Receiver files / Import from receiver.
   The list that appears shows all files stored in the receiver.
2. Tap the file(s) to transfer. A check mark appears next to the selected files.

   Note − To see more information about a file, highlight the file name and tap the Info softkey. To delete a file, highlight the file name and tap the Delete softkey.

3. Tap the Import softkey. The Copy file to Trimble Controller screen appears.
4. Tap the Start softkey.

To transfer files from the controller to the receiver:

1. From the main menu, select Instrument / Receiver files / Export to receiver.
   The list that appears shows all files stored in the \Trimble Data folder in the controller.
2. Tap the file(s) to transfer. A check mark appears next to the selected files.
2. Tap the Export softkey.
3. Tap the Start softkey.

Position

This function displays the current position of the base or rover GPS antenna.

A projection and datum transformation must be defined to view grid coordinates.

The precision of this position depends on which survey method is selected. Precisions are:

- +/− 10 m (no current survey)
- +/− 10 m (postprocessed survey)
- +/− 0.01 m (RTK survey)

To see the current position, from the main menu, select Instrument / Position.

If the antenna height is defined, the software calculates the position of the roving antenna. To view the position of the base antenna as well, tap the Base softkey.
Tap the Options softkey to find out whether the position is shown as WGS−84, local, or grid.

Receiver Status

To view the power and memory status of the connected GPS receiver, the GPS time, and the GPS week, select Instrument / Receiver status from the main menu.

Options

To view the configuration of the connected GPS receiver, select Instrument / Options from the main menu.

Alternatively, tap the receiver icon on the status bar.

Navigate to Point

You can navigate to a point without using a radio link, or without a survey running. If there is no radio link, all positions are autonomous. If radio corrections are received but the receiver is not initialized, all positions are Float solutions. When you start the Navigate to point function, it uses the settings in the last GPS Survey Style that you used.

If you are using a GPS receiver that can track WAAS signals, when the radio link is down you can use WAAS positions instead of autonomous positions. To use WAAS positions, set the *WAAS* field in the survey style to On.

To navigate to a point:

1. From the map, select the point you want to navigate to.
2. Tap and hold on the map and select Navigate to point from the shortcut menu. Alternatively, select Instrument / Navigate to point from the main menu.
3. If you want to display cross−track information, set the Navigate field to From fixed point or From start position.
4. Fill in the other fields as required and tap Start. The graphical display screen appears.
5. Use the arrow to navigate to the point, which is shown as a cross. When you are close to the point, the arrow disappears and a bull's−eye symbol appears.
6. When you are on the point, the bull's−eye symbol covers the cross.
7. Mark the point if required.

Station Setup Details

To view the instrument type and current station setup information when the controller is connected to a conventional instrument, select Instrument / Station setup details from the main menu.

Alternatively, if you are using a mechanical instrument (not a servo or robotic instrument), tap the Instrument icon on the status bar.

Laser pointer

In a Direct Reflex survey, the laser pointer eliminates the need to look through the telescope when measuring DR points.

Note − When using a 5600 DR200+ instrument, the laser pointer is not coaxial with the telescope.

To turn on the laser:

1. Tap the Instrument icon in the status bar (or the Trimble key on the ACU) to open the Trimble Functions screen.
2. Click the Laser pointer button.

Note − If DR is not yet enabled, turning on the laser pointer enables it. If you turn off the laser pointer, the instrument remains in DR mode. However, if you turn off DR mode, the laser is automatically turned off.

Electronic Level

To level the instrument electronically from startup:

1. Establish a connection between the controller and the instrument. The Electronic level screen appears as part of the connection process.
2. Turn the footscrews to center the bubbles for the sighting and trunnion axis.

Note − The electronic level is in Coarse mode, because the compensator has not been initialized.

Once accepted the instrument will initialize the compensator (unless the Disable compensator check box is selected).

To level the instrument electronically during a survey:

1. From the main menu, select Instrument / Electronic level.
2. Turn the footscrews to center the bubbles for the sighting and trunnion axis.

Note − The electronic level is now in Fine mode, because the compensator has already been initialized (unless the Disable compensator check box was selected last time the instrument was levelled).

The electronic level only works with Trimble 3600 and 5600 instruments.

For the Trimble 3600 instrument only, the laser plummet is also activated while the Electronic level screen is open.

Direct Reflex

When connected to an instrument with Direct Reflex (DR), select Instrument / Direct Reflex to configure the DR settings. Select DR to enable / disable DR measurement.

Select DR to enable / disable DR measurement.

The following settings are available if supported by the instrument:

- Enter a standard deviation to predefine the accuracy of the DR measurement. The decreasing standard deviation is displayed on the status line.
- Enable weak signal to accept measurements at a lower accuracy.
- Enter a minimum and maximum distance to restrict the DR measurement range. This can be used to avoid a result from a distant or intermittent object.

When using a Trimble 5600 or 3600 instrument with DR, target 2 is dedicated for DR use, so configure the prism constatnt and target height appropriately.
When you turn on DR, Trimble Survey Controller automatically switches to target 2. When you turn off DR, the software returns to target 1.
Alternatively, select target 2 to enable DR. Select target 1 to disable DR and return the instrument to its previous state.

Instrument Controls

If using a conventional servo or robotic instrument , you can use the Instrument controls options to control the movement of the instrument.

To do this:

1. From the main menu, select Instrument / Instrument controls. Alternatively, tap the Instrument icon on the status bar and click the Turn to button on the Trimble Functions form.
2. Select an instrument control method to turn the instrument to a specified angle or point:

- to a horizontal or vertical angle only, enter the angle in the Turn to field.
- to a horizontal and vertical angle, enter the horizontal angle in the Turn to HA field, and the vertical angle in the Turn to VA field.
- to a specified point, enter a point name in the Point name field.
- by distance, enter the distance from your current position to the point where the instrument lost lock.

Tap **Turn** . The instrument turns to the angle(s) or point you entered.

Tip − Use the ACU keys to turn the instrument. For example, in Stakeout:

- horizontally only
- vertically only
- horizontally and vertically
- change face

For information on other methods, see:

- Robotic instrument
- Map of current job

Search controls

The search controls define the horizontal and vertical range of the search window. Modify the controls to increase or decrease the size of the window that the instrument searches.

Tracklight

When connected to a Trimble 3600 or 5600 instrument, operate the Tracklight as follows.

To set the intensity of the guide−light:

1. From the main menu, select Instrument / Tracklight.
2. Select the Enable tracklight check box.
3. From the drop down list in the Intensity field, select Normal or High.

To switch on the tracklight or switch it off:

1. Tap the Trimble functions icon.
2. Tap the Tracklight button in the Trimble functions screen.

Autolock

If Autolock is available on the 5600 instrument, use it to lock on to and track a remote target.

To enable/disable Autolock, do one of the following:

- ♦ Press the Autolock key ( ).
- ♦ Tap the instrument icon on the status bar (or the Trimble icon on the ACU) to open the Trimble Functions screen. Then select the Autolock icon.

- ♦ Select Instrument / Autolock from the main menu.
  This provides additional Autolock controls:
  − Advanced lock to automatically lock on to a remote target
  − Autosearch to automatically perform a horizontal search when lock is lost to a remote target

Note − Do not use Autolock during the collimation or Horizontal tilt axis tests. For more information, see Instrument Adjustment .

Instrument Settings

When connected to a Trimble 3600 or 5600 instrument, select Instruments / Instrument settings from the main menu to access the Instrument settings dialog.

Use this dialog to view and set specific controls on the instrument, including:

- instrument model
- instrument firmware version
- long range mode
- signal volume
- EDM power save mode
- target test
- reticle illumination

Long range

Use the long range mode when a strong instrument signal is required for measuring to targets more than one kilometer (about 0.6 miles) away. This option is not available for DR instruments.

EDM power save

The power save mode turns off the EDM when the instrument is not measuring a distance. The instrument icon appears without the EDM indicator (*).
When the power save mode is off, the EDM is always turned on to receive a signal.
Except for the DR Standard, the power save mode is not available when the Trimble controller is connected to a Direct Reflex instrument.

Target test

The target test is used primarily in Survey Controller Basic when measuring a distance that is to be displayed as a dead record.
If the instrument is moved more than 30 cm from where the last measurement was observed, the HA and VA are updated but the SD reverts to "?" to avoid mistaking the next target's distance for the previously measured target's distance.

Radio Settings

These settings are used with a conventional instrument in robotic mode.

Radio Channel

Up to 12 channels can be used depending on how many are supplied or permitted by authorities in each country. Select a channel when the ACU is attached to the instrument. Then, when the ACU is detached and connected to the external radio, this radio will automatically receive the same channel as the instrument.

Station and Remote Address

To avoid conflicting with another user on the same radio channel, give your instrument and radio a unique address. Enter a station and a remote address between 0 and 99.

Note − In some countries, you must obtain a radio license before using your system on a working site. Make sure that you check the regulations for your country.

Instrument Adjustment

Select Instrument / Adjust from the main menu to complete the following tests:

HA VA Collimation

Horizontal tilt axis

Autolock collimation

Compensator calibration

HA VA Collimation and Horizontal tilt axis test

Set up the instrument on a stable surface and follow the prompts to complete the test. Current collimation values are displayed in each test (Horizontal collimation/Vertical collimation and Horizontal tilt axis). Press the keys lightly to avoid bumping the instrument. To take a measurement, aim at the target. Take the first measurement, turn the instrument away, and then re−aim. Take the second measurement.

Note − Do not use Autolock during Collimation or Horizontal tilt axis tests.

Position the instrument as follows:

1. Both tests − at least 100 m from the target.
2. Collimation − on the horizontal plane (<5°)
3. Hz tilt test − at least 14° from the horizontal plane.

You must take a minimum of two observations on each face.

Final collimation values must be within 0.02 gon (= 0°01'05") of standard values. If not, adjust the instrument mechanically.

Autolock collimation

This option is available only for instruments with Autolock.
Set up the instrument on a stable surface and follow the prompts. Press the keys lightly to avoid bumping the instrument. Ensure that there are no obstructions between the instrument and the target, which must be at least 100 m apart.

Compensator calibration

To calibrate the compensator in a 3600 instrument:

1. Select Instruments / Adjust / Compensator calibration.
2. When prompted, turn the instrument 180° to 0°.
3. Tap Accept.

Note − This option is not available for the 5600 because the compensator is calibrated when the instrument is levelled.

Survey Controller Basic

Survey Controller Basic is available when you connect a controller to a Trimble 3600 or 5600 instrument. From the main menu, select Instrument / Survey Controller Basic to display current values of the instrument and perform simple distance or angular checks.

Note − You can not store measurements in Survey Controller Basic.

The following table shows Survey Controller Basic functions.

Tap the ...	to ...
Trimble functions icon	access the Trimble functions screen
Instrument icon on the status bar	
Target icon	set or modify the target height
Zero softkey	set the instrument horizontal circle to 0
Set softkey	set the instrument height and horizontal circle
Options softkey	modify the correction values used in Survey Controller Basic
Display view button	switch the display between HA, VA, SD and HA, HD, VD
Press the ...	**to ...**
Distance key	measure a distance and continually update the the horizontal and vertical angles **Note** −

	The distance reverts to ? if target test is enabled and the instrument is turned more than 30 cm from the target.
Enter key	measure a distance and fix the horizontal and vetical angles

Note − When a survey is running you can not change:

- the instrument's horizontal circle
- correction values

Trimble Functions

To access the Trimble functions screen, tap the instrument icon on the controller screen, or the Trimble key on the ACU.

The Trimble functions screen is available for conventional total stations. Use it to control commonly used instrument functions, and to change instrument settings. Depending on the instrument that the controller is connected to, the following functions may be available:

- STD (EDM Standard mode)
- FSTD (EDM Fast Standard mode)
- TRK (EDM Tracking mode)
- Electronic level
- DR (Direct Reflex) mode
- Laser (Laser pointer for DR instruments)
- Tracklight
- Change face
- Joystick
- Turn to
- Autolock
- Search

Geodimeter users

Former Geodimeter users can enter a Geodimeter program number in the Trimble functions screen to launch the corresponding Trimble Survey Controller function. For example, Geodimeter program 26 (Compute join) is the same as the Trimble function Compute inverse.

Joystick

If you are operating a robotic instrument at the remote end (target), use the Joystick softkey to turn the instrument towards the target when lock has been lost.

To turn the instrument towards the target:

1. Tap the Joystick softkey.

2. Tap an arrow on the screen or press the up, down, left, or right arrow keys to turn the instrument. The instrument turns in the direction indicated by the solid/filled arrow.

   Note − When the instrument is on Face 2, the up and down arrows are reversed. For example, if you press down the instrument turns upwards. If you press up it turns downwards.

3. When using a Trimble 5600, turn the instrument as shown in the following table.

Tap this arrow	to turn the instrument
first left or right	horizontally 12^0
second left or right	horizontally 120^0
first up or down	vertically 1^0
second up or down	vertically 5^0

4. When using a Leica TPS1100 series instrument, select the same direction to increase the instrument turning speed. The second directional arrow becomes solid. Select the same arrow again to decrease the speed.
5. Tap the Esc softkey or another arrow to stop the instrument from turning. The directional arrow becomes hollow. The instrument now points towards the target.

To make the instrument locate and lock on to the target, tap the Search softkey.
The message "Searching..." appears and the instrument starts searching for the target.

The search results appear in the status line as messages:

- Target Locked − indicates that the target has been located and tracking locked.
- Target Detected − indicates that the target has been located (when the instrument is in servo mode).
- No Target − indicates that the target was not located.

Coordinate System

Coordinate System

A coordinate system consists of a projection and datum transformation and, sometimes, additional horizontal and vertical adjustments.

When you create a job, select a coordinate system by one of the following methods:

- Scale factor only
- Select from library
- Key in parameters
- No projection/ no datum

If you need to perform a GPS site calibration, or change the parameters manually after selecting the coordinate system, select Files / Properties of current job / Coord. sys.

Where the job parameters are keyed in, or a calibration is used, the coordinate system settings are displayed as "Local site".

If you modify the coordinate system by calibration or by manually changing the parameters, you must do so before you compute offsets or intersection points, or stake out points in the local coordinate system.

To set up a ground coordinate system for the job, choose the Select from library or Key in parameters option.

Scale Factor Only

Use this projection type when you are doing a conventional−instrument only survey with a local scale factor. This option is useful for areas that use a local scale factor to reduce distances to the local coordinate system.

To choose a Scale factor only projection:

1. Create a new job.
2. Select Scale factor only from the Select coordinate system menu.
3. Enter a value in the Scale field and tap Store.

Projection

A projection is used to transform local geodetic coordinates into local grid coordinates.

GPS coordinates are relative to the WGS−84 ellipsoid. To work in local grid coordinates, you must specify a projection and datum transformation.

You can specify a projection:

- when a job is created and you have to choose a coordinate system (select from a list, or key in)
- during a survey (you calculate values by performing a calibration)
- in the Trimble Geomatics Office software, when the data is transferred.

Do not change the coordinate system or calibration after you have staked out points, or computed offset or intersection points.

If a projection and datum transformation are specified, you can reduce any discrepancies between the WGS−84 coordinates and the local grid coordinates by performing a site calibration.

Ground Coordinate System

To set up a ground coordinate system, when you create a job:

1. Specify a coordinate system by choosing the Select from library, or Key in parameters option.
2. To use ground coordinates with the selected coordinate system, tap the Page down button, and then from the Coordinates field, do one of the following:
    - To key in a scale factor, select Ground (Keyed in scale factor).
    - To let the Trimble Survey Controller software calculate the scale factor, select Ground (Calculated scale factor). Enter values in the Project Location group to compute the scale factor.

   The Trimble Survey Controller applies the ground scale factor to the projection.

3. To add offsets to the coordinates, enter a value in the False northing offset and False easting offset field as required.

Note : Use offsets to differentiate ground coordinates from unmodified grid coordinates.

Project Height

The project height can be defined as part of the coordinate system definition when creating a new job. To find it, select Files / Properties of current job for a coordinate system in either the Library or Key in projection dialogs.

If a point has no elevation, the Trimble Survey Controller software uses the project height in Cogo calculations. If you combine GPS and 2D conventional observations, set the Project height field to approximate the height of the site. This height is used with 2D points to calculate grid and ellipsoid distances from measured ground distances.

In 2D surveys where a projection has been defined, enter a value for the project height that approximates the height of the site. You need this value to reduce measured ground distances to ellipsoid distance, and to compute coordinates.

If you edit the project height (or any other local site parameter) after calibrating, the calibration becomes invalid and must be reapplied.

No Projection / No Datum

To select a coordinate system with an undefined projection and datum, when you create a job:

1. Tap the Coord. sys button and select No projection/no datum.
2. Set the *Coordinates* field to *Ground* , and enter a value (average site height) in the *Project height* field to use ground coordinates after a site calibration. Alternatively, set the *Coordinates* field to *Grid* .
3. Select the *Use geoid model* check box, and select a geoid model to calculate a Geoid/Inclined plane vertical adjustment after a site calibration.

Any points measured using GPS are displayed only as WGS84 coordinates. Any points measured using a conventional instrument are displayed with null (?) coordinates.

The Trimble Survey Controller software performs a calibration that calculates a Transverse Mercator projection and a Molodensky three−parameter datum transformation, using the supplied control points. The project height is used to compute a scale factor for the projection so that ground coordinates can be computed at elevation.

Horizontal Adjustment

A horizontal adjustment is a least−squares adjustment that is applied to minimize the differences between transformed grid coordinates and local control points.

Horizontal and vertical adjustments are calculated if you perform a calibration when a projection and datum transformation are defined.

Trimble recommends that you use a minimum of four control points to compute a horizontal and vertical adjustment.

Alternatively, you can key in horizontal adjustment parameters when you start a new job.

Vertical Adjustment

This is a least−squares adjustment that is applied to convert (ellipsoid) heights to elevation. It is computed when you do a calibration. A minimum of one point is required to compute the adjustment. If more points are used, an inclined plane adjustment can be calculated.

If you have a geoid model selected, you can choose to use only the geoid model, or to use the geoid model and do an inclined plane adjustment. Trimble recommends that you use a geoid model to obtain more accurate orthometric heights from your GPS measurements.

You can specify the type of vertical adjustment when you create a job. Set this parameter when you choose the coordinate system. You can also key in the parameters when you create a job. Alternatively select Files / Job / Coordinate system from the main menu, then select Vertical adjustment and key in the parameters.

Coordinate Systems

Before starting a GPS survey, decide which coordinate system to use. This topic discusses some things to consider when making this decision.

Choosing a Coordinate System for a Conventional Survey

Choosing a Coordinate System for a GPS Survey

GPS Coordinate System

Local Coordinate Systems

Calibration

Using a Datum Grid File

Using a Geoid Model

Working with Ground Coordinates

If you intend to combine conventional observations with GPS measurements, read the whole of this topic. To make only conventional observations, see Choosing a Coordinate System for a Conventional Survey.

Choosing a Coordinate System for a Conventional Survey

When surveying using conventional equipment, it is important to choose a suitable coordinate system.

For example, if a job is to combine GPS measurements with conventional observations, choose a coordinate system that lets you view GPS observations as grid points. This means that you must define a projection and a datum transformation. For more information, see Creating a job.

Note − You can complete the field work for a combined survey without defining a projection and a datum transformation, but you will not be able to view the GPS observations as grid coordinates.

If you want to combine GPS measurements with two−dimensional conventional observations, specify a project height for the job. For more information, see Project Height.

If a job is to contain conventional observations only, select one of the following when you create the job:

- A typical coordinate system and zone that provide mapping plane coordinates. For example, State Plane coordinates.

- Scale factor only.

  In a conventional survey, measurements are made at ground level. To compute coordinates for these measurements, observations are reduced to grid level. The specified scale factor is applied to measured distances to reduce them from ground to grid.

  The *Scale factor only* option is useful for areas that use a local scale factor to reduce distances to grid.

Tip − If you are not sure what coordinate system to use, select the *Scale factor only* projection and enter a scale factor of 1.000.

Choosing a Coordinate System for a GPS Survey

When you create a new job, the Trimble Survey Controller software prompts you to define the coordinate system you are using. You can select a system from the library, key in the parameters, select Scale factor only, or select no projection and no datum transformation. For more information, see Creating a job.

The most rigorous coordinate system consists of four parts:

- datum transformation
- map projection
- horizontal adjustment
- vertical adjustment

Note − To conduct a realtime survey in terms of local grid coordinates, define the datum transformation and map projection before starting the survey.

Tip − In the *Coordinate view* field, select *Local* to display local geodetic coordinates. Select *Grid* to display local grid coordinates.

When WGS84 coordinates are transformed onto the local ellipsoid, using a datum transformation, local geodetic coordinates result. Local geodetic coordinates are transformed into local grid coordinates using the map projection. The result is Northing and Easting coordinates on the local grid. If a horizontal adjustment is defined, it is applied next, followed by the vertical adjustment.

GPS Coordinate System

GPS measurements are referenced to the 1984 World Geodetic System reference ellipsoid, known as WGS84. However, for most survey tasks, results in terms of WGS84 have little value. It is better to display and store results in terms of a local coordinate system. Before you start a survey, choose a coordinate system. Depending on the requirements of the survey, you can choose to give the results in the national coordinate system, a local coordinate grid system, or as local geodetic coordinates.

When you have chosen a coordinate system, search your survey archives for any horizontal and vertical control points in that coordinate system that are in the area to be surveyed. You can use these to calibrate a GPS survey. For more information, see Calibration.

Local Coordinate Systems

A local coordinate system simply transforms measurements from a curved surface (the earth) onto a flat surface (a map or plan). Four important elements constitute a local coordinate system:

- local datum
- datum transformation
- map projection
- calibration (horizontal and vertical adjustments)

When you survey using GPS, consider each of these.

Local Datum

Because an exact model of the earth's surface cannot be created mathematically, localized ellipsoids (mathematical surfaces) have been derived to best represent specific areas. These ellipsoids are sometimes referred to as local datums. NAD83, GRS80, and AGD66 are examples of local datums.

Datum Transformation

GPS is based on the WGS84 ellipsoid, which is sized and positioned to best represent the entire earth.

To survey in a local coordinate system, the WGS84 GPS positions must first be transformed onto the local ellipsoid using a datum transformation. Three types of datum transformation are commonly used. Alternatively, you can choose not to use a transformation at all.

The datum transformations are as follows:

- three−parameter − This assumes that the rotational axis of the local datum is parallel with the rotational axis of WGS84. The three−parameter transformation involves three simple translations in X, Y, and Z. The three−parameter transformation that the Trimble Survey Controller software uses is a Molodensky transformation, so there may also be a change in ellipsoid radius and flattening.

Note − Positions on a local datum are commonly called "local geodetic coordinates". The Trimble Survey Controller software abbreviates this to "Local".

- seven−parameter − This is the most complex transformation. It applies translations **and** rotations in X, Y, and Z, as well as a scale factor.
- datum grid − This uses a gridded data set of standard datum shifts. By interpolation, it provides an estimated value for a datum transformation at any point on that grid. The accuracy of a datum grid depends on the accuracy of the gridded data set it uses. For more information, see Using a Datum Grid File.

Map Projection

Local geodetic coordinates are transformed into local grid coordinates using a map projection (a mathematical model). Transverse Mercator and Lambert are examples of common map projections.

Note − Positions on a map projection are commonly called "local grid coordinates". The Trimble Survey Controller software abbreviates this to "Grid".

Horizontal and Vertical Adjustments

If published datum transformation parameters are used, slight discrepancies can exist between local control and GPS−derived coordinates. These discrepancies can be reduced using minor adjustments. The Trimble Survey Controller software calculates these adjustments when you use the *Site calibration* function. They are called horizontal and vertical adjustments.

Calibration

Calibration is the process of adjusting projected (grid) coordinates to fit the local control. You can key in a calibration, or let the Trimble Survey Controller software calculate it. You should calculate and apply a calibration before:

- staking out points
- computing offset or intersection points

The rest of this section describes how to perform a calibration using the Trimble Survey Controller software. To key in a calibration, see Creating a job.

Calibration Calculations

Use the Trimble Survey Controller software system to perform a calibration in one of two ways. Each method results in the computation of different components, but the overall result is the same if enough reliable control points (coordinates in your local system) are used. The two methods are:

- If you use published datum transformation parameters and map projection details when creating a job, and if you provide enough control points, the Trimble Survey Controller software performs a calibration that computes horizontal and vertical adjustments. Horizontal control points allow scale error anomalies in the map projection to be removed. Vertical control allows local ellipsoid heights to be transformed into useful orthometric heights.

Tip − Always use published parameters if they exist.

- If you do not know the map projection and datum transformation parameters when creating the job and defining the local coordinate system, specify *No projection / no datum* .

  Then specify whether grid or ground coordinates are required after a site calibration. When ground coordinates are required, you must specify the project height. In this case, the Trimble Survey Controller software performs a calibration that calculates a Transverse Mercator projection and a Molodensky three−parameter datum transformation using the supplied control points. The project height is used to compute a ground scale factor for the projection so that ground coordinates are computed at that height.

The following table shows the output of a calibration when various data is supplied.

Projection	Datum transformation	Calibration output
Yes	Yes	Horizontal and vertical adjustment

Yes	No	Datum transformation, horizontal and vertical adjustment
No	Yes	Transverse Mercator projection, horizontal and vertical adjustment
No	No	Transverse Mercator projection, zero datum transformation, horizontal and vertical adjustment

Local Control for Calibration

Trimble recommends that you observe and use a minimum of four local control points for the calibration calculation. For best results, local control points should be evenly distributed over the job area as well as extending beyond the perimeter of the site (assuming that the control is free of errors).

Tip − Apply the same principles as you would when placing control for photogrammetric jobs. Make sure that the local control points are evenly distributed to the extent of the job area.

Why Calibrations Are Needed

If you calibrate a project and then survey in real time, the Trimble Survey Controller software gives real−time solutions in terms of the local coordinate system and control points.

Operations That Require Calibration

Note − Perform a calibration at any time, but always complete the calibration ***before*** staking out any points, or computing offset or intersection points.

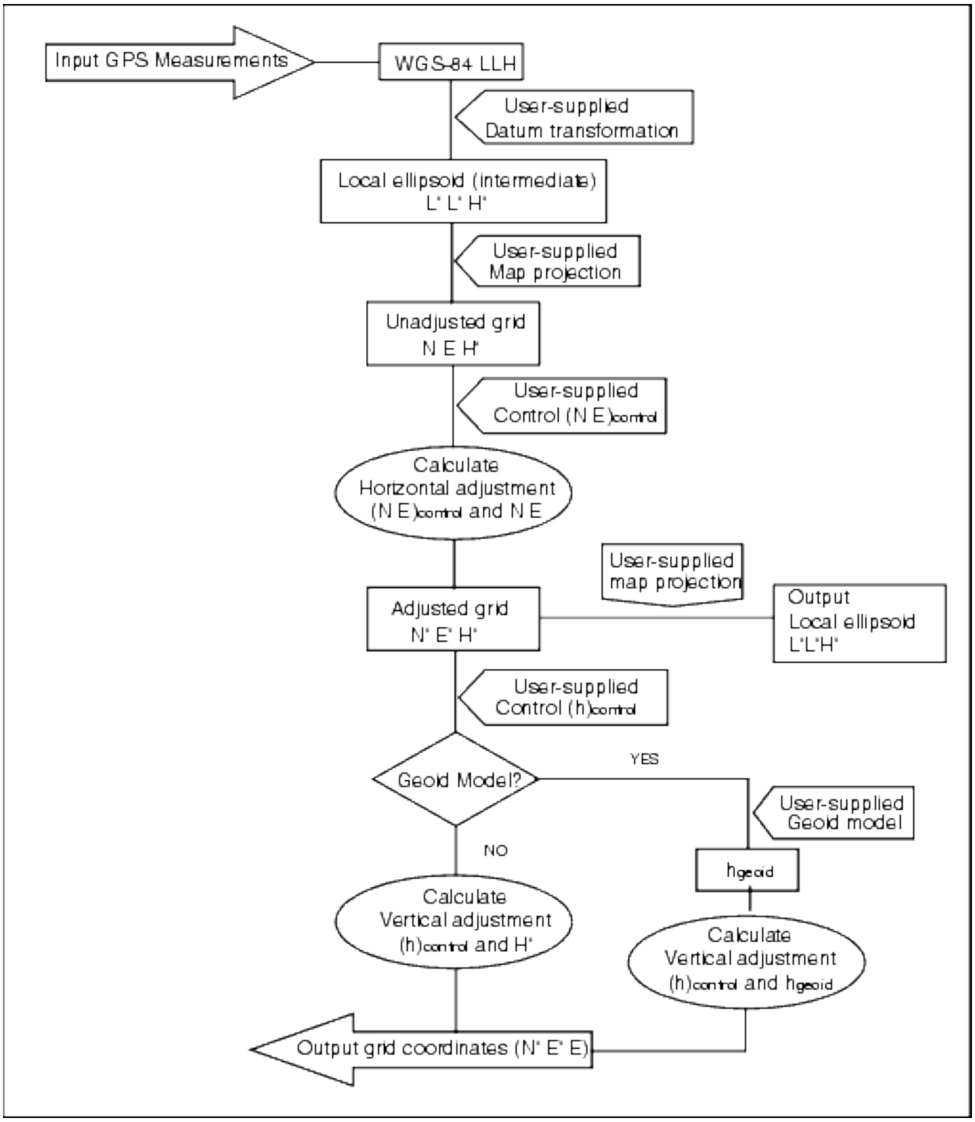
If no datum and no projection are defined, you can only stake out lines and points that have WGS84 coordinates. Displayed bearings and distances are in terms of WGS84.

Specify a projection before staking out arcs, roads, and DTMs. The Trimble Survey Controller software does not assume that WGS84 is the local ellipsoid, so you must also define a datum.

Without a datum transformation, you can only start a real−time base survey with a WGS84 point.

For information on how to perform a calibration, see Calibration.

The following diagram shows the order of calculations performed when a calibration is calculated.



Copying Calibrations

You can copy a calibration from a previous job if the new job is completely encompassed by that initial calibration. If a portion of the new job lies outside the initial project area, introduce additional control to cover the unknown area. Survey these new points and compute a new calibration. Use this as the calibration for the job.

Using a Datum Grid File

A datum grid transformation uses interpolative methods to estimate the value of the datum transformation at any point in the area covered by the datum grid files. Two gridded datum files are required for this interpolation−a latitude datum grid file and a longitude datum grid file. When you export a datum grid using the Trimble Geomatics Office software, the two datum grid files associated with the current project are combined into a single file for use in the Trimble Survey Controller software.

Selecting a Datum Grid File

To select a datum grid file when creating a job, do one of the following:

- Select a coordinate system from the library provided in the Trimble Survey Controller software. Select the *Use datum grid* check box. In the *Datum grid* field, select the file that you want to use.
- Key in the coordinate system parameters. Select *Datum transformation* and set the *Type* field to Datum grid. In the *Datum grid* field, select the file that you want to use.

Note − The U.S. State Plane 1927 and the U.S. State Plane 1983 coordinate systems in the Trimble Survey Controller software use three−parameter transformations.

To select a datum grid file for use in the current job:

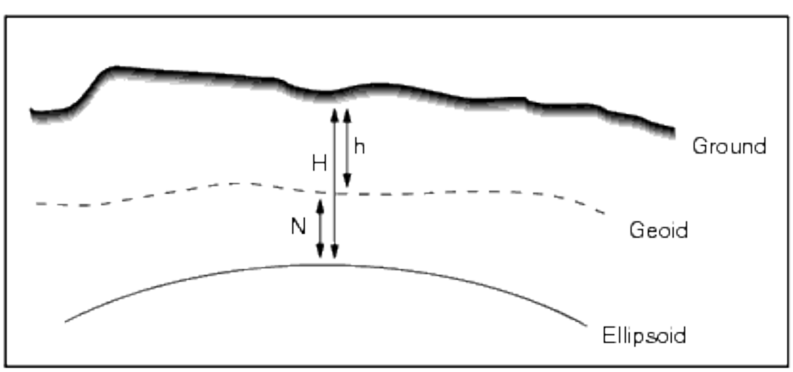
1. From the main menu, select *Files / Properties of current job − Coord. Sys.:*
2. Do one of the following:
    - ♦ If *Key in parameters* is selected, select Next. Select *Datum transformation* and set the *Type* field to Datum grid. In the *Datum grid* field, select the file that you want to use.
    - ♦ If *Select coordinate system* is selected, select Next. Select the *Use datum grid* check box. In the *Datum grid* field, select the file that you want to use.

   The semi−major axis and flattening values for the selected datum grid file are displayed. These details overwrite any already provided by a specified projection.

Using a Geoid Model

The geoid is a surface of constant gravitational potential that approximates mean sea level. A geoid model or Geoid Grid file (*.ggf) is a table of geoid−ellipsoid separations that is used with the GPS ellipsoid height observations to provide an estimate of elevation.

The geoid−ellipsoid separation value (N) is obtained from the geoid model and is subtracted from the ellipsoid height (H) for a particular point. The elevation (h) of the point above mean sea level (the geoid) is the result. This is illustrated in the following diagram.



Note − For correct results, the ellipsoid height (H) must be based on the WGS−84 ellipsoid.

When you select geoid model as the vertical adjustment type, the Trimble Survey Controller software takes the geoid−ellipsoid separations from the geoid file chosen, and uses them to display elevations on the screen.

The benefit of this function is that you can display elevations without having to calibrate on elevation benchmarks. This is useful when local control or benchmarks are not available, as it makes it possible to work "on the ground" rather than on the ellipsoid.

Note − If you are using a geoid model in a Trimble Geomatics Office project, make sure you transfer that geoid file (or the relevant part of it) when transferring the job into a Trimble Controller.

Selecting a Geoid File

To select a geoid file when creating a job, do one of the following:

- Select a coordinate system from the library provided in the Trimble Survey Controller software. Select the *Use geoid model* check box. In the *Geoid model* field, select the file to be used.
- Key in the coordinate system parameters. Select *Vertical adjustment* and set the *Type* field to *Geoid model* or *Geoid/Inclined plane* as required. (Select *Geoid/Inclined plane* if you intend to key in the inclined plane adjustment parameters.)

To select a geoid file for the current job:

1. From the main menu select *Files* / *Properties of current job − Coord. Sys.:*
2. Do one of the following:
    - ♦ If *Key in parameters* screen is selected, select Next. Select *Vertical adjustment* and set the *Type* field to *Geoid model* or *Geoid/Inclined plane* as required. (Select *Geoid/Inclined plane* , if you intend to key in the inclined plane adjustment parameters.)
    - ♦ If *Select coordinate system* screen is selected, select Next. Select *Use geoid model* check box. In the *Geoid model* field, select the file to be used.

Working with Ground Coordinates

If you need coordinates to be at ground level instead of projection level (for example, in areas of high elevation), use a ground coordinate system.

When you select a ground coordinate system, grid distances equal ground distances.

Setting up a Ground Coordinate System

When you set up a ground coordinate system in a Trimble Survey Controller job, the software applies a ground scale factor to the coordinate system projection definition.

To set up a ground coordinate system when creating a job:

1. Define the coordinate system for the job. Do one of the following:
    - ♦ Choose the *Select from library* option to select a coordinate system from the library provided in the Trimble Survey Controller software. Tap Next.
    - ♦ Choose the *Key in parameters* option to key in the coordinate system parameters. Tap Next and select *Projection* .
2. In the *Coordinates* field, choose an option to define the ground scale factor.

Additional fields appear below the *Coordinates* field.

3. If you select the *Ground (keyed in scale factor)* option, enter a value in the *Ground scale factor* field.
4. In the *Project location* group, enter values in the fields as required. Tap the Here softkey to enter the current autonomous position derived by the GPS receiver. The autonomous position is displayed in terms of WGS−84.

   The project height is used with 2D points to reduce ground distances in Cogo calculations. For more information, see Project Height. If you select the *Ground (calculated scale factor)* option, the fields are used to calculate the ground scale factor. When the fields are completed, the computed ground scale factor is displayed in the *Ground scale factor* field.
5. To add offsets to the coordinates, enter a value in the *False northing offset* and *False easting offset* field, as required.

Note − Use offsets to differentiate ground coordinates from unmodified grid coordinates.

To configure a ground coordinate system for the current job:

1. From the main menu, select *Files / Properties of current job − Coord.Sys.:*
2. Do one of the following:
   - If *Key in parameters* screen is selected, tap Next and select *Projection.* Select an option from the *Coordinates* field. Complete the fields below as required.
   - If *Select coordinate system* screen is selected, select Next. Select an option from the *Coordinates* field and complete the fields below as required.

Options Softkey

This softkey appears in only some screens. It allows you to change the configuration for the task being performed.

If you make changes using the Options softkey, they only apply to the current survey or calculation. The changes do not affect the current Survey Style or the job configuration.

Distances setting options

The computed area varies according to the *Distance* display setting. The following table shows the effect of the distance setting on the area calculated.

Distances setting	Computed area
Ground	At the average ground elevation
Ellipsoid	On the ellipsoid surface
Grid	Directly off the grid coordinates

Traverse Options

Use these options to specify how a traverse calculation is adjusted.

Field	Option	What it does
Adjustment method	Compass	Adjusts the traverse by distributing the errors in proportion to the distance between traverse points
	Transit	Adjusts the traverse by distributing the errors in proportion to the northing and easting ordinates of the traverse points
Error distribution		
Angular	Proportional to distance	Distributes the angular error among the angles in the traverse based on the sum of the inverses of the distances between traverse points
	Equal proportions	Distributes the angular error evenly among the angles in the traverse
	None	Does not distribute the angular error
Elevation	Proportional to distance	Distributes the elevation error in proportion to the distance between traverse points
	Equal proportions	Distributes the elevation error evenly among the traverse points
	None	Does not distribute the elevation error

Note – The *Compass* option is the same as the Bowditch method of adjustment.

For information about calculating and adjusting a traverse, see Traverses .

Measure Display

Use the *Measure display* field to define how the observations are displayed on the controller. See the following table for a description of the measure display options.

Option	Corrections applied	Description
HA VA SD (raw)	None	Observation as seen on the conventional instrument display
HA VA SD	Prism constant	Raw observation corrected for prism constant
HA HD VD	Prism constantPressure and temperatureInstrument height and Target height Curvature and refraction	HA and HD from Station ground point to Target ground point and the height difference (VD) between these points
Az VA SD	Prism constantPressure and temperature OrientationCurvature and refraction	Raw observation corrected for prism constant, orientation, and atmospheric effects.
Az HD VD	Prism constantPressure and temperatureOrientationInstrument height and Target height Curvature and refraction	Same as HA HD VD but with backsight orientation applied to the HA
”Grid	Prism constantPressure and temperatureOrientation Instrument height and Target height Curvature and refractionPolar to	Trigonomical calculation of the ”NEE relative to the

	rectangular	instrument The same information as AZ HD VD but presented as rectangular coordinates
Grid	Prism constantPressure and temperatureOrientation Instrument height and Target height Curvature and refraction Polar to rectangular conversionFull coordinate transformation	Reduced grid coordinates

Subdivide Pts Code

When you subdivide a line or an arc, a number of points are created. Use the Subdivide pts code field to specify the code that the new points will be allocated. Choose from the name or the code of the line or arc that is to be subdivided.

Coordinate View Settings

To change the *Coordinate view* setting (when reveiwing a job) for a point that you want to view:

1. When reviewing the database, highlight the point record and tap Enter.
2. Tap Options and set the *Coordinate view* field as required.

If the coordinate value for a point is *?* , one of the following situations may have occurred:

- The point may be stored as a GPS point but with the *Coordinate view* field set to *Local* or *Grid* and a datum transformation and projection not defined. To correct this, change the *Coordinate view* setting to *WGS−84* , define a datum transformation and/or projection, or calibrate the job.
- The point may be stored as a polar vector from a point which has been deleted. To correct this, restore the point.
- In a 2D survey, a projection may have been defined with the project height at null. To correct this, set the project height to approximate the site elevation.

Data Transfer

Data Transfer

This topic describes how to transfer data between a Trimble controller (ACU or TSCe) and an office computer. It lists the types of files that can be transferred, and shows how to connect the equipment for transfer. It then shows how to transfer point names, point codes, and grid coordinates in ASCII format between a Trimble controller and a variety of conventional instruments, data collectors, and office computers.

For more information, see:

Data Transfer between a Trimble controller and the office computer

Using the Trimble Data Transfer Utility

Using Data Transfer with the Microsoft ActiveSync software enabled

Using Microsoft Explorer with the Microsoft ActiveSync software enabled

File conversion

AutoCAD Land Development Desktop software

Data Transfer between Trimble Survey Controller and another device

Transferring ASCII data to and from an external device

Sending ASCII data to an external device

Receiving ASCII data from an external device

Data Transfer between a Trimble controller and the office computer

You can transfer various types of files between a Trimble controller and the office computer, including data collector (.dc) files, feature code files, digital terrain models (DTM), and language files. The data transfer process on the Trimble controller is controlled by the office computer software when you connect the Trimble controller to the office computer and select the appropriate options.

You can transfer files using:

- The Trimble Data Transfer utility
- The Trimble Data Transfer utility with Microsoft ActiveSync software enabled
- Microsoft Explorer with the Microsoft ActiveSync software enabled

To use Microsoft ActiveSync, you must first download and install it. Download it from http://www.microsoft.com/mobile/pocketpc/downloads/activesync35.asp

You can also transfer data to and from aTrimble controller using other Trimble software packages. For more information, refer to the help provided with the Trimble office software.

Note – To transfer ASCII data between a Trimble Controller and other devices, see Data Transfer between the Trimble Survey Controller software and another device .

Using the Trimble Data Transfer Utility

Use the Trimble Data Transfer utility to transfer files between Trimble Survey Controller and the office computer.

Data Transfer uses a device definition to store information about the Trimble controller you connect to it. The first task when using Data Transfer to transfer files to or from a Trimble controller is to create a device definition for it with the Add Device wizard. Once a definition exists for a device, you can use Data Transfer to transfer files to or from it whenever it is connected to your office computer.

For more information on using Data Transfer, refer to the Data Transfer Help.

Using the Trimble Data Transfer Utility with the Microsoft ActiveSync software enabled

To transfer files between the Trimble Survey Controller software and the office computer:

1. Make sure that the Trimble controller and office computer are switched on.
   Disconnect any devices that are communicating with the Trimble controller, and close down any applications to ensure that the communications ports are available.
2. Connect the Trimble Controller to the office computer. Use one of the following methods:
   - Serial cable
   - USB cable (using the Multiport adaptor)
   - Network (Ethernet) card (using the Multiport adaptor)
   - Infrared (if your controller supports it)
3. The Microsoft ActiveSyncicon on your Windows taskbar will start spinning and the Trimble controller prompts you with the message, Connect to desktop. Tap Yes.
4. If the message does not appear on the Trimble controller and the Microsoft ActiveSync icon does not spin, there is a connection problem. Check that the connection settings in the Microsoft ActiveSync software are correct and that there are no applications using the COM port on the Trimble controller. If necessary, perform a soft reset (warm boot). If you are using USB, remove the connector **before** rebooting. For more information on rebooting, refer to the Trimble Survey Controller Getting Started Guide.

5. On the office computer, start the Data Transfer utility. The rest of the procedure is controlled by this software.

Note – To transfer files to and from earlier versions of the Trimble Survey Controller software or Trimble GPS receivers, turn off the Microsoft ActiveSync software and use the Trimble Data Transfer utility directly.

Using Microsoft Explorer with the Microsoft ActiveSync Software Enabled

You can use the Microsoft Explorer and ActiveSync software to move or copy files to or from the Trimble controller. Use the software to transfer files that do not require conversion by Data Transfer (for example, comma delimited (.csv) files). See the table below.

From the Microsoft ActiveSync window:

1. Click **Explore** to move or copy files between the office computer and the Trimble Controller for sharing information. Alternatively, use Windows Explorer to move or copy files.
2. Click **Tools** to backup and restore files.

For more information on using Microsoft ActiveSync software to transfer files, refer to the Microsoft ActiveSync Help.

File Conversion

When data is transferred to and from the Trimble Survey Controller software, some files are converted for use in the Trimble software.

The following table lists the files that are used in the Trimble Survey Controller software and the file types they are converted to when transferred to and from Trimble office software.

PC	Controller	Description	Data Transfer	MS Explorer / ActiveSync
.dc	.job	Survey Controller job files	Y	N
.csv	.csv	Comma Delimited (CSV) files	Y	Y
.txt	.txt	Comma Delimited (TXT) files	Y	Y
.dtx	.dtm	Digital Terrain Model files	Y	N
.ttm	.ttm	Triangulated Terrain Model files	Y	Y
.fcl	.fal	Feature and Attribute Library files	Y	N
.ddf	.fal	Data Dictionary files	Y	N
.ggf	.ggf	Geoid Grid files	Y	Y
.cdg	.cdg	Combined Datum Grid files	Y	Y
.pgf	.pgf	UK National Grid files	Y	Y
.dxf	.dxf	Background Map files	Y	Y

.ini	.dat	Antenna files	Y	N
.lng	.lng	Language files	Y	Y
.wav	.wav	Sound files	Y	Y
.dat	.dat	GPS data files	Y	Y

N = No. Use Data Transfer to convert the file.

When a .dc file is transferred to the Trimble Geomatics Office software, any GPS data files associated with that file are also transferred. Information about the .dc file format is available from the Trimble website (www.trimble.com). For more information, contact your local Trimble dealer.

Note − If a Trimble Geomatics Office project uses a geoid model, remember to also transfer the geoid file (or the subgridded part of it) when transferring the job into the Trimble Survey Controller software.

AutoCAD Land Development Desktop software

Use the Trimble Link software to transfer data between the Trimble Survey Controller software and Autodesk AutoCAD Land Development Desktop software.

When job data is transferred from the Trimble Survey Controller software to the AutoCAD Land Development Desktop software, a .tic file is created.

Data Transfer between the Trimble Survey Controller Software and another device

This section shows you how to use the ASCII data transfer function in the Trimble Survey Controller software. Use this function to transfer point names, point codes, and grid coordinates in ASCII format between the Trimble Controller and a variety of conventional instruments, data collectors, and office computers.

In addition, you can transfer ASCII files directly to the office computer using third−party download software, such as HyperTerminal.

Note − Only points with grid coordinates are transferred when you use the ASCII data transfer function. If the job does not have a projection and datum transformation specified, GPS points cannot be transferred. Furthermore, deleted points, and any points stored as polar vectors from a deleted point, cannot be transferred.

Transferring ASCII Data to and from an external device

You can transfer ASCII data to and from an external device or office computer in the following formats:

- Geodimeter (Area)
- Comma delimited (*.csv, *.txt)
- SDR33 coordinates

- SDR33 DC
- SC Exchange
- TDS
- Topcon (GTS−7)
- Topcon (FC−5)
- Trimble DC v10.0
- Trimble Zeiss (M5)

In an SC Exchange .dc file, all observations are reduced to WGS84 positions and grid positions (coordinates). Use this file format to transfer .dc files between different versions of the Trimble Survey Controller software running on the ACU and TSCe controllers.

The next sections describe how to connect a Trimble Controller, and how to send and receive data to and from the Trimble Survey Controller software.

Sending ASCII Data to an external device

Warning − When sending data to a device that does not include a units setting as part of its file, make sure that the Trimble Survey Controller file uses the units setting of that device.

If you are not sure whether the device file includes a units setting, set the Trimble Survey Controller file to the same units as the device.

To send ASCII data to an external device:

1. Select the files to transfer:
    1. Select *Files* / *Import* / *Export* / *Send ASCII data* .
    2. Use the File format field to specify the type of file that you want to send.
       If the File format field is set to Comma Delimited (*.CSV. *.TXT), SC Exchange or SDR33 DC, the Send to field appears. Set the field to External device.

2. Set the transfer parameters:
    1. Set the *Controller port* field to the Trimble Controller port you are using for the transfer.
    2. Set the *Baud rate* and *Parity* fields to match the corresponding parameters on the device that you are communicating with.

Note − If the *File format* field is set to Comma Delimited (*.CSV, *.TXT), set the baud rate correctly on the external device. If appropriate, also set the flow control (xon/xoff).

    3. If you are transferring a .dc file, and you want the Trimble Survey Controller software to include a checksum when the file is transferred, select *On* in the *Checksum* field.

Note − For the Geodimeter (Area), SDR33, TDS, Topcon (GTS−7), Topcon (FC−5), and Trimble Zeiss (M5) output options, the format is controlled by the external device.

3. Set the file parameters:
    1. If the *File format* field is set to *SDR33 coordinates* or *TDS* , the *Job name* field appears. Enter a name for the file that is created when the data is transferred.

2. Set the *Point name* field to *Unchanged* or *Auto−generate* . Unchanged sends the point names as they appear on the Trimble Controller. Auto−generate adds two extra fields:
    ◊ Use the *Start point name* field to specify the name of the first point to be transferred.
    ◊ Use the *Auto point step size* field to define the amount by which the *Start point* value is incremented or decremented when the Trimble Survey Controller software generates point names for subsequently transferred points.

Note − If the *File format* field is set to TDS and the *Point name* field is set to Unchanged, a point will only be transferred if the point name is less than eight characters long and contains numeric characters only.

3. Use the *Point code* field to specify what is sent to the external device selected in the *Code* field:
    ◊ Select *Use point code* to send the point code.
    ◊ Select *Use point name* to send the point name.

Note − If you have used long codes (up to 42 characters) in the Trimble Survey Controller software, and the file format you are transferring to does not support long codes, the codes will be shortened.

4. If the *File format* field is set to *SDR33 coordinates* , there is an *Output notes* check box. Select this to output all user−entered notes with the point data. The notes are output in SDR33 record 13NM format.
5. If the File format field is set to Comma Delimited (*.CSV, *.TXT), you can specify the format of the data to be output. Five fields appear: *Point name* , *Point code* , *Northing* , *Easting* ,and *Elevation* . Using the options provided, select a position for each field. Select *Unused* if you do not want to send a particular value. For example:

   Point name Field 1

   Point code Unused

   Northing Field 3

   Easting Field 2

   Elevation Field 4

4. Transfer the files:
    1. When the format details are complete, tap Send.
    2. If you are sending points (not a .dc file), the *Select points* screen appears. Select the points to send.
       The procedure is similar to that to create a *Stake out points* list. For more information, see Stakeout points
    3. The Trimble Survey Controller software prompts you to initiate receiving on the instrument that you are sending data to. For more information about receiving data, refer to the manual for the receiving device.
       When the other device is ready to receive, tap *Yes* to send the data. The data is transferred.

Note − When sending ASCII data from a Trimble Controller to an external device, it is important to follow on−screen instructions. The cable must not be connected until you are prompted to do so. If you connect the cables at the wrong time, the transfer will fail.

Receiving ASCII data from an external device

Warning − When receiving data from a device that does not include a units setting as part of its file, make sure that the Trimble Survey Controller file uses the units setting of that device. If you are not sure whether the device file includes a units setting, set the Trimble Survey Controller file to the same units as the device.

To receive ASCII data from an external device:

1. Select the files to send:
    1. Select *Files* / *Import* / *Export* / *Receive ASCII data.*
    2. In the File format field, specify the device that you want to receive data from.
       If the File format field is set to Comma Delimited (*.CSV, *.TXT), SC Exchange, or SDR33 DC, the Receive from field appears. Set this field to External device.

2. Set the transfer parameters:
    1. In the *Port details* / *Controller port* field, select the Trimble Controller port used for the transfer.
    2. Set the *Baud rate* and *Parity* fieldsto match the corresponding parameters on the device that the Trimble Survey Controller software is communicating with.

Note − If the File format field is set to Comma Delimited (*.CSV, *.TXT), set the baud rate correctly on the external device. If appropriate, also set the flow control (xon/xoff).

- ♦ If you are transferring a .dc file, and you want the Trimble Survey Controller software to validate the checksum when the file is transferred, select *On* in the *Checksum* field.

3. The option in the *File format* field determines what you do next:
    - ♦ If one of the following options is selected, the format is controlled by the external device:

      Geodimeter (Area)
      SDR33
      TDS
      Topcon (GTS−7)
      Topcon (FC−5)
      Trimble Zeiss (M5)

      Use the *Point name* field to define how the point names in the data are received.

Note − Trimble Survey Controller point names have a maximum of 16 characters, but some points received from other devices can exceed this. If point names have 16 characters or more, choose either Truncate left or Truncate right.

- ♦ If the Comma Delimited (*.CSV, *.TXT) option is selected, you can specify the format of the data that is received. Five fields appear: *Point name, Point code, Northing, Easting,* and *Elevation* .

Using the options provided, select a position for each field. Select *Unused* if a particular value is not present in the file being received. For example:

Point name Field 1

Point code Unused

Northing Field 2

Easting Field 3

Elevation Field 4

4. Store the files:
   1. When the format details are complete and the external device is ready to send, connect the cables and tap *Receive.*

      The Trimble Survey Controller software prompts you to initiate sending on the external device. For more information about sending data, refer to the manual for the sending device.

      When sending is initiated, the Trimble Survey Controller software starts to receive data, and a progress bar appears.

      When the transfer is complete, the Trimble Survey Controller software automatically terminates the operation and saves the received data.
   2. If it is clear that the transfer is complete but the operation has not been terminated, tap *Esc.* The following message appears:

      Transmission interrupted. What would you like to do now? Do one of the following:
      - Tap *Continue* to return the Trimble Survey Controller software to receive mode.
      - Tap *Finish* to terminate the operation and save any received data to the current job.
      - Tap *Cancel* to terminate the operation and discard any received data.

Note − When receiving ASCII data from an external device to a Trimble controller, you must follow on−screen instructions. Do not connect the cable until you are prompted to do so, otherwise the transfer will fail.

Database Search Rules

Database Search Rules

This topic explains the database search rules relevant to the Trimble Survey Controller database.

The Database

The Trimble Survey Controller software includes a dynamic database. This stores networks of connected vectors during RTK and conventional surveys, making the positions of some points dependent on the positions of others. If you change the coordinates of a point that has dependent vectors (for example, an instrument station, a backsight point, or a GPS base station), this affects the coordinates of all points that depend on it.

To change the coordinates of a point, measure or key in another point with the same name as the existing point. When the Duplicate point, out of tolerance warning appears, select Overwrite.

Note – This warning only appears if the new point is out of tolerance with the original point. If you have changed the tolerance values, the message may not appear. For more information see, Duplicate point tolerance.

The Trimble Survey Controller software uses database search rules to resolve the coordinates of dependent points, based on the new coordinates for a point they depend on. If the coordinates of a point with dependent points move by a certain amount, the dependent points are shifted by the same amount.

If a point name already exists in the database, the Trimble Survey Controller software displays the Duplicate point, out of tolerance warning message when you try to store a point that is outside the duplicate point tolerance, and that has the same name. If you chose to overwrite the coordinate, the coordinate and observation of the original point are overwritten.

If you store a face 2 observation to a point that already has a face 1 observation, the face 2 observation is checked to see if it is within tolerance of the face 1 observation and then stored. For more information about face 1 and face 2 observations, see Measuring a point in two faces.

Warning – The duplicate point warning could indicate that you are about to overwrite a point that has dependent vectors. If you continue, the coordinates of the dependent vectors could change.

Search Rules

The Trimble Survey Controller software lets multiple points with the same point name (point ID) exist in the same job:

- If you measure or key in a point with a name that already exists in the database, you can choose to overwrite it when you store the new one. All previous points of the same name, and with the same or a lower search class, are deleted.

Note − Deleted points remain in the database and have a search class of Deleted. For more information, see Search Class .

- If you measure or key in a point with a name that already exists in the database, you can choose to store both points in the database, and both are transferred with the job. The Trimble Survey Controller search rules ensure that the point with the highest class is used for calculations. If there are two points of the same class, the **first** is used.

To distinguish between points of the same name and to decide how these points are to be used, the Trimble Survey Controller software applies a set of search rules. When you ask for the coordinates of a point in order to perform a function or calculation, these search rules sort the database according to:

- the order in which the point records were written to the database
- the classification (search class) given to each point

Order in the Database

A database search starts at the beginning of the job database and works down to the end of the job, looking for a point with the specified name.

The Trimble Survey Controller software finds the first occurrence of a point of that name. It then searches the rest of the database for points of the same name.

Note − The database search changed for version 7.50 and later of the Trimble Survey Controller software. Previously the software searched from the end of the job database and worked up.

The rules generally followed by the software are:

- If two or more points have the same class and the same name, it uses the first point.
- If two or more points have the same name but different classes, it uses the point of higher class, even if this is not the first occurrence of the point.
- If two or more points−one from the job database and one from an attached linked file−have the same name, it uses the one in the job database.

Search Class

The Trimble Survey Controller software gives most Coordinates and Observations a classification. It uses this classification to determine the relative importance of points and observations stored in the job database.

Note − Coordinates are higher than Observations.

The Coordinates Classes are arranged in a descending hierarchy, as follows:

- Control − (the highest class) can only be set when a point is keyed in or transferred.
- Adjusted − is given to points that are adjusted in a traverse computation.
- Normal − is given to all measured points apart from staked points. Transferred points can also be given this class.

- Construction − is given to all points measured using Fastfix, which are typically used in the computation of another point.
- Deleted − is given to points that have been overwritten, where the original point had the same (or a lower) search class than the new point.
  Deleted points are not displayed in point lists and they are not used in calculations. However, they do remain in the database.

Note − You cannot overwrite a control class point with a measured point.

Control class is used in preference to other classes. It can only be set by you. Use control class for points that you want to use in preference to points of the same name in the same job database. For more information, see Assigning control class to a point.

If points have the same class as well as the same name, the first point in the database is used.

The Observation Classes are arranged in a descending hierarchy, as follows:

- Mean Turned Angle (MTA)
- Normal
- Construction
- Stakeout
- Backsight
- Check
- Deleted
  Deleted observations are not displayed in point lists and they are not used in calculations. However, they do remain in the database.

Note − Matched pair records are not used by the Trimble Survey Controller search rules. A mean turned angle record always exists when there is a matched pair record and the mean turned angle record is always used in preference.

Example

If a point named "1000" is entered as the start point when calculating a from−a−baseline offset, the Trimble Survey Controller software searches for the first occurrence of point "1000". It then searches the rest of the database for any point named "1000", under the following rules:

- If no other point of this name is found, it uses the one it has to calculate the offset.
- If another point "1000" is found, the software compares the classes of the two points. It uses the point "1000" that has the highest classification. Remember that a Coordinate class point (for example, keyed−in) is higher than an Observation class point.
  For example, if both points were keyed in, one was given a normal classification and the other a control classification, Trimble Survey Controller uses the control class point to calculate the offset, regardless of which record the search finds first. If one point was keyed in and one was observed, Trimble Survey Controller uses the keyed−in point.
- If the points are of the same class, Trimble Survey Controller uses the first one.
  For example, if both points named "1000" were keyed in, and both were given a normal classification, the first one is used.

Assigning control class to a point

Control class is the highest classification that you can give to a point. Any high−accuracy point that you use as a fixed standard in a job can be a control point.

If you specify control search class when you key in the coordinates for a point, you can be sure that those coordinates will not change until you key in another point of the same name and the same search class (control) and choose to overwrite the first point.

The Trimble Survey Controller software never elevates measured points to control class. This is because measured points have measurement errors and may change or be measured again during the course of the job. If the keyed−in point "CONTROL29" is control class, generally you would not want the coordinates of that point to change. A control class point is held fixed for the job.

The Trimble Survey Controller software can measure control points−observed control points−but it does not give them control classification. This is because, in calibration, the measured point often has the same name as the keyed−in control point. This makes it easier to set up the calibration. It also makes it easier to manage your data, for example, if you know that all references to point "CONTROL29" on the ground are also references to point "CONTROL29" in the database.

Exceptions to the search rules

Normal search rules are not used in the following situations:

- In calibration − Calibration searches for the highest class point stored as grid coordinates. This grid point is used as one of a pair of calibration points. The Trimble Survey Controller software then searches for the highest class GPS point stored as WGS84 coordinates or as a WGS84 vector. This point is used as the GPS part of the point pair.
- When starting an RTK rover − When you start a rover survey, if the broadcast base point is called "BASE001", choosing *Start survey* causes the Trimble Survey Controller software to search for the highest class GPS (WGS−84) point of that name. If no GPS point exists with the name "BASE001", but "BASE001" exists with grid or local coordinates, the Trimble Survey Controller software converts the grid or local coordinates of the point into a GPS (WGS−84) point. It uses the projection, datum transformation, and current calibration to calculate the point. It is then stored, as "BASE001", with WGS−84 coordinates and is given a check class classification so that the original grid or local coordinates will still be used in calculations.

Note − The WGS−84 coordinates of the base point in the Trimble Survey Controller database are the coordinates from which GPS vectors are solved.

If there is no base point in the database, the position broadcast by the base receiver is stored as a normal class point and it is used as the base coordinates.

Glossary

Glossary

This topic explains some of the terms used in this Help.

almanac	Data, transmitted by a GPS satellite, that includes orbit information on all the satellites, clock correction, and atmospheric delay parameters. The almanac facilitates rapid SV acquisition. The orbit information is a subset of the ephemeris data with reduced precision.
Angles and distance	Measurement of horizontal and vertical angles and a slope distance.
Angles only	Measurement of horizontal and vertical angles.
Anti−Spoofing (AS)	A feature that allows the U.S. Department of Defense to transmit an encrypted Y−code in place of P−code. Y−code is intended to be useful only to authorized (primarily military) users. Anti−Spoofing is used with Selective Availability to deny the full precision of GPS to civilian users.
Autolock	A tracking unit that enables a servo instrument to automatically lock on to and track a Remote Target (RMT).
automated rounds	The process of automatically measuring a multiple observations to observed points.
autonomous positioning	The least precise form of positioning that a GPS receiver can produce. The position fix is calculated by one receiver from satellite data alone.
azimuth	Horizontal direction relative to a defined coordinate system.
Backsight	Point with known coordinates or known azimuth from the instrument point that is used to orientate the instrument during station setup.
base station	In a GPS survey, you observe and compute baselines (the position of one receiver relative to another). The base station acts as the position from which all unknown positions are derived. A base station is an antenna and receiver set up on a known location specifically to collect data to be used in differentially correcting rover files.
baud	A unit of data transfer speed (from one binary digital device to another) used in describing serial communications; generally one bit per second.
C/A (Coarse Acquisition) code	A pseudorandom noise (PRN) code modulated onto an L1 signal. This code helps the receiver compute the distance from the satellite.
change face	

	Turn a servo instrument from the face 1 observing face to face 2.
CMR	Compact Measurement Record. A satellite measurement message that is broadcast by the base receiver and used by RTK surveys to calculate an accurate baseline vector from the base to the rover.
constellation	A specific set of satellites used in calculating positions: three satellites for 2D fixes, four satellites for 3D fixes. All satellites visible to a GPS receiver at one time. The optimum constellation is the constellation with the lowest PDOP. See also PDOP .
construction offsets	A specified horizontal and/or vertical offset distance to enable equipment to operate without disturbing construction stakes.
Construction point	A point that is measured using the "quick fix" option in COGO.
curvature and refraction	Correction to the measured vertical angle for the curvature of the earth and the refraction caused by the earth's atmosphere.
data message	A message, included in the GPS signal, that reports on the location and health of the satellites as well as any clock correction. It includes information about the health of other satellites as well as their approximate position.
datum	Seegeodetic datum.
design code	The code name given to the design point.
design name	The name given to the design point.
Differential Positioning	Precise measurement of the relative position of two receivers tracking the same satellites simultaneously.
Direct Reflex (DR)	Type of EDM that can measure to non reflective targets.
DOP (Dilution of Precision)	An indicator of the quality of a GPS position. DOP takes into account the location of each satellite relative to other satellites in the constellation, as well as their geometry relative to the GPS receiver. A low DOP value indicates a higher probability of accuracy. Standard DOPs for GPS applications are: − PDOP − Position (three coordinates) − RDOP − Relative (Position, averaged over time) − HDOP − Horizontal (two horizontal coordinates) − VDOP − Vertical (height only) − TDOP − Time (clock offset only)
Doppler shift	The apparent change in frequency of a signal caused by the relative motion of satellites and the receiver.
DTM	Digital Terrain Model. An electronic representation of terrain in three dimensions.
dual−frequency	GPS receiver that uses both L1 and L2 signals from GPS satellites. A dual−frequency receiver can compute more precise position fixes over longer distances and under more adverse conditions because it compensates for ionospheric delays.
Dual−prism offset	Measurement of horizontal and vertical angles and a slope distance to two prisms located on one prism pole for the purpose

	of positioning an obstructed point.
Earth−Centered−Earth−Fixed (ECEF)	A cartesian coordinate system used by the WGS−84 reference frame. In this coordinate system, the center of the system is at the earth's center of mass. The z axis is coincident with the mean rotational axis of the earth and the x axis passes through 0° N and 0° E. The y axis is perpendicular to the plane of the x and z axes.
eccentric object	Measurement of horizontal and vertical angles and a slope distance to the face of a radial object (for example, power pole). An additional horizontal angle is observed to the side of the object to calculate the radius and thus position the center of the object.
elevation	Height above mean sea level. Vertical distance above the geoid.
elevation mask	The angle below which Trimble recommends that you do not track satellites. Normally set to 13 degrees to avoid interference from buildings and trees as well as ground multipath errors.
ellipsoid	A mathematical model of the earth formed by rotating an ellipse around its minor axis.
ephemeris	The current satellite position predictions, transmitted in the data message.
epoch	The measurement interval of a GPS receiver. The epoch varies according to the survey type: − for real−time surveys it is set at one second − for postprocessed surveys it can be set to a rate of between one second and one minute
Face 1 (F1)	Observing position of an instrument where the vertical circle is commonly on the left hand side of the telescope.
Face 2 (F2)	Observing position of an instrument where the vertical circle is commonly on the right hand side of the telescope.
feature codes	Simple descriptive words or abbreviations that describe the features of a point. For more information, refer to the Help
fixed solution	Indicates that the integer ambiguities have been resolved and a survey is initialized. This is the most precise type of solution.
float solution	Indicates that the integer ambiguities have not been resolved, and that the survey is not initialized.
FSTD (fast standard)	The method of measuring one distance and one angle to coordinate a point.
GDOP	Geometric Dilution of Precision. The relationship between errors in user position and time, and errors in satellite range. See also DOP .
geodetic datum	A mathematical model designed to fit part or all of the geoid (the physical earth's surface).
geoid	The surface of gravitational equipotential that closely approximates mean sea level.
GPS	

	Global Positioning System. Based on a constellation of 24 operational satellites orbiting the earth at a high altitude.
GPS time	A measure of time used by the NAVSTAR GPS system.
H. Angle offset	Measurement of vertical angle and slope distance. Horizontal angle is then measured separately, usually to an obstructed point.
H. Angle only	Measurement of horizontal angle.
HDOP	Horizontal Dilution of Precision. See also DOP .
horizontal circle	Graduated or digital disc from which the horizontal angle is measured
instrument height	Height of the instrument above the instrument point.
instrument point	Point that the instrument is occupying.
integer ambiguity	The whole number of cycles in a carrier phase pseudorange between the GPS satellite and the GPS receiver.
ionosphere	The band of charged particles 80 to 120 miles above the earth's surface. The ionosphere affects the accuracy of GPS measurements if you measure long baselines using single−frequency receivers.
L1	The primary L−band carrier used by GPS satellites to transmit satellite data. The frequency is 1575.42 MHz. It is modulated by C/A code, Pcode, or Y−code, and a 50 bit/second navigation message.
L2	The secondary L−band carrier used by GPS satellites to transmit satellite data. The frequency is 1227.6 MHz. It is modulated by Pcode or Y−code, and a 50 bit/second navigation message.
local ellipsoid	The ellipsoid specified by a coordinate system. The WGS84 coordinates are first transformed onto this ellipsoid, then converted to grid coordinates.
measurement modes: Standard (STD) Fast Standard (FSTD) Tracking (TRK)	Angles are measured and averaged as one distances is measured. STD mode is indicated by an S next to the instrument icon on the status bar. One angle and one distance are measured. FSTD mode is indicated by an F next to the instrument icon on the status bar. Angles and distances are continually measured. TRK mode is indicated by a T next to the instrument icon on the status bar.
multipath	Interference, similar to ghosting on a television screen. Multipath occurs when GPS signals traverse different paths before arriving at the antenna.
NMEA	A standard, established by the National Marine Electronics Association (NMEA), that defines electrical signals, data transmission protocol, timing, and sentence formats for communicating navigation data between marine navigation instruments.
P−code	The `precise' code transmitted by the GPS satellites. Each

	satellite has a unique code that is modulated onto both the L1 and L2 carrier waves.
parity	A form of error checking used in binary digital data storage and transfer. Options for parity checking include Even, Odd, or None.
PDOP	Position Dilution of Precision, a unitless figure of merit expressing the relationship between the error in user position and the error in satellite position.
PDOP mask	The highest PDOP value at which a receiver will compute positions.
postprocess	To process satellite data on a computer after it has been collected.
PPM	Parts per million correction that is applied to measured slope distances to correct for the affects of the earth's atmosphere. PPM is determined using observed pressure and temperature readings together with specific instrument constants.
Prism constant	Distance offset between the centre of a prism and the point being measured.
projection	Used to create flat maps that represent the surface of the earth or parts of that surface.
QC records	Quality Control records. With precise positioning applications, this receiver option lets you process RTCM104 corrections and satellite data in real time to provide position precision statistics.
ratio	During initialization, the receiver determines the integer number of wavelengths between each satellite and the GPS antenna phase center. For a particular set of integers, it works out the probability that this is the correct set. The receiver then calculates the ratio of the probability of correctness of the currently−best set of integers to the probability of correctness of the next−best set. A high ratio indicates that the best set of integers is much better than any other set. (This gives us confidence that it is correct.) The ratio must be above 5 for New Point and OTF initializations.
RDOP	Relative Dilution of Precision. See also DOP .
reference station	See **base station** .
resection	The process of establishing the position of an occupied point by taking measurements to two or more known points.
RMS	Root Mean Square. This is used to express the accuracy of point measurement. It is the radius of the error circle within which approximately 70% of position fixes are to be found.
RMT	Remote target
rounds	Conventional observation method of multiple observations to multiple points.
rover	Any mobile GPS receiver and field computer collecting data in

	the field. The position of a roving receiver can be differentially corrected relative to a stationary base GPS receiver.
RTCM	Radio Technical Commission for Maritime Services, a commission established to define a differential data link for the real−time differential correction of roving GPS receivers. There are two types of RTCM differential correction messages, but all Trimble GPS receivers use the newer Type 2 RTCM protocol.
RTK	Real−time kinematic, a type of GPS survey.
single−frequency	A type of receiver that only uses the L1 GPS signal. There is no compensation for ionospheric effects.
Single dist. Offset	Measurement of horizontal and vertical angles and a slope distance. Plus additional offset distances to position obstructed points.
SNR	Signal−to−Noise Ratio, a measure of the strength of a satellite signal. SNR ranges from 0 (no signal) to around 35.
Station setup	The process of defining the instrument occupation point and setting the orientation of the instrument to a backsight point or points.
stationing	The distance or interval along a line, arc or road.
SV	Satellite Vehicle (or Space Vehicle).
target height	Height of prism above the point being measured.
TDOP	Time Dilution of Precision. See also DOP .
TOW	Time of Week in seconds, from midnight Saturday night/Sunday morning GPS time.
tracking	The process of receiving and recognizing signals from a satellite.
Tracklight	A visible light that guides the prism operator on the correct bearing.
Trk	Tracking mode. Used to measure towards moving targets.
UTC	Universal Time Coordinated. A time standard based on local solar mean time at the Greenwich meridian. See also GPS time.
VDOP	Vertical Dilution of Precision. See also DOP .
vertical circle	Graduated or digital disc from which the horizontal angle is measured.
WAAS	Wide Area Augmentation System. A satellite−based system that broadcasts GPS correction information.
WGS−84	World Geodetic System (1984), the mathematical ellipsoid used by GPS since January 1987. See also ellipsoid .
Y−code	An encrypted form of the information contained in the Pcode. Satellites transmit Y−code in place of Pcode when Anti−Spoofing is in effect.