USER GUIDE

Trimble M3® Total Station

Trimble

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Version 1.00
Revision A
Part Number C192E
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Trimble

Contact Information

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Release Notice

This is the October 2005 release of the *Trimble M3 Total Station User Guide*, part number C192E. It applies to version 1.0x of the Trimble M3 total station.

Notices

USA

FCC 15B Class B satisfied.
This equipment has been tested and found to comply with the limits for a Class B personal computer and peripherals, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING - This equipment has been certified to comply with the limits for a Class B personal computer and peripherals, pursuant to Subpart B of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to this equipment. Operation with non-certified personal computer and/or peripherals is likely to result in interference to radio and TV reception. The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment.
You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

European Union

EU EMC Directive satisfied.

Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.
Cet appareil numérique de la Class B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Recycling

Taiwan Battery Recycling Requirements

The product contains a removable battery. Taiwanese regulations require that waste batteries are recycled.

Notice to Our European Union Customers

For product recycling instructions and more information, please go to:
www.trimble.com/environment/summary.html

Recycling in Europe

To recycle Trimble WEEE, call: +31 497 53 2430, and ask for the WEEE associate, or mail a request for recycling instructions to:
Trimble Europe BV
c/o Menlo Worldwide Logistics
Meerheide 45
5521 DZ Eersel, NL

Safety and Warnings

For your safety read the safety and warnings and this user guide carefully and thoroughly before using the Trimble® M3 total station.

Although Trimble products are designed for maximum safety, using them incorrectly or disregarding the instructions can cause personal injury or property damage.

You should also read the instruction manual for the battery charger, and the documentation for any other equipment that you use with a Trimble M3 total station.

Note – *Always keep the manual near the instrument for easy reference.*

Laser safety

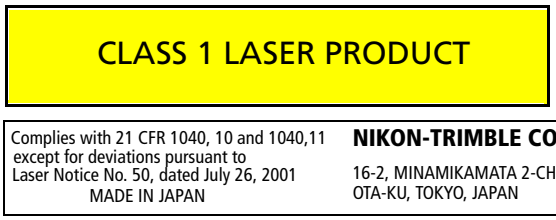
WARNING – The Trimble M3 3" and 5" DR total stations are Class 1 laser instruments. The laser beam is hazardous to the eyes and the body. Do not sight the instrument on the face or body of a person. If you suspect an injury caused by exposure to the laser beam, seek medical advice immediately. If the instrument housing is open and the instrument is turned on, the laser emits a beam stronger than the Class 1 safety level.

Specifications for laser emission

Wave length	870 nm
Drive method	Pulse repetitive drive
Output power	< 6.4 W
Repetition rate	<5 ns

Conforming standards

EU	EN60825-1/Am.2:2001 (IEC60825-1/Am.2:2001), class 1
USA	FDA21CFR Part 1040 Sec.1040.10 and 1040.11 Except for deviations pursuant to Laser Notice No.50, dated July 26, 2001): class 1



Warnings and Cautions

The following conventions are used to indicate safety instructions:

WARNING – Warnings alert you to situations that could cause death or serious injury.

CAUTION – Cautions alert you to situations that could cause injury or property damage.

Always read and follow the instructions carefully.

Warnings

Before using the instrument, read the following warnings and follow the instructions that they provide:

WARNING – Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

WARNING – The Trimble M3 total station is not designed to be explosion-proof. Do not use the instrument in coal mines, in areas contaminated with coal dust, or near other flammable substances.

WARNING – The Trimble M3 total station is a Class 1 laser instrument. The laser beam is hazardous to the eyes and the body. Do not sight the instrument on the face or body of a person. If you suspect an injury caused by exposure to the laser beam, seek medical advice immediately. If the instrument housing is open and the instrument is turned on, the laser emits a beam stronger than the Class 1 safety level.

WARNING – Never disassemble, modify, or repair the instrument yourself. If you do, you may receive electric shocks or burns, or the instrument may catch fire.

WARNING – Use only the specified battery charger (part number Q-75U/E) to charge the battery pack (part number BC-65). Using other chargers, such as a charger with part number Q-7U/E or Q-7C, may cause the battery pack to catch fire or rupture. (The BC-65 cannot be charged by the Q-7U/E or Q-7C.)

WARNING – Do not cover the battery charger while the battery pack is being recharged. The charger must be able to dissipate heat adequately. Coverings such as blankets or clothing can cause the charger to overheat.

WARNING – Avoid recharging the battery pack in humid or dusty places, in direct sunlight, or near heat sources. Do not recharge the battery pack when it is wet. If you do, you may receive electric shocks or burns, or the battery pack may overheat or catch fire.

WARNING – Although the battery pack (part number BC-65) has an auto-reset circuit breaker, you should take care not to short circuit the contacts. Short circuits can cause the battery pack to catch fire or burn you.

WARNING – Never burn or heat the battery. Doing so may cause the battery to leak or rupture. A leaking or ruptured battery can cause serious injury.

WARNING – Before storing the battery pack or battery charger, cover the contact points with insulation tape. If you do not cover the contact points, the battery pack or charger may short circuit, causing fire, burns, or damage to the instrument.

WARNING – The battery BC-65 is not waterproof on its own. Do not get the battery wet when it is removed from the instrument. If water seeps into the battery, it may cause a fire or burns.

Cautions

Before using the instrument, read the following cautions and follow the instructions that they provide:

CAUTION – Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

CAUTION – The tops of the tripod ferrules are very sharp. When handling or carrying the tripod, take care to avoid injuring yourself on the ferrules.

CAUTION – Before carrying the tripod or the instrument in the carrying case, check the shoulder strap and its clasp. If the strap is damaged or the clasp is not securely fastened, the carrying case may fall, causing personal injury or instrument damage.

CAUTION – Before setting up the tripod, make sure that no-one's hands or feet are underneath it. When the legs of the tripod are being driven into the ground, they could pierce hands or feet.

CAUTION – After mounting the instrument on the tripod, securely fasten the thumb screws on the tripod legs. If the thumb screws are not securely fastened, the tripod may collapse, causing personal injury or instrument damage.

CAUTION – After mounting the instrument on the tripod, securely fasten the clamp screw on the tripod. If the clamp screw is not securely fastened, the instrument may fall off the tripod, causing personal injury or instrument damage.

CAUTION – Securely fasten the tribrach clamp knob. If the knob is not securely fastened, the tribrach may come loose or fall off when you lift the instrument, causing personal injury or instrument damage.

CAUTION – Do not stack objects on the plastic carrying case, or use it as a stool. The plastic carrying case is unstable and its surface is slippery. Stacking or sitting on the plastic carrying case may cause personal injury or instrument damage.

CAUTION – Before charging the battery pack, read the instruction manual for the quick charger (part number Q-75U/E).

CAUTION – Make sure the laser is disabled before disposing of the instrument.

Contents

CHAPTER

1

Introduction

In this chapter:

Welcome

Thank you for purchasing the Trimble® M3 total station.

Before you operate the instrument, read this manual carefully. In particular, pay attention to the warnings and cautions that appear in the Safety section at the front of the manual, see Safety and Warnings, page iii.

You should also read the maintenance section, see Maintenance, page 14.

About the Trimble Trimble M3 total station

The Trimble M3 total station is easy to use. The software for the Trimble M3 series has been designed to make it easy for you to learn to operate one model of instrument and apply that knowledge to the other models with little additional training.

The Trimble M3 total station offers reflectorless operation, allowing you to take measurements to points inaccessible with a prism. This manual shows the unique capabilities and features available in the Trimble M3 total station.

System diagram

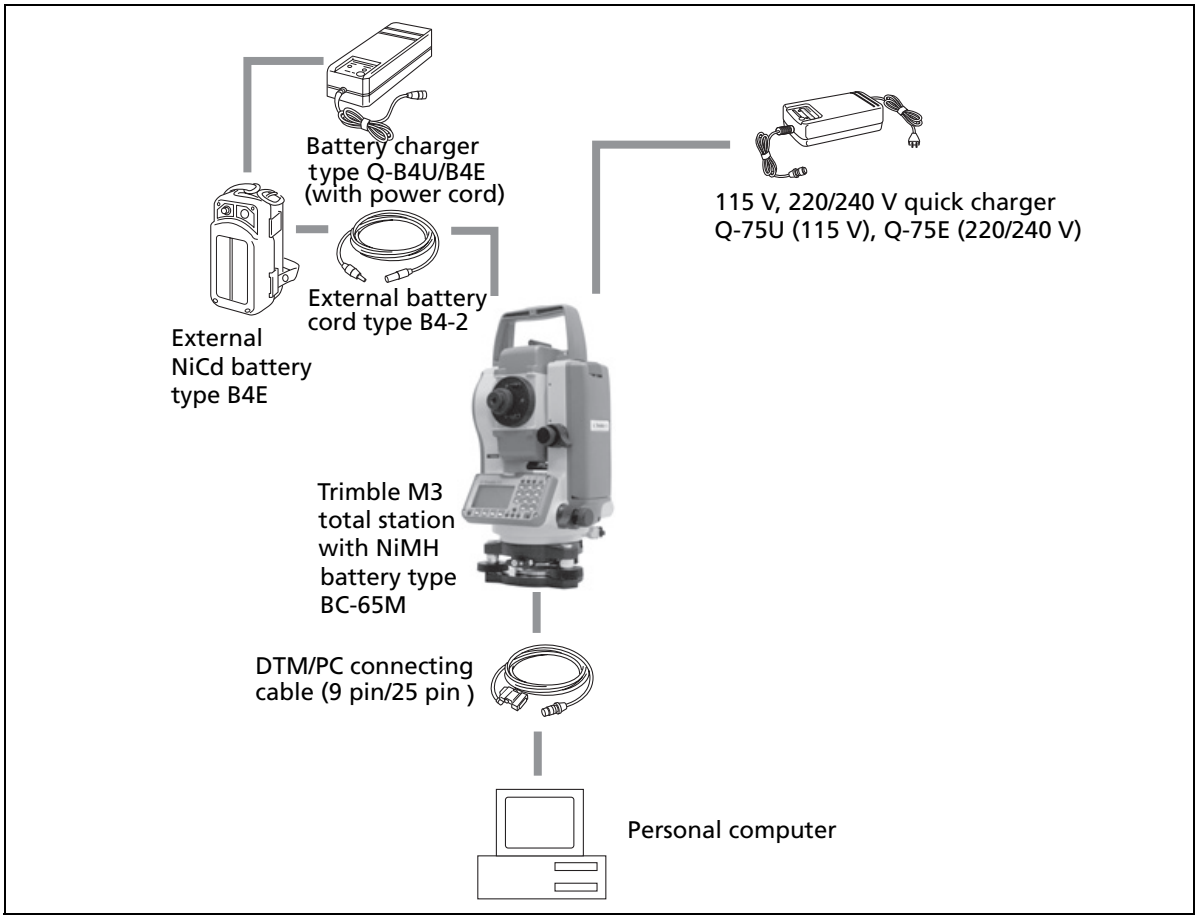


Figure 1.1 System diagram

Related information

- Contact your local Trimble dealer for more information about the support agreement contracts for software and firmware, and an extended warranty program for hardware.
- Trimble training courses – Consider a training course to help you use your total station to its fullest potential. For more information, go to the Trimble website at www.trimble.com/training.html.

Technical assistance

If you have a problem and cannot find the information you need in the product documentation, ***contact your local dealer***.

Technical support

If you need to contact Trimble technical support:

1. Go to the Trimble website (www.trimble.com).
2. Click the **Support** button at the top of the screen. The Support A–Z list of products appears.
3. Scroll to the bottom of the list.
4. Click the **submit an inquiry** link. A form appears.

Alternatively, you can send an e-mail to trimble_support@trimble.com

Your comments

Your feedback about the supporting documentation helps us to improve it with each revision. E-mail your comments to ReaderFeedback@trimble.com.

CHAPTER

2

Overview of the Trimble M3 Total Station

In this chapter:

This chapter gives you an overview of the operation and controls of the Trimble M3 total station, as well as the programs which are a special feature.

Hardware overview

Figure 2.2 and Figure 2.3 show the main parts of the Trimble M3 total station.

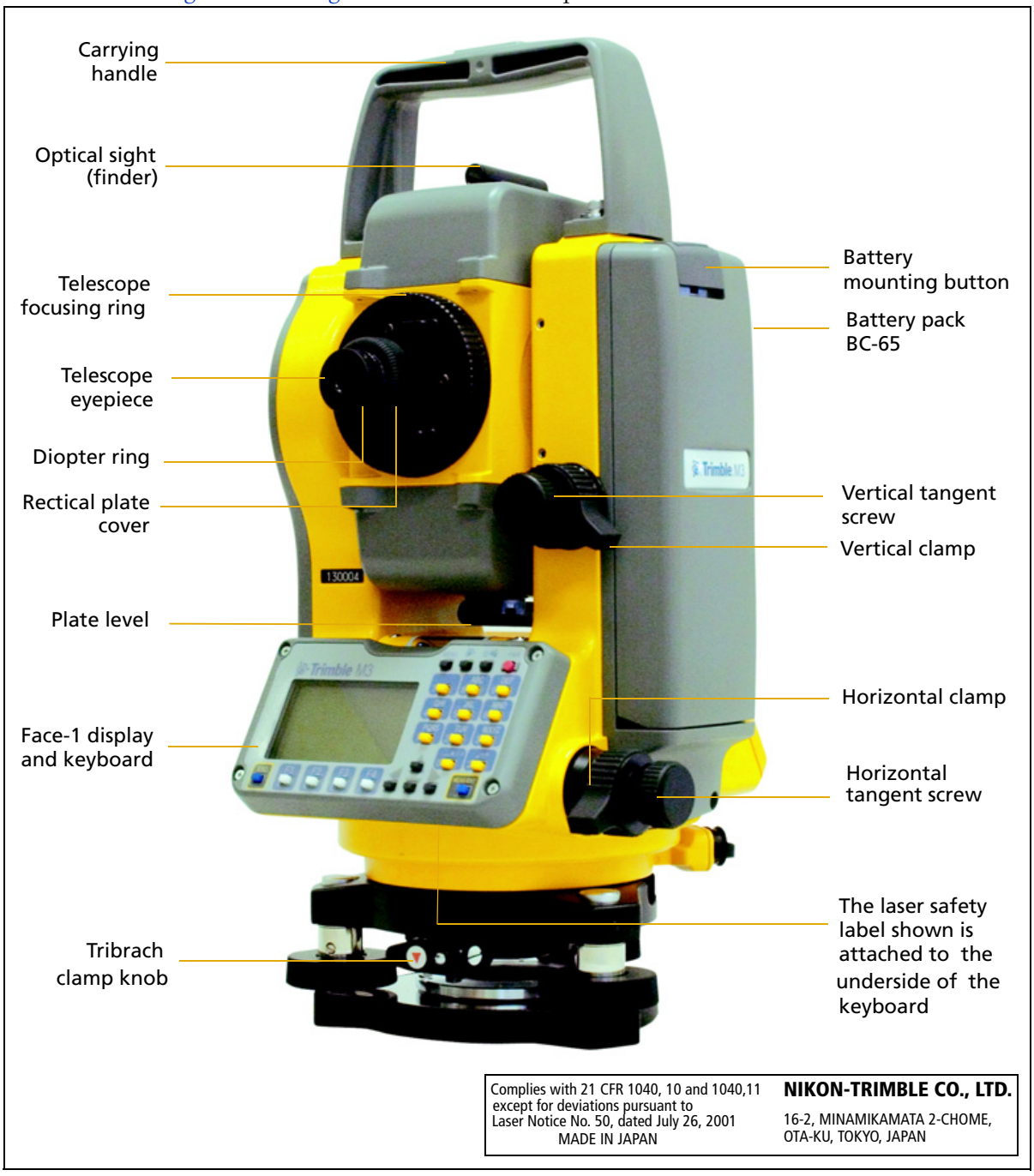


Figure 2.2 Trimble M3 total station – Face-1 (control side)

Figure 2.3 Trimble M3 total station – Face-2

Maintenance

Before using the instrument, read and follow the following maintenance instructions:

- Do not leave the instrument in direct sunlight or in a closed vehicle for prolonged periods. Overheating the instrument may reduce its efficiency.
- If the Trimble M3 total station has been used in wet conditions, immediately wipe off any moisture and dry the instrument completely before returning the instrument to the carrying case. The instrument contains sensitive electronic assemblies which have been well protected against dust and moisture. However, if dust or moisture gets into the instrument, severe damage could result.
- Sudden changes in temperature may cloud the lenses and drastically reduce the measurable distance, or cause an electrical system failure. If there has been a sudden change in temperature, leave the instrument in a closed carrying case in a warm location until the temperature of the instrument returns to room temperature.
- Do not store the Trimble M3 total station in hot or humid locations. In particular, you must store the battery pack in a dry location at a temperature of less than 30 °C (86 °F). High temperature or excessive humidity can cause mold to grow on the lenses. It can also cause the electronic assemblies to deteriorate, and so lead to instrument failure.
- Store the battery pack with the battery discharged.
- When storing the instrument in areas subject to extremely low temperatures, leave the carrying case open.
- Do not overtighten any of the clamp screws.
- When adjusting the vertical tangent screws, upper plate tangent screws, or leveling screws, stay as close as possible to the center of each screw's range. The center is indicated by a line on the screw. For final adjustment of tangent screws, rotate the screw clockwise.
- If the tribrach will not be used for an extended period, lock down the tribrach clamp knob and tighten its safety screw.
- Do not use organic solvents (such as ether or paint thinner) to clean the non-metallic parts of the instrument (such as the keyboard) or the painted or printed surfaces. Doing so could result in discoloration of the surface, or in peeling of printed characters. Clean these parts only with a soft cloth or a tissue, lightly moistened with water or a mild detergent.
- To clean the optical lenses, lightly wipe them with a soft cloth or a lens tissue that is moistened with alcohol.

- The reticle plate cover has been correctly mounted. Do not release it or subject it to excessive force to make it watertight.
- Before attaching the battery pack, check that the contact surfaces on the battery and instrument are clean. Press the battery pack into place until the battery mounting button rises up to the battery pack top surface. If the battery pack is not attached securely, the instrument is not watertight.
- Press the cap that covers the data output/external power input connector terminal until it clicks into place. The instrument is not watertight if the cap is not attached securely, or when the data output/external power input connector is used.
- The carrying case is designed to be watertight, but you should not leave it exposed to rain for an extended period.
- The BC-65 battery pack contains a NiMH battery. When disposing of the battery pack, follow the laws or rules of your municipal waste system. See also Recycling, page ii.
- The instrument can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the instrument, touch any other conductive material once to remove static electricity.

LCD display and key functions

The LCD display and keys on the Trimble M3 total station keyboard are shown below.

Key functions

Table 2.1 summarizes the functions of the Trimble M3 series keys.

Table 2.1 Key functions

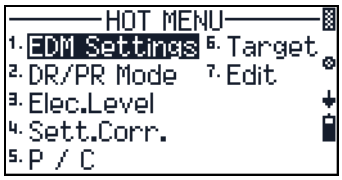
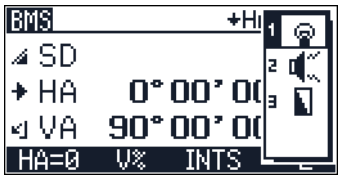
Key	Function
	Menu key. Press to display the MENU screen which contains the following options: 1. Job Manager 2. Adjustment 3. Applications 4. Coordinates 5. Setting Instrument 6. Setting interface 7. Data Transfer 
	Trimble key. Press to display the HOT MENU screen which contains the following options: 1. EDM Settings 2. DR/PR Mode 3. Electronic Level 4. Setting Corrections 5. Point number / Point code 6. Target 7. Edit 
	Illumination key. Press to display the 3-switch window which contains the following options: 1. Backlight on/off. 2. Sound on/off 3. Display contrast adjustment See Adjusting lighting, sound, and contrast, page 17. 
	PWR button. Press to turn the instrument on or off. See Turning the instrument on and off, page 53.
	ESC key. Press to return to the previous screen. If you are in numeric or alpha-numeric mode press this key to delete your input.
	MEAS/ENT key. Press to do any of the following: • Proceed to the next step • Initiate a measurement and record the point • Confirm the input value/name/code when you are in input mode
	F1 - F4 Function keys. When softkeys (for example Stack) are displayed at the bottom of the screen, press the function key beneath the softkey indication. ***Note –*** *The fields at the bottom of each screen relate to the function of the keys situated below the display. They indicate the next possible setting,* ***not*** *the current setting.*

Table 2.1 Key functions

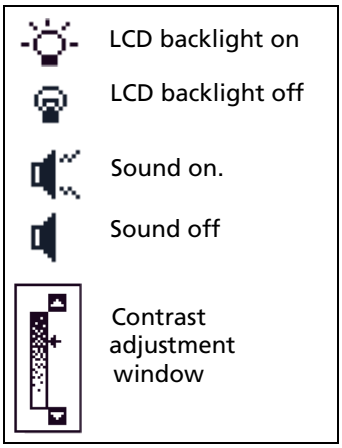
Key	Function
	[<] Left arrow key. Move the highlighted cursor to the left, or delete a character when you are in the input mode.
	[>] Right arrow key. Move the highlighted cursor to the right.
	[^] [v] Up and down arrow keys. Move the highlighted cursor up or down in list and MENU screens. Also used to move between the BMS screens.
	The keypad is used to enter numbers and alphabetic characters. In this example, press the key to enter [1] when the instrument is set for numeric input, and press the key one or more times to enter P, Q, R, or S in capitals or lower-case characters.

Adjusting lighting, sound, and contrast

You can adjust the lighting and sound levels from any screen:



1. Press the illumination key to display the 3-switch window.



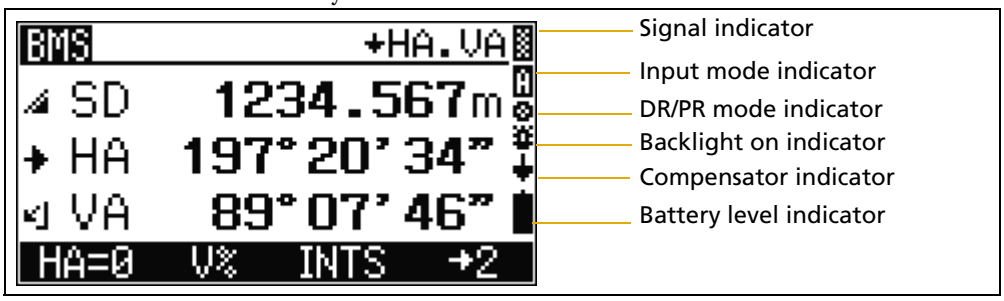
2. To cycle through the settings for the backlight and sound, press the number beside the switch. For example, to turn the backlight on or off, press [1]. Alternatively, to highlight the switch that you want to set, press [^] or [v] and then press [<] or [>] to change the setting.
3. To adjust the contrast when the 3-switch window is open:
   a. Press [3], [<] or [>] to display the contrast adjustment window.
   b. Press [^] or [v] to change the contrast level. The arrow indicates the current contrast level.

c. To return to the 3-switch window, press [<] or [>].

4. Press [ESC] to close the 3-switch window.

Status bar

The status bar appears on the right side of every screen. It contains indicators that reflect the status of various system functions:



Signal level indicator

The signal level indicator shows the reflected light intensity:

Indicator	Signal level
	Level 4 (maximum)
	Level 3
	Level 2
	Level 1 (minimum)
	If this indicator is blinking, there is excessive signal for DR-mode measurement.
	If this indicator is blinking rapidly, there is no signal. If this indicator is blinking slowly, the signal is low.
	If there is no indicator, analog power for EDM is off.

Input mode indicator

The input mode indicator only appears when you are entering points or coordinates. It shows the following data input mode:

Indicator	Input mode
	Input mode is numeric. Press a key on the number pad to enter the number printed on the key.
	Input mode is alphabetic (capital letters). Press a key on the number pad to enter the first letter printed above the key. Press the key repeatedly to cycle through all the letters assigned to the key. For instance, to enter the capital letter O in alphabetic mode, press 6 three times.
	Input mode is alphabetic (lower case). Press a key on the number pad to enter the first letter printed above the key. Press the key repeatedly to cycle through all the letters assigned to the key. For instance, to enter the lower case letter o in alphabetic mode, press 6 three times.

DR/PR mode indicator

The mode indicator indicates the current measurement mode. The icon blinks when you take a measurement.

Indicator	Measurement mode
	Current measurement mode is DR-mode (Direct-Reflex mode).
	Current measurement mode is PR-mode (Prism mode).

Backlight-ON indicator

When the backlight is ***on***, the  indicator appears. When the backlight is off, no indicator appears.

Compensator indicator

When the automatic compensator correction is set to on, the  indicator appears. When the automatic compensator correction is off, no indicator appears.

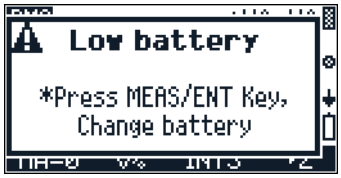
Battery level indicator

The battery level indicator shows the battery voltage level:

Indicator	Battery level
	Level 4 (full)
	Level 3
	Level 2

Indicator	Battery level
	Level 1
	Battery low ***Note –*** *When the Battery low icon starts to blink, the remaining battery level is less than 10 minutes. Please replace the battery with a fully charged battery immediately.*

If the battery level is critically low, the following message appears:



Software overview

There are two software menus, the main MENU and the HOT MENU.

MENU overview

To access the main MENU screen, press MENU and then select options from the menu using the keypad. Use the MENU screen to access important functions and settings.

Menu item	Sub-menu	Description
1. Job Manager	1. New	Create a new job. See Creating a new job, page 68.
	2. Open	Open an existing job. See Opening an existing job, page 70.
	3. Delete	Delete a job. See Deleting a job, page 70.
	4. Ctrl Point	Set a control point job. See Setting the Control Point job, page 71.
	5. Info	Show job information (including free space, recorded points). See Displaying job information, page 72
2. Adjustment C&I		Zero point adjustment for vertical scale, horizontal angle corrections, and compensator. See Checking and adjusting the compensator (C) and index (I), page 119.
3. Applications	1. Connect Distance	See Connecting distance, page 96.
	2. Remote Object	See Remote object height, page 100.
	3. Station + Offset	See Station and offset, page 102.
	4. Vertical Plane	See Vertical plane, page 105.
	5. Compute Area	See Compute area, page 107.

Menu item	Sub-menu	Description
4. Coordinates	1. Resection	See Resection, page 74.
	2. Known Station	1. Hz - known station setup by BS Azimuth input. 2. YX - Known station setup by XYZ to BS. See , page 79.
	3. Station elevation	REM. See Station elevation, page 83.
	4. Measure topo	Eccentricity (softkey) - In/Out, Right/Left offset distance input, height and frequency settings. See Eccentric measurement, page 85. Input dSD (softkey). See Measure topo, page 83.
	5. Stake Out	1. XY - stakeout by coordinate, 2D. See Stake out by coordinates (XY or XYZ), page 87. 2. HD - stakeout by angle and distance, 2D. See Stakeout by angle and distance (HD or HDh), page 89. 3. XYZ - stakeout by coordinate, 3D. See Stake out by coordinates (XY or XYZ), page 87. 4. HDh - stakeout by angle and distance, 3D. See Stakeout by angle and distance (HD or HDh), page 89. 5. RefLine 2D - stakeout points from a line defined by Sta and O/S. See Stakeout by reference line, page 90. 6. DivLine 2D - stakeout points after dividing a line by equal distances. See Stakeout by dividing line, page 91.
5. Setting - Instrument	1. Angle	Set angle accuracy, display unit, VA reference and direction.See Angle settings, page 34.
	2. Distance	Set distance accuracy and display unit. See Distance settings, page 35.
	3. Coord. System	Set axis type and display order. See Coordinate system settings, page 36.
	4. Units	Set temperature and pressure. See Units settings, page 36
	5. Turn Off	Set auto-power cut-off settings and sleep settings for the main and EDM units. See Turn Off settings, page 36.
	6. Clock	Set the built-in clock. See Clock settings, page 37.
	7. Miscellaneous	Set default input modes in the code and point name fields. See Miscellaneous settings, page 37.
6. Settings - interface		Set the recording format. See Configuring data recording and external communication settings, page 38.
7. Data Transfer	1. MEM-Periph	Download data.See Downloading internal memory to an office computer, page 111.
	2. Periph-MEM	Upload data (coordinates).See Uploading data from an office computer to the internal memory, page 113.
	3. Upload Point List	Upload point-number list. See Uploading a point name/number list from the office computer, page 114.
	4. Upload Code List	Upload point-code list. See Uploading a point code list from the office computer, page 114.

HOT MENU overview

To access the HOT MENU, press . In any measurement screen, you can use the HOT MENU to change the point number and point code and the EDM mode, or check recorded data.

Menu item	Sub-menu	Description
1. EDM Settings		Set distance precision. See Distance measurement settings (EDM), page 39.
2. DR / PR Mode		Select measure mode. See Changing target mode (DR or Prism), page 40.
3. Elec. level		Display the bubble and change tilt correction. See Bubble level display (electric level), page 40.
4. Sett. Corr.	Prism const.	Input prism constant. See Configuring error corrections, page 40.
	Temperature	Input temperature.
	Pressure	Input pressure.
	Scale	Input scale factor.
	C&R corr.	Setting for curvature and refraction correction.
	Sea level corr.	Select sea-level correction.
5. P/C		Input point number and code to prepare for the next recording point. See Selecting a point name and point code, page 41.
6. Target		Select a target set (a combination of target height and measure mode). See Selecting a target configuration, page 41.
7. Edit	Internal Memory	See Editing data, point number lists or point code lists, page 42.
	Point Number List	See Managing your list of point names, page 44.
	Point code list	See Managing your list of point codes, page 45.

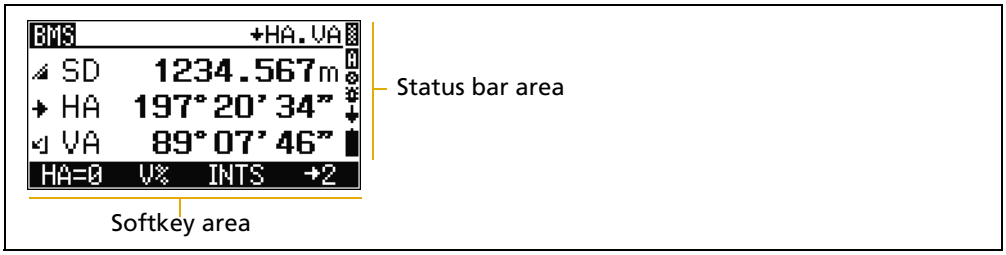
Principles of display

The following are typical program screens:

- Basic Measurement Screen (BMS)
- Input screens
- Menu screens

Basic Measurement Screen (BMS)

The BMS is an observation screen. To take a measurement and store the point data, press MEAS/ENT.

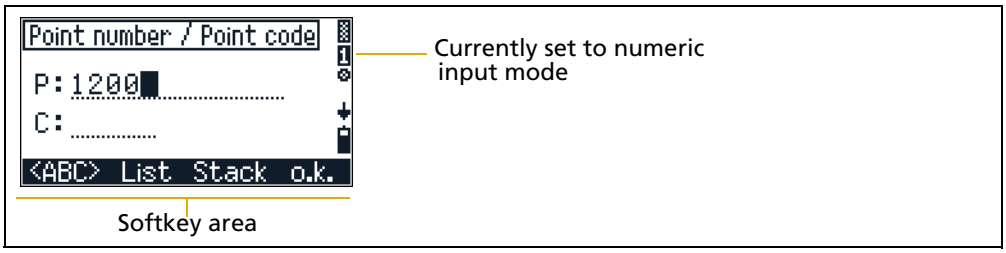


The bottom part of the screen is the softkey area. To use the softkeys, press the function key directly below the softkey command. For example, to reset the horizontal angle to zero HA=0, press F1.

The Status bar, page 18 shows indicators for the signal level, the character input mode, operating mode, backlight and tilt status, and the battery level.

Input screen

An input screen enables you to enter data.



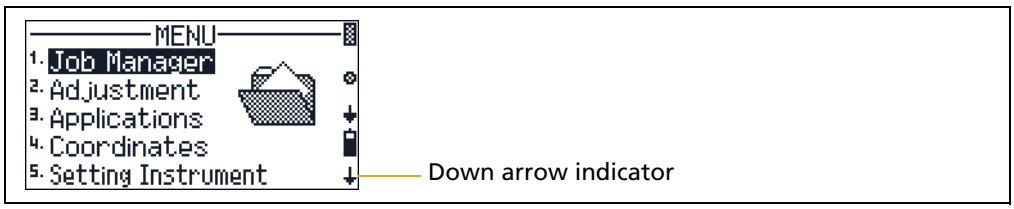
In an input screen, the status bar displays the current input mode and the softkeys provide different input options.

In the example shown here, press

- F1 <ABC> to change the input mode to capital alphanumeric letters
- F2 List to show the point name list
- F3 Stack to display the point stack
- F4 o.k. to complete both the point name and point code input

Menu screen

A menu screen gives a list of options. When you have selected a menu item, a secondary menu screen or input screen appears.



To choose a menu item, use the number keys, or the ^ or v arrow keys.

On a menu screen, a down-arrow on the right bottom corner of the screen indicates that there are more items in the menu. To see the other menu items, press v.

Inputting data

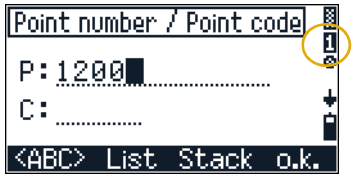
Changing between alphanumeric and numeric input

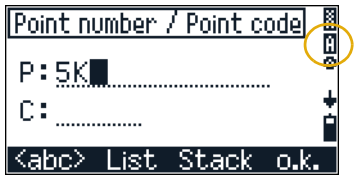
You can enter characters into fields using the numeric <123> or alphanumeric <ABC>/<abc> mode. A 1, A, or a in the sidebar indicates the current input mode.

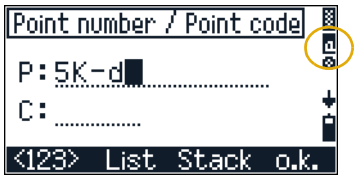
The default input mode is numeric.

- To change the input mode from numeric to capital letter alphanumeric, press F1.
- To change the input from capital letter to lower case alphanumeric, press F1.
- To change back to the numeric input mode, press F1 again.

Note – *The alphanumeric mode includes the plus and minus sign.*

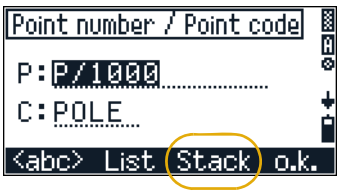






Stack

Use the stack function to input a previously used string.

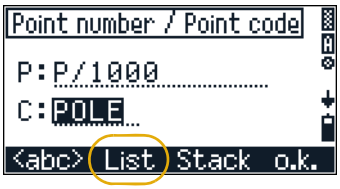


1. Press F3 Stack when you are in an input screen. A window appears that contains the current contents in the stack memory.
2. To select a string from the stack list, press ^ or v and then press MEAS/ENT to insert the selected string in the input screen.
3. To cancel the process, press ESC.

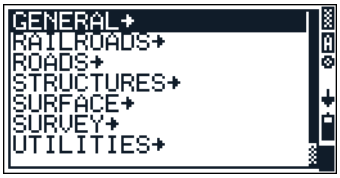
Note – *The stack list can hold up to 5 strings used for recording points.*

List

Use the list function to input a string from the registered list. The system maintains two lists: one for the point name, and one for the point code.



1. Press F2 List when you are in an input screen. A window appears that contains the current contents in the list memory.
2. To select a list, press ^ or v and then press MEAS/ENT to insert the selected string in the Point name or Point code field.
3. To cancel the process, press ESC.



Note – *The lists can hold up to 254 point names or point codes. When you have a large number of items, you can group them by using the Layer functionality. See* *Adding a layer, page 46**.*

CHAPTER

3

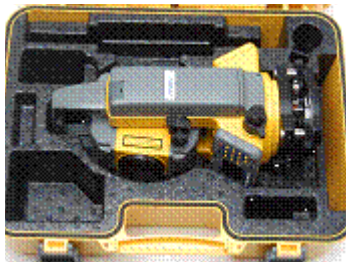
Before Going to the Field

In this chapter:

Unpacking and packing the instrument

Note – *Handle the Trimble M3 total station carefully to protect it from shocks and excessive vibration.*

Unpacking the instrument



To unpack the instrument, grip the carrying handle and carefully remove the instrument from the carrying case.

Packing the instrument

Note – *Store the instrument with the battery pack attached.*

To pack the instrument back into the carrying case:

1. Set the telescope in the horizontal face-1 position.
2. Align the ∇ storage mark on the bottom of the face-1 keyboard with the ∇ mark on the tribrach clamp knob.
3. Lightly fasten the clamp knobs.
4. Place the instrument in the carrying case.

Note – *When packing the charger (Q-75U/E) in the plastic carrying case, make sure that you store it as shown on the sticker inside the case. Make sure that the battery charger cable is not pinched when you close the case cover.*

Charging and discharging the battery pack

Safety notices

Before charging the battery pack, read the following warnings, cautions and notes.

WARNING – Use only the specified battery charger (part number Q-75U/E) to charge the battery pack (part number BC-65). Using other chargers, such as a charger with part number Q-7U/E or Q7C, may cause the battery pack to catch fire or rupture.

WARNING – Do not cover the battery charger while the battery pack is being recharged. The charger must be able to dissipate heat adequately. Coverings such as blankets or clothing can cause the charger to overheat.

WARNING – Avoid recharging the battery pack in humid or dusty places, in direct sunlight, or near heat sources. Do not recharge the battery pack when it is wet. If you do, you may receive electric shocks or burns, or the battery pack may overheat or catch fire.

WARNING – Although the battery pack (part number BC-65) has an auto-reset circuit breaker, you should take care not to short circuit the contacts. Short circuits can cause the battery pack to catch fire or burn you.

WARNING – Never burn or heat the battery. Doing so may cause the battery to leak or rupture. A leaking or ruptured battery can cause serious injury.

WARNING – Before storing the battery pack or battery charger, cover the contact points with insulation tape. If you do not cover the contact points, the battery pack or charger may short circuit, causing fire, burns, or damage to the instrument.

WARNING – The battery BC-65 is not waterproof on its own. Do not get the battery wet when it is removed from the instrument. If water seeps into the battery, it may cause a fire or burns.

CAUTION – Before charging the battery pack, read the instruction manual for the quick charger (part number Q-75U/E).

Note – *Charge the battery pack indoors where the ambient temperature is between 0 °C and 40 °C (between 32 °F and 104 °F). If you try to charge the battery when the ambient temperature is outside this range, the protective circuit will work and prevent it from being charged normally.*

Note – *To prevent malfunction, keep the charging plug clean.*

Note – *If the CHARGE indicator blinks repeatedly after charging starts, there is a problem with the battery pack. Do not use or charge the battery pack any further, and contact your dealer.*

Note – *If the ambient temperature drops below 0 °C (32 °F) while the battery pack is charging, the charger stops charging the battery pack. When the ambient temperature rises above 0 °C (32 °F), charging resumes. Charging will be completed after restarting.*

Note – *If the CHARGE indicator remains lit for more than four hours, and the ambient temperature during charging was within the specified operational range (0 °C through 40 °C or 32 °F through 104 °F), there is a problem with the battery pack. Do not use or charge the battery pack any further, and contact your dealer.*

Note – *During charging or discharging, the battery pack and quick charger will become warm. This is normal.*

Note – *After charging the battery pack, do not recharge it until it has been fully discharged. Recharging a fully charged battery pack lowers its performance.*

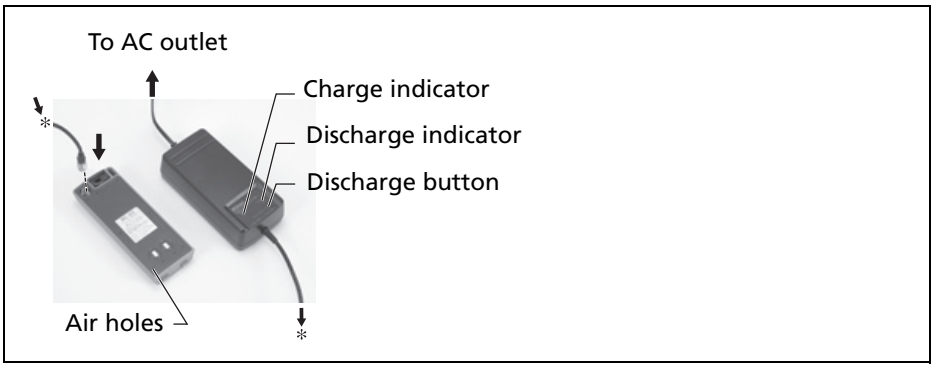
Note – *If the battery pack is used at low temperatures (below -20 °C or -4 °F), its capacity is reduced, and it will allow less operation time than a battery pack used at normal (room) temperature.*

Note – *If a battery pack is not used for a long period, it cannot be charged to its full capacity again. To improve the battery pack's capacity, charge and discharge it several times. See* *Discharging the battery pack, page 30**.*

Note – *You can use a battery charger with part number Q-70U/E or Q-70C to partially charge a battery pack with part number BC-65. However, these chargers cannot fully charge the BC-65 battery pack.*

Charging the battery pack

1. Connect the power plug on the charger to an AC power outlet.



2. Connect the charging plug on the charger cable to the charging connector on the battery pack.

   The charge indicator lights up, and charging starts automatically.

   When the battery pack is fully charged, the charge indicator turns off.

Discharging the battery pack

1. Connect the power plug on the charger to an AC power outlet.
2. Connect the charging plug on the charger cable to the charging connector on the battery pack.
3. Press the Discharge button on the battery charger.

   The discharge indicator lights up, and the charger starts to discharge the battery. When discharging is completed, the discharge indicator turns off. Then the charge indicator lights up, and charging starts automatically.
4. To stop discharging the battery pack, press the discharge button again.

Note – *The battery pack can be recharged repeatedly. If you recharge the battery pack while it still has enough power to operate the instrument, however, it will last for a shorter period. This is called the memory effect. If you experience the memory effect, discharge the battery pack as described above and then recharge it. This returns the battery pack to its full capacity. Trimble recommends that you discharge the battery pack in this way at least once every ten charges.*

Detaching the BC-65 battery pack from the instrument

CAUTION – Avoid touching the contacts on the battery pack.

1. If the instrument is turned on, press PWR to turn it off.
2. Depress the battery mounting button while holding the battery pack.

Attaching the BC-65 battery pack to the instrument

CAUTION – If the battery pack is not attached securely, this could adversely affect the watertightness of the instrument.

1. Before you attach the battery pack, clear any dust or other foreign particles from the battery socket.

2. Fit the two projections at the bottom of the battery pack into the concave sections at the bottom of the socket on the instrument.
3. Hold the instrument steady with one hand and push the battery pack against the instrument.
4. Make sure that the battery mounting button is securely locked.

Note – *An external battery is available as an optional accessory for the Trimble M3 total station. When the external battery is connected and the BC-65 battery pack is mounted on the instrument, the instrument automatically uses the power source that has the most available power.*

Selecting a language

The Trimble M3 total station provides three language selections, depending on the language pack that you have installed:

- Language pack 1: English, Russian, and Spanish
- Language pack 2: English, German, and French

Language pack 1 is the default language pack installed at the factory. To have another language pack installed, contact an authorized Trimble total station service provider.

1. To select a different language, power on the instrument and at the `TILT TELESCOPE` screen, press ESC and then press 3.

   The `SELECT LANGUAGE` screen appears. The screen shows up to three languages that are currently available.

   The current language selection is highlighted.

2. Press ^ or v to highlight the required language and then press ENT.

   The instrument reboots and displays the start-up *Tilt Telescope* screen in the selected language.

Changing regional configuration presets

You can quickly configure the Trimble total station to a pre-set combination of default regional settings. The *Regional Configuration* screen appears only after the language is selected.

To change the regional configuration pre-sets:

1. Follow the steps in Selecting a language, page 32.

   After the instrument is rebooted and the telescope is tilted, the `REGIONAL CONFIGURATION` screen appears.

2. Press ^ or v to highlight the required regional settings and then press ENT.

3. If you do not want to change the current settings, press ESC. The instrument will continue to use the last settings that were configured.

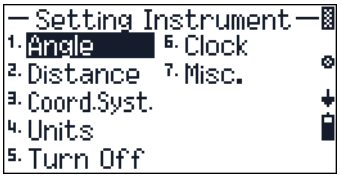
The settings affected by the REGIONAL CONFIGURATION screen are:

Table 3.2 Regional configuration pre-sets

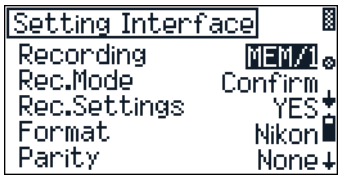
Category	Setting	Europe	International	United States
Angle	Accuracy	0.2 mg - 0.5 mg	1″	1″
	Unit	gon	DMS	DMS
	VA-Reference	Zenith	Zenith	Zenith
	AZ-Zero-Direct	North	North	North
	HA Initialize	OFF	OFF	OFF
Distance	Accuracy	0.001 m	0.001 m	0.001 f
	Unit	Meter	Meter	US-feet (survey feet)
	Time out EDM	30 s	30 s	30 s
Coord. System	Axis Type	X↑ → Y	N↑ → E	N↑ → E
	Displ. Order	Y, X	N, E	N, E
Units	Temp	Centigrade (°C)	Centigrade (°C)	Fahrenheit (°F)
	Press	hPa	mmHg	In Hg
Turn Off	Main Unit	OFF	OFF	OFF
	EDM Unit	3 minutes	3 minutes	3 minutes
	Sleep	5 minutes	5 minutes	5 minutes
Miscellaneous	P Input	<123>	<123>	<123>
	C Input	<ABC>	<ABC>	<ABC>
	Add PT for S-O	0	0	0
Settings Interface	Recording	MEM/3	MEM/3	MEM/3
	Rec. Mode	All	All	All
	Rec. Settings	No	No	No
	Format	M5	Nikon	Nikon
	Parity	None	None	None
	Baud	4800	4800	4800
	Position P	16	16	16
	Position C	11	11	11
	Position I	1	1	1
EDM Settings	Mode	PREC	PREC	PREC
	Ave	1	1	1
Settings correction	Prism constant	-18mm	-18mm	-18mm
	Scale	1.000000	1.000000	1.000000
	C & R corr.	0.142	0.142	0.142
	Sea level corr.	OFF	OFF	OFF

Instrument settings

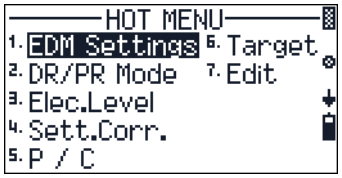
The required instrument settings can be divided into the following groups:



- Basic measurement settings – access the basic measurement setting options from MENU 5 `Settings Instrument`. See Basic measurement settings, page 34.



- Data recording and transfer related settings – access the basic measurement setting options from MENU 6 `Setting Interface`. See Configuring data recording and external communication settings, page 38.



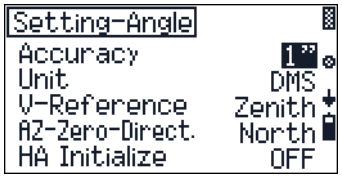
- Frequently used settings – the Trimble key is available in most observation screens and is used to change the EDM mode, point number/code, and target and correction settings. You can also activate bubble indication to check leveling, and check and edit data from this menu.

  See Frequently used settings (HOT MENU settings), page 39.

Basic measurement settings

Press MENU 5 `Settings Instrument` to enter or change the basic measurement settings.

Angle settings



1. From the `Settings Instrument` menu, select 1 `Angle`,

   To move from one line to the next, press V.

2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.

The angle settings are:

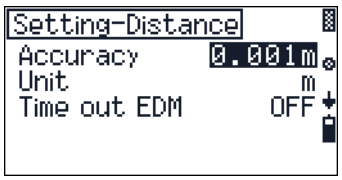
	Options
Accuracy	**Trimble M3 3"DR** 1" / 0.0002° / 0.2mg / 0.01M 5" / 0.001° / 1mg / 0.1M 10" / 0.005° / 5mg / 0.5M **Trimble M3 5"DR** 1" / 0.0005° / 0.5mg / 0.01M 5" / 0.001° / 1mg / 0.1M 10" / 0.005° / 5mg / 0.5M
Unit	DMS Deg gon mil
V-Reference	Zenith Vertical ± Elev
AZ-Zero-Direct	North South
HA Initialize	ON OFF ***Note –*** *When HA Initialize is set to ON, the horizontal angle needs to be initialized (by rotating alidade) every time the vertical index is initialized (that is, when you turn the instrument on). By doing this, the azimuth direction will be kept after rebooting the instrument.*

Distance settings

1. From the `Settings Instrument` menu, select 2 `Distance`,

   To move from one line to the next, press v.

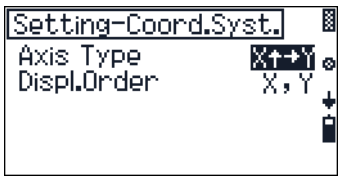
2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.



The distance settings are:

	Options
Accuracy	0.001 m / 0.001 ft 0.005 m / 0.01 ft 0.01 m / 0.02 ft
Unit	Meter United States foot (U-ft) International foot (I-ft)
Time out EDM	OFF 10 sec 30 sec

Coordinate system settings



1. From the `Settings Instrument` menu, select 3 `Coord-Syst`,

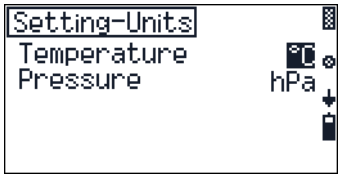
   To move from one line to the next, press v.

2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.

The coordinate system settings are:

	Options
Axis Type	X↑ → Y Y↑ → X N↑ → E
Displ.Order	Y, X X, Y N, E E, N

Units settings



1. From the `Settings Instrument` menu, select 4 `Units`,

   To move from one line to the next, press v.

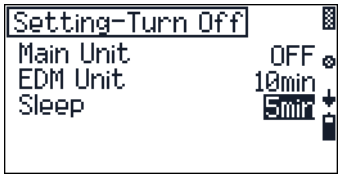
2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.

The coordinate system settings are:

	Options
Temperature	Celsius Fahrenheit
Pressure	mmHg hPa inHg

Turn Off settings

This option controls power saving.



1. From the `Settings Instrument` menu, select 5 `Turn Off`,

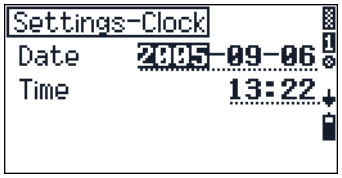
   To move from one line to the next, press v.

2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.

The power savings settings are:

	Options
Main Unit	OFF 10 min 30 min
EDM Unit	OFF Once 6 sec 30 sec 3 min 10 min
Sleep	OFF 1 min 3 min 5 min

Clock settings



1. From the `Settings Instrument` menu, select 6 `Clock`,

   To move from one element of the date or time field (for example from the year to the month field), press v, ^, or MEAS/ENT.

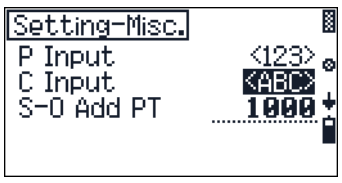
2. To change the settings of each date or time element, press < to select a character and then use the keypad to enter a number. Press v to move to the next element.

3. Press MEAS/ENT to confirm the change.

The clock settings are:

	Options
Date	Enter in the order Year > Month > Day
Time	Enter in the order Hour > Minutes (24-hour clock)

Miscellaneous settings



1. From the `Settings Instrument` menu, select 7 `Misc`,

   To move from one line to another press v.

2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.

The miscellaneous settings are:

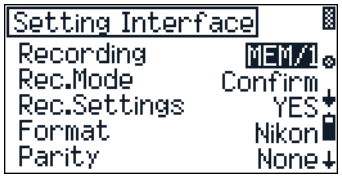
	Options
P Input	123 ABC abc
C Input	123 ABC abc ***Note –*** *P Input and C Input are the settings used to define the default input mode when you enter a point number or name (P Input) and point code (C Input). For example, if you often use a point name such as K-101 or T3, you can change the setting to start entering the point name in alphabetic mode.*
S-O Add PT	0 - 999999 (numeric input) ***Note –*** *This field is a setting for recoding a point in stakeout functions. It is used to specify an integer that is added to the point number being staked to generate a new number for recording the staked point. The default value is 0. For example, when you stake out PT3 with an Add Constant of 1000, the default number for stakeout recording is PT1003.*

Configuring data recording and external communication settings

1. Press MENU 6 `Settings Interface` to set up data recording/transfer related settings.

   To move from one line to the next, press v.

2. To change the settings in each line, press < or > and then press MEAS/ENT to confirm the change.



The setting options are:

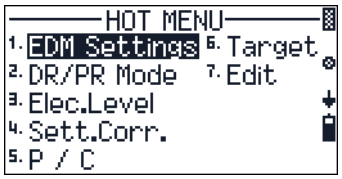
	Options
Rec. Data Type	MEM/1 /2 /3 - record data to the internal memory, where: • /1 records measured values • /2 records computed values • /3 records both measured and computed value V24/1 /2 /3 - output data to external device via the RS232 interface, where: • /1 outputs measured values • /2 outputs computed values • /3 outputs both measured and computed value OFF - no data recorded
Rec. Mode	All Confirm
Rec. Settings	Yes No

	Options
Format (output format)	M5, see M5 data format, page 128 Nikon, see Nikon data format, page 140
Parity	None Even Odd
Baud rate	1200 2400 4800 9600 19200 38400
Position P (only for M5 format)	1 - 16
Position C (only for M5 format)	1 - 23
Position I (only for M5 format)	1 - 21

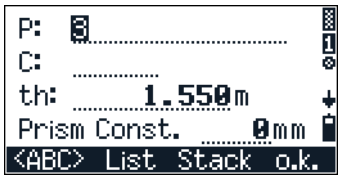
Note – *As the remote control command, the Trimble M3 total station supports Nikon External Commands. When you use your Trimble M3 total station with any data collector, please set your equipment to use Nikon External Command.*

Frequently used settings (HOT MENU settings)

Press the Trimble key to access the HOT MENU.



Tip – When you hold down the Trimble key for one second in any observation screen, a shortcut screen appears that enables you to enter the point, code, target height, and prism constant.

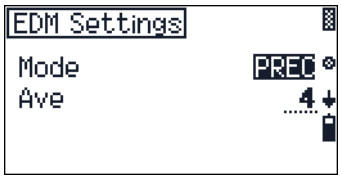


Distance measurement settings (EDM)

1. Press 1 in the HOT MENU screen to open the EDM Settings screen.
2. Press < or > to change the Mode setting. The options are PREC/STD where:

   PREC is precise measurement mode

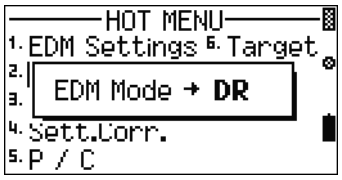
   STD is fast measurement mode



3. Press [v] to move to the AVE field. AVE is the number of measurements to average when computing the measured distance value. Enter a number between 1 and 99.
4. To return to the HOT MENU screen, press [ESC].

Changing target mode (DR or Prism)

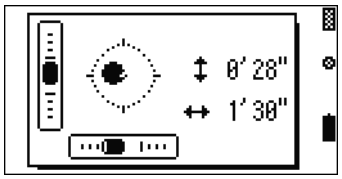
Press [2] in the HOT MENU screen to change the current EDM mode. For example, if you are currently in Prism measurement mode (PR), press [2] to change the mode to Direct-Reflex mode (DR).



Tip – When you change the DR/PR mode, the prism constant and target height is updated using the setting value in [6] Target. In DR mode, the prism constant and target height for DR is used. In PR mode, the values are the last ones used in PR mode.

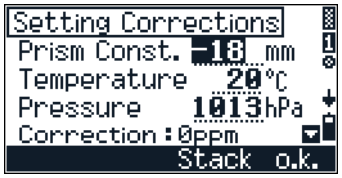
Bubble level display (electric level)

1. Press [3] Elec. Level in the HOT MENU screen to view the bubble level display.
2. To change the tilt compensation settings, press [<] or [>].
3. To return to the HOT MENU screen, press [ESC].



Configuring error corrections

1. Press [4] in the HOT MENU screen to open the Settings Corrections screen. There are seven settings related to distance corrections.
2. In the first settings screen Correction is updated when you change the temperature and/or pressure value.
3. Do one of the following:
   - To display the next screen, press [v] when you are in the Pressure field.
   - To use values from the stack, press [F3] Stack in any numeric input field.
   - To finish the settings, press [F4] o.k.

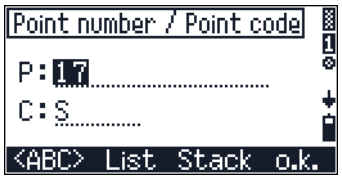


4. Press [ESC] to return to the HOT MENU screen.

Table 3.3 Allowable values for error corrections

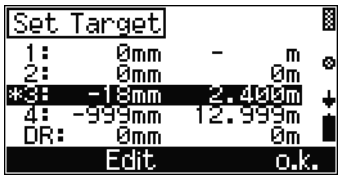
Setting	Input range
Prism constant	-999 – 999 (numeric input)
Temperature	-40 °C – 70 °C
Pressure	440 hPa – 1460 hPa
Scale	0.995000 – 1.00500
C&R corr.	0.132, 0.142, 0.200, or OFF
Sea level corr.	ON/OFF

Selecting a point name and point code



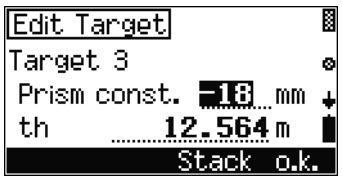
1. Press [5] in the HOT MENU screen to open the Point number/Point code screen.
2. Do one of the following:
   - To change the input mode, press [F1] <ABC>.
   - To select the input from the list, press [F2] List.
   - To select the input from a previously used point name or code, press [F3] Stack.
3. Then do one of the following:
   - To return to the screen in which you pressed , press [F4].
   - To return to the HOT MENU screen, press [ESC].

Selecting a target configuration



1. Press [6] in the HOT MENU screen to open the Set Target screen.
2. Do one of the following:
   - To move the cursor in the target list, press [^] or [v] or [1] – [5] and then press [MEAS/ENT] to select the highlighted item.
   - Press [F2] Edit to edit the target settings, see Editing target settings, page 42.
3. To select the highlighted target, press [F4] o.k..

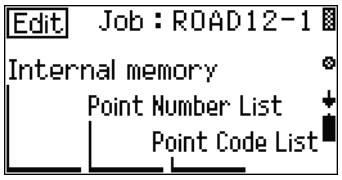
Editing target settings



1. Press F2 Edit in the Set Target screen. The Edit Target screen appears.
2. Do one of the following:
   - Use the keypad to enter a new value.
   - To use values from the stack, press F3 Stack.
   - To return to the previous screen, press ESC.
3. To finish the edit, press F4 o.k..

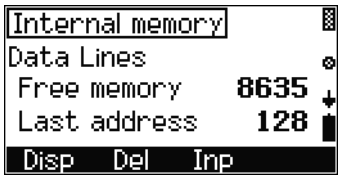
Note – *Input the value that is shown on the prism into the Prism const. field.*

Editing data, point number lists or point code lists



1. Press 7 in the HOT MENU screen to open the Edit screen.
2. Do one of the following:
   - To view and edit data stored in the memory, press F1. See Viewing and editing data in internal memory, page 42.
   - To edit the point number list, press F2. See Managing your list of point names, page 44.
   - To edit the point code list, press F3. See Managing your list of point codes, page 45
3. To return to the HOT MENU screen, press ESC.

Viewing and editing data in internal memory



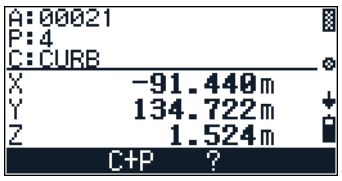
This screen reports the current status of the internal memory:

- Free memory indicates how many more lines you can record.
- Last address is the address of the last recorded line in the internal memory.

Do one of the following:

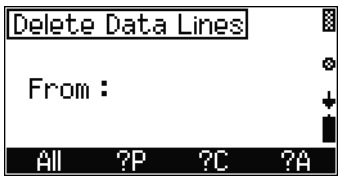
- To open the view data screen, press F1 Disp. See Reviewing stored data, page 43.
- To delete data lines, press F2 Del. See Deleting data, page 43.
- To input coordinate data, press F3 Inp.

Reviewing stored data



1. Press F1 Disp in the Internal memory screen.
2. Do any of the following:
   - To edit point number and code, press F2 C+P.
   - To search data, press F3 ?. See Searching your data, page 44.
   - To display the previous data line in the internal memory, press ^.
   - To display the next data line in the internal memory, press v.
   - To return to the previous screen, press ESC.

Deleting data

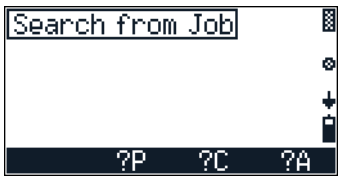


1. Press F2 Del in the Internal memory screen to delete data lines,
2. Do any of the following:
   - To delete all points in the current job, press F1 All.
   - To define the point so that you can delete by point number, press F2 ?P.
   - To define the point so that you can delete by point code, press F3 ?C.
   - To define the point so that you can delete by address, press F4 ?A.

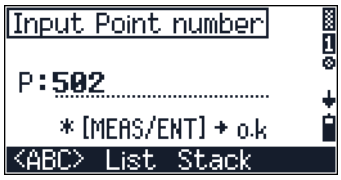
Note – *When the address is specified by ?P, ?C, or ?A, everything, from the specified data line to the end of the file, will be deleted.*

Searching your data

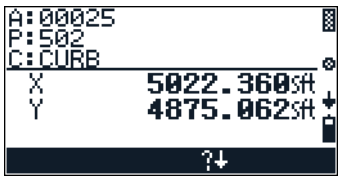
1. Press F3 ? in the View data screen to open the Search from Job screen.



2. Do one of the following:
   - To search a point by point name or number, press F2 ?P. When you have selected or entered a point name or number, press MEAS/ENT.
   - To search a point by point code, press F3 ?C.
   - To search a point by address, press F4 ?A.



   The search result screen appears.



3. Do one of the following:
   - To search another point with the same condition, press F3 ?↓.
   - To define a new search, press ESC to return to the previous screen.

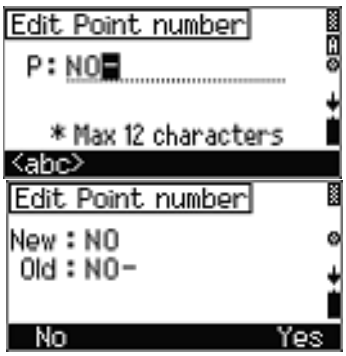
Managing your list of point names

This screen shows the current point name list. Press the ^ or v key to select the point name or number, or a layer that you want to edit or delete.

Do one of the following:

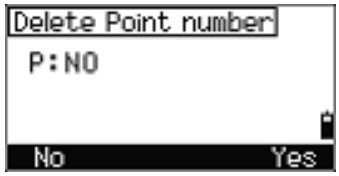
- To delete the highlighted point name or number, press F1 DEL. See Deleting a point name or number, page 45.
- To edit the highlighted point name or number, press F2 Edit. See Editing a point name or number, page 45.
- To add a point name or number, press F3 Add. See Adding a point name or number, page 45.
- To return to the previous screen, press ESC.

Editing a point name or number



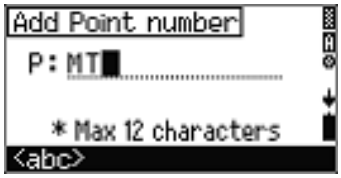
1. Press F2 Edit in the point number list screen. The Edit Point Number screen appears.
2. Enter the required name or number. Press F1 <abc> to change the input mode.
3. Press MEAS/ENT. A confirmation screen appears. Do one of the following:
   - To return to the list without any change, press F1 No.
   - To accept the change and update the list, press F4 Yes.

Deleting a point name or number



1. Highlight an item in the point number list screen and then press F1 DEL. A confirmation screen appears.
2. Do one of the following:
   - To return to the list without deleting the item, press F1 No.
   - To delete the item, press F4 Yes.

Adding a point name or number



1. Press F3 Add in the point number list screen. The Add screen appears.
2. Do one of the following:
   - Use the keypad to enter a new value.
   - To change the input mode, press F1 <ABC>.
   - To return to the previous screen, press ESC.
3. Press MEAS/ENT to update the list.

Managing your list of point codes

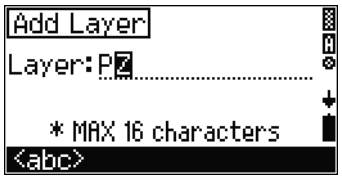
This screen shows the current point code list. Press ^ or v to select the point name or number, or a layer that you want to edit or delete.

Note – *A layer is a group of point codes with an arrow showing at the end of the string.*

All the procedures that are used to edit a point name list, are also used to edit a point code. See Managing your list of point names, page 44. In addition, you can add a layer. See Adding a layer, page 46.

Adding a layer

A layer is a folder to categorize a set of point codes. This is especially useful when you have many codes and need to quickly find and input the point code that you want to use in the field.



1. Press F4 `Layer` in the point code list screen. The `Add Layer` screen appears.
2. Do one of the following:
   - Use the keypad to enter a new value.
   - To change the input mode, press F1 `<abc>`.
   - To return to the previous screen, press ESC.
3. Press MEAS/ENT to update the list.

CHAPTER

4

Getting Started in the Field

In this chapter:

Setting up the tripod

CAUTION – The tops of the tripod ferrules are very sharp. When handling or carrying the tripod, take care to avoid injuring yourself on the ferrules.

Note – *Do not carry the instrument while it is attached to a tripod.*

1. Open the tripod legs far enough for the instrument to be stable.
2. Locate the tripod directly over the station point. To check the tripod's position, look through the center hole in the tripod head.
3. Firmly press the tripod ferrules into the ground.
4. Level the top surface of the tripod head.
5. Securely fasten the thumb screws on the tripod legs.
6. Place the instrument on the tripod head.
7. Insert the tripod mounting screw into the center hole of the base plate of the instrument.
8. Tighten the tripod mounting screw.

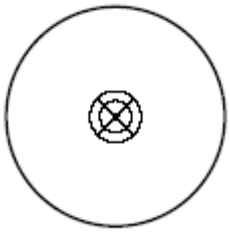
Centering

When you center the instrument, you align its central axis precisely over the station point. To center the instrument, you can either use the optical plummet or a plumb bob. The plumb bob is sold separately.

Centering with optical plummet

Note – *If you require high accuracy, check and adjust the optical plummet before you center the instrument. For detailed instructions, see* *Checking and adjusting the optical plummet, page 117**.*

1. After setting up the instrument on the tripod, look through the optical plummet and align the reticle with the station point. To do this, turn the leveling screws until the center mark ⊙ of the reticle is directly over the image of the station point.



2. While supporting the tripod head with one hand, loosen the tripod leg clamps and adjust the lengths of the legs until the air bubble is in the center of the circular level.
3. Tighten the tripod leg clamps.
4. Use the plate level to level the instrument. See Leveling, page 49. Look through the optical plummet to check that the image of the station point is still in the center of the reticle mark.

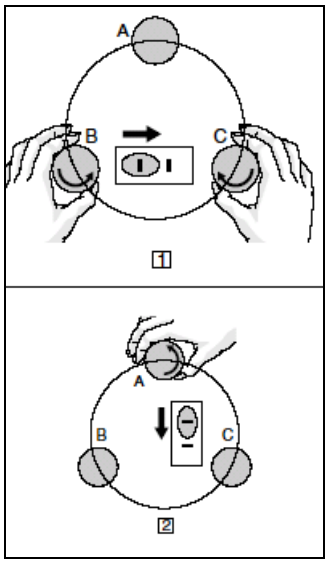
5. If the station point is off center, do one of the following:
   - If the station point is slightly off center, loosen the tripod mounting screw and then center the instrument on the tripod. Use only direct movement to center the instrument. Do not rotate it.

     When the instrument is centered, tighten the mounting screw.
   - If the displacement of the station point is major, repeat this procedure from Step 2.

Leveling

When you level the instrument, you make the vertical axis of the instrument exactly vertical.

To level the instrument, use the plate level.

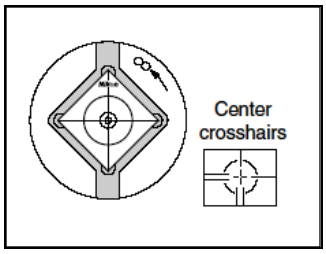


1. Loosen the upper plate clamp.
2. Rotate the alidade until the plate level is parallel with any two of the leveling screws (B and C).
3. Use leveling screws B and C to move the bubble into the center of the level.
4. Rotate the alidade approximately 90°.
5. Use leveling screw A to move the bubble into the center of the level.
6. Repeat Step 1 through Step 5 to center the bubble in both positions.
7. Rotate the alidade 180°.
8. If the bubble in the plate level remains centered, the instrument is level. If the bubble moves off center, adjust the plate level. For detailed instructions, see Checking and adjusting the plate level, page 116.

Focusing the telescope

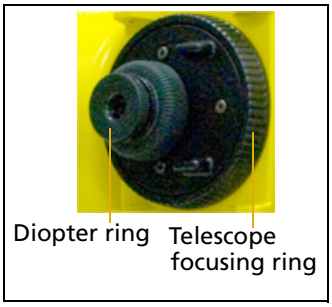
WARNING – Never look at the sun through the telescope. If you do, you may damage or lose your eyesight.

When you sight the instrument, you aim the telescope at the target, bring the target image into focus, and align the image with the center crosshairs of the reticle.



Note – *In DR-mode, the center circle of the crosshair is the beam passing area. The diameter is about 15 cm at 100 m distance from the instrument.*

To sight the instrument:



1. Adjust the diopter:
   a. Aim the telescope at a blank area, such as the sky or a piece of paper.
   b. Looking through the eyepiece, rotate the diopter ring until the reticle crosshairs are in sharp focus.
2. Eliminate parallax:
   a. Aim the telescope at the target image.
   b. Rotate the focusing ring until the target image is in sharp focus on the reticle crosshairs.
   c. Move your eye vertically and laterally to check whether the target image moves relative to the reticle crosshairs.

      If the target image does not move, there is no parallax.
   d. If the target image does move, rotate the telescope focusing ring. Then repeat from Step c.
3. Rotate the tangent screw. The final turn of the tangent screw should be in a clockwise direction, to align the target accurately on the center crosshairs.

Setting the measurement mode and preparing the target

WARNING – The Trimble M3 3" and 5" DR total stations are Class 1 laser instruments. The laser beam is hazardous to the eyes and the body. Do not sight the instrument on the face or body of a person. If you suspect an injury caused by exposure to the laser beam, seek medical advice immediately. If the instrument housing is open and the instrument is turned on, the laser emits a beam stronger than the Class 1 safety level.

WARNING – Observe all other warnings and cautions. See Safety and Warnings, page iii.

The Trimble M3 total station has two measurement modes: Prism mode (Prism) and Direct Reflex mode (DR). To change the mode at any time from any observation screen, press and then press 2. See also Changing target mode (DR or Prism), page 40.

Table 4.4 describes how to set the measurement mode depending on the target you want to measure.

Table 4.4 Measurement modes

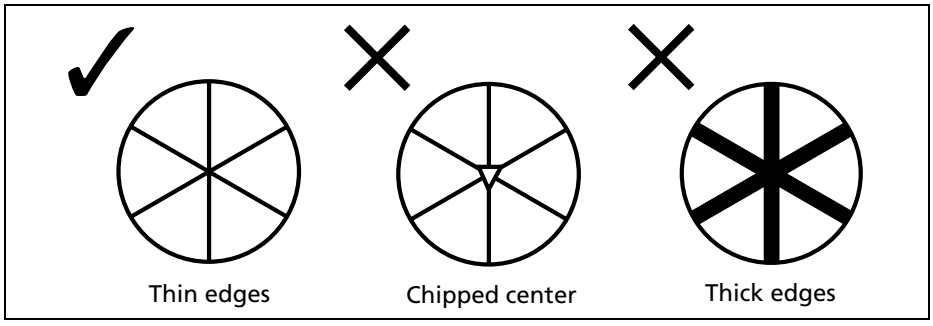
Target	Target settings	Indicator on status bar
Prism, reflector sheet	Prism (Prism mode)	
Other, reflective materials	DR (Direct-Reflex mode)	

Measurement with a prism

As the Trimble M3 total station is extremely sensitive, multiple reflections on the prism surface can sometimes cause a significant loss in accuracy.

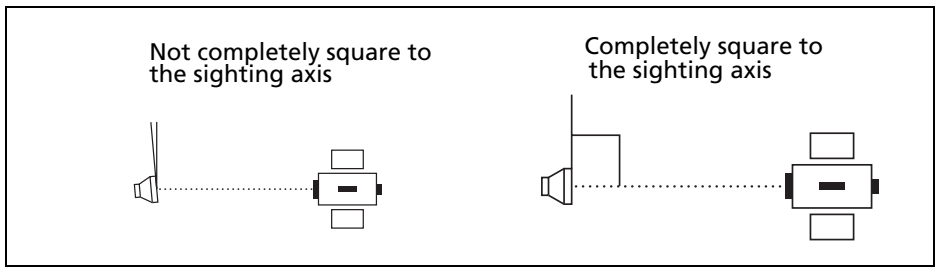
To maintain the accuracy of your measurements:

- Do not use a prism with scratches, a dirty surface, or a chipped center. Trimble recommends that you use prisms with thin edges as shown below.



- When using a reflector sheet, take measurements longer than 5 meters.
- When using a mini or standard prism, take measurements longer than 10 meters.

- When measuring a short distance, incline the prism slightly so that the EDM can ignore unnecessary reflections on the prism surface, as shown below.



Hold the prism securely in place and do not move while taking measurements.

In Prism mode, in order to avoid false measurements on objects other than the prism or reflector-sheet, targets that are less reflective than the prism or reflector sheet are not measured. Even if you start a measurement, measured values are not displayed. To measure less reflective objects, use the Direct-Reflex mode.

Measurement in Direct-Reflex mode

The intensity of the reflection from the target determines the distance the Trimble M3 total station can measure in this mode. The color and condition of the target surface also affect the measurable distance, even if the targeted objects are the same. Some less-reflective targets may not be measured.

Table 4.5 describes some examples of targets and approximate measurable distances.

Table 4.5 Targets and measurement distances

Target	You can measure approximately...
Traffic signs, reflectors	500 meters (1640 feet)
Paper (white), veneer (new)	200 meters (660 feet)
Wall (brightly painted), brick	50 to 100 meters (160 to 330 feet)

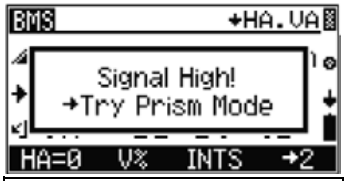
Measurable distances may be shorter or measurement intervals may be longer in the following cases:

- the angle of the laser against the target is small
- the surface of the target is wet

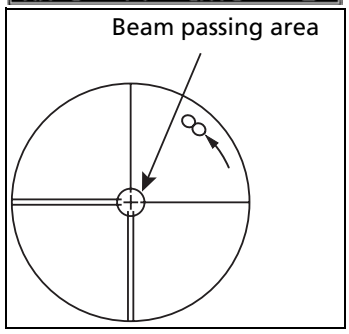
In direct sunlight, the measurable distance may be shorter. In this case, try to throw a shadow on the target.

Targets with completely flat surfaces, such as mirrors, cannot be measured unless the beam and the target are perpendicular to each other.

Sighting a prism in Direct-Reflex mode may cause an excessive signal error. In this case, change the prism mode to PR - press and then press 2.



In the Direct-Reflex mode, the beam passing area is shown by a circle in crosshairs on the telescope reticle.



If the target is smaller than the circle and there is something highly reflective in the background, the measured data may be affected by these adverse conditions.

When an obstacle momentarily passes through the beam between the instrument and the target (for example, passing cars on the road), the false data (short distance) is deleted automatically. However, if the amount of reflection is almost the same and the difference in distances between the correct and the false data is less than two meters, it may cause an error in measurements.

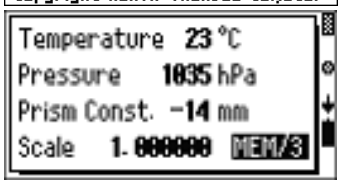
Make sure there are no obstacles between the instrument and the target when taking measurements. When you need to take measurements across a road or a place where vehicles or other objects are frequently moving, take several measurements to a target for the best result.

Turning the instrument on and off

Turning on the instrument

1. To turn on the instrument, press PWR. The start-up screen appears. This screen shows the version of the program.

2. When you tilt the telescope, current settings of temperature, pressure, prism constant, and scale appear for about two seconds.



3. The Rec Current Settings screen appears. Do one of the following:

   – To skip recording the current instrument settings, press F1 No.

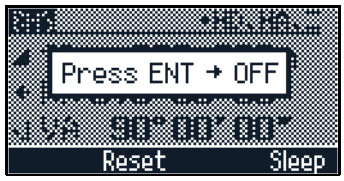
– To record current settings, press F4 Yes. If you select Yes, the Recording to screen appears.

Note – *To initialize the horizontal angle every time you power on, set the HA initialize setting to ON. Select MENU/Settings Instrument/Angle.*

4. After this, the instrument will automatically return to the screen that was showing before the instrument powered off.

Turning off the instrument

To turn the instrument off, press PWR and then press ENT.



Then do one of the following:

Press	to...
ENT again	turn off the instrument
F2 Reset	reboot the program and restart the instrument ***Note –*** *If you press the Reset softkey, the software is rebooted and the Basic Measurement Screen (BMS) appears.*
F4 Sleep	put the program into power-saving mode, see Sleep mode, page 54
ESC	cancel the power-off process and return to the previous screen

Sleep mode

If you press F4 Sleep in the Press ENT OFF screen, or enable the Power Save setting (select MENU/5 Settings Instrument/5 Turn-off), the instrument goes into sleep mode.

When the instrument is in sleep mode, it wakes up if any of the following occurs:

- You press any key.
- The instrument receives any remote control command via the serial interface.
- You rotate the alidade.
- You tilt the telescope.

CHAPTER

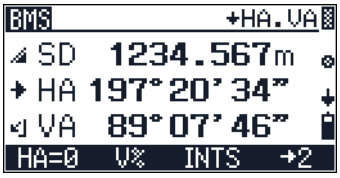
5

Basic Measurement Screen

In this chapter:

Measurement mode

The Basic Measurement Screen BMS appears after the Tilt Telescope screen. The Basic Measurement Screen displays the current angle measurements and most recent distance measurement.



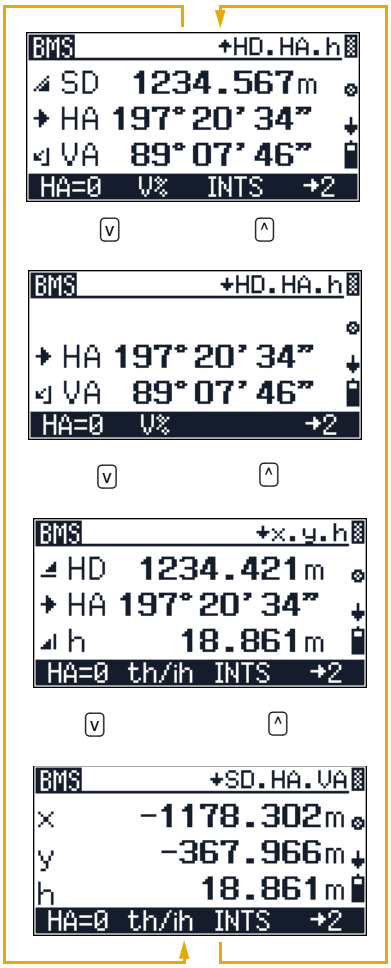
The measurement (MEAS) indicators are shown on the left of the screen. They are:

Table 5.6 Measurement mode indicators

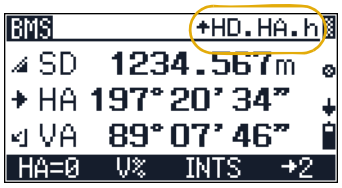
SD Slope distance			
HA Horizontal angle	Clockwise	Counter-clockwise	
VA Vertical angle	Zenith	Vertical	± Elev.
HD Horizontal distance			
h Height			
V% Percent grade			

Changing the screen display

There are four BMS screens. To move between the screens, press ^ or v.

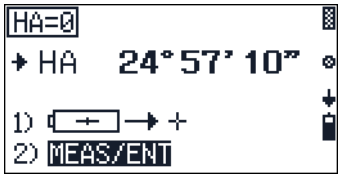


The items that will appear in the next screen are shown in the screen header (upper right corner).

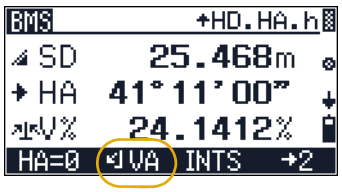


You can also do the following using the Trimble menu key and function keys:

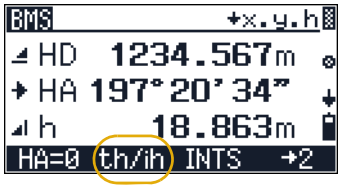
- To access the HOT MENU screen from any BMS screen, press .
- From the startup BMS screen, press F1 to go to HA=0 screen, see Setting the horizontal angle (HA), page 60.



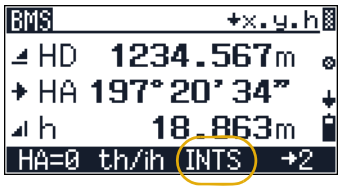
- To change VA to V %, press F2 in either of the first two screens.



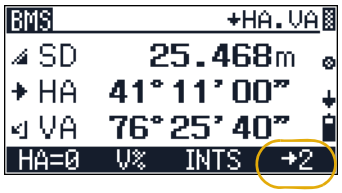
- To set the target or instrument heights, go to the th/ih input screen. Press F2 th/ih in the third and fourth screens. See Setting target height (th) and instrument height (ih), page 60.



- To go to the INTS screen (Intersection function menu), press F3 INTS. See Intersection, page 65.



- There are three sets of data. To display a different set of data, press F4 until the required data appears.



Changing the distance unit

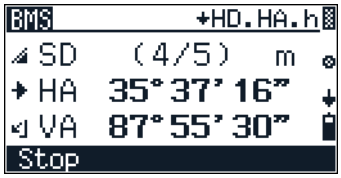
To change the distance unit:

1. Press F4 in the BMS screen. The second set of data appears.
2. To change the distance unit press F1.
   - When the unit is set to meters, the softkey is set to U-ft.
   - When the unit is set to US-feet, the softkey is set to I-ft.
   - When the unit is set to international feet, the softkey is set to m.

Taking measurements

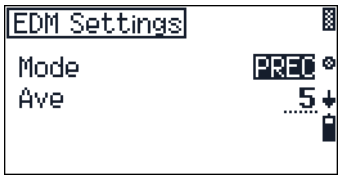
To take a measurement in any BMS screen:

1. Press MEAS/ENT. The prism constant value appears in small characters until the measured value appears.

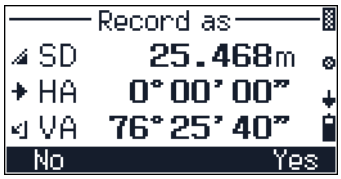


Note – *When the average count is set to more than one, the intermediate measurement process is shown in the SD field by numbers in parentheses. For example if the average count is set to 5, the following appears on screen (1/5) (2/5) (3/5) (4/5) (5/5). To set the average count, press , select 1 and set the Ave field to the required count.*

2. To stop measurement, press F1 Stop or ESC.



3. If the Recording mode is set to Confirm (Menu / 6) the Record As screen appears and you are prompted to record the measurements. To record the measurements, press F4 Yes.



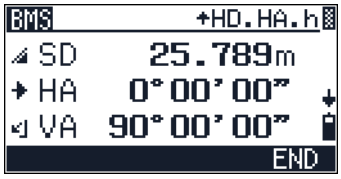
Note – *If the Rec. Mode is set to All, the* Recording to Adr:xxxxx *screen appears. See* *Configuring data recording and external communication settings, page 38.*

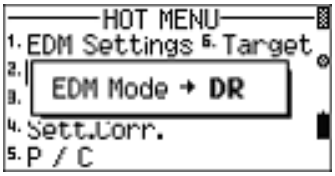
Tracking mode

Tracking mode initiates a continuous measurement until you stop measurement by pressing F4 END.

To initiate tracking mode, press MEAS/ENT for one second.

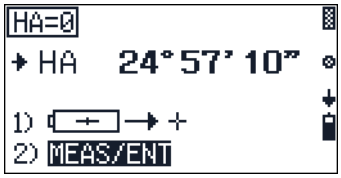
Note – To *change the EDM mode, press , select 2 and select the required mode.*





Setting the horizontal angle (HA)

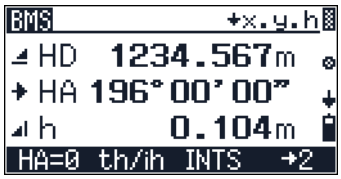
To set or reset the horizontal angle:



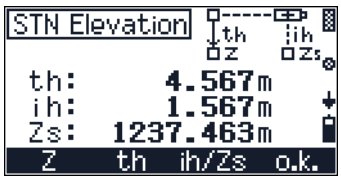
1. Press F1 HA=0 in any BMS screen. The HA=0 screen appears.
2. Sight the target and press MEAS/ENT to set or reset the horizontal angle.

Setting target height (th) and instrument height (ih)

To set the target height and instrument height:



1. Press F2 th/ih in the third or fourth BMS screen.



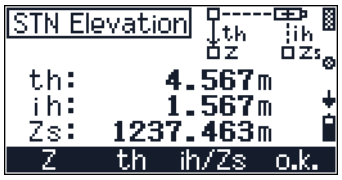
The STN Elevation screen appears. The current values for target height (th), instrument height (ih). and the Z-coordinate of the station point (Zs) appear.

2. Do one of the following:
   - To activate the station elevation function, press F1 Z. See Setting the station elevation, page 61.
   - To input target height, press F2 th.
   - To input the instrument height and/or a new height for station-Z, press F3 ih/Zs. See Instrument height (ih) and station-Z coordinate (Zs), page 62.
   - To confirm the current value and return to the previous screen, press F4 o.k..

Setting the station elevation

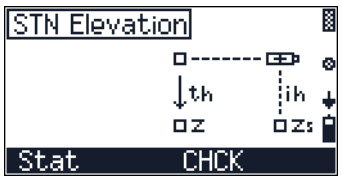
The station elevation function defines the Z coordinate of the station point after you have set up the instrument by 2D.

To activate the station elevation function, press F1 Z in the STN Elevation screen.

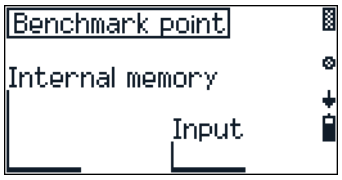


To set the station elevation:

1. Do one of the following:
   - To start the program, press F1 Stat.
   - To activate the Adjustment C&I program, press F3 CHCK. See Checking and adjusting the compensator (C) and index (I), page 119.



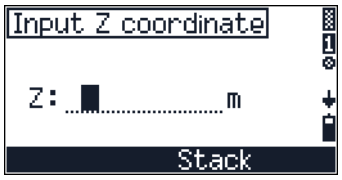
2. To select a benchmark point, do one of the following:
   - To select the benchmark point from the internal memory (database), press F1.
   - To input a new benchmark point, press F3.



3. Enter the station Z coordinate value and press MEAS/ENT. The Input ih screen appears.

   Enter the instrument height ih and press MEAS/ENT. The Input th screen appears.

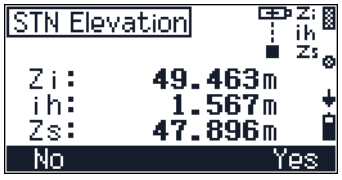
   Enter the target height th and press MEAS/ENT. The Sight backsight point screen appears.



Note – *You can also press F3 in any input screen (when you input Z, ih, or th) to select a previously input value from the Stack.*

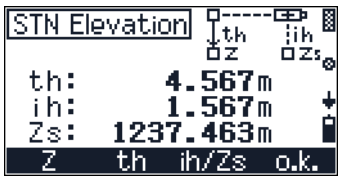
4. To go directly to the bearing and distance function, press F4 BeaDist. See Bearing-Distance, page 63.

5. The STN Elevation screen shows the result. Do one of the following:
   - To exit the program without saving the result, press F1 No.
   - To record the result on the screen and finish the program, press F4 Yes.

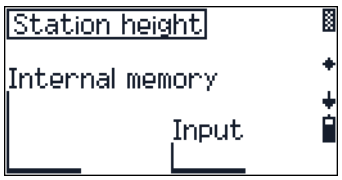


Instrument height (ih) and station-Z coordinate (Zs)

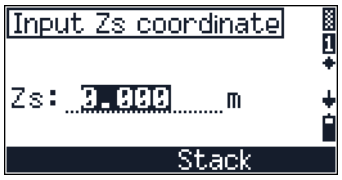
To input instrument height (ih) and station Z coordinates (Zs):



1. Press F3 ih/Zs in the STN Elevation screen.

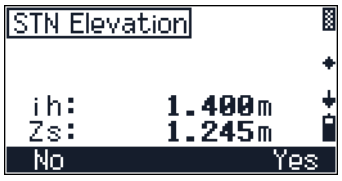


2. Select a method to input Station height.
   - To input from recorded data, press F1 Internal memory.
   - To input directly using the keypad, press F3 Input.



3. Input the Zs coordinate. Do one of the following:
   - Enter the coordinates using the keypad and then press MEAS/ENT.
   - To use previous input, press F3 Stack, select the required value and then press MEAS/ENT.

4. Input the instrument height. Do one of the following:
   - Enter the instrument height using the keypad and then press MEAS/ENT.
   - To use previous input, press F3 Stack, select the required value and then press MEAS/ENT.

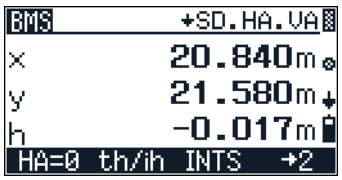


5. The STN Elevation screen shows the result. Do one of the following:
   - To exit the program without saving the result, press F1 No.
   - To record the result on the screen and finish the program, press F4 Yes.

Measuring edges and corners using the Intersection program (INTS)

To measure edges and corners, especially in DR mode, Trimble recommends that you use the Intersection program (INTS).

To access the INTS screen, press F3 INTS in a BMS screen.



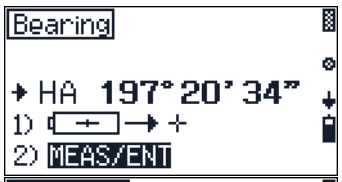
Bearing-Distance

Use this method when you want to shoot to the exact corner of a pillar or wall, or when it is difficult to place a target at the point you need to measure. You can first set the angle by sighting the point and then take a measurement to the closest point where the distance is almost the same.

1. Press 1 to open the Bearing-Dist. screen.
2. Press < or > to change the Mode setting. The options are OFF/Once/Perm.

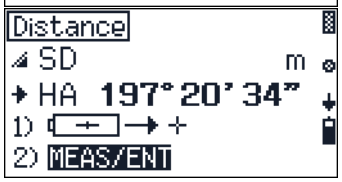
   If Mode is set to Perm you can continue using this offset measurement until you escape from the function.

3. Press F4 o.k..
4. Sight the point you need to record and press MEAS/ENT. The horizontal and vertical angles are fixed on the screen.



5. Find a target at the closest possible point and press MEAS/ENT.

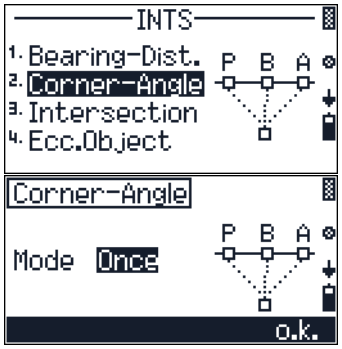
   After taking a distance measurement, the BMS screen appears from which you entered the INTS program. The screen shows the new measurements.



Note – *When Record mode (Rec. mode) is set to Confirm, a confirmation screen appears before you record a point. See* *Taking measurements, page 59*.

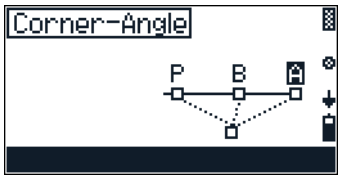
Corner-Angle

Use this method to measure points, edges, and corners on vertical planes. Any point of the plane can be measured and measurements to points A and B can be repeated.

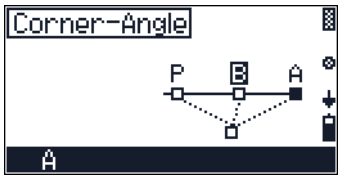


1. Press 2 in the INTS menu to open the Corner-Angle screen.
2. Press < or > to change the *Mode* setting. The options are OFF/Once/Perm.

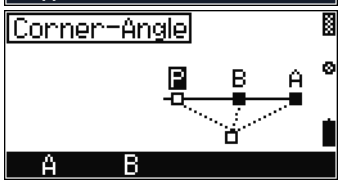
   If *Mode* is set to Perm you can continue using this offset measurement until you escape from the function.
3. Press F4 o.k.
4. Sight point A and then press MEAS/ENT.



5. Sight point B and then press MEAS/ENT.



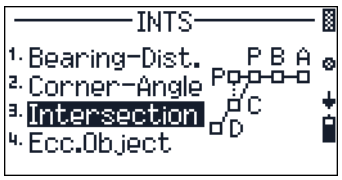
6. Sight point P and then press MEAS/ENT.
7. If you want to repeat a measurement:
   - Press F1 A to return to the point A measurement screen.
   - Press F2 B to return to the point B measurement screen.

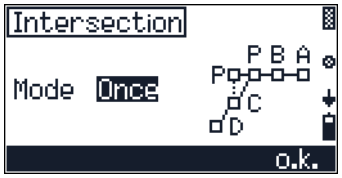


   After you have completed your measurements, the BMS screen appears from which you entered the INTS menu. The BMS screen shows the new measurements.

Intersection

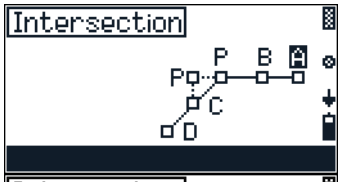
Use this method to determine the intersection point of two vertical planes.



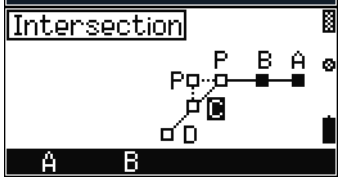


1. Press 3 in the INTS menu to open the Corner-Angle. screen.
2. Press < or > to change the Mode setting. The options are OFF/Once/Perm.

   If Mode is set to Perm you can continue using this offset measurement until you escape from the function.
3. Press F4 o.k.



4. Sight point A (on the first wall) and press MEAS/ENT.
5. Sight point B (on the same wall) and press MEAS/ENT.

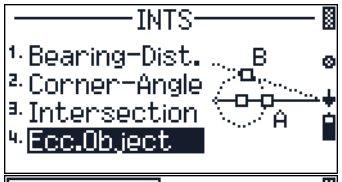


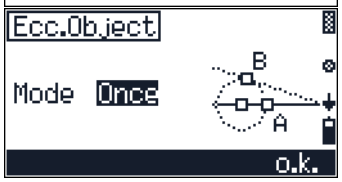
6. When you have taken two measurements, sight point C (on another wall) and press MEAS/ENT.
7. If you want to repeat a measurement:
   - Press F1 A to return to the point A measurement screen.
   - Press F2 B to return to the point B measurement screen.

   After you have completed your measurements, the BMS screen appears from which you entered the INTS program. The BMS screen shows the new measurements.

Eccentric Object

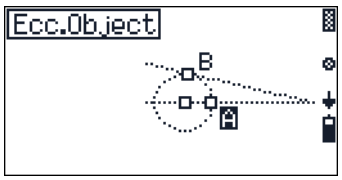
Use this method to determine the radius and the center point of a vertical round object.



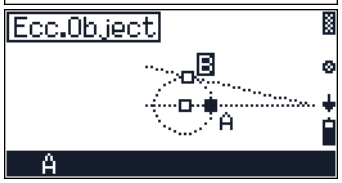


1. Press 4 in the INTS menu to open the Ecc. Object screen.
2. Press < or > to change the Mode setting. The options are OFF/Once/Perm.

   If Mode is set to Perm you can continue using this offset measurement until you escape from the function.
3. Press F4 o.k.
4. Sight point A and press MEAS/ENT.



5. Sight point B and press MEAS/ENT.
6. If you want to repeat a measurement, press F1 A to remeasure to point A.



   The calculated radius appears.

7. Do one of the following:
   - To record the result, press F4 o.k.
   - To change the point name or code before you record the point, press  .
   - To return to the first screen without recording data, press ESC.

CHAPTER

6

Job Manager

In this chapter:

The Trimble M3 total station is equipped with an intelligent data management system called Job Manager. You can record survey data into a folder (a job) and categorize data by day, by site, or zone-independent.

Up to 32 jobs can be created in the internal memory.

Use the Job Manager to open, create, delete, and manage jobs.

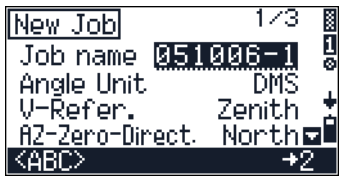
Note – *The Trimble M3 total station can also operate without creating a job. In this case, the system automatically creates a job called NONAME using the current instrument settings.*

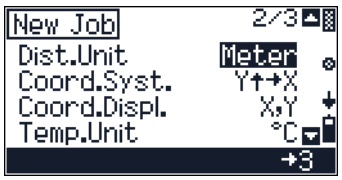
To open the Job Manager, select MENU 1.

Creating a new job

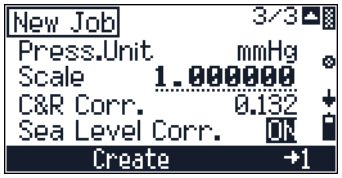
1. From the Job Manager menu, select 1 New.

2. In the New Job screen, enter a job name and press MEAS/ENT.
3. Enter the other job settings (11 settings presented in three screens) by doing one of the following:
   - enter values using the keypad
   - press < or > to change settings





4. In the third screen, press F2 CREATE to create the job.



The job settings are:

Setting	Options
Job name	Consists of the date and a unique letter or number
Angle Unit	DMS Deg gon mil
VA-Reference	Zenith Vertical ±Elev.
AZ-Zero-Direct	North South
Dist.Unit	Meter (m) US feet (U-ft) International feet (I-ft)
Coord.System	YX XY NE
Coord.Display	Y, X X,Y N,E E,N
Temp.Unit	Celsius Fahrenheit
Press.Unit	mmHg hPa inHg
Scale	0.995000~1.005000 (numeric input)
C&R Correction	0.132 0.142 0.200 OFF
Sea Level Correction	ON OFF

Opening an existing job

1. From the Job Manager menu, select 2 Open.

A list of all jobs stored in the internal memory appears in descending date order.

A star (*) appears next to the job that is currently open.

An arrow indicates the control-point job (if specified).

Note – *For more information on control point jobs, see* *Setting the Control Point job, page 71*.

2. Press ^ or v to select a job from the job list and then press MEAS/ENT to open the highlighted job.

Note – *When you open a job, all job settings are automatically imported to the instrument.*

Deleting a job

CAUTION – There is no undelete function in the Job Manager. Before you press F4 Yes on this screen, make sure that the selected job is the one that you want to delete.

1. From the Job Manager menu, select 3 Delete.

A list of all jobs stored in the internal memory appears in descending date order.

2. Press ^ or v to select the job that you want to delete and then press MEAS/ENT.

3. A confirmation message appears. Press F4 Yes to delete the selected job.

Setting the Control Point job

Especially for stakeout or station setup work, a Control Point job can be used as an independent coordinate file when you have a list of coordinate data on your office computer.

Before you go to the field, upload or input the list of coordinate data to a Control Point job. See also Uploading data from an office computer to the internal memory, page 113.

In the field, create a working job and set the Control Point job by the process described below.

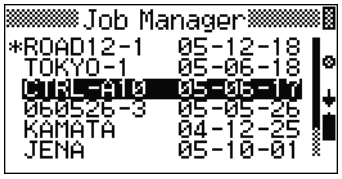
If you search for a point when the Control PT job is specified, and the system cannot find the point in the current job, the Control PT job is also searched. If the point is found in the Control PT job, it is copied to the current job.

A control job has the same format as a standard job. You can open and modify it like any other job, and you can use it to record any measured data when you open it as a current job.

To identify the Control Point file, do the following:

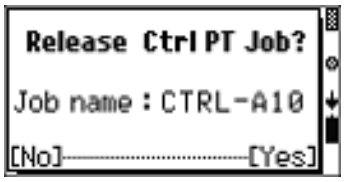
1. From the `Job Manager` menu, select 4 `Ctrl Point`.

   A list of all jobs stored in the internal memory appears in descending date order.



2. Press ^ or v to select the job to which you want to assign a control point and then press MEAS/ENT.
3. A confirmation message appears. To assign the control point job, press F4 `Yes`.

4. To cancel the assigned control point job, open the job list again, select the currently assigned control point job, and press MEAS/ENT.
5. A confirmation message appears. To cancel the assigned control point job, press F4 `Yes`

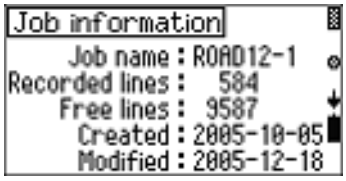


Displaying job information

1. From the Job Manager menu, select 5 Info.

A list of all jobs stored in the internal memory appears in descending date order.

2. Press ^ or v to select the job for which you want to display job information and then press MEAS/ENT.



3. The following fields appear:

Field	Description
Lines	Lines of currently stored records.
Free memory	Number of records that can be stored additionally.
Created	The date on which this job was created.
Modified	The date on which the latest changes to the job where made.

4. Press MEAS/ENT again to return to the Job Manager menu.

Editing data

To access the editor, press  and then select 7 Edit. See Editing data, point number lists or point code lists, page 42.

CHAPTER

7

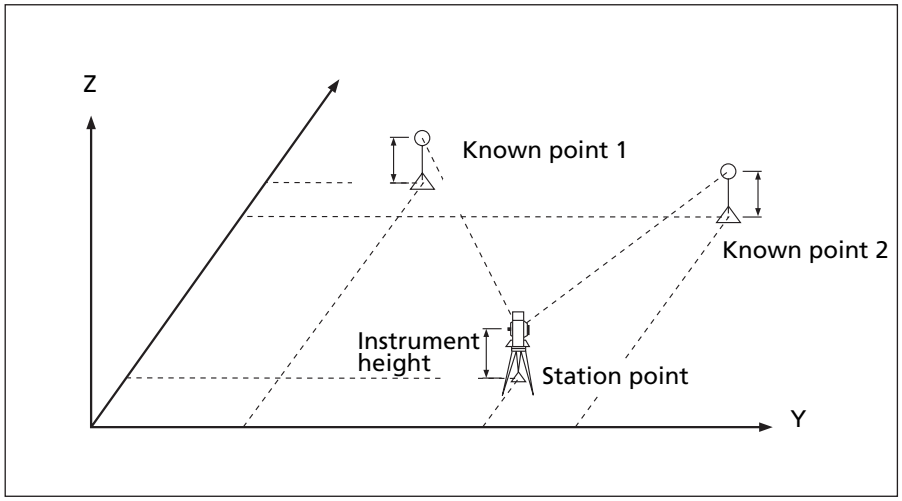
Coordinates

In this chapter:

Resection

A resection sets up the station using angle/distance measurements to known points.

If it is not possible to occupy a point with a known position in order to sight the points to be surveyed or set out, you can carry out a free stationing (or resection). If all backsight points have a known height, the Z coordinate can be determined simultaneously.



A maximum of 10 points can be measured. Measurements can be distance and angle, or angle only. Calculations starts automatically when enough measurements are taken.

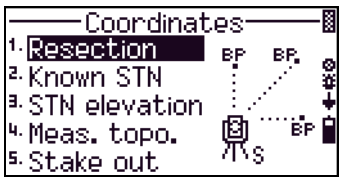
At least two sets of distance and angle measurement are required to determine the station coordinate. After at least two measurements are taken, approximate coordinates are calculated and residuals are displayed.

You can delete poor observations and recalculate if necessary. You can also select the backsight (BS) point.

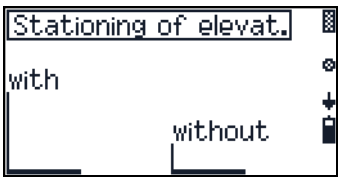
To go to the 3D station setup, press F1 `with`. To go to the 2D station setup, press F3 `without` press ESC to return to the *Coordinates* menu.

Note – *The "3-D station setup" is also referred to as "known height" and "Z-coordinate".*

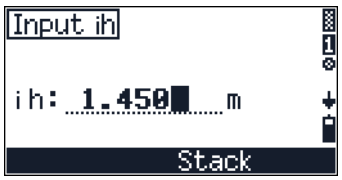
When you select 1 Resection in the Coordinates menu screen, you are prompted to select 2D setup without or 3D setup with before starting the resection function.



1. Press F1 with in the Stationing of elev. screen. You are prompted to input the instrument height (ih).

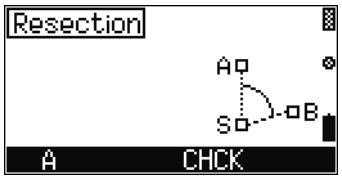


2. Use the number keys to input the ih value and then press MEAS/ENT.

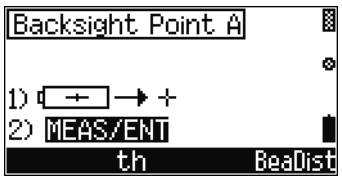


3. The Record as screen appears. Press F4 Yes.
4. The Resection screen appears.

   A and B are backsight points with known coordinates. S is the station. The coordinates of S will be calculated after the measurement is completed.



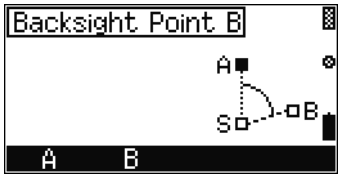
5. Press F1 A to take a measurement to Point A.
6. Sight point A and then press MEAS/ENT.
7. Do the following:
   - The previously set target height will be used with this measurement. If you need to change the height of the target, in the Backsight Point A screen, press F2 th.
   - Alternatively, open the bearing and distance screen, press F4 BeaDist. See Bearing-Distance, page 63.



Tip – To change the point name, press .

After you have taken the measurement to point A, the box for point A changes to a black box, which means that the measurement is done.

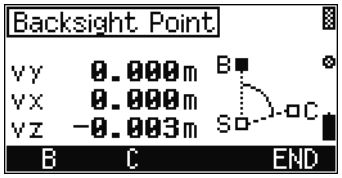
8. You can now either proceed with point B measurement, or remeasure point A. Do one of the following:



   – To take a measurement to point B, press F2 B.

   – To remeasure point A, press F1 A.

   After at least two measurements, approximate coordinates are calculated and the deviation to the current measurement appears:



   – vy: residual in Y-direction

   – vx: residual in X-direction

   – vz: residual in Z-direction

   Based on the quality of your residual data, you may want to add more points to the resection, or remeasure your last point (point B).

Note – *If the angle between known point A and known point B (measured from the station point) is extremely acute or extremely oblique, the resulting solution will be less reliable geometrically. For geometric reliability, select known point locations (or station point locations) that are widely spaced.*

9. Do one of the following:

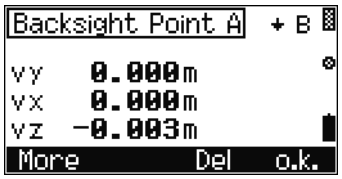
   – To remeasure to point B, press F1 B.

   – To measure to the next point, press F2 C.

   – To finish observation and proceed to the Residual screen, press F4 END.

After completing the observation, the solution residuals for each point are displayed for review. You can delete points from the solution, add more points to the calculation, or accept the current points.

10. In the Residuals check screen, do one of the following:



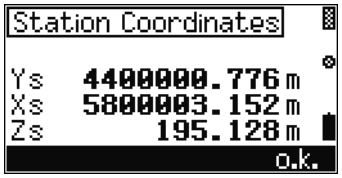
   – To show the previous or next point observation result, press ^ or v.

   – To add more points to the observation, press F1 More.

– To delete the point shown in this screen (for example because of large residuals), press F3 Del.

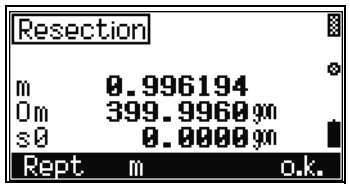
– To accept the current points and proceed to the next screen, press F4 o.k..

11. The Station Coordinates screen displays the current station solution.



Tip – From the Station Coordinates screen or Scale screen, you can change a point name or code or verify data by pressing .

12. To accept the computed station coordinates, press F4 o.k. in the Station Coordinates screen.



The Resection screen shows a quality summary. These values indicate how good your computed station coordinates fit with the points used in the resection. For example, if your are using ground coordinates, and your scale value, m, is close to 1, you have established good control in your station setup.

13. In the Resection screen, do one of the following:

– To return to the observation screen, press F1 Rept.

Note – *If you decide to go back and remeasure the corresponding points, the observed points data after the point you are going to remeasure is lost. Trimble recommends that you complete the measurement after three backsight points, and then delete and re-measure the corresponding direction. New measurements are added at the end. As a result, the assignments of the point codes (A, B, etc.) are shifted.*

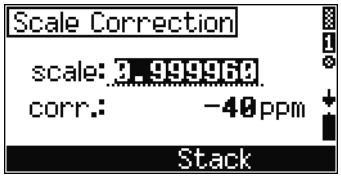
– To change the scale, m, press F2 (m), where:
m - calculated scale
Om - orientation unknown
s0 - standard deviation of the weighting unit (mean point error)

– To record the station data and finish the setup, press F4 o.k.

If the scale is outside the permissible range, an error message appears. If you edit the scale value the corr. field is updated when you press ENT.

When you press F2 in the previous screen, a scale input screen appears.

14. To display a previously used scale value, press F3 Stack.



After the scale has been confirmed, the station coordinates are recalculated. When this has been done, the residuals can be evaluated again.

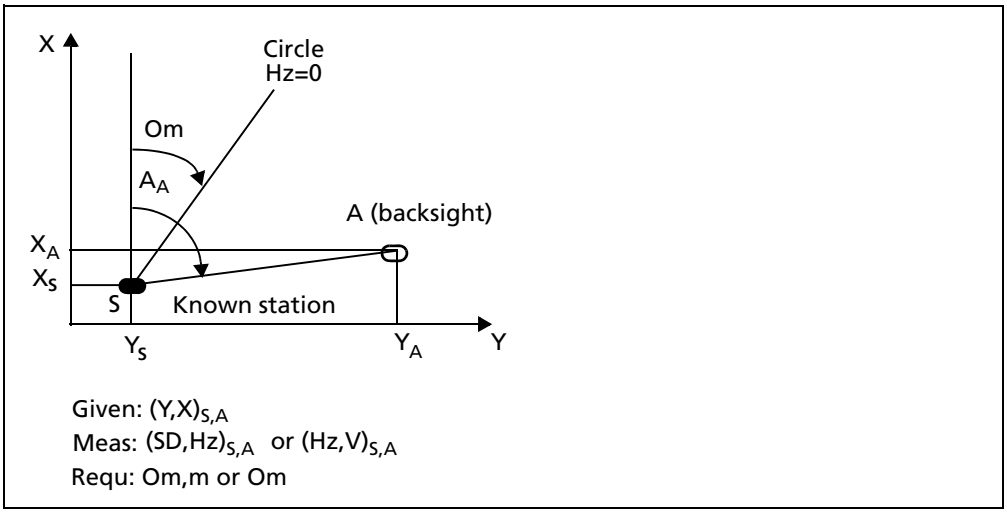
Stored resection data

The following resection data is stored in internal memory and is available for download:

- Mode designation
- Point numbers and code
- Backsight points A, B, C, D, E, F, G, H, I, J
- Y, X, and Z coordinates
- SD, HA, and VA readings
- vy, vx, and vz backsight point residuals (M5 format only)
- Y, X, and Z coordinates of the station point (S)
- Scale and circle orientation, m, Om (M5 format only)
- Standard deviation of the weight unit, s0 (M5 format only)

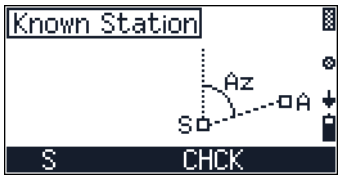
Known Station

If you set up an instrument on a known point, use the known station function.



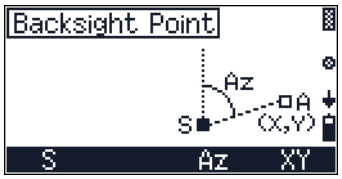
Set up the instrument on a known point (point **S**). By measuring to a known backsight (point **A**), the instrument will calculate the circle orientation **Om** and the scale **m**.

1. From the MENU screen, select 4 Coordinates and then select 2 Known Station.



2. Do one of the following:
   - To input the station coordinates or to select them from internal memory, press F1 S.

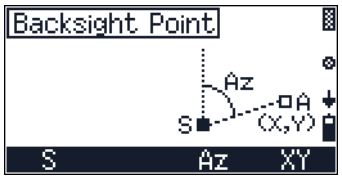
     If the input point number or name is an existing point, its coordinates are displayed. If the point is new, select Internal Memory to select coordinates from an existing job, or select Input to enter coordinates in the input screen.
   - To activate the Adjustment C&I program, press F3 CHCK.
3. After you have input or selected the station coordinates, do one of the following:
   - To return to the station coordinate input, press F1 S.

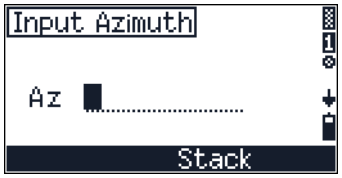


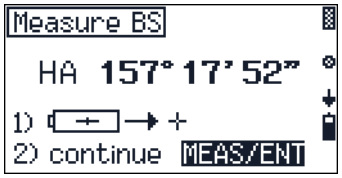
- To input the azimuth value of the backsight point, press F3 Az. See also Orientation using known coordinates, page 81.
- To input coordinates of the backsight point, press F4 XY. See also Orientation using a known azimuth, page 80.

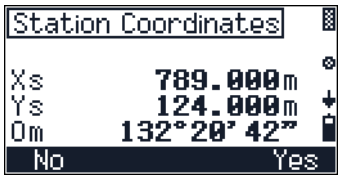
Orientation using a known azimuth

When you press F3 (Az) in the Backsight Point screen, you are prompted to input the azimuth to the backsight point.









1. To input the azimuth do one of the following:
   - Input the azimuth value.
   - Press F3 Stack to select from previously input values.
2. Sight the backsight point and then press MEAS/ENT.

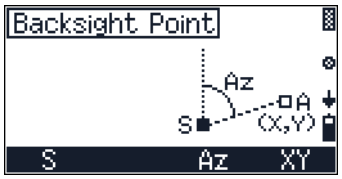
Note – *To change the point name, point code, or target height, press* .

When you have taken a measurement to the backsight point, the calculated station coordinates and orientation appear.

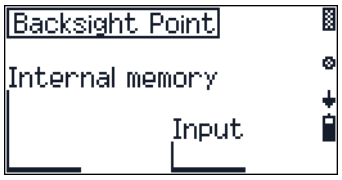
3. Do one of the following:
   - To return to the Backsight Point screen, press F1 No.
   - To record the result and complete the station setup, press F4 Yes.

Orientation using known coordinates

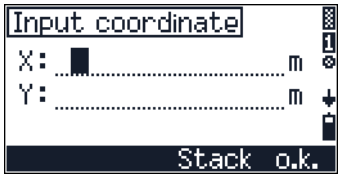
When you press F4 YX in the Backsight Point screen you can select to input coordinates of the backsight point.



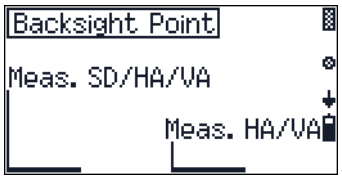
1. In the Backsight Point screen, press F3 Input to input coordinates of the backsight point.



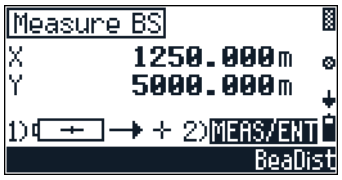
2. To sight the backsight by entering coordinates do one of the following:
   - Input the coordinate values directly
   - Press F3 Stack to select from previously input values.
   - Press F4 o.k. to accept new or existing coordinates.



3. After you have input the coordinates, you can do one of the following:
   - To measure distance and angle, press F1.
   - To measure angle only, press F3.

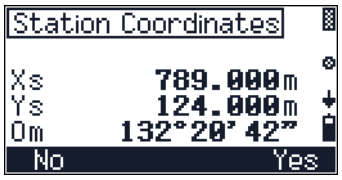


4. Sight the backsight point and then press MEAS/ENT.



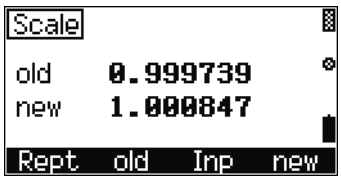
Note – *To change the point name, point code, or target height, press* .

When you have taken a measurement to the backsight point, the calculated station coordinates and orientation appear.

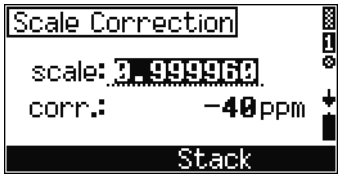


5. Do one of the following:
   - To return to the Backsight Point screen, press F1 No.
   - To record the result and complete the station setup, press F4 Yes.

6. When distance and angle measurements are taken to the backsight (press F1 in the Backsight Point screen), the Scale screen appears. Do one of the following:



   - To return to the Select backsight point input method screen, press F1 Rept.
   - To keep the old value for the scale and record the station setup, press F2 old.
   - To show the Scale Correction input screen, press F3 Inp.
   - To replace the scale with a new value and record the station setup, press F4 new.



Stored known station data

The following known station data is stored in internal memory and is available for download:

- Mode designation
- Point numbers and code
- Y and X coordinates of the station point
- Y and X coordinates of backsight point A
- SD, HA, and VA readings for backsight point A (according to selection)
- Scale, and circle orientation (according to selection)
- Set direction Az
- V (vertical angle) at Az

Station elevation

In a conventional survey, use the station elevation function to determine the elevation of the instrument point by making observations to points with known elevations. It is also known as the remote benchmark function.

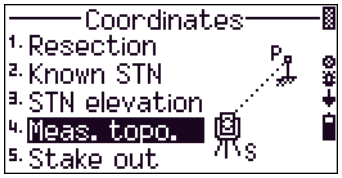
Note – *The Station Elevation function can also be accessed from the* `BMS` *screen.*

From the `MENU` screen, select 4 `Coordinates` and then select 3 `STN elevation`.

For a detailed description of this function, see Setting the station elevation, page 61.

Measure topo

After you have set up the station, you can calculate the coordinates and heights of new points using distance and angle measurements. This section will describe how to measure topographic points.

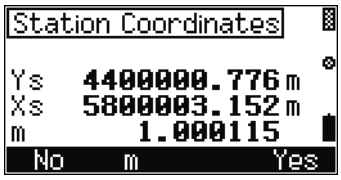


From the `MENU` screen, select 4 `Coordinates` and then select 4 `Meas. topo.`

The `Station Coordinates` screen appears.

Confirming the station coordinates

This screen enables you to confirm the station coordinates.



Do one of the following:

- To terminate the program, press F1 `No`.
- To show the Scale edit screen, press F2 `m`.
- To accept the station coordinates and proceed to the reference direction confirmation screen, press F4 `Yes`.

Confirming the backsight point angle

This screen enables you to confirm the reference direction.

Do one of the following:

- To terminate the program, press F1 `No`.
- To accept the backsight point angle and proceed to the instrument height and station-Z coordinate screen, press F4 `Yes`.

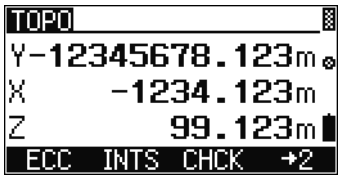
Confirming the instrument height and Station-Z coordinates

This screen enables you to confirm the instrument height and station coordinates.

Do one of the following:

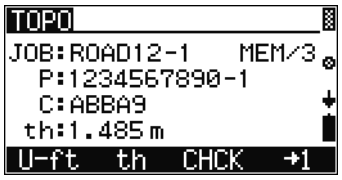
- To terminate the program, press F1 No.
- To input the instrument height and station coordinates, press F3 ih/Zs,
- To accept the instrument height and station Z coordinates and proceed to the Topo observation screen, press F4 Yes.

Sighting new points in the Topo observation screen



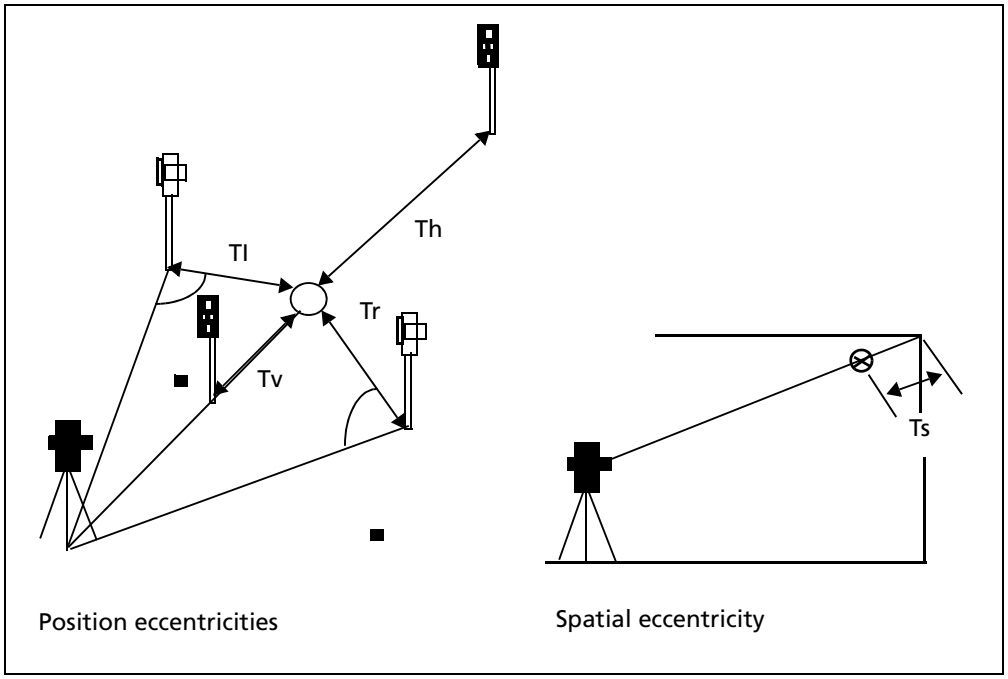
This screen enables you to sight new points.

1. Sight new points and press MEAS/ENT.
2. Do one of the following:
   - To take a tracking measurement, hold press MEAS/ENT down for one second.
   - To access the HOT MENU, press the key from any Topo observation screen.
   - To go to the eccentric measurement screen, press F1 ECC, see Eccentric measurement, page 85
   - To activate the INTS program press F2 INTS, see Measuring edges and corners using the Intersection program (INTS), page 63.
   - To run the Adjustment C&I program press F3 CHCK, see Checking and adjusting the compensator (C) and index (I), page 119.
   - To change the screen to show the job name, point number, code, height of target and recording mode, press F4 2.



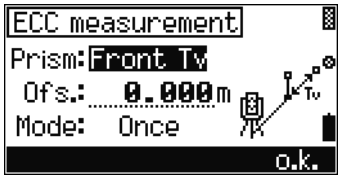
Eccentric measurement

If points cannot be measured directly, the eccentric measurement option can provide the solution. This may also be called "taped offset measurement". You can select the direction you are going to input the offset value.



Spatial eccentric target measurements are very helpful, especially for indoor surveys.

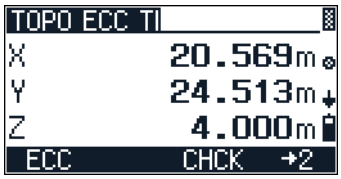
To enter offset distance values before you record the point, in the `Topo` observation screen, press F1 `ECC`.



1. In the `ECC measurement` screen, do one of the following:
   - To move the cursor to a different field, press v or ^.
   - To change the setting in the `Prism` field, press < or >.
   - To change the setting in the `Ofs.` field, use the keypad.
   - To change the setting in the `Mode` field, press < or >.

Note – *If the mode is set to* ***Once****, the offset value will be applied for only one measurement after the ECC setting. If mode is set to* ***Perm*** *the offset will be applied until you change the setting to OFF.*

– Press F4 o.k. to finish the setting for eccentricity. The TOPO ECC xx screen appears.

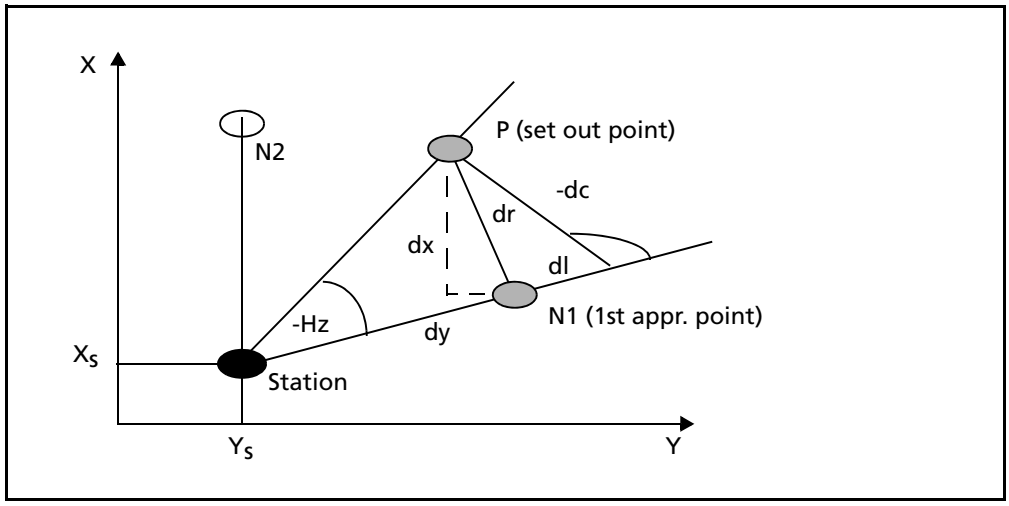


Note – *The last two characters in the screen name indicate the prism direction.*

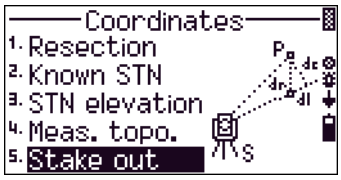
2. Press MEAS/ENT to take a measurement and record the point with offset values.

Stakeout

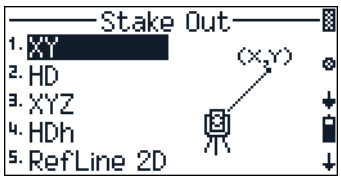
You can search points or stake out points in a given system of coordinates.



1. From the MENU screen, select 5 Stake out.



2. The Stake Out menu screen appears. Do one of the following:

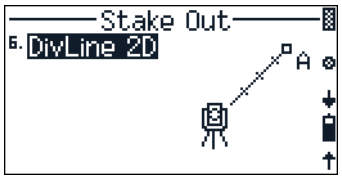


   – To stake out points using 2D coordinates, press 1 XY, see Stake out by coordinates (XY or XYZ), page 87.

   – To stake out points using 2D angle and distance, press 2 HD, see Stakeout by angle and distance (HD or HDh), page 89.

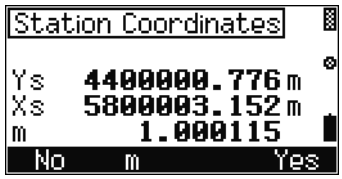
   – To stake out points using 3D coordinates, press 3 XYZ, see Stake out by coordinates (XY or XYZ), page 87.

- To stake out points using angle, distance, and height, press 4 HDh, see Stakeout by angle and distance (HD or HDh), page 89.
- To stake out points using reference line, press 5 RefLine 2D, see Stakeout by reference line, page 90.
- To stake out using division line, press 6 DivLine 2D, see Stakeout by dividing line, page 91.



Stake out by coordinates (XY or XYZ)

1. From the Stake out menu, select 1 XY or 3 XYZ. A confirmation screen appears enabling you to verify the current station coordinates.



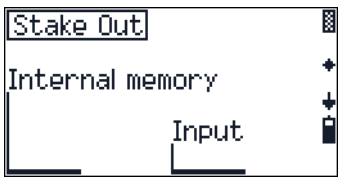
2. Do one of the following:
   - To terminate the program, press F1 No.
   - To show the Scale edit screen, press F2 m.
   - To accept the station coordinates and proceed to the reference direction confirmation screen, press F4 Yes.

   The Reference Dir screen enables you to confirm the reference direction.

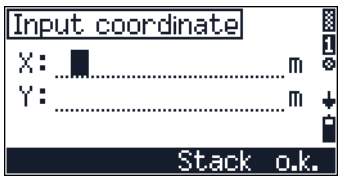
3. Do one of the following:
   - To terminate the program, press F1 No.
   - To accept the backsight point angle and proceed to the Stake Out screen, press F4 Yes.

Note – *When you select 3 XYZ, the station elevation confirmation screen appears when you confirm the reference direction.*

4. In the Stake Out screen, press F3 Input to input coordinates of the backsight point.

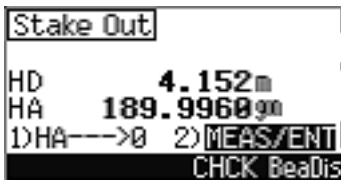


5. To input the coordinates do one of the following:



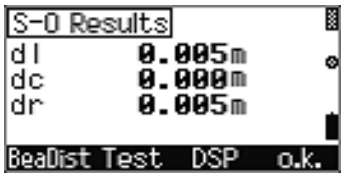
   - Input the coordinate values
   - Press F3 Stack to select from previously input values.
   - Press F4 o.k. to accept new or existing coordinates.

6. To take a measurement to the point. sight the point and press MEAS/ENT.

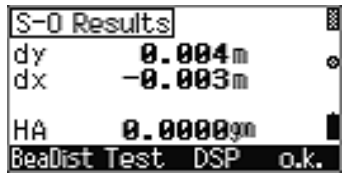


Note – *If you are in the 3D coordinate stakeout screen (3 YXZ from the Stakeout menu), press F2 to input the target height.*

   The stake out results appear on screen.



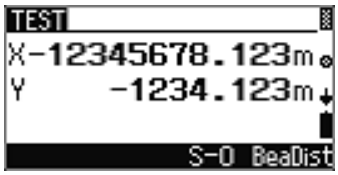
7. Do one of the following:
   - To open the test screen, press F2 TEST, see Test screen, page 88.
   - To change the screen display, press F3 DSP.
   - To record the point and return to the new point input screen, press F4 o.k..



Note – *While a tracking measurement is taken, the softkey shows DSP and END. To stop measurement, press F4 END. The Test and o.k. softkeys appear.*

Test screen

In the S-O Results screen, press F2 TEST.

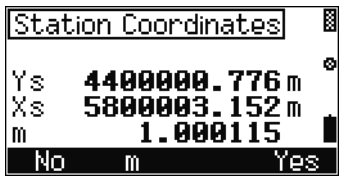


Do one of the following:

- To open a new Stake Out Point input screen, press F3 S-O.
- To go to the Bearing Distances screen, press F4 BeaDist.

Stakeout by angle and distance (HD or HDh)

1. From the Stake out menu, select 2 HD or 4 HDh. A confirmation screen appears enabling you to verify the current station coordinates.



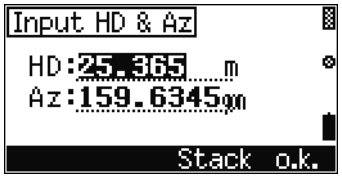
2. Do one of the following:
   - To terminate the program, press F1 No.
   - To show the Scale edit screen, press F2 m.
   - To accept the station coordinates and proceed to the reference direction confirmation screen, press F4 Yes.

   The Reference Dir screen enables you to confirm the reference direction.

3. Do one of the following:
   - To terminate the program, press F1 No.
   - To accept the backsight point angle and proceed to the Input HD & Az screen, press F4 Yes.

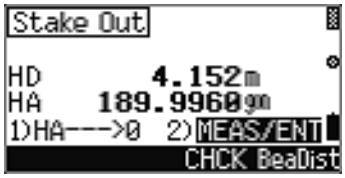
Note – *When you select 4 HDh, the station elevation confirmation screen appears when you confirm the reference direction in the horizontal angle.*

4. In the Input HD & Az screen, do one of the following:
   - Input the coordinate values.
   - To select from previously input values, press F3 Stack.
   - To accept new or existing values and move to the observation screen, press F4 o.k..



Note – *If you press F4 without having entered any value in the field, the current HA reading will automatically be set as AZ.*

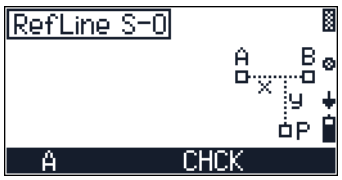
5. Sight the point and press MEAS/ENT to take a measurement to the point.



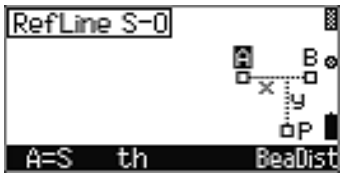
Note – *The th softkey appears only when you have selected 4 HDh.*

Stakeout by reference line

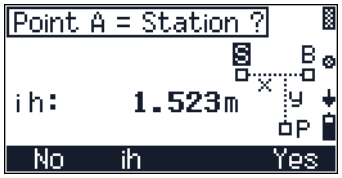
The RefLine StakeOut function enables you to stake out a point (P) based on the distance (x) from the base point A and the offset value (y) from the line AB.



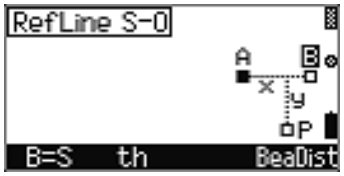
1. From the `Stake Out` menu, select 5 `RefLine 2D`. The `RefLine S-O` screen appears.
2. Do one of the following:
   - To open the point A observation screen, press F1 `A`.
   - To activate the Adjustment C&I program, press F3 `CHCK`.



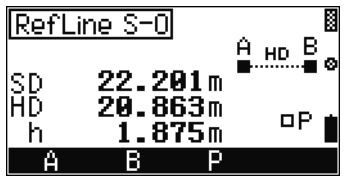
3. In the second `RefLine S-O` screen, do one of the following:
   - To define A as the station point, press F1 `A=S`.
   - To measure the target height, press F2 `th`.



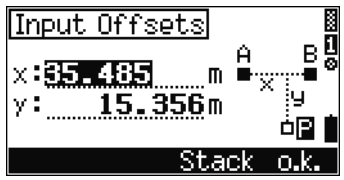
4. In the `Point A - Station?` screen, do one of the following:
   - To return to the `RefLine` screen, press F1 `No`.
   - To input the instrument height, press F2 `ih`,
   - To define A as the station point (S), press F4 `Yes`.



5. To take a measurement to point A, press MEAS/ENT. The measurement is recorded, and the next measurement screen appears.
6. You can now define and measure point B in the same way, and then proceed to point P input.



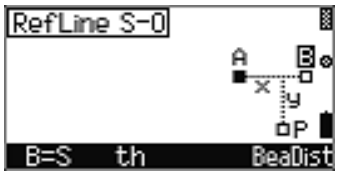
7. Do one of the following:
   - To stake out point A or B again, press F1 `A` or F2 `P`.
   - To define point P, press F3 `P`.



8. To define point P by entering the distance from A (as x), and the perpendicular line A-B (as y).

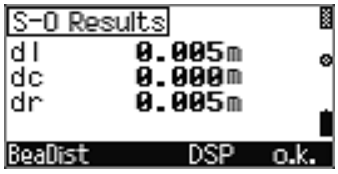
   You can also select a value from the stack, press F3 `Stack`.
9. To go to the observation screen, press F4 `o.k.`

10. Do one of the following:



   - To measure the target height, press F2 th.
   - To activate the Adjustment C&I program, press F3 CHCK.
   - To measure point P, press MEAS/ENT.

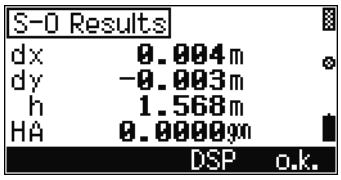
   The following results are shown:



   - dl: errors in In/Out from the station point to the target point
   - dc: errors in Right/Left from the station point toward the target point
   - dr: errors in horizontal distance between the measured and calculated value.

11. Do one of the following

   - To change the display, press F3 DSP.
   - To record the result, press F4 o.k.

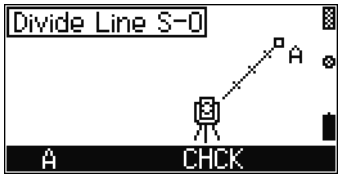


Stakeout by dividing line

To stake out stations on a defined line at the stationing intervals along the line, use the Stakeout by dividing line function.

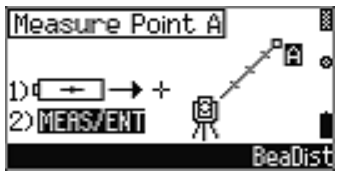
This function divides the line between the instrument and the first target by an inputspan number. It then guides you to stake out the points one by one.

1. From the Stake out menu, select 6 DivLine 2D. Do one of the following:

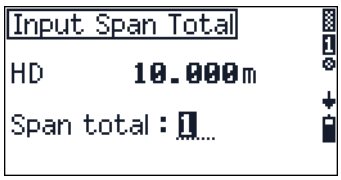


   - To define point A, press F1 A.
   - To activate the Adjustment C&I program, press F3 CHCK.

2. Sight point A and then press MEAS/ENT to take a measurement.

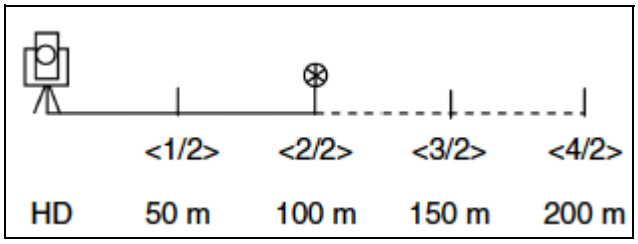


3. After taking a measurement to point A, enter the number of spans you are going to use to divide the distance from instrument to point A and then press MEAS/ENT.

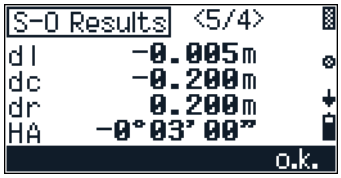


4. Sight the closest point from the station and press [MEAS/ENT]. Do one of the following:
   - To change the target point to the previous point (in this case, point 8/4), press F2 Prev.
   - To change the target point to the next point (in this case, point 2/4), press F3 Next.

Tip – If you measure to the end point at 100 m from the instrument and set the span total to 2, the next four points are calculated and can be staked.



After taking a measurement to each target, the error between the calculated and measured point are to be displayed.



5. Do one of the following:
   - To record the point, press F4 o.k.
   - To return to the Input Span Total screen, press ESC.

Stored stakeout data

The following stakeout data is stored in internal memory and is available for download:

- Mode designation
- Point numbers and code
- HD, HA, Z or Y, X, Z coordinates
- SD, HA, and VA readings
- dl, dc, and dr stake-out differences
- dy and dx stake-out differences (only if nominal coordinates are used)
- dz stake-out difference (only if the height is set out)
- th reflector height (only if changed)
- SD, HA, and VA readings and Y,X, and Z coordinates (actual coordinates of check measurement)

CHAPTER

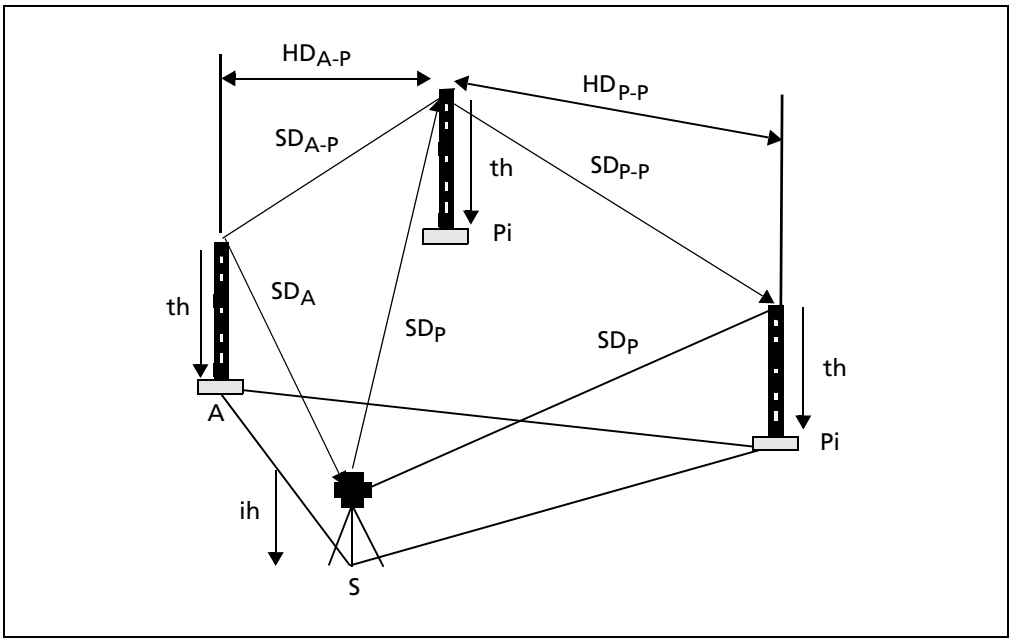
8

Applications

In this chapter:

Connecting distance

The Connecting Distance application enables you to measure the distance between two points in situations where it is not possible to measure this distance directly.



This option enables you to measure cross sections, and check the distances between points, boundaries, and buildings.

If it is not possible to measure a distance between two points directly, the measurement to the two points must be started at a station point (S). The program calculates the distances (SD and HD) and the height difference (h) between the points.

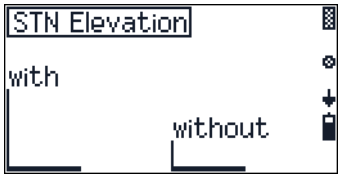
This option enables you to measure cross sections, and check the distances between points, boundaries and buildings.

To start the `Connecting Distance` option, select 1 `Conn.Dist` from the `Applications` menu.

Note – *In any measurement screen, you can press to change the point number and point code and the EDM mode, or check recorded data.*

Choosing 2D or 3D observation

From the `Application` menu, select 1 `Conn. Dist`. The `STN Elevation` screen appears.



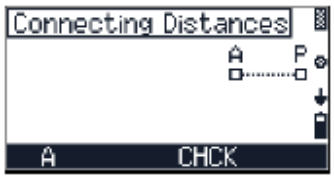
Do one of the following:

- To define th, ih, and Zs, press F1 `with`. See Setting target height (th) and instrument height (ih), page 60.

- To start the connecting distance function in 2D (XY) observation mode, press F3 `without`. The `Connecting Distances` screen appears.
- To return to the previous screen, press ESC.

Start connecting distances

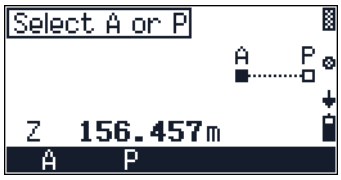
In the `Connecting Distances` screen, do one of the following:



- To adjust C&I, press F3 `CHCK`. See Checking and adjusting the compensator (C) and index (I), page 119.
- To take a measurement to point A, press F1 `A`.

In the `Measure A` screen, do one of the following:

- To input the reflector height (th), press F2 `th`.
- To take a measurement, press MEAS/ENT.

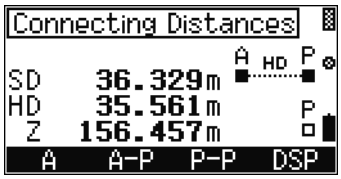


After taking a measurement to point A, you can select the next point to measure.

Note – *When you select without in the STN Elevation screen, the Z value does not appear.*

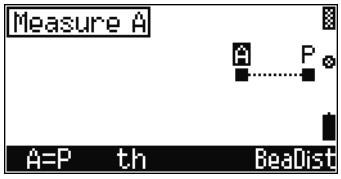
Do one of the following:

- To remeasure point A, press F1 `A`.
- To take a measurement to point P, press F2 `P`.



The first result screen appears. This shows the slope distance, horizontal distance, and height difference (h) or Z-coordinate.

Do one of the following:



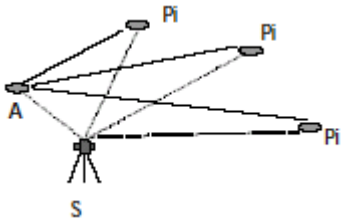
- To remeasure point A or to replace point A with the previous observation (point P), press F1 `A`. In the `Measure A` screen:
  - To replace point A with P, press F1 `A=P`.
  - To input the target height, press F2 `th`.
  - To take an offset measurement by using the Bearing and Distance function, press F4 `BeaDist`. See Bearing-Distance, page 63
- To proceed with Radial Connecting Distance function, press F2 `A-P`. See Radial connecting distance A - P, page 98.

- To proceed with Polygonal Connecting Distance function, press F3 P-P. See Polygonal connecting distance P - P, page 98.

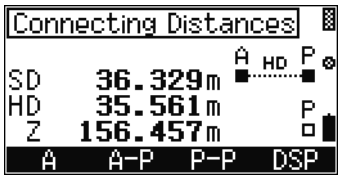
Note – *If you are taking 3D measurements, you can press* F4 *DSP to change the display between SD/HD/Z and SD/HD/h.*

Radial connecting distance A - P

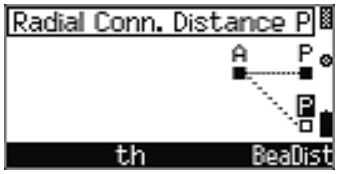
The results always relate to point A.



In the first result screen, press F2 A-P.



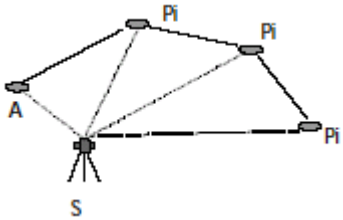
In the Radial Conn. Distance P screen, do one of the following:



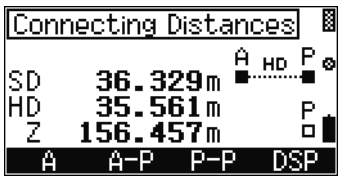
- To take a measurement to point P, press MEAS/ENT.
- To change target height, press F2 th.
- To go back to the Select A & P screen, press ESC.

Polygonal connecting distance P - P

The results always relate to the last two points measured.



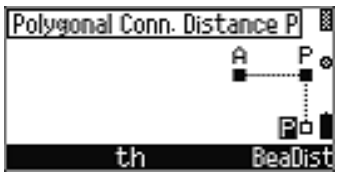
In the first result screen, do one of the following:



- Press F3 P-P.
- To change the display between Z and h, press F4 DSP.

Note – *This option is only available when you are taking 3D measurements.*

In the Polygonal Conn. Distance P screen, do one of the following:



- To change target height, press F2 th.
- To measure a point and record, press MEAS/ENT.
- To go back to the Select A & P screen, press ESC.
- To go to the bearing and distance function, press F4 BeaDist.

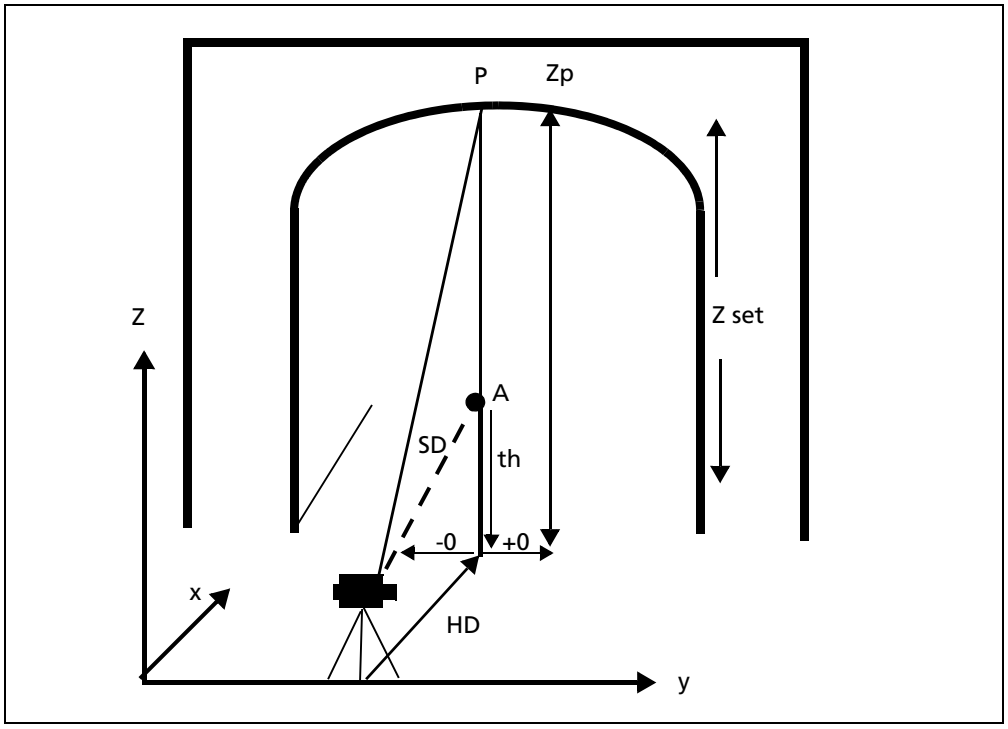
Recording data from connecting distance

The following lines are stored:

- Mode designation
- Point numbers and code
- SD, HA, and VA
- Polar coordinates A and P
- Reflector height (th) and instrument height (ih), only if changed.
- SD, HD, h or Z
- Connecting distance A-P/P-P

Remote object height

The Remote Object application allows you to determine heights of inaccessible points, such as tree heights, the widths of tree tops and trunk diameters, power lines, passageways, and bridge profiles. It also allows you to set out heights on vertical objects.



Note – *Zset is the Z-coordinate value in this vertical plane direction. You can define the Z-coordinate for any measuring point (P) when the design value is known or when you want to define a reference point for other points.*

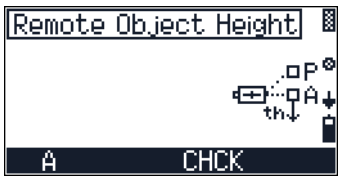
Heights of inaccessible points are determined by measuring SD,V to an accessible point in the plumb line. Only the angle V is measured to the inaccessible point.

This option enables you to determine tree heights, the widths of tree tops and trunk diameters, power lines, passageways and bridge profiles, and enables you to set out heights on vertical objects

To start the Remote Object option, select 2 `Remote Obj.`

Note – *In any measurement screen, you can press*  *to change the point number and point code and the EDM mode, or check recorded data.*

The Remote Object Height screen appears. Do one of the following:



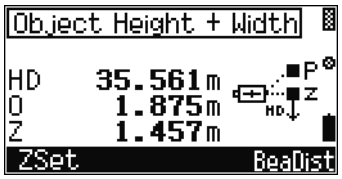
- To adjust C&I, press F3 CHCK. See Checking and adjusting the compensator (C) and index (I), page 119.
- To take a measurement to point A, press F1 A.

After taking a measurement to point A, you can select the next point to measure.

Do one of the following:

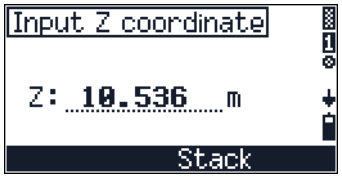
- To remeasure point A, press F1 A.
- To take a measurement to point P, press F2 P.

The Object Height and Width result screen appears. This shows the horizontal distance to the target slope distance (O), horizontal distance (HD), and height difference (h) or Z-coordinate (Z).



Do the following:

1. To go to the Z-coordinate input screen, press F1 Zset.



2. When you have input the Z-coordinate of the reference point, sight the point and press MEAS/ENT.

   The Object Height and Width result screen appears.

Recording data from connecting distance

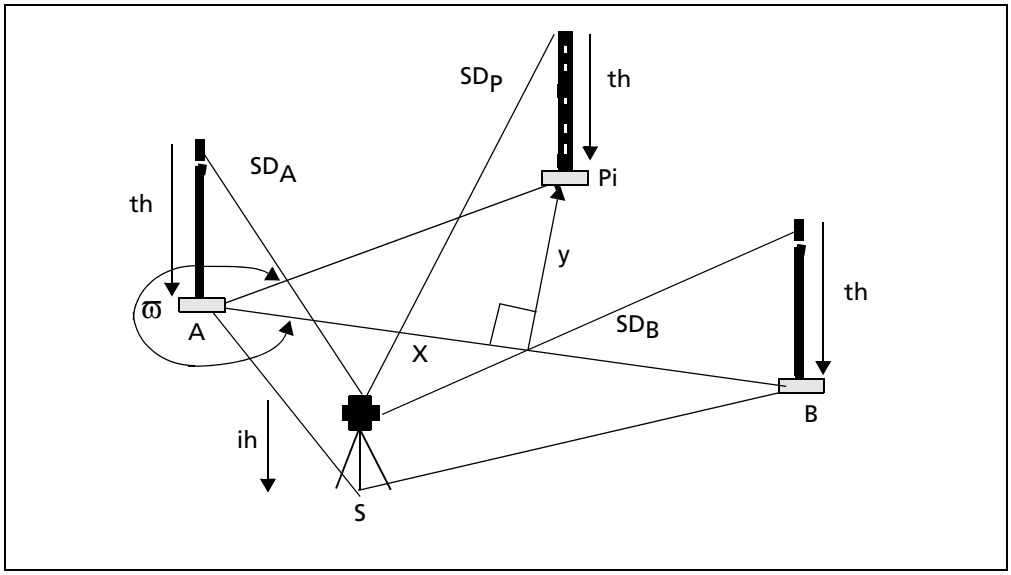
The following lines are stored:

- Mode designation
- Point numbers and code
- SD, HA, and VA readings
- Polar coordinates A
- HA, and VA readings
- Measured point P

- HD, O, and Z coordinates
- Measured point P
- Set value Z

Station and offset

You can determine the rectangular coordinates of any point in relation to a reference line defined by points A and B.

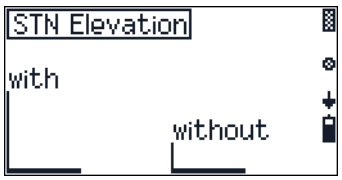


This option enables you to check point distances from a reference line, check boundaries, intersection of sight rails; determine the distances of buildings from boundaries, footpaths or streets; check the alignment of long straight lines in the event of visual obstacles on the line, surveying of supply lines and channel routes referred to roads and buildings, and free stationing in a local system.

To start the station and offset option, from the Application menu, select 3 STN+Offset.

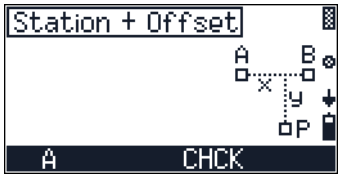
Note – *In any measurement screen, you can press to change the point number and point code and the EDM mode, or check recorded data.*

The STN Elevation screen appears.



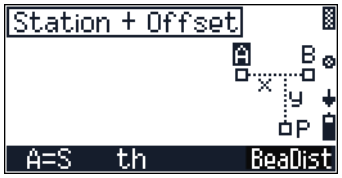
Do one of the following:

- To define th, ih, and Zs, press F1 with. See Setting target height (th) and instrument height (ih), page 60.
- To start the connecting distance function in 2D (XY) observation mode, press F3 without. The Station + Offset screen appears.
- To return to the previous screen, press ESC.



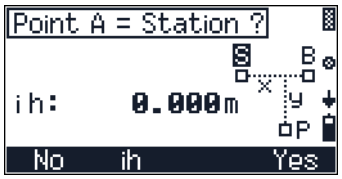
In the Station + Offset screen, do one of the following:

- To adjust C&I, press F3 CHCK. See Checking and adjusting the compensator (C) and index (I), page 119.
- To take a measurement to point A, press F1 A.

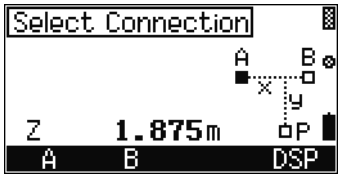


In the second Station + Offset screen, do one of the following:

- To define point A as the station point, press F1 A=S.
- To input the reflector height (th), press F2 th.
- To take a measurement to point A, press MEAS/ENT.



After taking a measurement to point A, you can select the next point to measure.

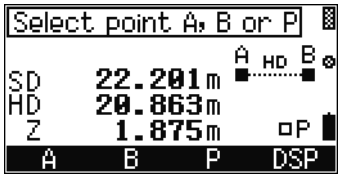


Do one of the following:

- To remeasure point A, press F1 A.
- To take a measurement to point B, press F2 B.
- To change the display between Z and h, press F4 DSP.

Note – *This option is only available when you are taking 3D measurements.*

The first result screen appears. This shows the slope distance, horizontal distance, and height difference (h) or Z-coordinate (Z).

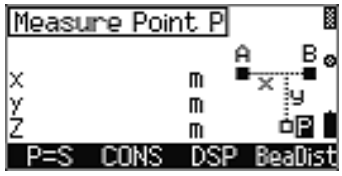


Do one of the following:

- To remeasure point A, press F1 A.
- To measure point B, press F1 B.

- To change the display between Z and h, press F4 DSP.

Note – *This option is only available when you are taking 3D measurements.*

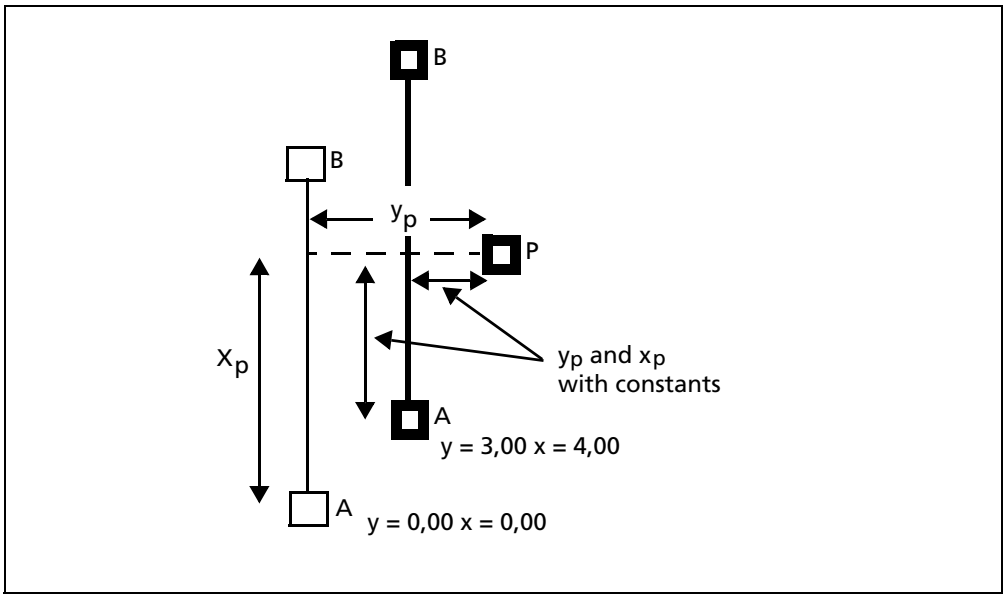


To measure to point B or to point P, do one of the following:

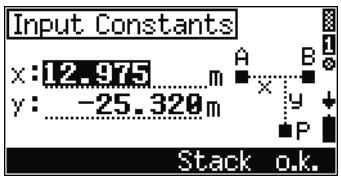
- To define point B or P as the station point, press F1 B=S/P=S.
- To shift the coordinate axes y and x, press F2 CONS. See Shifting the coordinate axes y, x, page 104.
- To change the display between Z, h, and w, press F3 DSP.
- To take a measurement to point P, press MEAS/ENT.

Shifting the coordinate axes y, x

The result of a measurement to a point P is displayed as follows: The input of shift values for y and x axes, for example x = 5,000 m. The change is recorded if a line does not begin with the coordinate x=0,00. The corresponding value can be entered after having the line. If it is a parallel line, the parallel distance y can be entered in the same way. Consequently, the computation is always related to the new and parallel line.

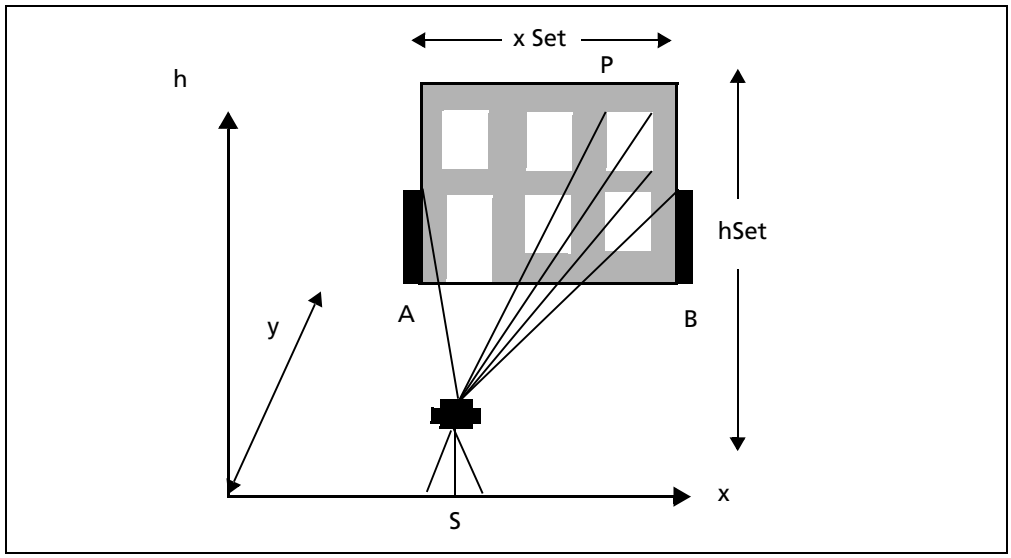


To accept the constants that appear, press F4 o.k..



Vertical plane

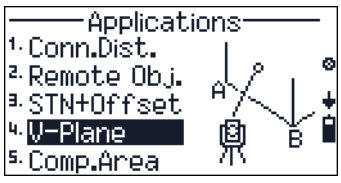
A vertical plane is defined by angle and distance measurements to two points. The coordinates of further points in this plane are determined by an angle measurement only.



Note – *xSet is the x-coordinate value in this plane direction. You can define the x-coordinate for any measuring points (P). For h-axis direction, hSet performs the same function.*

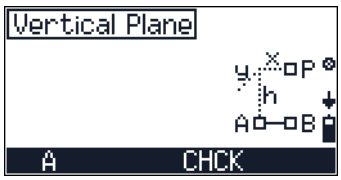
This option enables you to determine coordinates in a vertical plane to compute heights and volume. It also allows you to set out sectional planes for facade construction.

To start the vertical plane option, from the Application menu, select 4 V-Plane.



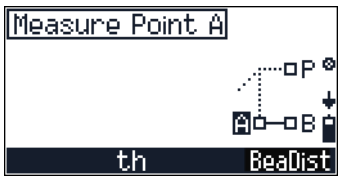
Note – *In any measurement screen, you can press to change the point number and point code and the EDM mode, or check recorded data.*

The Vertical Plane screen appears. Do one of the following:



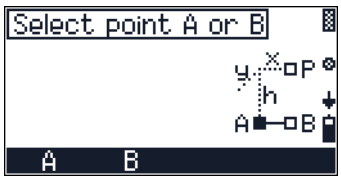
- To adjust C&I, press F3 CHCK. See Checking and adjusting the compensator (C) and index (I), page 119.
- To take a measurement to point A, press F1 A.

In the Measure Point A screen, do one of the following:



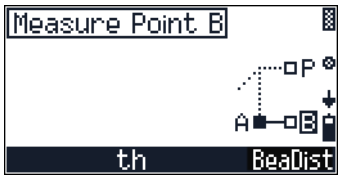
- To change target height, press F2 th.
- To measure point A, press MEAS/ENT.

The Select point A or B screen appears. Do one of the following:



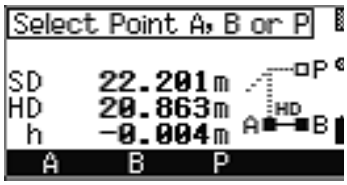
- To remeasure point A, press F1 A.
- To measure point B, press F2 B.

In the Measure Point A screen, do one of the following:



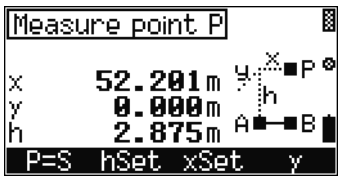
- To change target height, press F2 th.
- To measure point A, press MEAS/ENT.

The Select point A, B, or P screen appears. Do one of the following:



- To remeasure point A, press F1 A.
- To remeasure point B, press F2 B.
- To measure point P, press F3 P.

In the Measure Point P screen, do one of the following:



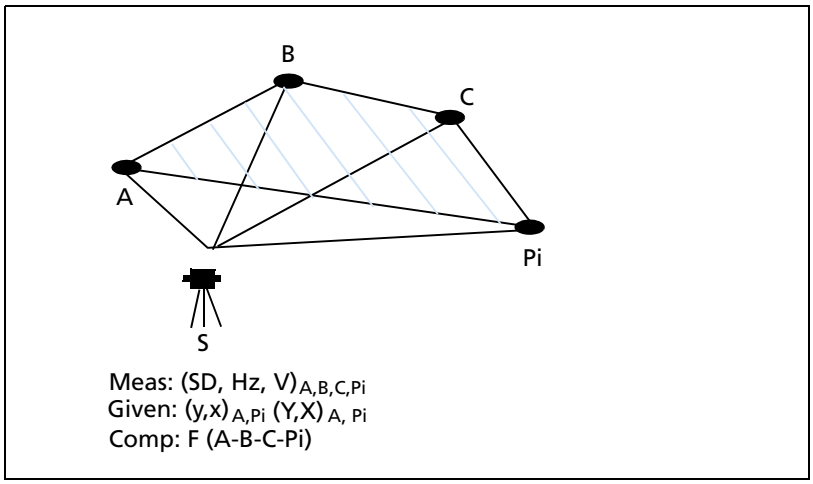
- To define the point P as the Station point, press F1 P=S.
- To input the offset h, press F2 hSet.
- To input the offset x, press F3 xSet.
- To input the offset y, press F4 y.

Compute area

The compute area function enables you to calculate an area by:

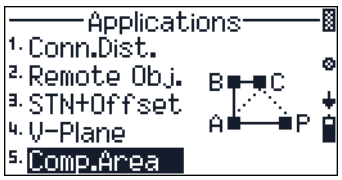
- measuring to the corner points
- input of the corner point coordinates of the area
- calling them from the memory

The area is delimited by straight lines.



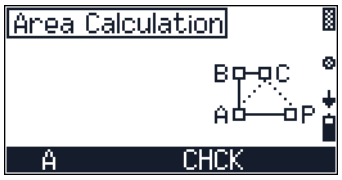
Any number of corner points can be used.

To start the Compute area option, from the Application menu, select 5 Comp.Area.



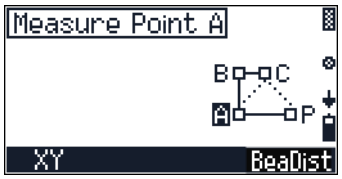
***Note** – In any measurement screen, you can press to change the point number and point code and the EDM mode, or check recorded data.*

The Area Calculation screen appears. Do one of the following:



- To adjust C&I, press F3 CHCK. See Checking and adjusting the compensator (C) and index (I), page 119.
- To take a measurement to point A, press F1 A.

In the Measure Point A screen, do one of the following:

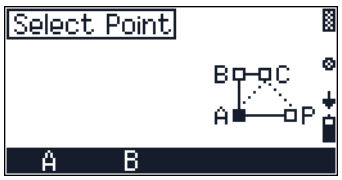


- To input the XY coordinates, press F1 XY. See Orientation using known coordinates, page 81.

***Note** – You can input XY coordinates in each of the Measure Point screens.*

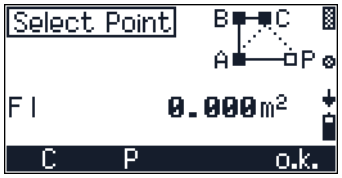
- To measure point A, press MEAS/ENT.

The Select Point screen appears. Do one of the following:



- To remeasure point A, press F1 A.
- To measure point B, press F2 B and then press MEAS/ENT in the Measure Point B screen.

The Select Point screen appears. Do one of the following:



- To measure point C, press F1 C and then press MEAS/ENT in the Measure Point C screen.
- To measure point P, press F2 P and then press MEAS/ENT in the Measure Point P screen.

CHAPTER

9

Data Transfer

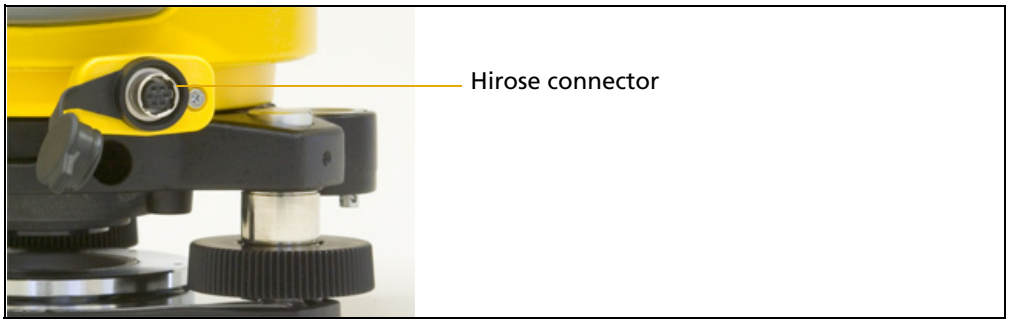
In this chapter:

To transfer data from the Trimble M3 total station to your office computer, use a cable connection between the RS232 ports on the Trimble M3 total station and your office computer.

Hardware interface

CAUTION – Make sure that the power supplied is within the rated input range (7.2 V to 11 V, 1 A maximum). Power supplied outside this range will damage the instrument.

The external device connector is a Hirose HR 10A-7R-6S female connector.



The pinouts for connecting it to an external device connector are as follows:

Pin	Signal	Description
1	RxD	Receive data (input)
2	TxD	Send data (output)
3	+	Power
4	-	Ground
5, 6		No connection

To communicate with an external device, connect the RS-232C signal from the external device to Pin 1 (input terminal) and to Pin 2 (output terminal) on the instrument.

To connect to an external power source, supply power to Pin 3 (power terminal) and Pin 5 (ground terminal) on the instrument. The instrument will use the external power source even if the carrying handle battery BC-65 is attached.

Note – *Cap the data output/external power input connector securely while not in use. The instrument is not watertight if the cap is not attached or not attached securely, and when the data output/external power input connector is in use.*

Note – *The instrument can be damaged by static electricity from the human body discharged through the data output/external power input connector. Before handling the instrument, touch any other conductive material once to remove static electricity.*

Specifications

CAUTION – Use only the male connectors specified here. Using other connectors will damage the instrument.

Input voltage: 7.2 V to 11 V DC

System: RS-232C

Signal level: ±9 V standard

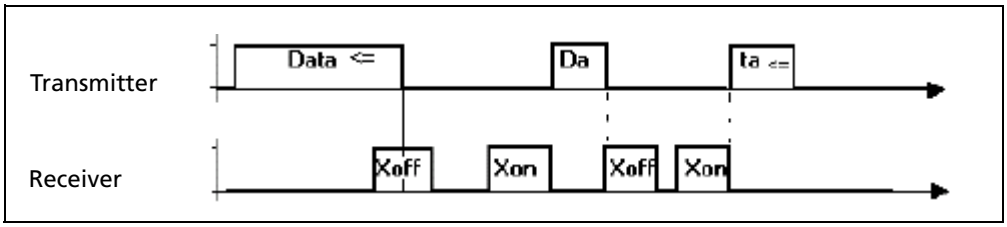
Maximum baud rate: 38400 bps asynchronous

Compatible male connector: Hirose HR10A-7P-6P or HR10-7P-6P

XON/XOFF Control

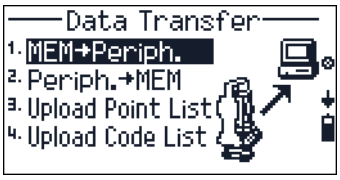
The XON/XOFF protocol is a very simple, but efficient data transmission protocol which is used by the Trimble M3 total station as well as terminal applications such as Hyperterminal and Xtalk.

Make sure that your PC application is configured for XON/XOFF operation when communicating with the Trimble M3 total station.



Downloading internal memory to an office computer

To use data transfer functions, press MENU 7 Data Transfer.



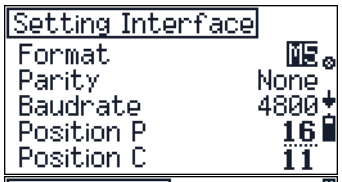
- To transfer recorded data in the instrument to the office computer, press 1 MEM-Periph. See Transferring recorded data to the office computer, page 112.
- To upload data created on an office computer to the instrument, press 2 Periph-MEM. See Uploading data from an office computer to the internal memory, page 113.

- To upload a point number/name list to the instrument, press 3 Upload Point List. See Uploading a point name/number list from the office computer, page 114.
- To upload a point code list to the instrument, press 4 Upload Code List. See Uploading a point code list from the office computer, page 114.

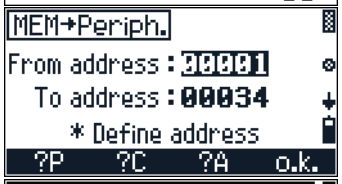
Transferring recorded data to the office computer

1. Press 1 MEM-Periph. in the DATA TRANSFER menu to open the MEM-Periph screen. The job that is currently open, and the start and end address for downloading appears.

2. Do one of the following:
   - To open the job list, press F1 Job.
   - To go to the Setting Interface screen, press F2 Int. Use < or > to change settings or input a new value.

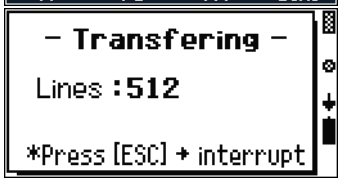


   - To search for or define an address, press F3 Search. You can search the point by point name, point code, or address. Press F4 o.k. to download data.



   - To start downloading data to the office computer, press F4 o.k.

     To stop the process, press ESC. The number of lines that have already been transmitted appear on screen.



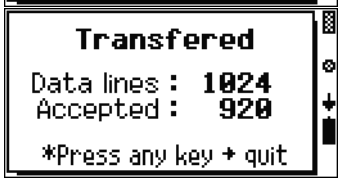
Uploading data from an office computer to the internal memory

1. Press 2 Periph-MEM in the DATA TRANSFER menu to open the MEM-Periph screen. The job to which you will upload data appears.

2. Do one of the following:
   - To open the job list, press F1 Job and select a job to upload data
   - To go to the Setting Interface screen, press F2 Int.
   - To start uploading data from the office computer, press F4 o.k.

     To stop the process, press ESC.

     When the transmission is completed, the result appears.

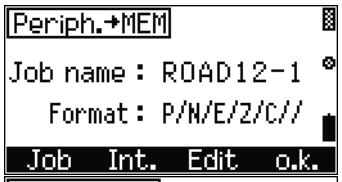


Nikon data fields

If you set the Format as **Nikon** in MENU 6 Setting Interface, detailed format information appears in the Periph.-MEM screen.

To edit the Nikon data fields:

- In the Periph.-MEM screen, press F3 Edit. The Data Fields screen appears.



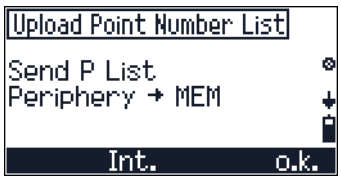
The **Nikon** format is a simple comma-delimiter or space delimiter text file of coordinates. You can freely define the elements and their order.

Do one of the following:

- To change the item in each field, press F2 or F3.
- To finish editing, press F4 o.k.

Uploading a point name/number list from the office computer

1. Press 3 Upload Point List in the DATA TRANSFER menu to open the Upload Point Number List screen.



2. Do one of the following:
   - To go to the Setting Interface screen, press F2 Int.
   - To proceed with uploading a point number list, press F4 o.k.

   Before actual transmission starts, a confirmation screen appears. Press F4 Yes to accept the import.

Uploading a point code list from the office computer

1. Press 4 Upload Code List in the DATA TRANSFER menu to open the Upload Point Number List screen.

2. Do one of the following:
   - To go to the Setting Interface screen, press F2 Int.
   - To proceed with uploading a point code list, press F4 o.k.

   Before actual transmission starts, a confirmation screen appears. Press F4 Yes to accept the import.

CHAPTER

10

Checking and Adjustment

In this chapter:

Increased strain placed on the instrument by extreme measuring conditions, transportation, prolonged storage and major changes in temperature may lead to misalignment of the instrument and faulty measuring results. Such errors can be eliminated by instrument adjustment or by specific measuring methods. This section will guide you through such adjustments.

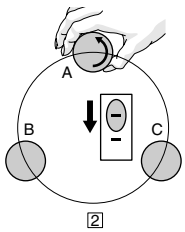
Checking and adjusting the plate level

The axis of the plate level vial must be at right angles to the vertical axis of the instrument.

To check and adjust the plate level:

1. Set up the instrument on the tripod.
2. Follow the leveling procedures described in Leveling, page 49.
3. Rotate the alidade 180°.
4. Check whether the bubble is in the center of the vial.
5. If the bubble is not in the center of the vial, adjust the plate level:
   a. Using the adjusting pin supplied, rotate the plate level's adjustment screw until the bubble has moved half of the distance back to the center.

   b. Using leveling screw A, move the bubble into the center of the vial.



6. Repeat from Step 4.

Checking and adjusting the circular level

Once you have checked and adjusted the plate level, check the circular level.

If the bubble is not in the center of the level, use the adjusting pin to rotate the three adjustment screws until the bubble is centered.

Checking and adjusting the optical plummet

The optical axis of the plummet must be aligned with the vertical axis of the instrument.

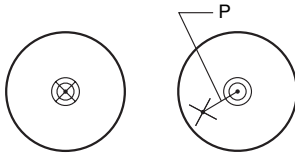
To check and adjust the optical plummet:

1. Place the instrument on the tripod. You do not have to level the instrument.
2. Place a thick sheet of paper marked with an X on the ground below the instrument.

   While you are looking through the optical plummet, adjust the leveling screws until the image of the X is in the center of the reticle mark.

3. Rotate the alidade 180°.

   If the marked image is in the same position in the center of the reticle mark, no adjustment is required.



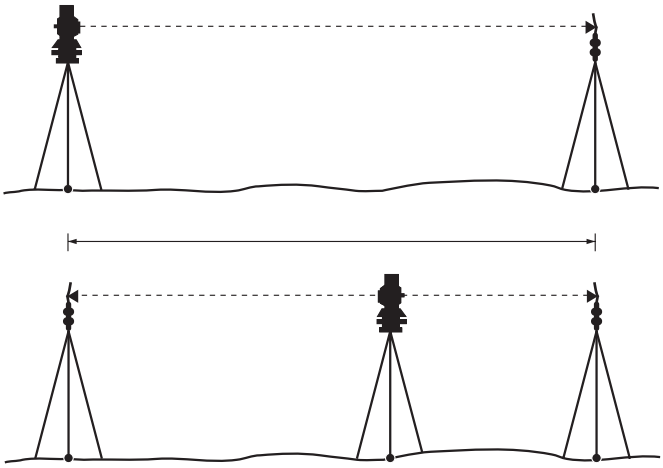
4. If the image is not in the same position, adjust the optical plummet: Use the supplied hexagonal wrench to turn the adjustment screws until the image of the X is in Position P. Position P is the center point of the line connecting the X and the center of the reticle mark.

5. Repeat from Step 2.

Checking the instrument constant

The instrument constant is a numerical value used to automatically correct for the displacement between the mechanical and electrical centers when measuring distances. The instrument constant is set by the manufacturer before the instrument is shipped. However, to ensure the highest operational accuracy, we recommend that you check the instrument constant several times a year.

To check the instrument constant, you can either compare a correctly measured base line with the distance measured by the EDM, or follow the procedure below.



To check the instrument constant:

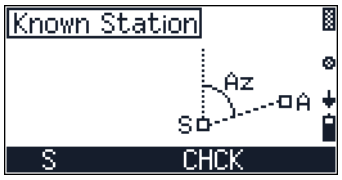
1. Set up the instrument at Point P, in as flat an area as possible.
2. Set up a reflector prism at Point Q, 100 m away from Point P. Make sure that you take the prism constant into account.
3. Measure the distance between Point P and Point Q (PQ).
4. Install a reflector prism on the tripod at Point P.
5. Set up another tripod at Point R, on the line between Point P and Point Q.
6. Transfer the Trimble M3 total station to the tripod at Point R.
7. Measure the distance from Point R to Point P (RP), and from Point R to Point Q (RQ).
8. Compare the value of PQ to the value RP + RQ. The difference should be within the specified range of error for the instrument (±23 mm + 2 ppm × distance).

   At 100 m distance, the error range is ±23.2 mm. If the error is out of range, contact your dealer.
9. Move the Trimble M3 total station to other points on the line between Point P and Point Q.
10. Repeat Step 5 through Step 9 several times.

11. Calculate the average of all the values of RP, and the average of all the values of RQ.
12. Compare the value of PQ to averaged RP + averaged RQ. The difference should be within the specified range of error for the instrument (±23 mm + 2 ppm × distance).

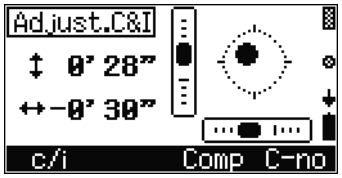
    At 100 m distance, the error range is ±23.2 mm. If the error is out of range, contact your dealer.

Checking and adjusting the compensator (C) and index (I)



1. To activate the Adjustment C&I program from any screen that shows the CHCK softkey, press F3.

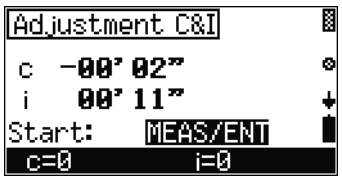
   The electric level is shown in graphic format.



2. Do one of the following:
   - To go to the angle adjustment screen, press F1 c/i, see Vertical index and HA collimation, page 119.
   - To go to compensator adjustment, press F3 Comp, see Compensator adjustment, page 120.
   - To turn the compensator adjustment on or off, press F4 C-no/C-yes.

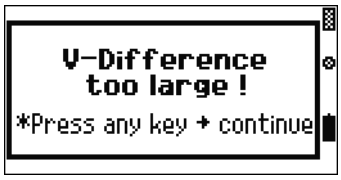
Tip – Before starting this procedure, level the instrument precisely.

Vertical index and HA collimation

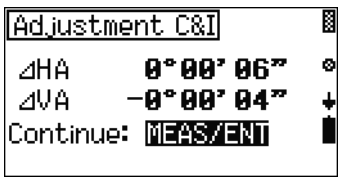


1. To open the Adjustment C&I screen, press F1 c/i in the Adjust. C&I screen. The Adjustment C&I screen shows the current sight axis correction and vertical index correction will be shown.
2. Do one of the following:
   - To reset c to zero, press F1 c=0.
   - To reset i to zero, press F3 i=0.
   - To return to the previous screen, press ESC.
3. To take an angle measurement on Face-1, press MEAS/ENT.

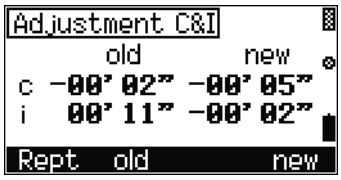
Note – *If the reference target is placed too high or too low (+/- 20 gon), a warning screen appears when you press* MEAS/ENT.



4. After taking a measurement on Face-1, turn to Face-2 and sight the same target. Press MEAS/ENT to take an angle measurement on Face-2.

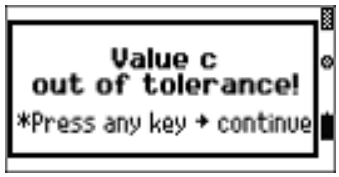


   The Results screen appears.



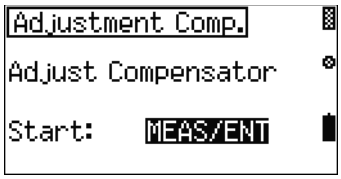
5. Do one of the following:
   - To return to the Face-1 measurement, press F1 Rept.
   - To ignore the latest result and keep the previous values, press F2 old.
   - To update c and i by the latest result, press F4 new.

Note – *When the result of* c *is larger than 30", or* i *is larger than 3', a warning screen appears.*

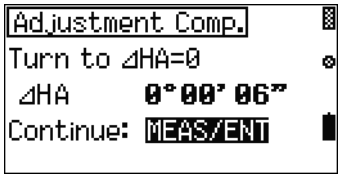


Compensator adjustment

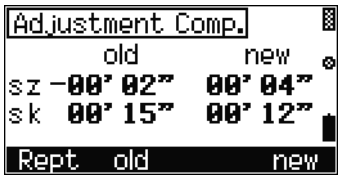
1. To activate the compensator adjustment program, press F3 Comp in the Adjust. C&I screen.



2. Do one of the following:
   - To take an angle measurement on Face-1, press MEAS/ENT.
   - To return to the previous screen, press ESC.
3. Turn to Face-2 and press MEAS/ENT.



   The Result screen appears, where:



   - sz is an error on the sighting axis (sighting shaft inclinations)
   - sk is an error on the vertical axis (vertical shaft inclinations)

4. Do one of the following:
   - To return to the Face-1 measurement, press F1 Rept.
   - To ignore the latest result and keep the previous values, press F2 old.
   - To update c and i by the latest result, press F4 new.

APPENDIX

A

Troubleshooting

In this chapter:

Points

Error message	Cause	Solution
Point number not found. Point code not found	You selected an invalid point number or code.	Press any key to return to the previous screen, and then enter a different point number or code.
XY-coordinate is required.	The point was a benchmark or angle/distance data and you did not enter a point that has an XY coordinate.	Press any key to return to the previous screen and then enter a point that has an XY-coordinate.
XY & Z-coordinate is required	You input a benchmark point or 2D coordinate point when the program requires XYZ coordinate data.	Press any key to return to the previous screen and then enter a point with 3D coordinates.
Z-coordinate is required.	The input point for the benchmark does not have a Z coordinate.	Press any key to return to the point input screen and then enter a point that has a Z-coordinate.
Same coordinate.	The point or coordinate that you entered is identical to the previous input point.	Press any key to return to the point input screen and then enter a different point.

Settings interface

Error message	Cause	Solution
Err. Positions P/C Default Values	The input value in Position P and Position C for the M5 format does not follow the rule.	Both values will be reset to the default value

Job Manager

Error message	Cause	Solution
Total job number. Delete old job.	You are creating a new job, and the maximum number of jobs has been reached.	Delete an old job
Can¤t Create. Data area is full.	You are creating a new job, and the internal memory is full.	Do one of the following: • Delete an old job • Continue recording some points until the internal memory reaches the maximum capacity.
Existing Job. Change job name.	You are creating a new job, and the job name you select already exists.	Change the job name.
Invalid Job	You are creating a new job, and necessary files for the job are missing.	Job files may mistakenly be deleted when using service tool software. You must contact customer support as this cannot occur during normal operation.

Error message	Cause	Solution
Can't assign CTRL PT Job	You are creating a new job and are trying to assign the current open job as the control point job.	Press any key to return to the previous screen and specify a different job as the control point job. ***Note –*** *If you need to use the current job as the control job, then you need to create/open a different job as the current job.*
Cannot delete opened job	You are about to delete an open (active) job.	Press any key to return to previous screen.
Cannot delete NONAME job	You are about to delete a NONAME job.	Press any key to return to previous screen.

Stakeout

Error message	Cause	Solution
S-O point = STN	The stakeout point and the station point have the same coordinates:	Input a different coordinate for the stakeout.

Uploading Point Name / Point Code list

Error message	Cause	Solution
Up to 254 Labels	The point name/code lists can not contain more than 254 items.	Press any key to return to the previous screen and then delete items from the list so that it has less than 254 items.
Change Name Already Exist	The list contains an item that has the same name as the one your are assigning.	Press any key to return to the previous screen and then change the item name or delete one of the items.
Check Data Line nnn	There was a grammatical error in the list.	Press ESC to return to the previous screen and check the format in the indicated line.
Data full Change Recording=OFF	When the internal memory is becoming full during the recording process.	Press any key. The system automatically turns off the data recording mode and continues the process.
Data area is full	When the internal memory is getting full while uploading coordinate, point number list or point code list.	Press any key to return to the previous screen.
Recording: OFF	Occurs when you hold down the Trimble key for one second or select 5 P/C in the HOT menu while the Recording setting is OFF.	Press any key to return to the HOT menu screen.

Adjustment C&I

Error message	Cause	Solution
`Value C was out of tolerance.`	The collimation axis error is out of range.	Press any key to return to the results screen and then repeat the observation.
`Value i was out-of-tolerance.`	The index axis error is out of range.	Press any key to return to the results screen and then repeat the observation.
`Compensator oper.-range exceeded.`	The compensator was out-of-range when the measurement was started in Adjustment C&I.	Press any key to return to the previous screen. Then, level the instrument finely and repeat the observation.
`V-Difference too large!`	In the Adjustment C&I program, the observed target was more than +/- 20gon from the horizontal line.	Press any key to return to the previous screen. Then, set a target closer to the horizontal. Set another target and remeasure.
`Compensator Out of tolerance.`	The adjustment value for the compensator is out of tolerance.	Press any key to return to the previous screen.

Application

Error message	Cause	Solution
`Distance A-B too small.`	The distance between point A and B is less than 10 cm.	Press any key to return to the `Select point B` screen. Use a different point as point B.
`Geometrical situation is undefined.`	The angle between A-B and S-A or the angle between A-B and S-B is less than 9 degrees.	Press any key to return to the `Select point B` screen. Use a different point as point B.

APPENDIX

B

Data Formats

In this chapter:

The Trimble M3 total station supports two data formats for downloaded recorded internal memory data: M5 format and Nikon raw format.

There is also a simple text file format for point number/name list and point code list.

The data output from the Trimble M3 total station can be used with the Trimble Total Control™ software (TTC), Trimble Geomatics Office™ software (TGO), the TerraModel® (TM) software, and the Trimble Data Transfer utility.

Trimble surveying instruments are used for measurement functions with different data processing requirements.

The Trimble M3 total station allows densely packed internal measurement and result data lines to be output in various formats.

This chapter describes the structure of data format and the type identifier of measured and calculated values.

Tip – All instruments have a serial interface which ensures the data exchange.

M5 data format

The point identification in the M5 data format is 27-digit, of which 12 digits are used as point numbers and 5 digits are used as the point code in the Trimble M3 total station.

The original Zeiss M5 data format is the common standard for the current TTrimble M3 total stations, the Trimble 3300, and all former Elta® surveying systems.

All five data blocks are preceded by a type identifier. The three numerical data blocks have a standard layout comprising 14 digits. In addition to the decimal point and sign, they accept numeric values with the specified number of decimal places.

The information block is defined by 27 characters. It is used for point identification (PI) and text information (for example TI).

The address block is comprised of five digits (from address 1 to 99999).

The M5 data line

The data line of the M5 format consists of 121 characters (bytes). The multiplication of this figure by the number of addresses (lines) stored shows the size of the project file in bytes.

Blanks are significant characters in the M5 file and must not be deleted.

The example describes an M5 data line at address 176 with coordinates (YXZ) recorded in unit m. The point identification of marking 1 is DDKS S402 4201. Column 119 includes a blank (no error code).

The end of the line has CR, LF (columns 120 and 121, shown here as <=). See also Special characters, page 130.

```
1         10        20        30        40        50        60        70        80        90        100       110       121
123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
For M5 | Adr . 12345 | T2a . 12345678901234567890123456 | T3 . 12345678901234 . dim3 | T4 . 12345678901234 . dim4 | T5 . 12345678901234 . dim5 | ?<=
               Value1          Value 2                   Value 3                   Value 4                   Value 5
For M5 | Adr . 176 | PI1 DDKS S402 4201 | Y 56590.405 m | X 74968.796 m | Z 334.784 m | <=
```

Column	Description
120-121	Carriage Return <, Line Feed =
119	Blank field, in case of error “e“
114-117	Unit for block5
99-112	Block5 value block
96-97	Type identifier5 for block5
91-94	Unit for block4
76-89	Block4 value block
73-74	Type identifier4 for Block4
68-71	Unit for block3
53-66	Block3 value block
50-51	Type identifier3 for block3
22-48	Information block PI or TI (point identification PI or text information TI, TO etc.)
18-20	Type identification2 PIa (a=1-0, for 10 Markings) or TI
12-16	Memory address of data line
8-10	Type identifier1 Adr for address
1-6	Defines M5 format

Explanation of the data line

Abbreviation	Description	Digits	Characters	Meaning
For	Format identifier	3	alpha	Trimble M3 format
M5	Format type	2	alpha	Measured data blocks
Adr	Address identifier	3	alpha	Value1
	Value 1	5	numeric	Memory address
T2	Type identifier	2	alpha	Value2 (Pla, TI, TO..)
a	Marking Value2	1	numeric	a =1, 2, 3, .. , 9, 0
		27	alpha	PI or TI
T3	Type identifier	2	alpha	Value3
	Value3	14	numeric	14-digit value
dim3	Unit	4	alpha	4-digit unit
T4	Type identifier	2	alpha	Value4
	Value4	14	numeric	14-digit value
dim4	Unit	4	alpha	4-digit unit
T5	Type identifier	2	alpha	Value5
	Value5	14	numeric	14-digit value
dim5	Unit	4	alpha	4-digit unit
?	Identifier	1	alpha	Error message or blank space

Special characters

Special characters		Digits	ASCII code	Hex code
|	Separator	1	124	7C
	Blank	1	32	20
<	Carriage return	1	13	0D
=	Line feed	1	10	0A

Additional data lines of M5 data format – header/changed setting

The additional M5 data lines are implemented to optimize transferring data (import / export) from and to the Trimble office software. Trimble office software includes the Trimble Total Control software, Trimble Geomatics Office software, and the TerraModel software.

The Header is recorded after you switch ON the instrument and begins with START and ends with END.

For M5 | Adr 00001 | TI START	|01	M3 5"DR	|02	131500	|03	1.00 |
For M5 | Adr 00002 | TI	|04	30	|		|	|
For M5 | Adr 00003 | TI	|05	1	|06	1	|	|
For M5 | Adr 00004 | TI	|20	1	|21	11	|22	16 |
For M5 | Adr 00005 | TI	|th	1.900 m	|ih	1.600 m	|	|
For M5 | Adr 00006 | TI	|i	-0.0005 grd	|c	0.0025 grd	|SZ	0.0005 grd |
For M5 | Adr 00007 | TI	|		|		|SK	0.0060 grd|
For M5 | Adr 00008 | TI	|T_	20 C	|P	1012 hPa	|PC	0.035 m |
For M5 | Adr 00009 | TI END	|m	1.000000	|		|	|

The new identifiers in the M5 Format – Header are:

Abbreviation	Description	Digits	Characters
01	Type instrument	7	M3 3"DR or M3 5"DR
02	Number of instrument	6	numeric
03	Version software	4	numeric
04	Language See *2 Depending on the "Coord System" settings, 1:YX/XY/EN, 2:XY/YX/NE, page 131.	2	numeric
05	Coord System	1	numeric *1
06	Order Coord. Syst	1	numeric *2
20	Position I	2	numeric
21	Position C	2	numeric
22	Position P	2	numeric

*1 1:XY, 2:YX, 3:NE

*2 Depending on the "Coord System" settings, 1:YX/XY/EN, 2:XY/YX/NE

Language codes

The two-digit language codes are:

Code	Language
23	German
30	English
31	Czech
32	Italian

Code	Language
33	Croatian
34	French
35	Dutch
36	Spanish
37	Danish
38	Polish
39	Hungarian
40	Japanese
41	Turkish
42	Russian
43	Finnish
44	Estonian
45	Portuguese
46	Serbo-Croatian
47	Chinese
48	Korean

The content of the header explanation of the example shown is as follows:

Abbreviation	Description	Meaning of example
01	Type instrument	M3 5"DR
02	Number of instrument	131500
03	Version software	1.00
04	Language	English
05	Coord System	xy
06	Order Coord. Syst	yx
20	Position I	Start position 1
21	Position C	Start position 11
22	Position P	Start position 16
th	Target height	1.90 m
ih	Instrument height	1.60 m
i	Vertical index cor.	-0.0005 gon
c	Sighting axis cor.	0.0025 gon
SZ	Run Center comp.	0.0005 gon
SK	Run Center comp.	0.0060 gon
T	Temperature	20 °C
P	Air Pressure	1012 hPa
PC	Prism constant	-0.035 m
m	Scale	1.000000

Record changed settings of the instrument

To permanently record change instrument settings, activate the `Record Settings` menu. The following changed settings and adjustments are recorded when the instrument is ON.

For M5 | Adr 00009 | TI INPUT			|th	2.000 m	|ih	1.700 m	|	
For M5 | Adr 00011 | TI ADJUST			|		|SK	0.0040 grd	|SZ	0.0055 grd|
For M5 | Adr 00012 | TI ADJUST			|V1	92.4505 grd	|V1	307.5515 grd	|i	-0.0010 grd|
For M5 | Adr 00013 | TI ADJUST			|Hz	284.1015 grd	|Hz	84.1060 grd	|c	0.0025 grd|
For M5 | Adr 00015 | TI ADJUST			|		|SK	0.0040 grd	|SZ	0.0055 grd|
For M5 | Adr 00016 | TI INPUT			|T_	25 C	|P	1000 hPa	|PC	-0.005 m|
For M5 | Adr 00017 | TI INPUT			|m	1.000005	|		|	|
For M5 | Adr 00018 | TI COM-OFF			|		|		|	|
For M5 | Adr 00019 | TI COM-ON			|		|		|	|
For M5 | Adr 00020 | TI Hz=0			|		|Hz	0.0000 grd	|	|
For M5 | Adr 00021 | TI HOLD			|		|Hz	300.000 grd	|	|
For M5 | Adr 00022 | TI DR			|th	0.000 m	|PC	0.000 m	|A	0.035 m|
For M5 | Adr 00023 | TI PR			|th	2.000 m	|PC	-0.005 m	|A	0.030 m|
For M5 | Adr 00024 | TI KN STAT			|		|		|	|
For M5 | Adr 00025 | PI1	A	BS1000	|		|Hz	300.0035 grd	|VI	92.4435 grd|
For M5 | Adr 00026 | PI1	S	1000	|Y	1000.000 m	|X	2000.000 m	|Z	0.000 m|
For M5 | Adr 00027 |TI			|		|Om	200.0035 grd	|	|

Record	T1	T2	T3	Comment
INPUT	th	ih	-	input th/ih
ADJUST	V1(1)	V1(2)	i	adjustment V-index/Collimator
ADJUST	Hz(1)	Hz(2)	c	adjustment V-index/Collimator
ADJUST	-	SK	SZ	adjustment V-index/Collimator or Compensator
INPUT	T_	P	PC	Input Temp., Air Pressure, Prism constant
INPUT	m	-	-	Input scale
COM-ON	-	-	-	Compensator switched ON
COM-OFF	-	-	-	Compensator switched OFF
Hz = 0	-	Hz(=0)		
HOLD	-	Hz	-	HA set to desired angle
DR	-	PC	A	DR mode switched on. PC=set, A=calculated (PC is the set value in Target set.)
PR	-	PC	A	PR mode switched on. PC=set, A=calculated (PC is the set value in Target set.)
Hz +	-	-	-	HA increment direction is set to clockwise.
Hz -	-	-	-	HA increment direction is set to counter-clockwise.

The point identification PI in M5 Format

The PI is comprised of 27 characters. It starts in column 22 and terminates in column 48 in the M5 data line. The data structure within the PI is defined by markings. A maximum of 10 markings, marked in the preceding type identifier with PI1 to PI0 (columns 18, 19, 20), can be designated to the PI (depending on the instrument).

The type identifier in the M5 Format

Data format requirements have changed and increased over the years. For backwards compatibility, the M5 Format carries most of the type identifiers of all available formats, always based on the preceding format (Rec500).

Type identifiers are defined by two characters (except for Adr). If only one character is necessary, the second character is a blank.

In the M5 Format there are five type identifiers (TK) defined:

- TK1: Adr Identifier address (Value1)
- TK2: T2 Identifier information (Value2)
- TK3: T3 Identifier 3. Value field (Value3)
- TK4: T4 Identifier 4. Value field (Value4)
- TK5: T5 Identifier 5. Value field (Value5)

Example: PI for point identification or TI for text information can be used for T2. For T3, T4, T5, D, Hz, V or Y, X, Z can be used.

The Special characters, page 130 are analogous to the M5 format.

Marking in the M5 format

The Trimble M3 total station uses a mark which is saved internally in the instrument. This mark consists of three blocks with clearly defined block lengths. The user can change the order of the point number and point code blocks as well as the position of the information block.

Example 1: PI dataline

Layout gage	1 10 20 27 12345678901234567890123456 7	
Sample marking	PPPPPPPPPPPP CCCCC	
Sample marking	CCCCCPPPPPPPPPPPP	
Where	PPPPPPPPPPPP	is a 12-digit point number
	CCCCC	is a 5-digit point code

Example 2: TI dataline

Layout gage	1 10 20 27 12345678901234567890123456 7	
Sample marking	IIIIIII	
Sample marking	IIIIIII	
Where	IIIIIII	is a 7-digit information block

Tip – The information block (I) is left-aligned, the code (C) and point number (P) are right-aligned.

To change settings of the Trimble M3 total station in the M5 format, select MENU and 6 `Settings Interface`.

Tip – In case of overlapping information in the blocks, the instrument returns to the default settings.

Value blocks

In the M5 format three value blocks are available:

Format	Value1	Value2	Value3	dim
M5	14	14	14	4

All value blocks are preceded by a type identifier which specifies the function of the succeeding value.

In the M5 format for the value block there is a unit (dim), which follows the 4-digit (divided by blanks) value block.

The values are typed right-aligned in the blocks. Decimal point, digits after the comma and definitions of preceding characters correspond to the internal instrument specifications.

The following units are defined:

Values	Units
Angle measurement	gon, DEG, DMS, mil,%
Distances, Coordinates	m, ft
Pressure	mmHg, hPa, inHg
Temperature	Centigrade, Fahrenheit
Standard, PR, etc.	No unit defined

CAUTION – If the files of the Trimble Elta formats are entered manually, it is important to remember that when using the data in the instrument, the digits after the comma and the units need to be adjusted correspondingly.

Recording data lines

Table B.7 shows how data lines are recorded.

Table B.7 Recording data lines

Mode	Rec 1	Mode 2	Content of record P, C, I	T1	T2	T3	Comments
Single meas.	x		CCCCC PPPPPPPPPPP		Hz	Vk	HA VA mode, k=1, 2, 3, 4 depending on V system
	x		CCCCC PPPPPPPPPPP	HD	Hz	h/Z	horizontal distance mode
	x		CCCCC PPPPPPPPPPP	SD	Hz	Vk	slope distance mode, k=1, 2, 3, 4 depending on V system
	x		CCCCC PPPPPPPPPPP	y	x	h/Z	coordinates mode, sequence y,x
	x		CCCCC PPPPPPPPPPP	x	y	h/Z	coordinates mode, sequence x,y
	x		CCCCC PPPPPPPPPPP	n	e	h/Z	coordinates mode, sequence n,e
	x		CCCCC PPPPPPPPPPP	e	n	h/Z	coordinates mode, sequence e,n
Adjustment c/i	x	x	ADJUST	Vk	Vk	i	k=1, 2, 3, 4 depending on V system
	x	x	ADJUST	Hz	Hz	c	
	x	x	ADJUST		SK	SZ	
Adjust comp.	x	x	ADJUST		SK	SZ	
Input values	x	x	INPUT	th	ih		
	x	x	INPUT	T_	P	PC	
	x	x	INPUT	m			
	x	x	S PPPPPPPPPPP			Z	Z ... station height
Compensator	x	x	COM-ON				Compensator activated
	x	x	COM-OFF				Compensator deactivated

Table B.7 Recording data lines (continued)

Mode	Rec 1	Mode 2	Content of record P, C, I	T1	T2	T3	Comments
Point to line (Station + Offset)	×	×	STA+OFF				point to line
	×		A PPPPPPPPPPP	SD	Hz	Vk	reference point A
	×		B PPPPPPPPPPP	SD	Hz	Vk	reference point B
	×		A=S				if station is defined as A
	×		B=S				if station is defined as B
		×	A-B	SD	HD	h	base length
	×		CCCCC PPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		×	CCCCC PPPPPPPPPPP	y	x	h/Z/ω	meas. pt. P; y, x, e, n depending on the coordinate system if station is defined as P
	×		P=S	Y	X	h/Z/ω	
Connect. distance	×		CON. DST.				
	×		A PPPPPPPPPPP	SD	Hz	Vk	reference point A
	×		CCCCC PPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		×	A-P	SD	HD	h/Z	connecting distance A-P
	×		P-P	SD	HD	h/Z	connecting distance P-P
Object height	×	×	OBJ. HT				
	×		A PPPPPPPPPPP	SD	Hz	Vk	reference point A
	×		CCCCC PPPPPPPPPPP		Hz	Vk	meas. pt. P, k=1...4, depending on V system
		×	CCCCC PPPPPPPPPPP	HD	O	Z	meas. pt. P
	×		! PPPPPPPPPPP			Z	Set Z value
	×		PPPPPPPPPPP		Hz	Vk	k=1, 2, 3, 4 depending on V system
Vertical plane	×	×	VERT. PL				
	×		A PPPPPPPPPPP	SD	Hz	Vk	reference point A
	×		B PPPPPPPPPPP	SD	Hz	Vk	reference point B
		×	A-B	SD	HD	h	base length
	×		CCCCC PPPPPPPPPPP		Hz	Vk	meas. pt. P, k=1...4, depending on V system
		×	CCCCC PPPPPPPPPPP	y	x	h	meas. pt. P; y, x, e, n depending on the coordinate system
	×		P=S				if station is defined as P
	×	×	! PPPPPPPPPPP		y		set value for y, x, or n depending on the coordinate system
	×	×	! PPPPPPPPPPP			h	set value for h
	×		PPPPPPPPPPP		Hz	Vk	
		×		Y	X	h	

Table B.7 Recording data lines (continued)

Mode	Rec 1	Mode 2	Content of record P, C, I	T1	T2	T3	Comments
Area Calculation	x	x	AREA				
	x		CCCCC PPPPPPPPPPP	SD	Hz	Vk	meas. pt. P
		x	CCCCC PPPPPPPPPPP	Y	X	Z	meas. pt. P
		x	CCCCC PPPPPPPPPPP	Y	X	Z	input (or from MEM) pt. P
	x	x	AREA	Fl			
Unknown station	x	x	UN STAT				
		x	A PPPPPPPPPPP	Y	X		reference point A, B, C, D, E
	x		A PPPPPPPPPPP	SD	Hz	Vk	measurement to A, B, C, D, E
		x	A PPPPPPPPPPP	vy	vx	vz	residual point A, B, C, D, E
	x	x	S PPPPPPPPPPP	Y	X		station coordinates
	x	x		m	Om	s0	scale, orient., standard deviation
Known station	x	x	KN STAT				
		x	S PPPPPPPPPPP	Y	X		station coordinates
		x	A PPPPPPPPPPP	Y	X		reference point A
	x		A PPPPPPPPPPP		Hz	Vk	measurement to A (Hz, V mode)
	x		A PPPPPPPPPPP	SD	Hz	Vk	measurement to A (SD, Hz, V mode)
	x	x			Om		orientation (Hz, V)
	x	x		m	Om		scale, orientation (SD, Hz, V)
Station elevation	x	x	EL STAT				
	x	x	! PPPPPPPPPPP			Z	height of A
	x		A PPPPPPPPPPP	SD	Hz	Vk	measurement of A
	x	x	S PPPPPPPPPPP			Z	computed station height
Meas. Topo.	x	x	POLAR				
	x		CCCCC PPPPPPPPPPP	SD	Hz	Vk	original readings
		x	CCCCC PPPPPPPPPPP	Y	X	Z	coordinates
	x	x	CCCCC PPPPPPPPPPP	T			eccentricity Tv, Th, Tl, Tr, Ts

Table B.7 Recording data lines (continued)

Mode	Rec 1	Mode 2	Content of record P, C, I		T1	T2	T3	Comments
Stake out	x	x	ST-OUT					
	x	x	SO P-LN					RefLine 2D
	x	x	SO D-LN					DifLine 2D
		x	!	PPPPPPPPPPPP	Y	X	Z	depending on stake-out method
		x	!	PPPPPPPPPPPP	Y	X		depending on stake-out method
		x	!	PPPPPPPPPPPP	HD	Hz	Z	depending on stake-out method
		x	!	PPPPPPPPPPPP	HD	Hz		depending on stake-out method
	x	x	!	PPPPPPPPPPPP	y	x		depending on stake-out method (RefLine 2D)
		x	!	PPPPPPPPPPPP	HD			depending on stake-out method (DivLine 2D)
	x			PPPPPPPPPPPP	SD	Hz	Vk	k =1, 2, 3, 4, depending on the V system
		x		PPPPPPPPPPPP	dy	dx	dz	stake-out difference depending on meas. method
		x		PPPPPPPPPPPP	dy	dx		stake-out difference depending on meas. method
		x		PPPPPPPPPPPP	dl	dc	dr	stake-out difference depending on meas. method
		x		PPPPPPPPPPPP	dz			stake-out difference depending on meas. method
		x		PPPPPPPPPPPP	dy	dx	h	stake-out difference depending on meas. method (RefLine 2D)
		x		PPPPPPPPPPPP	Y	X	Z	verification
		x		PPPPPPPPPPPP	Y	X		verification measurement
	x		A	PPPPPPPPPPPP	SD	Hz	Vk	reference point A (RefLine 2D, DivLine 2D)
	x		B	PPPPPPPPPPPP	SD	Hz	Vk	reference point B (RefLine 2D)
	x		A=S					if station is defined as A (RefLine 2D)
		x	A=B		SD	HD	h	RefLine 2D A-B
	x		B=S					if station is defined as B (RefLine 2D)

Note – *"Rec.mode" can be selected from the following: 1: MEM/1, V24/1; 2: MEM/2, V24/2; 3: 1+2*

Nikon data format

The Trimble M3 total station can be used with any program that supports Nikon formats.

Uploading coordinate data format

You can upload coordinate records in the following formats:

P, X , Y , Z, C

P , X , Y , Z

P , X , Y , , C

P , X , Y , ,

P , X , Y ,

P , , , Z , C

P , , , Z

Data example

20100,6606.165,1639.383,30.762,RKBSS

20104,1165611.6800,116401.4200,00032.8080

20105 5967.677 1102.343 34.353 MANHOLE

20106 4567.889 2340.665 33.444 PT1

20107 5967.677 1102.343 34.353

20109,4657.778,2335.667,,PT2

20111,4657.778,2335.667

20113 4657.778 2335.667

20115,,,34.353,MANHOLE

20117,,,33.444

Downloading Nikon raw format

Coordinate records

type , pt , (pt id) , northing , easting , elevation , code

type	One of the following codes: **UP** Uploaded point **MP** Manually input point **CC** Calculated coordinate **RE** Resection point
pt	Point number
(pt id)	(Point ID)
northing	Northing of the coordinate
easting	Easting of the coordinate
elevation	Elevation of the coordinate
code	Feature code

Station records

ST , stnpt , (stnid) , bspt , (bs id) , hi , bsazim , bsha

ST	Station record identifier (fixed text)
stnpt	Station point number
(stn id)	(Station ID)
bspt	Backsight point number
(bs id)	(Backsight ID)
hi	Height of instrument
bsazim	Backsight azimuth
bsha	Backsight horizontal angle

Control point records

CP , pt , (pt id) , ht , sd , ha , va , time , code

CP	Control point record identifier (fixed text)
pt	Point number
(pt id)	(Point ID)
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle

time	24-hour time stamp
code	Feature code

Sideshot records

SS , pt , ht , sd , ha , va , time , code

SS	Sideshot record identifier (fixed text)
pt	Point number
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp
code	Feature code

Stakeout records

SO , pt , (sopt) , ht , sd , ha , va , time ,

SO	Stakeout record identifier (fixed text)
pt	Recorded point number
(sopt)	(Original number of point staked)
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp

F1/F2 records

face , pt , ht , sd , ha , va , time

face	One of the following: **F1** Shot taken using Face-1 (fixed text) **F2** Shot taken using Face-2 (fixed text)
pt	Point number
ht	Height of target
sd	Slope distance
ha	Horizontal angle
va	Vertical angle
time	24-hour time stamp

Comment/note records

CO , text

CO	Comment record identifier (fixed text)
text	Comment text

Point number/name list and Point code list

PT lists and code lists use the same record format.

File format

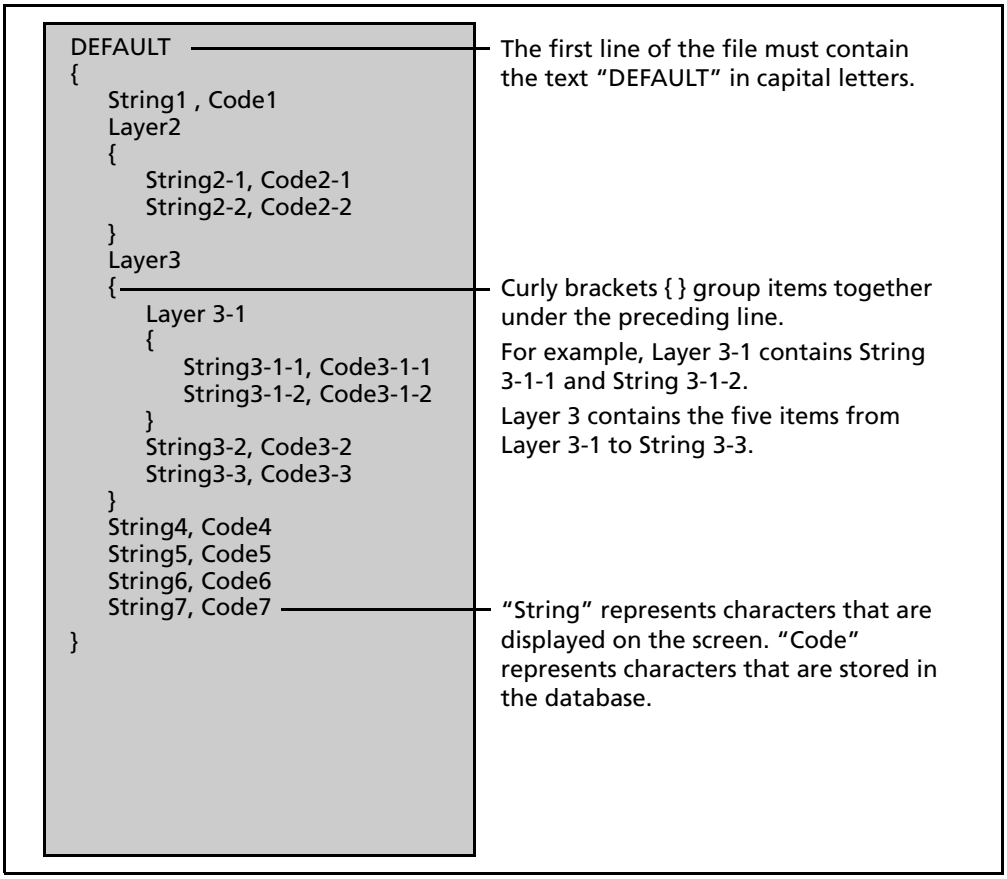


Figure B.4 Record format for PT lists and code lists

Data example

DEFAULT

```
{
    “STRUCTURES”
    {
            “TREE”, “S0001”
            “FENCE”, “S0002”
            “MAIL BOX”, “S0003”
            “FLOWER BED”, “S0004”
    }
    “ROADS”
    {
            “MANHOLE”, “R0001”
            “CENTER LINE”
            {
                “WHITE”, “R002-W”
                “YELLOW”, “R002-Y”
            }
            “SIDEWALK”, “R0003”
            “CROSSING”, “R0004”
            “BRIDGE”, “R0005”
            “SIGNAL”, “R0006”
            “HIGHWAY STAR”, “R0007”
    }
    “RAILWAY”
    {
            “CROSSING”, “RW001”
            “STATION”, “RW002”
            “SIGNAL”, “RW003”
            “BRIDGE”, “RW004”
            “TUNNEL”, “RW005”
    }
}
```

APPENDIX

C

Specifications

In this chapter:

Telescope

Tube length	153 mm (6.02 inch)
Magnification	26×
Effective diameter of objective	40 mm (1.57 inch) EDM 50 mm (1.97 inch)
Image	Erect
Field of view	1°30' 2.6 m at 100 m (2.6 ft at 100 ft)
Resolving power	3.0"

Measurement range

Distances shorter than 1.6 m (5.25 ft) cannot be measured with this EDM.

Measurement range with no haze, visibility over 40 km (25 miles)	
Prism Mode	
Reflector sheet (5 cm x 5 cm)	300 m (984 ft)
Mini prism	3,000 m (9,800 ft)
Standard prism (1P)	5,000 m (16,400 ft)
Direct-Reflex mode	
Reference target	200 m (656 ft)

Note – *The target should not receive direct sunlight.*

Note – *"Reference target" refers to a white, highly reflective material.*

Note – *For measurements at short range (approximately 1.6 m to 5 m (5.2 ft to 16.4 ft) to the mini prism, or 1.6 m to 10 m (5.2 ft to 33 ft) to the standard prism), it is recommended that you use a Nikon original prism to maintain accuracy.*

Distance measurement precision

Precise mode	
Prism mode	± (3 + 2 ppm × D) mm* (–10 °C to +40 °C) ± (3 + 3 ppm × D) mm* (–20 °C to –10 °C), (+40 °C to +50 °C)
Direct-Reflex	± (5 + 2 ppm × D) mm (–10 °C to +40 °C) ± (5 + 3 ppm × D) mm (–20 °C to –10 °C), (+40 °C to +50 °C)
Standard mode	
Prism mode	± (10 + 5 ppm × D) mm
Direct-reflex mode	± (10 + 5 ppm × D) mm

* These precision settings apply to measurements of 5 m (16 ft) or more to a reflector sheet and 10 m (33 ft) or more to a mini or standard prism. For measurements at shorter distances than these, the precision is ± 5 mm.

Measurement intervals

Measurement intervals may vary with the measuring distance or weather conditions.

Precise mode	
Prism mode	1.3 sec. (initial 2.6 sec.)
Direct Reflex mode	1.6 sec. (initial 3.5 sec.)
Standard mode	
Prism mode	0.5 sec. (initial 2.2 sec)
Reflectorless	0.8 sec. (initial 3.2 sec.)
Prism offset correction	–999 mm to +999 mm (1 mm step)

Angle measurement

Reading system	Photoelectric incremental encoder
Circle diameter (reading)	88 mm (3.46 in.) (79 mm (3.11 in.))
Minimum display increment	
DMS	1''/5''/10''
DEG	Trimble M3 3"DR: 0.0002°, 0001°, 0.005° Trimble M3 5"DR: 0.0005°, 0001°, 0.005°
400G	Trimble M3 3"DR: 0.2mg / 1mg / 5mg Trimble M3 5"DR: 0.5mg / 1mg / 5mg
MIL6400	0.01M / 0.1M / 0.5M
DIN18723 accuracy	Trimble M3 3"DR: 3"/ 1.0 mgon Trimble M3 5"DR: 5"/ 1.5 mgon

Dual-axis tilt sensor

Method	Liquid-electric detection
Compensation range	±3'

Clamps/tangent screws

Type	Coaxial tangent/clamp knobs
Range	±3.5°

Tribrach

Type	Detachable

Level vial sensitivity

Plate level vial	30'' / 2 mm
Circular level vial	10' / 2 mm

Optical plummet

Image	Erect
Magnification	3×
Field of view	5°
Focusing range	0.5 m (1.6 ft) to infinity

Display and keypad

Display type	Graphical LCD
Resolution	128 × 64
Display illumination	Backlight
Keys	25
Supplied on	face-1 side (face-2 side is optional)

Connections in the base of instrument

Communications	
Type	RS-232C
Maximum baud rate	38400 bps asynchronous
External power supply input voltage	7.2 V through 11 V DC

Battery pack BC-65

Output voltage	7.2 V DC rechargeable
Continuous operation time	
Continuous distance/angle measurement	6.5 hours (PR mode) 7.0 hours (DR mode)
Distance/angle measurement every 30 seconds	15 hours (PR mode) 16 hours (DR mode)
Continuous angle measurement	27 hours (both)

Note – *Tested at 25 °C (normal temperature). Operation times may vary depending on the condition and deterioration of the battery.*

Environmental performance

Operating temperature range	–20 °C through +50 °C (–4 °F through +122 °F)
Storage temperature range	–25 °C through +60 °C (–13 °F through +140 °F)

Dimensions

Main unit	168 mm W × 173 mm D × 347 mm H (6.6 inch W x 6.8 inch D x 13.7 inch H)
Carrying case	470 mm W × 350 mm D × 231 mm H (18.5 inch W x 13.8 inch D x 9.1 inch H)

Weight

Main unit	5.0 kg (11.02 lbs), approx. (including tribrach)
Battery BC-65	0.4 kg (0.88 lbs), approx.
Carrying case	3.2 kg (7.05 lbs), approx.
Quick charger Q-75U/E	0.45 kg (0.99 lbs)

Glossary

This section explains the softkeys and some of the terms used in this manual.

Softkey glossary

The following softkeys are used in the software.

?A	Search a point by address.
?C	Search a point by point code.
?P	Search a point by point number/name.
?↓	Search for another point with the same condition.
A=P	Replace point A with point P.
A=S	Define point A as the station point (S).
Add	Add an item (for example a point name or number).
A-P	Proceed with the radial connecting distance function.
Az	Input the azimuth value.
B=S	Define point B as the station point (S).
BeaDist	Open the bearing distance screen.
c/i	Set the angle adjustment
CHCK	Adjust C and I.
C-no / C-Yes	Turn the compensator adjustment on and off.
Comp	Set the compensator adjustment.
CRAT	Create a job.
Del	Delete data lines.
Disp	Open a view data screen.
DISP	Change the display between Z, h, and w.
ECC	Open the eccentric measurement screen.
Edit	Enables you to edit data fields.
HA=0	Set or reset the horizontal angle to zero.
hSet	Input offset h.

I-ft	The unit is currently set to US-feet. Press the softkey to set the unit to international feet.
ih	Set the instrument height.
ih/Zs	Set the instrument height and station-Z coordinate.
Inp	Open an input screen, for example to input coordinate data.
Input	Input data.
Int	Open the set interface screen.
INTS	Open the intersection function menu.
Job	Open the job list.
Layer	Add a layer (for example to a point name list).
List	Open the point name or point code list.
m	The unit is currently set to international feet. Press the softkey to set the unit to meters. Open the scale edit screen.
More	Add more points.
o.k.	Confirm changed or existing settings or input.
old	Retain old (existing) values.
Om	Orientation unknown.
P=S	Define point P as the station point (S).
P-P	Proceed with the polygonal connecting distance function.
Rept	Return to the observation screen.
Reset	Reboots the program to restart the instrument.
Search	Search for a defined address.
Sleep	Initiates power-saving mode.
Stack	Open the point name or point code stack to use previously input values.
Stop	Stop measurement.
Test	Open a test screen.
th	Set the target height. Set the reflector height.

th/ih	Set or change the target height/instrument height.
U%	Percentage grade between two points.
U-ft	The unit is currently set to meters. Press the softkey to set the unit to US-feet.
xSet	Input offset x.
XY	Input XY coordinates.
y	Input offset y.
Z	Set the Z coordinate.

Glossary of terms

This glossary describes surveying terms used in the manual.

2D observation	Two-dimensional observation, X and Y.
3D observation	Three-dimensional observation, X, Y, and Z.
accuracy	The closeness of a measurement to the actual (true) value of the quantity being measured.
adjusted values	Values derived from observed data (measurement) by applying a process of eliminating errors in that data in a network adjustment.
adjustment	The process of determining and applying corrections to observations for the purpose of reducing errors in a network adjustment.
algebraic sign	The sign (+ or -) associated with a value that shows whether it is a positive or negative number.
algorithm	A set of rules for solving a problem in a finite number of steps
alidade	In this manual, alidade refers to the housing part of the instrument. It includes die cast body part, H/V encorders, optical plummet, circular/plate levels, display and keyboard, and H/V tangent screw and clamp. The EDM part is independent from the alidade part.
ambient temperature	The current overall temperature.
angles and distance	Conventional measurement of horizontal and vertical angles and a slope distance.
attribute value	A particular value for a feature, chosen from the domain of an attribute. For example: surface type is an attribute; bitumen, gravel, and concrete are domains; and gravel is an attribute value.
axis	One of the reference lines of a coordinate system.
azimuth	The horizontal direction reckoned clockwise from the meridian (north) plane.

backsight	Point with known coordinates or known azimuth from the instrument point that is used to orient the instrument during station setup.
baseline	The position of a point relative to another point.
baud	Used to describe serial communications data transfer speed from one binary digital device to another. Baud rate is generally one bit per second.
bearing	The angular value defining the direction of a line, based on the local datum used in the survey.
benchmark point	A survey mark made on a monument having a known location and elevation, serving as a reference point for surveying.
bubble level	See **circular level**.
calibrate (equipment)	Adjustments made to the incoming raw decoded data values. For example, applying an orientation correction to the heading data
calibrate (local site adjustment)	A method of calculating local site coordinates based on ECEF Cartesian coordinates.
checksum	A method for checking the integrity of transmitted data. A checksum is an integer value computed from the data string.
circular level	A spirit level with the inside surface of its upper part ground spherical to form a circular bubble, and with graduations consisting of concentric circles, for application where high precision is not required.
compensator	A sensor mounted on the alidade aligned with the horizontal axis and the sighting axis internally. It detects the angular error and returns to the system to make necessary corrections.
component	One of the three surveying observations used to define a three-dimensional baseline between two control points. The same baseline can be defined by azimuth, delta height, and distance (in ellipsoid coordinates); by delta X, delta Y, and delta Z (in Earth-Centered Cartesian coordinates); and by delta north, delta east, and delta up (in local plane coordinates).
control point / control station	A monumented point to which coordinates have been, or are being, assigned by the use of surveying observations.
coordinate system	A mathematically defined method for specifying the locations of points. Distances or angles from suitable references located the points within the system.
coordinates	A set of numbers used in specifying the location of a point.
correction	Changes to the measured slope distance or vertical angle to correct for atmospheric conditions and the curvature of the earth.

DDDMMmmm A format for entering angles or latitudes and longitude values. With this option selected the values are entered as degrees, minutes, and decimal minutes. For example, 45°21.457' is entered as 45.21457. Southern latitudes and western longitudes are entered as negatives.

DDDMMSSsss A format for entering angles or latitudes and longitude values. With this option selected the values are entered as degrees, minutes, seconds and decimal seconds. For example, 45°21'45.7" is entered as 45 21 457. Southern latitudes and western longitudes are entered as negatives.

delta elevation The difference in elevation between two points.

delta N, delta E, delta U Coordinate differences expressed in a Local Geodetic Horizon coordinate system.

delta X, delta Y, delta Z Coordinate differences expressed in the earth-centered Cartesian coordinate system.

direct reflex (DR) The measurement mode for non-prism measurement.

direction The angle between a line and an arbitrarily chosen reference line. When the reference line is north or south and the angle is measured east or west, the direction is called a bearing. When the reference line is south and the angle is clockwise, the direction is called an azimuth

distance The (changing) amount of separation between any two points. For example, as someone moves toward a point, the distance changes.

eccentric measurement When the target point cannot be measured directly from the station point, you can use some functions in the "eccentric measurement" program to find a way to calculate the target point based on the result from alternative measurements.

EDM Electronic Distance Measurement (telescope part of the instrument).

elevation The vertical distance from a datum, generally mean sea level, to a point or object on the earth's surface. The terms "elevation" and "altitude" have sometimes been used synonymously, but in modern surveying practice the term "elevation" is preferred to indicate heights on the earth's surface whereas "altitude" is used to indicate the heights of points in space above the earth's surface.

error The difference between the measured value of a quantity and its true value. Surveying errors are generally divided into three categories: blunders, systematic errors, and random errors. Least squares analysis is used to detect and eliminate blunders and systematic errors, and least squares adjustment is used to measure and properly distribute random error.

h Height.

HA Horizontal angle.

HD See **horizontal distance**.

horizontal A plane perpendicular to the plumbline at the point of consideration or origin.

horizontal distance The distance between two points, computed horizontally from the elevation of either point.

input mode Data received by observation and measurement, or manual input.

instrument height (ih) 1) The height of the center of the telescope (horizontal axis) above the ground or station mark.

2) The height of the line of sight of the leveling instrument above the adopted datum.

intersection A series of calculation functions to define new points by using a combination of observations.

known station One of the methods to set up a station in the field. It uses a known coordinate point as the station point. The backsight point to define the orientation can be an angle point or a point with coordinates.

M5 format The original Zeiss M5 data format is the common standard for all former Elta surveying systems and current Trimble 3600 and M3 systems.

M5“ refers to the five measuring data blocks per data line:

All 5 data blocks are preceded by a type identifier. The 3 numerical data blocks have a standard layout comprising 14 digits. In addition to the decimal point and sign, they accept numeric values with the specified number of decimal places.

The information block is defined by 27 characters. It is used for point identification (PI) and text information (TI e.g.).

measure topo A topographic survey which has for its major purposes the determination of the configuration (relief) of the surface of the earth (ground) and the location of natural and man-made objects thereon.

MEM-Periph Downloading internal memory to an office computer.

NiMH Abbreviation for Nickel-MetalHydride, the material used in some battery packs. Unlike NiCad batteries, NiMH batteries do not use heavy metals that may have toxic effects. In addition, they can store up to 50% more power than NiCad batteries and do not suffer from memory effects.

polygonal connecting distance A function to calculate the horizontal distance, vertical difference and slope distance between two points. "Polygonal connecting" uses the latest two points for calculation.

prism constant A constant value subtracts from the measured distance when you measure to the prism. The value is unique to each prism manufacture.

prism mode (PR) The measurement mode for prism measurement.

radial connecting distance A function to calculate the horizontal distance, vertical difference and slope distance between two points. "Radial connecting" always uses the first measured point as the base point for calculation.

recording mode

In the *Settings Interface* menu, recording mode can be set as ALL or Confirm.

When you set recording mode to ALL, press MEAS/ENT takes a measurement and records the point with the default point number/code by one key press.

When you set recording mode to Confirm, the program will show you the recording contents before it returns to the observation screen.

Recording settings can be set to Yes or No.

If the recording settings are set to Yes, a series of observation condition settings will be recorded whenever you reboot the program. See Configuring data recording and external communication settings, page 38.

reflector

The target (usually refers to a prism).

reflectorless

Refers to direct-reflex mode.

regional configuration presets

Three regional configuration presets are recorded on the Trimble M3 total station. When you first start using the instrument, and you have selected the language, the REGIONAL CONFIGURATION screen appears from which you can select a region. See Changing regional configuration presets, page 32.

remote object

Heights of inaccessible points are determined by measuring SD, V to an accessible point in the vertical line. See Remote object height, page 100.

resection

One of the methods to set up the station. By measuring to two or more known points, the program will calculate the station coordinate and its orientation.

residuals

The indicator for the observation accuracy and reliability in resection result. If this is small enough, you can judge the new station setup is successfully done.

reticle

A system of wires, hairs, threads, etched lines, or the like, placed in a telescope perpendicular to its axis and at its principal focus, to define the line of sight of the telescope, to permit specific pointings to be made on a target or signal, or readings to be made on a rod or scale.

RS-232

This was originally a nine-wire interface standard for teletype machines from the Electronics Industry Association. It is the standard for computer serial-port transfers

scale

A multiplier used on coordinate and other linear variables, such as for map projections and transformations.

scale factor

A map projection parameter used to convert ellipsoid distances to projection (grid) distances, and vice versa.

SD

Slope distance.

sea-level correction

One of the coordinate conversion corrections referring to the sea-level. You can set it to ON or OFF. See Configuring error corrections, page 40.

spatial eccentricity

One of the eccentricity application function. It calculates the point by using the input spatial distance Ts. See Eccentric measurement, page 85.

stakeout	An application function to place the pin to the designed coordinate in the field. Also referred to as the *set-out function*.
station	Instrument position.
target height	Height of the target.
target set	Combination of target height and measure mode.
targeting	The distinctive marking of a ground point with material of any kind, placed in a symmetrical contrasting pattern about the point to facilitate the identification and precise recovery of that point on an aerial photograph.
temperature correction	An amount added algebraically to a measurement to account for length changes due to thermal variance from standard conditions.
topo	See **topographic**.
topographic	The features of the surface of the earth considered collectively as to form. A single feature, such as a mountain or valley, is termed a "topographic feature."
tribrach	The three-arm base of a surveying instrument which carries the foot-screws used in leveling the instrument.
VA	Vertical angle.
X, Y, or Z	An expression for coordinates, with separate meanings for EC Cartesian and rectangular coordinates. In the EC Cartesian system, X refers to the (direction of the) coordinate axis running from the system origin to the Greenwich Meridian, Y to the axis running from the origin through the 90-degree east longitude meridian, and Z to the polar ice cap. In rectangular coordinate systems, X refers to the east-west axis, Y to the north-south axis, and Z to the height axis.
XON/XOFF	Data transmission protocol.
zenith	The point of the sky directly above the observer's head.
zenith angle	An angle measured from a vertical reference. Zero degrees is a vertical line pointing up, 90 degrees is horizontal, and 180 degrees is straight down.

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