Getting Started

In this chapter:

- Parts of the instrument
- Instrument keyboard and display
- Turning on the instrument
- Turning off the instrument
- Regional configuration
- List available jobs or data
- Entering data
- Creating or opening a job
- Measuring distances

After you set up the instrument, see page 23, you can start using the Focus 4 total station.

This chapter describes the basic features of the instrument, how to turn it on, change the instrument settings, and start a job.

Parts of the instrument

Figure 3.1 and Figure 3.2 show the main parts of the Focus 4 total station.

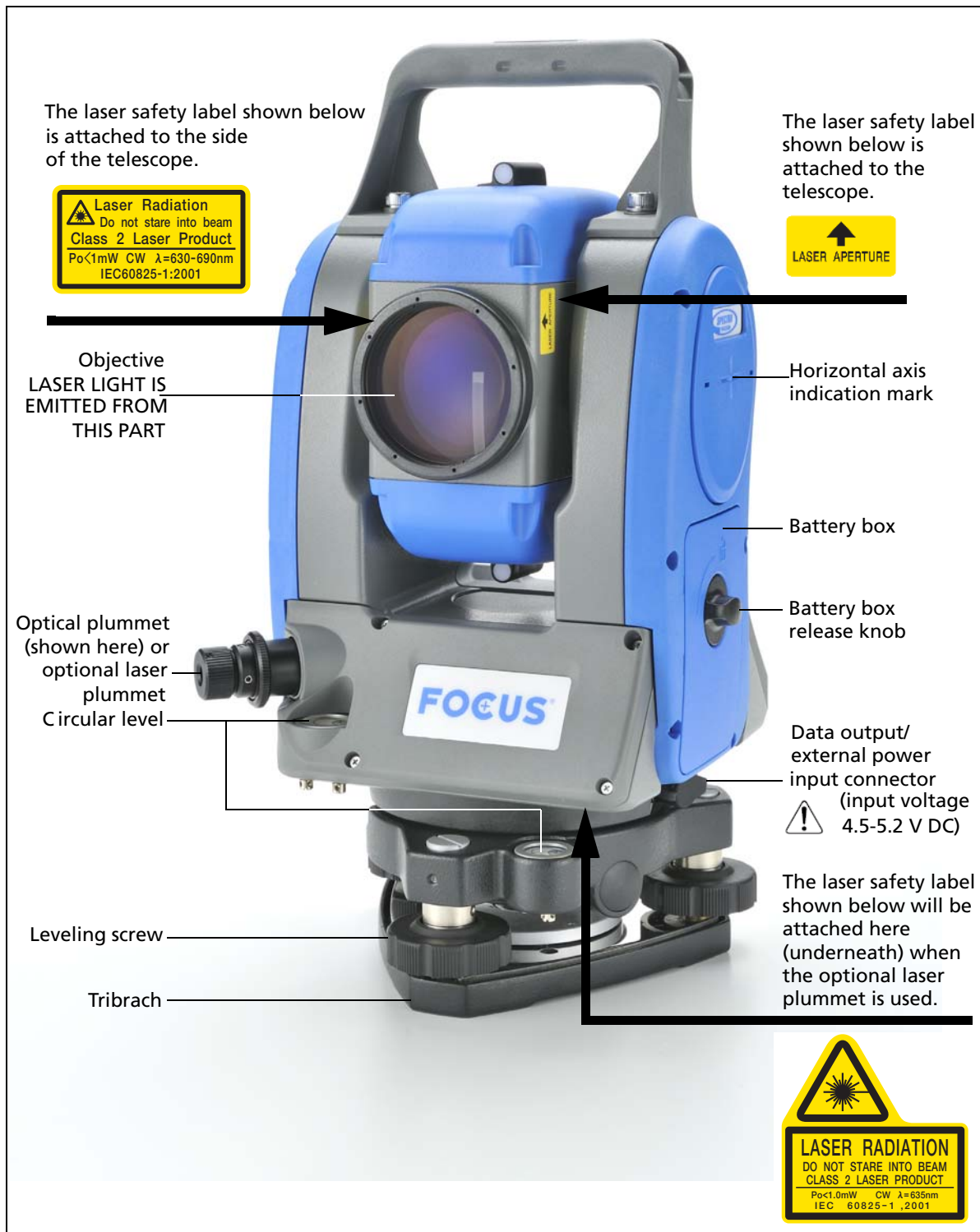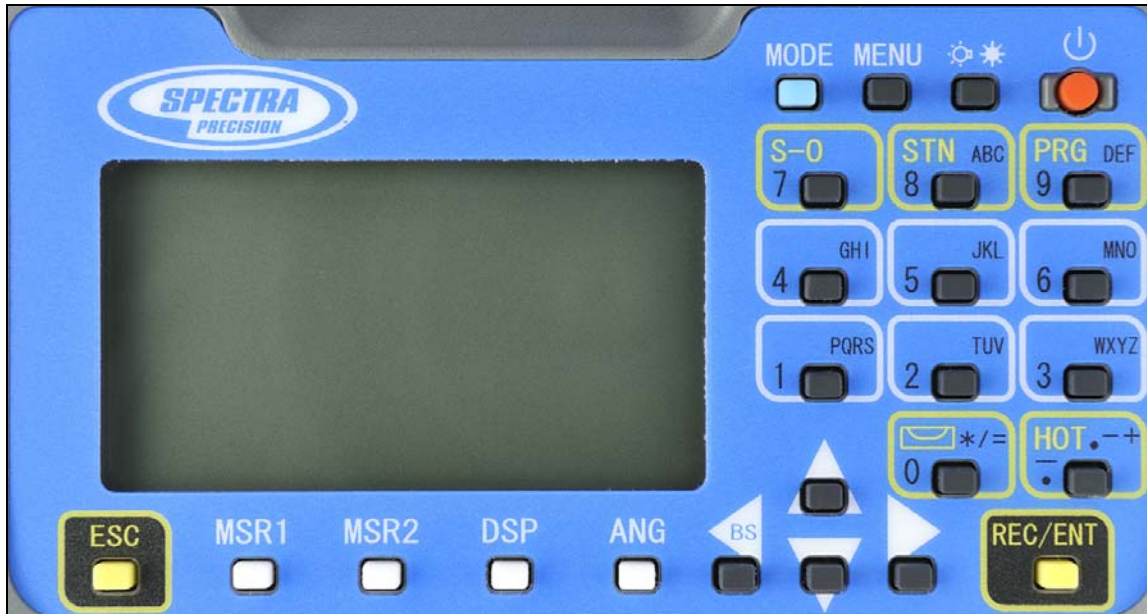Figure 3.1   Back view of the Focus 4 total station (Face 1)

The laser safety label shown below is attached to the side of the telescope.

Laser Radiation
Do not stare into beam
Class 2 Laser Product
Po<1mW CW λ=630-690nm
IEC60825-1:2001

The laser safety label shown below is attached to the telescope.

LASER APERTURE

Objective
LASER LIGHT IS
EMITTED FROM
THIS PART

Horizontal axis indication mark

Battery box

Battery box release knob

Optical plummet (shown here) or optional laser plummet

Circular level

Data output/ external power input connector (input voltage 4.5-5.2 V DC)

The laser safety label shown below will be attached here (underneath) when the optional laser plummet is used.

Leveling screw

Tribrach

LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT
Po<1.0mW   CW λ=635nm
IEC 60825-1 ,2001

Figure 3.2   Front view of the Focus 4 total station (Face 2)

Instrument keyboard and display

Instrument keyboard

Use the buttons on the instrument keyboard to carry out the following functions:

Button	Function	See ...
	Turns the instrument on or off.	page 48
	Illumination button. Turns the backlight on or off.	page 43
	Provides access to the switch window if held down for one second.	
	Displays the MENU screen.	page 91
	Changes the button input mode between alphanumeric and numeric if pressed when you are in a PT or CD field.	page 46
	Records measured data, moves on to the next screen, or confirms and accepts the entered data in input mode.	page 89
	Returns to the previous screen.	
	In numeric or alphanumeric mode, deletes input.	
	Starts distance measurement, using the measure mode settings for the [MSR1] button.	page 56
	Displays measurement mode settings, if held down for one second.	
	Starts distance measurement, using the measure mode settings for the [MSR2] button.	page 56
	Displays measurement mode settings, if held down for one second.	

| Button	Function	See ...
DSP	Moves to the next available display screen. Changes the fields that appear on the DSP1, DSP2, and DSP3 screens, if held down for one second.	page 44
ANG	Displays the Angle menu.	page 60
S-O 7	Displays the Stakeout function menu. In numeric mode, enters 7.	page 60
STN ABC 8	Displays the Station Setup menu. In numeric mode, enters 8. In alphanumeric mode, enters A, B, C, or 8.	page 60
PRG DEF 9	Displays the Programs menu. In numeric mode, enters 9. In alphanumeric mode, enters D, E, F, or 9.	page 75
HOT .−+	Displays the (HOT) menu, which includes Height of Target and Temp-Press settings. In numeric mode, enters − (minus). In alphanumeric mode, enters. (period), − (minus), or + (plus).	page 46
0 */=	Displays the Bubble indicator. In numeric mode, enters 0. In alphanumeric mode, enters *, /, =, or 0.	page 47

Status bar

The status bar appears on the right of every screen. It contains icons that indicate the status of various system functions.

Status bar
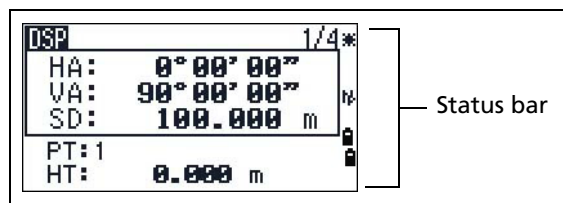
Laser-pointer indicator

The icon appears as you turn on the laser pointer. When the icon appears on the screen, the emitting power is laser class 2.
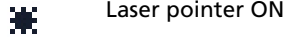
Laser pointer ON

If there is no icon, the laser pointer is off.

Input mode indicator

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

Input mode is numeric. Press a button on the number pad to enter the number printed on the button.

Input mode is alphabetic. Press a button on the number pad to enter the first letter printed beside the button. Press the button repeatedly to cycle through all the letters assigned to that button.
For example, to enter the letter O in alphabetic mode, press 6 three times.

Battery indicator

Shows each voltage level of the right and left internal batteries individually. When the external battery is connected with the instrument, its voltage is shown.

Internal batteries:
- Top: left battery
- Bottom: right battery

External battery

Internal batteries   External battery

Battery level indication
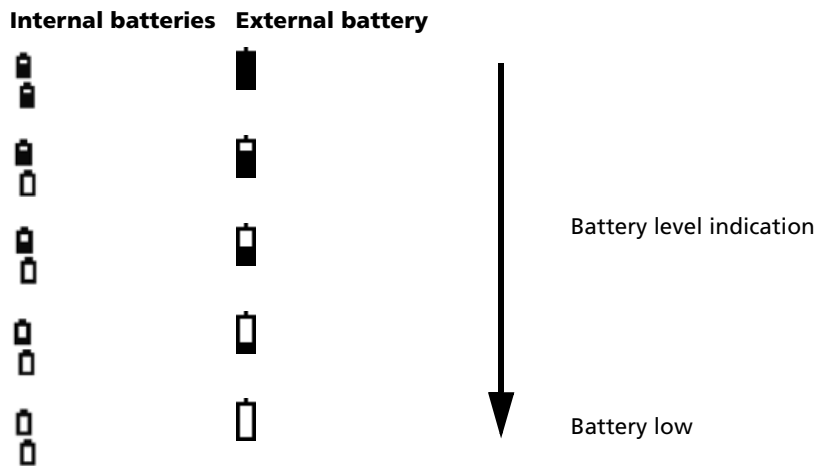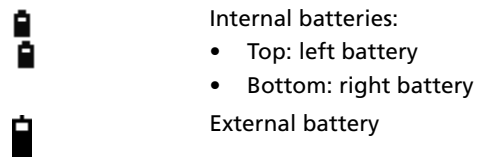
Battery low

If the battery level is critically low, a message appears.

```
! BATTERY DOWN
  Press ENT Key,
   Change Battery
```
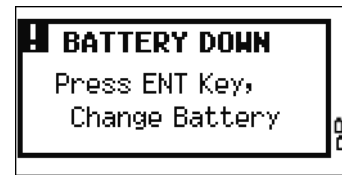
EDM measurement status

When you are taking measurements, the EDM measurement status shows the mode that is being used.

When you display observation data, the EDM measurement status shows the mode that was used when the data was collected:

Reflectorless mode

If there is no icon, Prism mode is being used.

LCD backlight, laser pointer, beep sound, and contrast adjustment

Press the illumination key to open the the 4-switch window and then press:

[1] to turn the LCD backlight on/off

[2] to turn the laser pointer on /off

[3] to turn the beep sound on /off

[4] to open the contrast adjustment window.

```
DSP                    ENT / 4       DSP
HA:  40°29' 10                      HA:  40°29' 11
VA:  89°07' 45      →               VA:  89°07' 46
SD:                                 SD×     345.123
                   ←
PT:1               ESC              PT:1
HT:   1.500 m                       HT:   1.500 m
Switch setup window          Contrast adjustment window
```

Do the following:

- To turn on/off each function, press [ENT] when the option 1, 2, 3 or 4 is selected or directly press the [1], [2], [3], or [4] key. Holding down the illumination key for one second also turns on/off the LCD backlight.

- To move the cursor up and down, press [^] or [v].

- To adjust the constrast, in the contrast adjustment window, press [>] or [<].

- To close the window, press [ESC].

Switch 1: Adjusting the LCD backlight

LCD backlight is on

LCD backlight is off

Switch 2: Turning on/off the laser pointer

Laser pointer is on

Laser pointer is off

The icon appears while turning on the laser pointer . When the icon is on the screen, the emitting power is Laser Class 2.
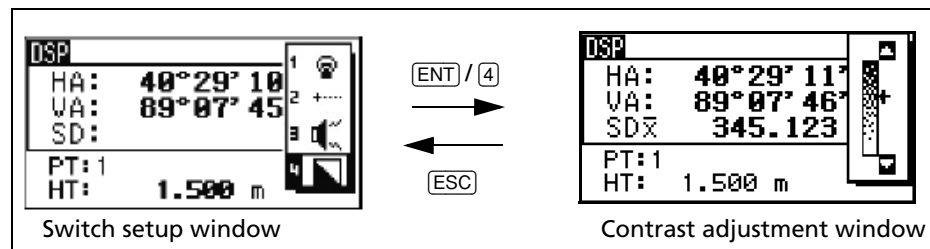
Switch 3: Turning on/off the sound

Sound is on

Sound is off

[DSP] button

Use the [DSP] button to change the current display screen or to change display settings.

Switching between display screens

When several display screens are available:

- the DSP indicator appears at the top left of the screen

- the screen indicator (for example, 1/4) appears at the top right

```
DSP              1/4
HA:    40°29'11"
VA:    89°07'46"
SDx̄    345.678 m

PT:1
HT:     1.500 m
```
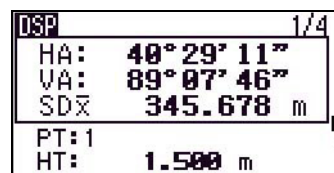
To move to the next available screen, press [DSP].

For example, if you are currently in the second display screen, press [DSP] to move to the third display screen. The screen indicator changes from 2/4 to 3/4.

When the secondary distance unit is set, an additional screen is available. It shows the HD, VD, and SD values. See also Other settings, page 101.

```
DSP              5/5
HD:>  476'09"3/8
VD:▶  092'10"15/
SDx̄>  800'00"1/4

PT:1
HT:    1.500 m
```
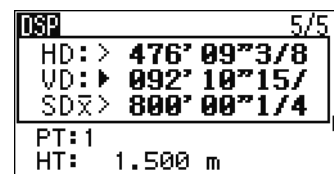
The smallest unit of display for distances measured in feet-and-inches is $^1/_{16}$ inch. Smaller units are impractical in the field.

When the actual value is greater than 99999'11"15/16, the > symbol appears. If the actual distance is less than –9999'11"15/16, the ▶ (solid triangle) symbol appears. This does not affect calculations. The precise value is used internally in all cases.

Customizing items in the Basic Measurement Screen (BMS)

To customize the items that are displayed on the DSP1, DSP2, and DSP3 screens:

1. Hold down ⌷DSP⌷ for one second.

2. Use the arrow buttons ⌷^⌷, ⌷v⌷, ⌷<⌷, and ⌷>⌷ to highlight the item that you want to change:
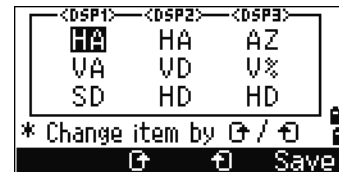
3. Press the ⊕ or ⊝ softkey to scroll through the list of items that can be displayed for this item.

    The items that you can choose from are HA, AZ, HL, VA, V%, SD, VD, HD, Z, and (none).

4. To save your changes, press the Save softkey.

    Alternatively, highlight the last item for DSP3 and press ⌷ENT⌷. The DSP screens show the items you have selected.

    Except for the (none) item, you cannot display the same item on more than one line of the same screen.

    The items displayed in the DSP1, DSP2, DSP3, and DSP4 screens are also used in the corresponding Layout screens (LO2, LO3, LO4, and LO5).

    You can also customize the displayed items in Layout.

Header characters

The following header characters appear in DSP screens:

*   Colon (:) indicates that tilt correction is applied to the value.

*   Hash symbol (#) indicates that tilt correction is off.

*   Underscore (_) under the tilt correction character indicates that Sea Level Correction or Scale factor is applied.
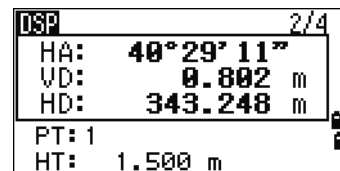
⌨ MODE button

The MODE button is on the top row of the Focus 4 keypad. Use it to change the keyboard mode for the current screen.

Changing the input mode while entering points or codes

When the cursor is in a point (PT) or code (CD) field, press MODE to change the input mode between alphanumeric (A) and numeric (1).

The input mode indicator in the status bar changes to show the current input mode.

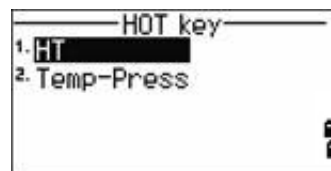When the cursor is in a height (HT) field, only numeric input mode is available. Pressing MODE has no effect when the cursor is in a HT field.

HOT key

The HOT key menu is available from any observation screen. To display the HOT key menu, press HOT.

Changing the height of the target

1. Press HOT to display the HOT menu.

2. Do one of the following:

   – Press 1.

   – Select HT.

3. Press ENT.

4. Enter the target height or select the height from the HT stack.
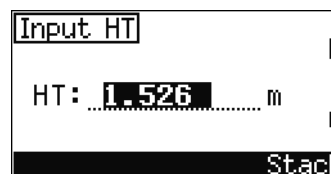
Note – *To display the HT stack, press the* Stack *softkey. The HT stack stores the last 20 HT values entered.*

Setting the current temperature and pressure

1. Press HOT to display the HOT menu.

2. Do one of the following:

   – Press 2.

   – Select Temp-Press.

3. Press ENT.

4. Enter the ambient temperature and pressure. The ppm value is updated automatically.
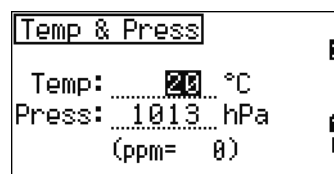
Bubble indicator

The bubble indicator appears if the instrument goes out of level while the compensator is turned on. It also appears directly after the start up screen.

To display the bubble indicator in an observation screen at any other time, press ▭.

The Focus 4 total station has a two-axis level compensation. To turn the leveling compensators on or off, press ⊲ or ⊳. When the levelling compensators are turned off, the text OFF appears on the screen.

If the instrument is more than ±3'30" out of level, the text OVER appears on the screen.
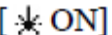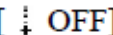
To return to the observation screen, press ESC or ENT.
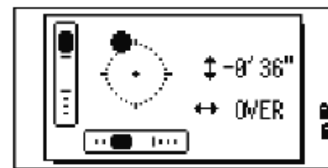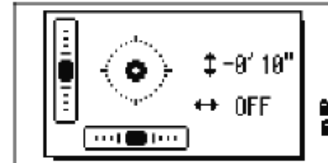
Laser plummet (option)

Laser plummet on / off

Do one of the following:

- To turn the laser plummet switch on, press [☀ ON].

- To close the bubble indicator window, press ESC.

- To turn the laser plummet switch off, press [⋮ OFF].

- To open the luminance adjustment window, press Lumi..

- To turn the laser plummet switch off and close the bubble indicator window, press ESC.
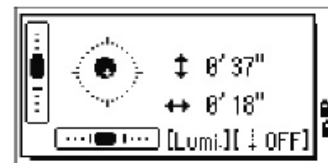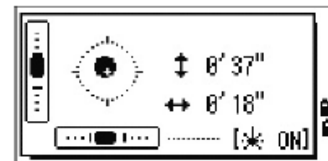
Laser luminance adjustment

Laser luminance can be set to 4 levels.

- To set the luminance brighter by one level, press Max. once.

- To set the luminance darker by one level, press Min. once
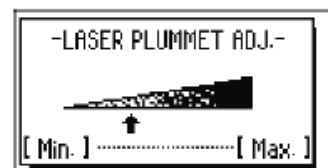
To return to the bubble indicator window, press ESC or ENT.

Note – *The current setting of leveling compensators is indicated by header characters (:, #, :, and #) after field labels (such as HA, VA, SD, and HD) in observation screens. For more information, see* *Header characters, page 45.*

Turning on the instrument

Press the PWR button. The start-up screen appears. It shows the model name, current temperature, pressure, date, and time. The display automatically changes to the electronic level after two seconds.

If you entered your name or your company's name in the Owner's detail field, the text from this field appears on the start-up screen. To set the Owner's detail field, press MENU and then select Settings / Other. See also Other settings, page 101.

```
┌─────────────────────────────┐
│        FOCUS 4              │
│  ───────────────────────    │
│  Temp     20°C          ▯   │
│  Press  1013hPa             │
│ 2009-01-14     17:34:00     │
└─────────────────────────────┘
┌─────────────────────────────┐
│    SPECTRA PRECISION        │
│        FOCUS 4              │
│  ───────────────────────    │
│  Temp     20°C          ▯   │
│  Press  1013hPa             │
│ 2009-01-14     17:37:59     │
└─────────────────────────────┘
```
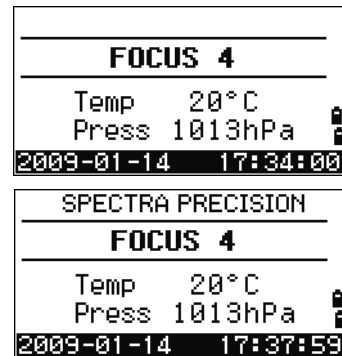
Turning off the instrument

1.   Press PWR and ENT.

2.   Do one of the following:

Press…	To…
ENT again	turn off the instrument
the Reset softkey	reboot the software and re-start the instrument
	access the Basic Measurement Screen (BMS) without an open job.
the Sleep softkey	put the instrument into power-saving mode
ESC	cancel the power-off process and return to the previous screen

Sleep mode

To put the instrument into sleep mode, do one of the following:

*   In the Press ENT → OFF screen, press the Sleep softkey.

*   Enable the Power Save setting. See also Power saving, page 100.

The instrument wakes up if any of the following events occur:

*   You press a button

*   The instrument receives a remote control command

*   You rotate the alidade

*   You tilt the telescope

Regional configuration

To provide easier configuration for common regional settings, you can quickly configure the Focus 4 total station to a pre-set combination of default regional settings. The *Regional Configuration* screen appears only after the language configuration is complete and the instrument has rebooted.

1. Follow the steps in Other settings, page 101 to select the required language.

   Once the instrument has rebooted the *Regional Configuration* screen appears.

2. Press ⌃ or ⌄ to highlight the required regional settings and then press ⌷ENT⌷.

3. If you do not want to change the current settings, press ⌷ESC⌷ and quit. The instrument continues to use the last settings that were configured.

The settings affected by the *Regional Configuration* screen are:

Category	Setting	Europe	International	United States
Angle	VA zero	Zenith	Zenith	Zenith
	Resolution	5"	5"	5"
Distance	Scale	1.000000	1.000000	1.000000
	T-P Corr.	On	On	On
	Sea Level	Off	Off	Off
	C&R corr.	0.132	0.132	0.132
Coordinates	Order	ENZ	ENZ	NEZ
	Label	ENZ	ENZ	NEZ
Power Save	Main Unit	Off	Off	Off
	EDM Unit	Off	Off	Off
	Sleep	5 minutes	5 minutes	5 minutes
Communication	Ext. Comm	Nikon	Nikon	Nikon
	Baud	4800	4800	4800
	Length	8	8	8
	Parity	None	None	None
	Stop bit	1	1	1
Units	Angle	GON	DEG	DEG
	Distance	meters	meters	US-ft
	Temp	°C	°C	°F
	Press	mm Hg	mm Hg	In Hg
Rec	Rec Data	OFF	OFF	OFF
	CD Field	OFF	OFF	OFF
	Add Const	1000	1000	1000
Others	XYZ disp	Fast	Fast	Fast
	2nd Unit	None	None	None
	CD Input	<ABC>	<ABC>	<ABC>

The default regional configuration pre-set is "Europe" settings. See also Settings (basic job settings), page 96.

List available jobs or data

The Focus 4 total station lists available jobs or data when you do any of the following:

- view or edit data (Press [MENU] then select `Data`)

- open the Job Manager (Press [MENU] then select `Job`)

- search for points or codes

The current cursor position is shown in inverted colors (it appears as white text on a black background).

Press [^] to move the cursor one line up, or press [v] to move the cursor one line down.

If the Page Up icon ▀ appears, there are more pages before the current page. Press [<] to move up one page.

```
UP,A100,FENCE
UP,A101,
UP,A100-1,MANHOLE
UP,A100-2,
UP,A100-4,
UP,A100-6,CODECODE
UP,A1000,
```

If the Page Down icon ▀ appears, there are more pages after the current page. Press [>] to move down one page.

To select an item from the list, move the cursor onto the item and press [ENT].
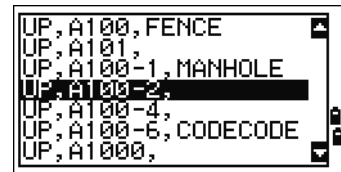
Entering data

You can enter the following into the Focus 4 total station:

- A point name or number, see page 50

- A code, see page 53

Entering a point name or number

You can use numeric or alphanumeric names up to 20 characters long to identify points.

The default name for a new point is the last point name entered, with the last digit incremented. For example, if the last point name was A100, the default name for the next point is A101.

If the last character of the previous point name is alphabetic, the default point name is identical to the last point name.

When the cursor is in a PT (point) field, there are several ways to specify a point, or to enter coordinates. You can:

- Enter an existing point, see page 51

- Enter a new point, see page 51

- Press $\boxed{\text{ENT}}$ without a point name, see

- Specify a wildcard, see

- Enter a point by recording an instant measurement, see

- Enter a point from a point stack, see

- Enter a point from the point list, see

Entering an existing point

When you enter a known point name or number, the coordinates of that point are briefly displayed. A short beep sounds before the next screen appears or the next field is selected.

To adjust the duration of the coordinate window display, press $\boxed{\text{MENU}}$ then select Settings / Others. To leave the window open until you press $\boxed{\text{ENT}}$, set the *XYZ disp* field to +ENT. See also .
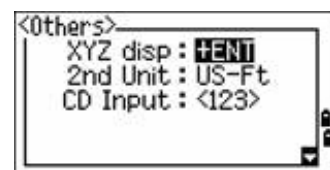
Entering a new point

When you enter a new point name or number, a coordinate input screen appears. Enter the coordinates for the point in NE, NEZ, or elevation-only (Z) format.

To store the point in the current job, press $\boxed{\text{ENT}}$ on the last line (the CD field).
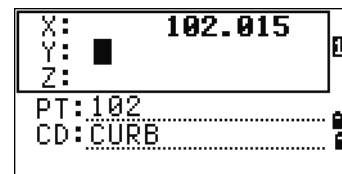
Pressing $\boxed{\text{ENT}}$ without a point name

To use a point without recording the coordinates, press $\boxed{\text{ENT}}$ in a PT field, without entering a point name.

The input coordinates are used in the calculation but they are not saved in the database. The message This PT will not be recorded appears.
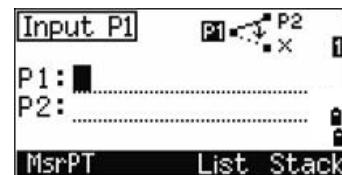
Specifying a wildcard (*)

If you include an asterisk (for example, A100*) when you enter a point or code name, a list of points that match the entered text appears.

Use $\boxed{\wedge}$ or $\boxed{\vee}$ to move the cursor to the point that you want to use. Then press $\boxed{\text{ENT}}$.

If the Page Up ▪ icon appears, you can use it to move up one page on the list. You can also use $\boxed{<}$.

If the Page Down ▪ icon appears, you can use it to move down one page. You can also use $\boxed{>}$.
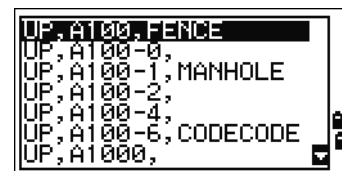
When you select a point from the list, its coordinates are displayed and a beep sounds.

Entering a point by recording an instant measurement

1. Press the MsrPT softkey:

   An observation screen appears.

2. To start a measurement, press MSR1 or MSR2.

3. To change the height of the target, select the HT softkey.

4. When you have finished the measurement, press ENT to go to the point recording screen.

5. Enter the point or code name and then press ENT.

When you move the cursor to a field, the current or default value appears in inverted colors. (It appears as white text on a black background). This is the default Replace All input mode.
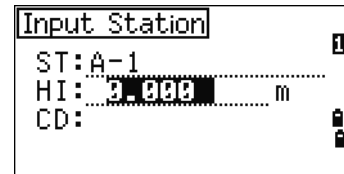
To change the input mode to Overwrite and highlight the first character, press ▷. To move the cursor to the end of the string, press ◁.
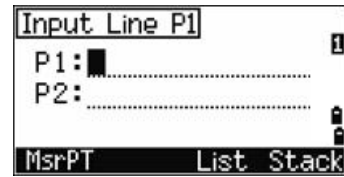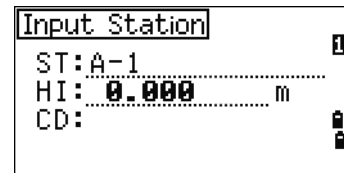
Entering a point from the point stack

The point stack is a list of the last 20 point names used, in chronological order from last used to first used. To enter a point from the point stack:

1. Select the Stack softkey when the cursor is in the PT field. The stack appears.

2. Press ∧ or ∨ to move the cursor to the point that you want to use.

3. Press ENT.
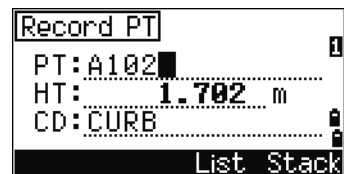
When you return to the point input screen, the selected point name is entered in the PT field, incremented by one. For example, if you selected the A101 point, A102 appears in the PT field.
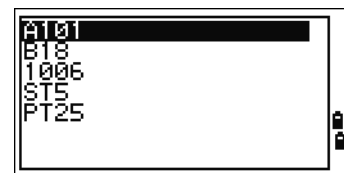
Entering a point from the point list

1. Select the `List` softkey when the cursor is in the PT field. A list of existing points appears.

2. Press ⌃ or ⌄ to move the cursor to the point that you want to use.

3. Press `ENT`.

When you return to the point input screen, the selected point name is entered in the PT field. Add numeric or alphabetic characters if required.
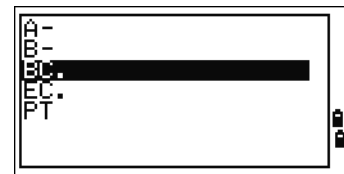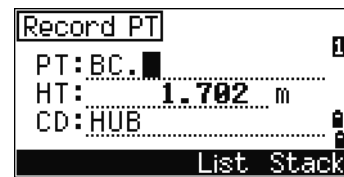
Entering a code

The CD (Code) field defaults to the last code used. You can select a different code in the input point screen.

Codenames can be numeric or alphanumeric, and up to 16 characters long.

There are several ways to enter a code:

- Enter a code directly, see page 53
- Enter a code from the code stack, see page 53
- Enter a code from the code list, see page 54

Entering a code directly

1. To change the input mode to alphanumeric or numeric, press `MODE`.

2. Use the keypad to enter the code.
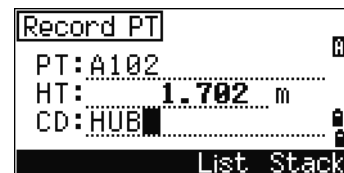
Entering a code from the code stack

The code stack is a list of up to 20 recently used codes. When you reboot the Focus 4 total station, the code stack is cleared.

To enter a code from the code stack:

1. Select the `Stack` softkey when the cursor is in the CD field. The stack appears.

2. To move the cursor to the code that you want to use, press ⌃ or ⌄.

3. Press `ENT`.

The selected code is copied to the CD field.

Entering a code from the code list

1. Select the `List` softkey when the cursor is in the CD field. A list of existing codes appear.

2. Press Ⓐ or Ⓥ to highlight the feature code that you want to use.

3. Press ⒠ⓃⓉ.

```
┌─────────────────────────┐
│ Record PT            1   │
│  PT:A102                 │
│  HT:    1.702 m          │
│  CD:BC2              ▯   │
│               List Stack │
└─────────────────────────┘
```

A layer has an arrow at the end of the code label. If you highlight a layer in the list and then press ⒠ⓃⓉ, the codes and layers in that layer are displayed.

When you return to the input screen, the selected code is entered in the CD field.

```
┌─────────────────────────┐
│ BB                      │
│ ELV                     │
│ EW                      │
│ HWM                     │
│ LWM                  ▯  │
│ NS                   ▯  │
│ OG                      │
└─────────────────────────┘
```

Advanced feature: Searching for a code using the first character
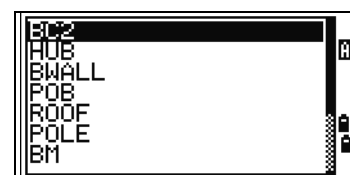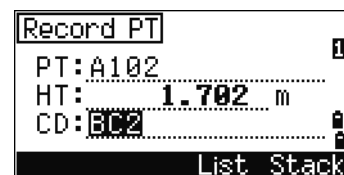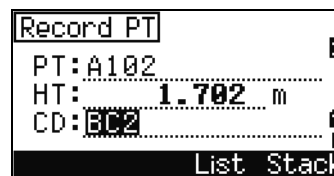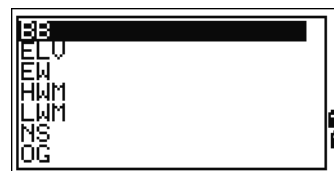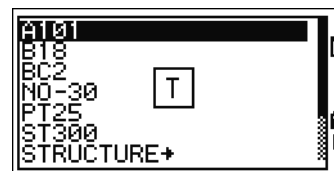
Items are shown in alphabetic order. To find a code quickly when the code list appears, use the first-character search. For example, to see feature codes that begin with T, use the keypad to enter the letter T (press Ⓣ twice).

After each button press, the input mode field displays the selected letter. For example, if you press Ⓣ, `S` appears. If you quickly press Ⓣ again, `T` appears. If you do not press the Ⓣ button again, the letter T is selected.

```
┌─────────────────────────┐
│ A101                 A  │
│ B18                     │
│ BC2                     │
│ NO-30        ┌─┐        │
│ PT25         │T│     ▯  │
│ ST300        └─┘        │
│ STRUCTURE+              │
└─────────────────────────┘
```

Once you select a letter, the cursor moves to the feature code beginning with that letter.

If there is no code beginning with that letter, the cursor moves to the next available letter.

```
┌─────────────────────────┐
│ PT25                 A  │
│ ST300                   │
│ STRUCTURE+              │
│ T-85                    │
│ TA                   ▯  │
│ Y60                  ▯  │
│ YHG-1                   │
└─────────────────────────┘
```
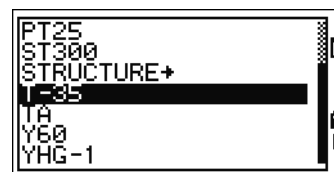
Entering values in feet and inches

If US Survey Feet (US-Ft) or International Feet (I-Ft) is selected as the distance unit, you can enter and display distances, HIs, HTs, and coordinate values in decimal feet or in feet and inches. See also Unit, page 99, and Other settings, page 101.

To enter values in feet and inches in an input screen, enter the elements, separated by periods (.), in the following format:

<Feet> ⒠.⒡ <Inches> ⒠.⒡ <Numerator> ⒠.⒡ <Denominator> ⒠ⓃⓉ
           (0–11)   (0–15)   (0–99)

The default denominator is 16. If the denominator is 16, you do not have to enter it, and it is not displayed on the screen.

For example, if you enter
⌈2⌉⌈.⌉⌈0⌉⌈8⌉⌈.⌉⌈5⌉⌈.⌉⌈ENT⌉, it appears as `2'08" 5⁄` (2 feet, 8
and 5/16ths inches).

```
┌─────────────────────┐
│ Record PT        🔋  │
│  PT:280             │
│  HT:    2'08" 5⁄    │
│  CD:O/S 5.300    🔋  │
│            List Stack│
└─────────────────────┘
```
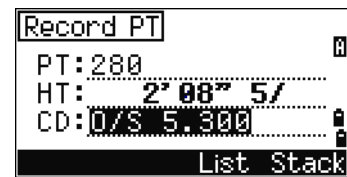
The following examples show how to enter various values:

To enter...	Key in...
65' 5 3/8"	⌈6⌉⌈5⌉⌈.⌉⌈5⌉⌈.⌉⌈3⌉⌈.⌉⌈8⌉⌈ENT⌉
65'	⌈6⌉⌈5⌉⌈ENT⌉
65' 5"	⌈6⌉⌈5⌉⌈.⌉⌈5⌉⌈ENT⌉
65' 5 3/8"	⌈6⌉⌈5⌉⌈.⌉⌈5⌉⌈.⌉⌈6⌉⌈ENT⌉
5 3/8"	⌈0⌉⌈.⌉⌈5⌉⌈.⌉⌈3⌉⌈.⌉⌈8⌉⌈ENT⌉ or ⌈0⌉⌈.⌉⌈5⌉⌈.⌉⌈6⌉⌈ENT⌉

The numerator and denominator that you enter are automatically converted to the
closest value from the following list: 0, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8, 1/16, 3/16, 5/16,
7/16, 9/16, 11/16, 13/16, 15/16.

If the denominator is 16, it is not shown on the screen.

Creating or opening a job

To record data on the Focus 4 total station, you must create or open a job.

*Note – Before using the Focus 4 total station for the first time, check that you are using the
required job settings.*

Creating a new job

1. Press ⌈MENU⌉. The MENU screen appears.

2. Press ⌈1⌉. The Job Manager appears.

3. Select the `Creat` softkey. The Create Job screen appears.

4. Enter the job name.

5. To check the job settings, select the `Sett` softkey.
    You cannot change the settings for a job once you
    have created the job.

```
┌─────────────────────┐
│ Create Job       🔋  │
│  Job name:080522-2  │
│                     │
│                  🔋  │
│  * MAX 8 characters │
└─────────────────────┘
```

6. Press ⌈ENT⌉ in the last field of the Job Sett screen.
   The new job is created.

Note – You can have a maximum of only 32 jobs.

Creating a control job

A control job, or common file, stores coordinate data that is used by several field jobs. To create a control job in the office:

1. Press ⌈MENU⌉. The MENU screen appears.

2. Press ⌈1⌉ or select Job. The Job Manager appears.

3. Move the cursor to the job to use as the control job.

4. Select the Ctrl softkey.

5. Select the Yes softkey.
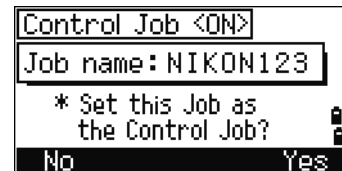
When you enter a point name or number, the system searches in the current job first. If the point is not found in the current job, the search is automatically extended to the control job. If the point is found in the control job, the selected point is copied to the current job as a UP record.

Measuring distances

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

⚠️ **WARNING** – Precautions should be taken to ensure that persons do not look directly, with or without an optical instrument, into the beam.

⚠️ **WARNING** – Laser beam path should be located well above or below eye level wherever practicable.

Sighting a prism reflector

Sight the telescope until you see cross-hairs at the center of the prism reflector.

Sighting a single prism   Sighting a tiltable single prism
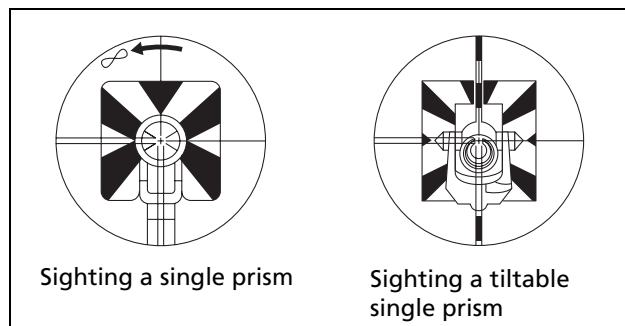
Taking a distance measurement

To take a distance measurement, press [MSR1] or [MSR2] in the Basic Measurement Screen (BMS) or in any observation screen.

While the instrument is taking a measurement, the prism constant appears in a smaller font.

If tracking is set to ON, measurements are taken continuously until you press [MSR1], [MSR2], or [ESC]. Each time a measurement is taken, the distance is updated.

```
DSP                    1/4
HA:     40°29'11"
VA:     89°07'46"
SDx     345.678 m
PT:1
HT:      1.500 m
```
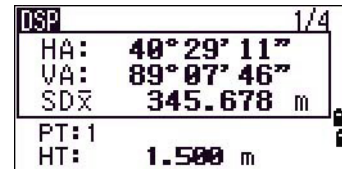
To change the height of target (HT), temperature, or pressure, press [HOT]. See also [HOT] button, page 46.

```
────── HOT key ──────
1. HT
2. Temp-Press
```

Settings that relate to corrections (T-P corr, Sea Level, C&R corr., and Map projection) are included in the job settings and are job-specific. To change any of these settings, you must create a new job. See also Job settings, page 93, and Settings (basic job settings), page 96.

```
<Job Sett 1/3>
  Scale : 1.000000
  T-P corr. : ON
  Sea Level : OFF
  C&R corr. : 0.132
```
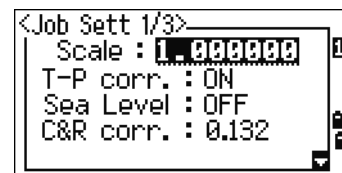
Viewing and changing the measurement settings

1. Hold down [MSR1] or [MSR2] for one second.

2. To move the cursor between the fields, press [^] or [v].

3. To change the value in the selected field, press [<] or [>].

```
<MSR1>
  Target: N-Prism
  Const: 0      mm
  Mode: Normal
  Track: OFF
```
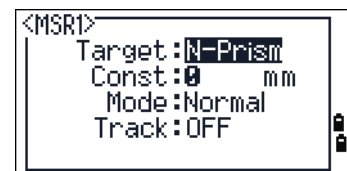
Field	Values
Target	Prism
	N-Prism
Const (prism constant)	–999 mm through 999 mm
Mode	Precise
	Normal
Track	Track (continuous MSR) ON
	Track (continuous MSR) OFF

Target field

- If the measurement is started with the Target field set to Prism, there is a dash "–" in front of the prism constant.

- If the measurement is started with the Target field set to N-Prism, there is a right square bracket "]" in front of the prism constant.

```
DSP                    1/4
 HA:    40°29' 11"
 VA:    89°07' 46"
 SD:      -  <30mm>    m
 PT:1
 HT:   1.500 m
```

The symbol then continuously moves from left to right over the prism constant in the display.

The Target setting is used by the Focus 4 total station to apply better cyclic-error adjustment in distance measurement. The target setting efficiently eliminates multipath reflection.

An incorrect Target setting may result in measurements outside the precision and intervals specified for the instrument.

If a prism target is aimed in N-prism mode, the warning message `Signal High!→Try Prism Mode` is displayed because of the excessive light reflection.

A measurement made immediately after changing the target setting may take longer than usual.

Applications

- HA reset and angle operations
- Station setup
- Stakeout menu
- Programs menu
- Recording measurement data
- Switching between display screens

This chapter describes the menu and display screens, and Focus 4 total station applications.

Use the following keystrokes when working in the display screens and when you use the applications:

To switch between display screens	Press [DSP]. See also page 90.
To change HT	Press [HOT]
To record points	Press [ENT]

HA reset and angle operations

To access the *Angle* menu, press ANG in the Basic Measurement Screen (BMS). To select a command from the *Angle* menu, press the corresponding number key. Alternatively, press ∧ or ∨ to highlight the command and then press ENT.

```
──────Angle──────
┌─────────────────┐
│ HA: 34°00'20"   │
└─────────────────┘
¹·█0-Set█
²· Input Angle        ▐
```
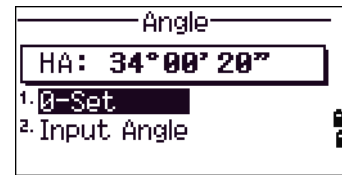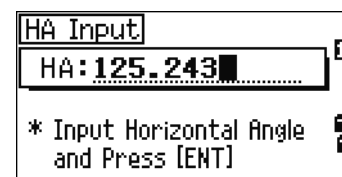
Setting the horizontal angle to 0

Press 1 or select 0-Set in the Angle menu. The display returns to the BMS.

Entering the horizontal angle

1. Press 2 or select Input in the Angle menu. The HA Input screen appears.

2. Use the numeric keys to enter the horizontal angle.

3. Press ENT.

```
┌HA Input┐            1
│ HA:125.243█ ........│
└─────────────────────┘
* Input Horizontal Angle ▐
  and Press [ENT]
```

To enter 123°45'50", key in 1 2 3 . 4 5 5 0.

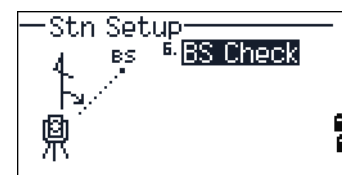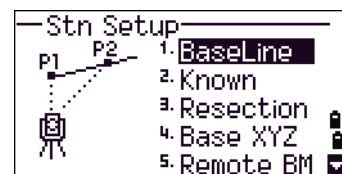The displayed value is rounded to the minimum angle increment.

Station setup

To access the Stn Setup menu, press STN in the BMS.

To select a command from the Stn Setup menu, press the corresponding number key. Alternatively, press ∧ or ∨ to highlight the command and then press ENT.

The last function used is highlighted.

The station setup options are:

- Baseline, page 61
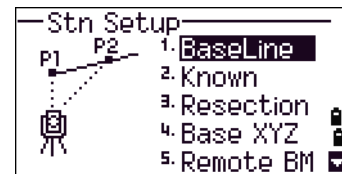- Known, page 62
- Resection, page 64
- Base XYZ, page 67
- Remote BM, page 68
- BS Check, page 69

```
┌─Stn Setup─────────┐
│    P2   ¹·█BaseLine█│
│ P1 ·    ²· Known   │
│   ··    ³· Resection ▐
│ ▣       ⁴· Base XYZ ▐
│ ⊼       ⁵· Remote BM ▼
└───────────────────┘
```

```
┌─Stn Setup─────────┐
│         BS ⁶·█BS Check█│
│  ↑ ·    │
│  ↳··    │
│ ▣       ▐
│ ⊼       │
└───────────────────┘
```

Baseline

Select this option for a two-point resection along a known line.

1. Press 1 or select BaseLine from the Stn Setup menu.

   ```
   ┌─Stn Setup──────────┐
   │ P2   ¹·BaseLine    │
   │P1 ⌐  ²·Known       │
   │  ⌐   ³·Resection  🔋│
   │  ⊡   ⁴·Base XYZ   🔋│
   │      ⁵·Remote BM ▼ │
   └────────────────────┘
   ```
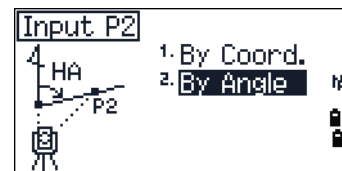
2. Enter a known point as P1.

   If you enter a new point name, a coordinate input screen appears.

   Sight P1 and press MSR1 or MSR2 to take a measurement. Press ENT.

   ```
   ┌STN─────────────────┐
   │ HA:    0°00'00"    │
   │ HD:       9.76   m │
   │ SDx̄      24.98   m │
   │ * Press [ENT] to next PT │
   └────────────────────┘
   ```
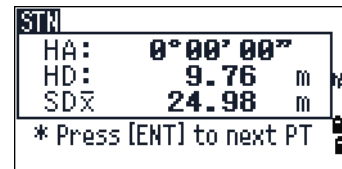
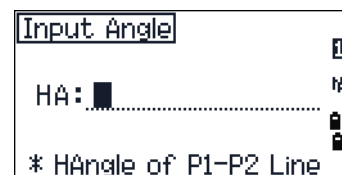3. Choose how you want to define a known line:

   – To define the line by entering P2 coordinates, press 1 or select By Coord.

   – To define the line by entering the azimuth, press 2 or select By Angle.

   ```
   ┌Input P2────────────┐
   │ ↗  HA   ¹·By Coord.│
   │ ⌐      ²·By Angle ►│
   │  ↘P2             🔋│
   │ ⊡                🔋│
   └────────────────────┘
   ```
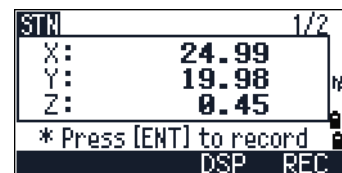
   a. If you select By Angle, the azimuth input screen appears: Enter the angle value and press ENT.
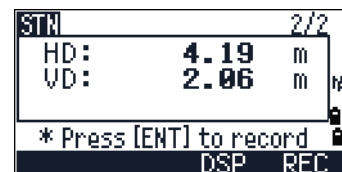
   A measurement screen appears.

   ```
   ┌Input Angle─────────┐
   │                  1 │
   │                    │
   │ HA:█.............  │
   │                  🔋│
   │ * HAngle of P1-P2 Line │
   └────────────────────┘
   ```

   b. Sight P2 and press MSR1 or MSR2 to take a measurement. Press ENT.

   After the measurement to P2 is completed, press ENT. The coordinates of the station are calculated.

   ```
   ┌STN──────────── 1/2─┐
   │ X:      24.99      │
   │ Y:      19.98      │
   │ Z:       0.45      │
   │ * Press [ENT] to record │
   │          DSP    REC│
   └────────────────────┘
   ```

4. To record the station, press ENT or the REC softkey.

5. To check the measurement, press the DSP softkey. If you defined the line by entering its azimuth, the HD and VD between P1 and P2 are displayed.

   ```
   ┌STN──────────── 2/2─┐
   │ HD:       4.19   m │
   │ VD:       2.06   m │
   │ * Press [ENT] to record │
   │          DSP    REC│
   └────────────────────┘
   ```

   If you defined the line by entering the P2 coordinates, the difference of HD (dHD) and VD (dZ) between your measurement data and input coordinate data are displayed.

6. Enter the station name, the height of instrument (HI), and a feature code (CD) if required. The station name defaults to the last recorded PT + 1.

7. Backsight (BS) defaults to the first point (P1). To change the selected point, highlight the BS field and then select the `Change` softkey.

8. To finish the setup and record the station, press `ENT` in the BS field.
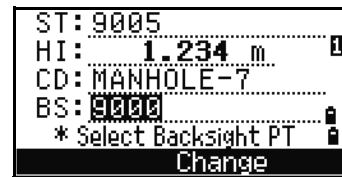
Known

Select this option to set up a station with known coordinates or azimuth.

1. Press `2` or select `Known` in the Stn Setup menu.

2. Enter a point name or number in the ST field.

   – If the input point number or name is an existing point, its coordinates are displayed and the cursor moves to the HI (Height of instrument) field.

   – If the point is new, a coordinate input screen appears. Enter the coordinates for the point. Press `ENT` after each field. When you press `ENT` in the CD field, the new point is stored.

   – If the specified point has a code, the code appears in the CD field.

3. Enter the instrument height in the HI field and then press `ENT`.

4. In the Backsight screen that appears, select an input method for defining the backsight point:

   – To sight the backsight by entering coordinates, see the following section.

   – To sight the backsight by entering the azimuth and angle, see page 64.
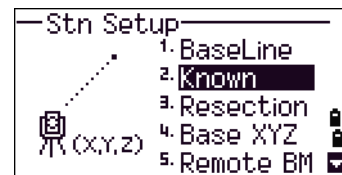
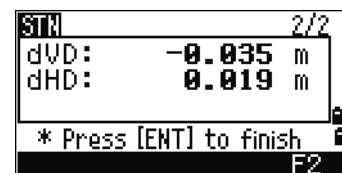## Sighting the backsight by entering coordinates
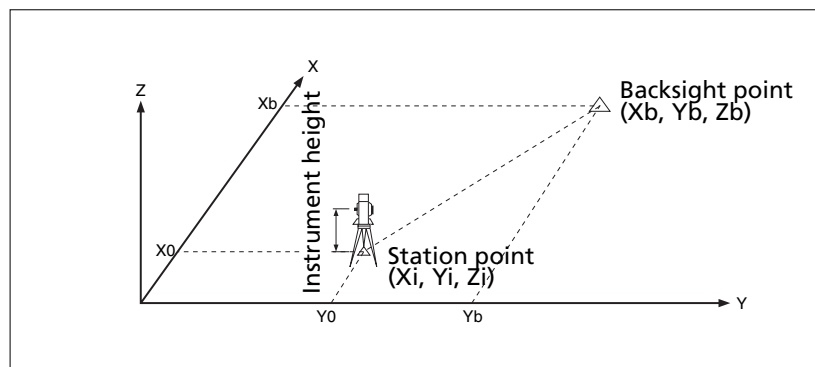
1. To enter coordinates for the backsight point (BS), press 1 or select Coord from the Backsight screen.

2. Enter the point name. If the point exists in the job, its coordinates are shown.

3. If you intend to take a distance measurement to the BS, enter the height of target in the HT field.

4. Sight the BS, and then press [ENT] to complete the setup.
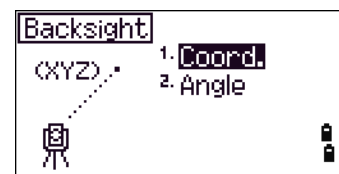
 | HA | Azimuth calculated by coordinates |
    |----|-----------------------------------|
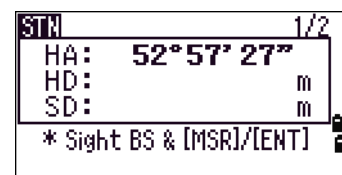
    If measuring to a known coordinate BS, press [DSP] to display a QA screen. The QA screen shows the dHD and dVD values, which indicate the difference between the measured distance and the distance calculated from the known coordinates.


5. To record the station, press [ENT].

6. To finish the station setup after taking a distance measurement, press [ENT].

Sighting the backsight by entering the azimuth angle
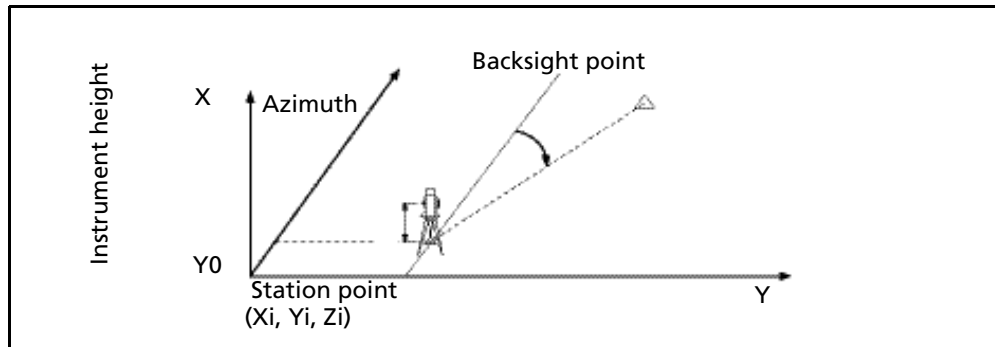
1. To enter the azimuth angle to the backsight point, press ② or select Angle from the Backsight screen.

2. If there is no point name for the BS, press [ENT] on the BS field.

3. In the HA field, enter the azimuth angle to the BS point.

   If you press [ENT] without entering a value in the HA field, the azimuth is automatically set to 0°00'00".

4. Sight the BS point and press [ENT].
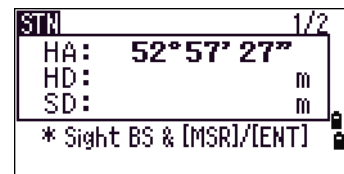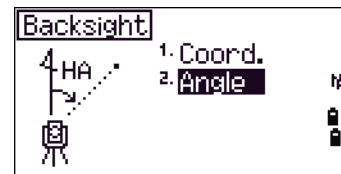
Resection

A resection sets up the station using angle/distance measurements to known points.
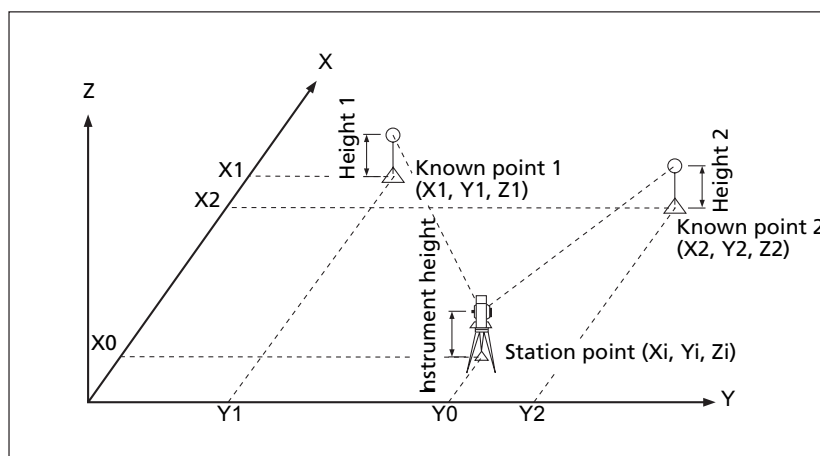
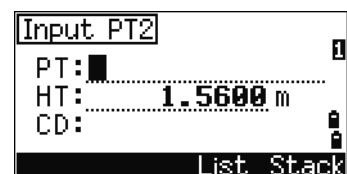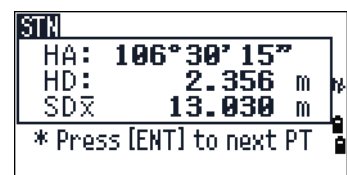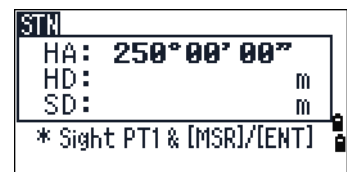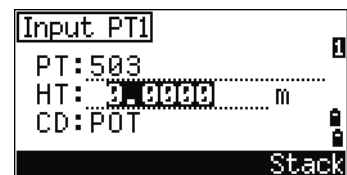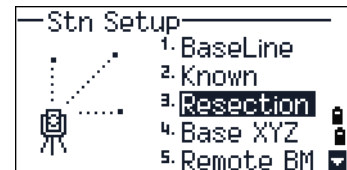You can use a maximum of 10 points in a resection. Measurements can be distance and angle, or angle only. Calculation starts automatically when enough measurements are taken.

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

Tip – If the angle between known point 1 and known point 2 (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.

1. To start the resection, press ② or select Resection in the Stn Setup menu.

```
┌─Stn Setup──────────────
│  .    ·   ¹·BaseLine
│ :   ·      ²·Known
│  \  ·      ³·█Resection█
│   \ ·····  ⁴·Base XYZ
│ ▣          ⁵·Remote BM ▼
```

2. Enter the point name for the first observation point (PT1).

```
┌Input PT1┐              Ⓐ
│ PT:█
│ HT:     0.0000 m
│ CD:
│                  List  Stack
```

3. Enter the target height and press [ENT].

```
┌Input PT1┐              Ⓘ
│ PT:503
│ HT: █0.0000█      m
│ CD:POT
│                        Stack
```

4. Sight PT1 and press [MSR1] or [MSR2].

```
┌STN┐
│ HA:  250°00'00"
│ HD:            m
│ SD:            m
│ * Sight PT1 & [MSR]/[ENT]
```

5. To proceed to the next point, press [ENT].

```
┌STN┐
│ HA:  106°30'15"
│ HD:      2.356 m
│ SDx̄     13.030 m
│ * Press [ENT] to next PT
```

6. Enter the second point (PT2) and its height of target.

```
┌Input PT2┐              Ⓘ
│ PT:█
│ HT:     1.5600 m
│ CD:
│                  List  Stack
```
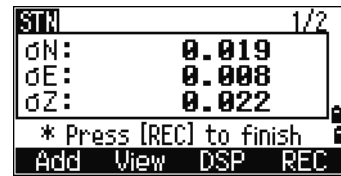
7. Measure to PT2 and press ⟨ENT⟩.

   When the instrument has enough data, it calculates the station (STN) coordinates.

   ```
   STN
    HA: 157°49'00"
    HD:              m
    SD:              m
   * Sight PT2 & [MSR]/[ENT]
   ```
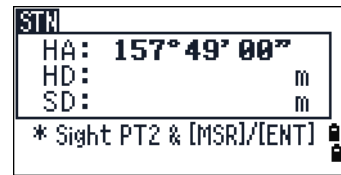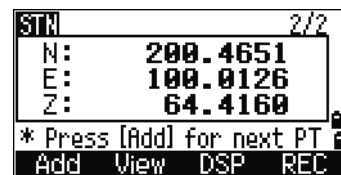
   – If more than the minimum required data is available, a standard deviation screen appears.

   – To take measurements to strengthen geometry of the resection, press the Add softkey. For information about the View softkey, see Advanced feature: Viewing and deleting a measurement in resection, page 67.

   ```
   STN                  1/2
   σN:          0.019
   σE:          0.008
   σZ:          0.022
   * Press [REC] to finish
   Add   View   DSP   REC
   ```

8. When the results are satisfactory, record the station. To do this, press ⟨ENT⟩ or the REC softkey.

   ```
   STN                  2/2
    N:        200.4651
    E:        100.0126
    Z:         64.4160
   * Press [Add] for next PT
   Add   View   DSP   REC
   ```

9. Enter the height of instrument, if required. Press ⟨ENT⟩. The ST field defaults to the last recorded PT + 1.
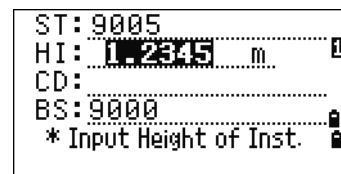
10. To change the station name, move to the ST field and edit or replace the text.

   ```
   ST: 9005
   HI: 1.2345  m
   CD:
   BS: 9000
    * Input Height of Inst.
   ```
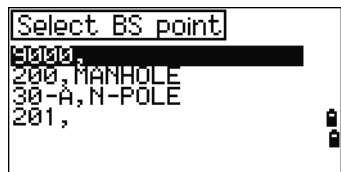
☼ **Tip –** If you have set *Split ST* to Yes, the ST field defaults to the last recorded ST value + 1.

   BS defaults to the first observed point.

11. To change the BS, press the Change softkey.

   ```
   ST: 9005
   HI:     1.234  m
   CD: MANHOLE-7
   BS: 9000
    * Select Backsight PT
              Change
   ```

12. Select the BS point that you want to use and press ⟨ENT⟩.

   ```
   Select BS point
   9000,
   200,MANHOLE
   30-A,N-POLE
   201,
   ```

13. To finish the resection setup, move the cursor to the BS field and press ⟨ENT⟩.

   ```
   ST: 9005
   HI:     1.2345m
       - REC STN -
    * Select Backsight PT
   ```
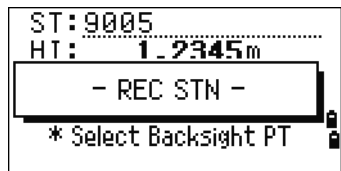
☼ **Tip –** The minimum data required for a resection is either three angle shots, or one angle shot and one distance shot. If you use a distance shot, the distance between the target points must be greater than the measured distance. Stn-Z is calculated from distance-measured data. If no distances are measured, then Stn-Z is calculated using angle-only measurements to points with 3D coordinates.

Advanced feature: Viewing and deleting a measurement in resection

To check the measurements to each known point, press the `View` softkey on the calculated STN (sigma or coordinate) screen.

dHA	Distributed HA errors in each direction
dVD	VD errors between measured distance and calculated distance
dHD	HD errors between measured distance and calculated distance
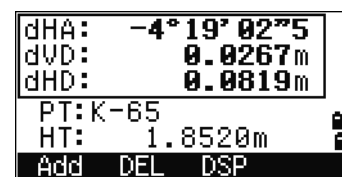
To delete a measurement (because of large sigma values, for example), highlight the measurement data or display the detail screen for the measurement. Then press the `DEL` softkey. The STN coordinates are automatically recalculated.

To continue resection observations, press the `Add` softkey. The input screen for the next PT appears.
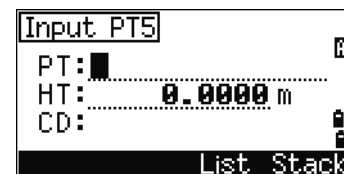
Base XYZ

Select this option to change the instrument XYZ values.

Base XYZ does not store an ST record in the job, so the BS Check cannot check the backsight if you enter a station using the Base XYZ option.

You can use this function without an open job.

1. Press ③ or select `Base XYZ` from the Stn Setup menu.

   The current instrument XYZ values are shown as the default.

2. Enter the new instrument XYZ values and then press `ENT`.

3. Do one of the following:
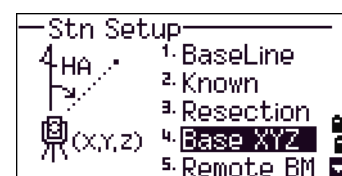
– To reset the horizontal angle, enter a value in the HA field and then press ENT.

– If you do not need to reset the horizontal angle, leave the HA field blank and then press ENT.

The Stn Setup menu appears.

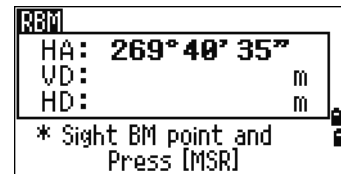## Remote BM

Select this option to determine the station elevation.
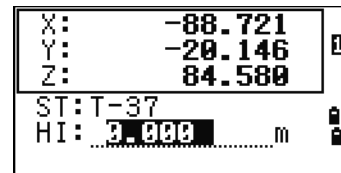
1. Press 4 or select Remote BM from the Stn Setup menu.
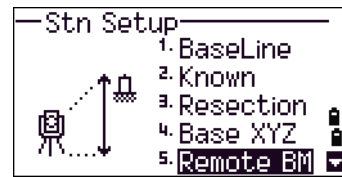
2. Enter the BM point and press ENT. The point appears briefly. The cursor then moves to the HT field.

3. Enter the HT and then press ENT.

4. Sight the Bench Mark point and then press MSR1 or MSR2.

The updated station coordinates are displayed. You can change the HI in this screen.

5. To record the updated STN, press ENT.

When the HI setting is changed, the Z coordinate is updated before the station is recorded.

You must complete a station setup before you use the Remote Benchmark function.

BS Check

Select these options to check and reset the backsight direction.

*Note – Complete a station setup before using the BS check function.*

This function always refers to the backsight point from the last station (ST) record stored in the current open job.

1. Press ⑤ or select `BS Check` in the Stn Setup menu.

The HA field refers to the current HA reading, and the BS field refers to the BS in the last station setup. Enter station coordinates for observations without recording data.

2. Do one of the following:

   - To reset the horizontal angle to the HA set in the last station setup, sight the BS and then select the `Reset` softkey or press `ENT`.

   - To cancel the process and return to the BMS, select the `Abrt` softkey or press `ESC`.
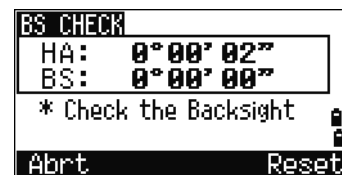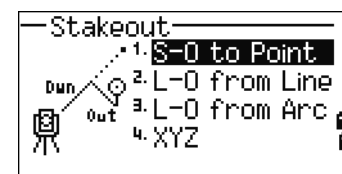
Stakeout menu

To access the Layout menu, press `L-O` in the BMS.

To select a command from the Layout menu, press the corresponding number key. Alternatively, press `^` or `v` to highlight the command and then press `ENT`.

The last function used is highlighted.

There are four layout options:

S-O to Point
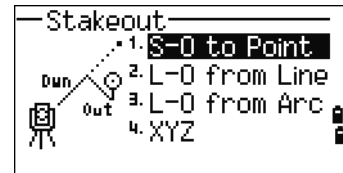
Use this method to lay out a point based on the down, out, and dZ location to a specified line.
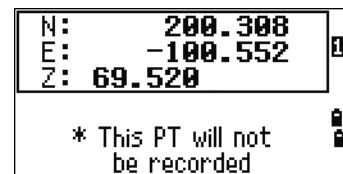
1. Press ① or select
   S-O to Point from the Layout menu.

2. Enter the first point (P1) along the line.

   Alternatively, select the MSR softkey to measure a point.

   If you press ENT without entering a PT name, you can enter temporary coordinates. Temporary coordinates are not recorded in the job.

3. Enter the second point (P2) along the line.

4. Enter offsets to the line.

   To enter the value 0.0000, press ENT in a blank field.

Sta	Distance from P1 along the line
O/S	Distance perpendicular to the line
(+)	Right side of the P1—P2 line
(-)	Left side of the P1—P2 line
dZ	Difference in height from the line
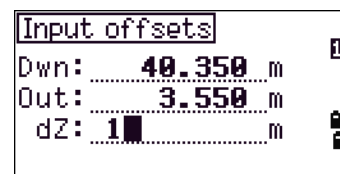
5. Rotate the instrument until the dHA is close to 0°00'00".
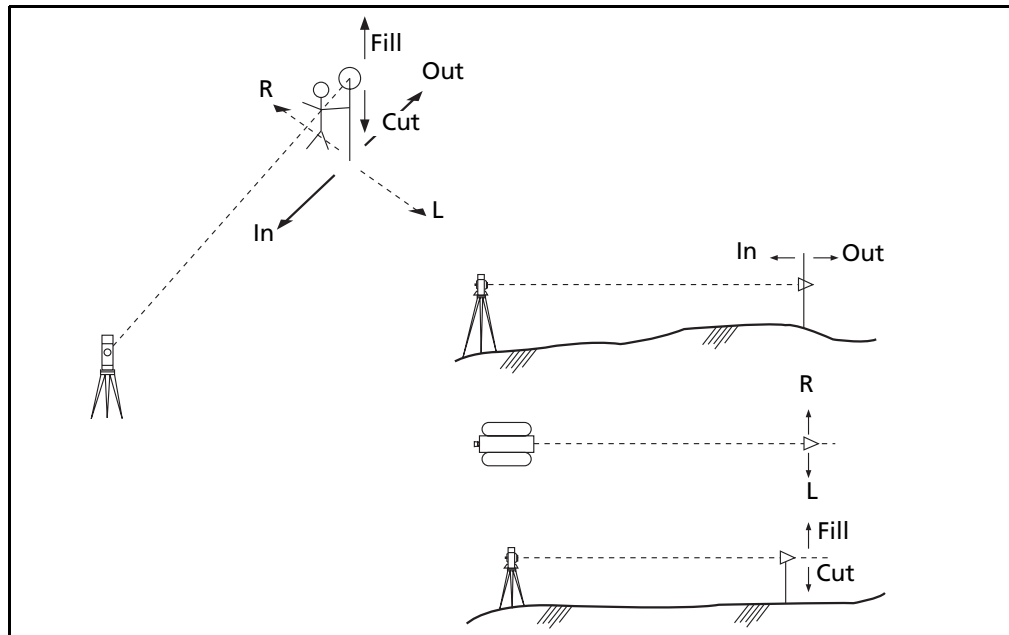
6. Sight the target, and then press MSR1 or MSR2.

   When a distance measurement is taken, the difference between the measured point and the design point appears.

7. To record the point as an SO record, press ENT.
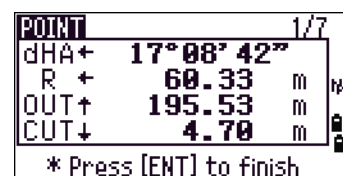
Note – Press DSP *to switch between display screens. See also* *.*

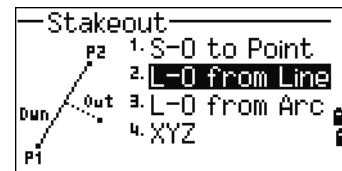The following figure shows the terminology used to guide you to the required point.

L-O from Line

Select this option to measure distance and offset values along a specified line.

1. Press ② or select `L-O from Line` from the Layout menu.

2. Enter the first point for the reference line.

   Alternatively, select the `MSR` softkey to measure a point.

   If you press `ESC` in the Record PT screen, the measured point is used but not recorded in the job.

3. Enter the second point for the reference line.

4. Enter an asterisk (for example, A*) in the PT field to perform a wildcard search. A list of matching points appears. Highlight a point in the list and then press `ENT`.

The following figure shows how to determine or input a location relative to a line used for Layout.

Dwn		Out
PT2		

Plain view   Side view
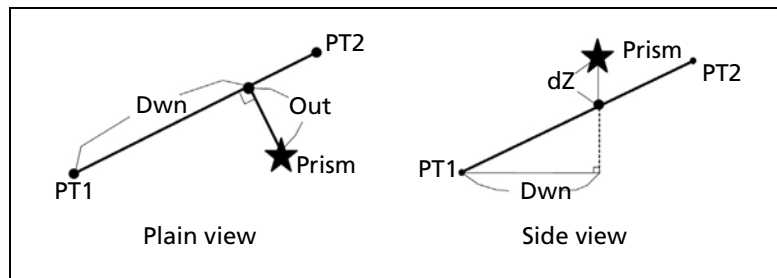
5.   Sight the prism or reflective sheet and press [MSR1] or [MSR2].

|	
Dwn	Horizontal distance from P1 to the measured point along the P1-P2 line
Out	Horizontal offset from the P1-P2 line to the measured point
dZ	Vertical offset from the P1-P2 line to the measured point
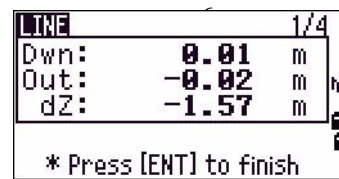
Note – Press [DSP] *to switch between display screens. See also* *.*

L-O from Arc

Select this option to measure distance and offset values on the arc-curve.

1.   Press ③ or select `L-O from Arc` from the Layout menu.

2.   Enter the start of the curve point (P1) and the azimuth of its tangent line (HA1).

     Alternatively, to enter P1 by direct measurement, select the `MSR` softkey.

3.   Choose a method to define the curve.
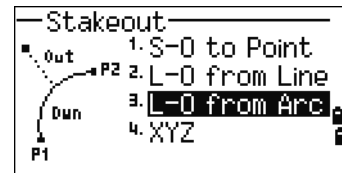
     P2 can be any point on the tangent line that is to exit the curve.

4.   In the radius (Rad) field, enter a positive value for a clockwise curve. Enter a negative value for a counter-clockwise curve.