



# USER GUIDE

Part 2

## Trimble® TS635 Construction Total Station





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## **Trimble® TS635 Construction Total Station**

Version 1.00  
Revision A  
February 2009



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### Release Notice

This is the February 2009 release (Revision A) of the *Trimble TS635 Construction Total Station User Guide*. It applies to version 1.00 of the TS635 construction total station.

### Manufacturer

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### Product Limited Warranty Information

For applicable product Limited Warranty information, please refer to the Limited Warranty Card included with this Trimble product, or consult your local Trimble authorized dealer.

### Notices

Class B Statement – Notice to Users. This equipment has been tested and found to comply with the limits for a Class B digital device, 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 communication. 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 the 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.

Changes and modifications not expressly approved by the manufacturer or registrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.



**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.

### Canada

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

## Europe

This product has been tested and found to comply with the requirements for a Class B device pursuant to European Council Directive 2004/108/EC on EMC, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA). These requirements are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or commercial environment.



### Representative in Europe

Trimble GmbH  
Am Prime Parc 11  
65479 Raunheim, Germany

### Australia and New Zealand

This product conforms with the regulatory requirements of the Australian Communications Authority (ACA) EMC framework, thus satisfying the requirements for C-Tick Marking and sale within Australia and New Zealand.



### Taiwan Battery Recycling Requirements

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



## 涝措珍惠岔澗

### Notice to Our European Union Customers

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

### For the Bluetooth unit

#### USA

FCC Part 15 Subpart/RSS-210, OET bulletin 65 supplement C satisfied

**CAUTION:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**NOTE:** *This equipment has been tested and found to comply with the limits for a Class B digital device, 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.

#### Canada

RSS-210 Low Power Device

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

### European Union countries, Iceland, Norway, Liechtenstein, Turkey, Switzerland

EN300 328v17.1, EN50360 satisfied

Hereby, Nikon-Trimble Co., Ltd., declares that this instrument is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

Declaration of Conformity available at <http://www.nikon-trimble.com/>.

### RF exposure compliance

1. To comply with FCC/IC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.
2. This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

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# Applications

## In this chapter:

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

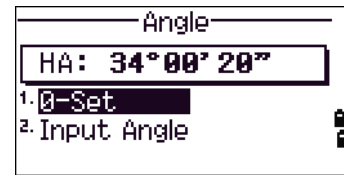
This chapter describes the menu and display screens, and TS635 Construction Total Station applications.

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

To switch between display screens	Press <b>[DSP]</b> . See also <a href="#">page 83</a> .
To change HT	Press <b>[HOT]</b>
To record points	Press <b>[ENT]</b>

## 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]**.

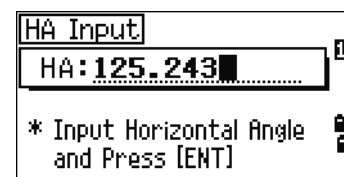


### Setting the horizontal angle to 0

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]**.



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

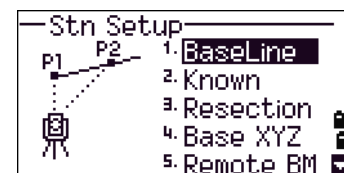
To access the Stn Setup menu, press **[STN]** in the BMS.

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:

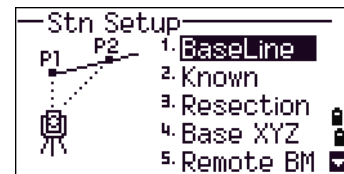
- [Baseline, page 57](#)
- [Known, page 58](#)
- [Base XYZ, page 60](#)
- [Remote BM, page 60](#)
- [BS Check, page 61](#)



## Baseline

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

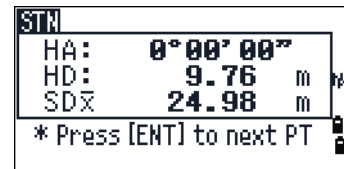
1. Press **1** or select BaseLine from the Stn Setup menu.



2. Enter a known point as P1.

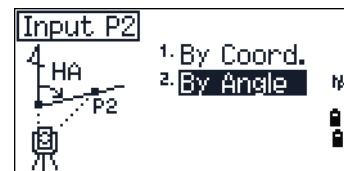
If you enter a new point name, a coordinate input screen appears.

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

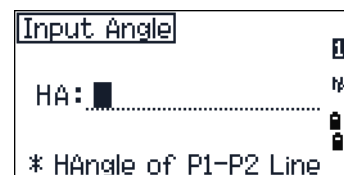


3. Choose how you want to define a known line:

- 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.**



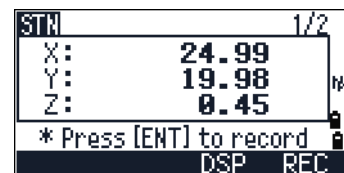
- a. If you select **By Angle**, the azimuth input screen appears: Enter the angle value and press **ENT**.



A measurement screen appears.

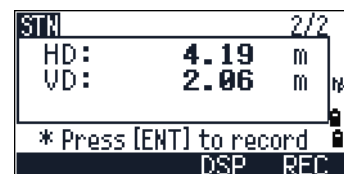
- b. Sight P2 and press **MSR1** or **MSR2** to take a measurement. Press **ENT**.

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



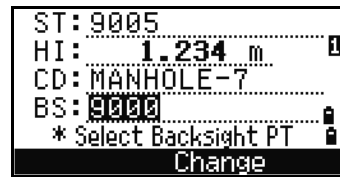
4. To record the station, press **ENT** or the REC softkey.

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.



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.

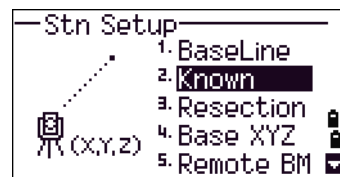
6. Enter the station name, the height of instrument (HI), and a feature code (CD) if required. The station name defaults to the last recorded PT + 1.
7. Backsight (BS) defaults to the first point (P1). To change the selected point, highlight the BS field and then select the **Change** softkey.
8. To finish the setup and record the station, press **ENT** in the BS field.



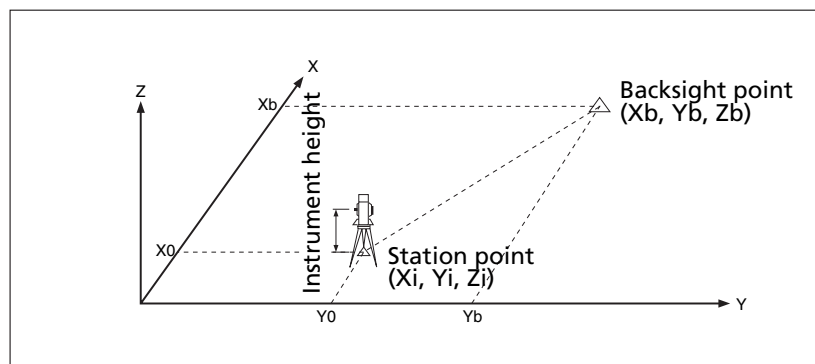
## Known

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

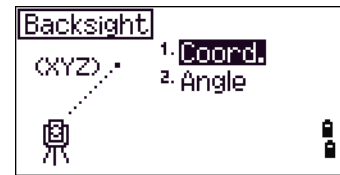
1. Press **2** or select **Known** in the Stn Setup menu.
2. Enter a point name or number in the ST field.
  - If the input point number or name is an existing point, its coordinates are displayed and the cursor moves to the HI (Height of instrument) field.
  - If the point is new, a coordinate input 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 59](#).



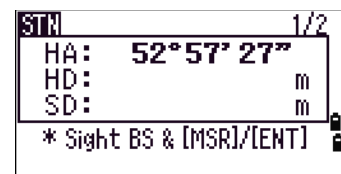
## Sighting the backsight by entering coordinates



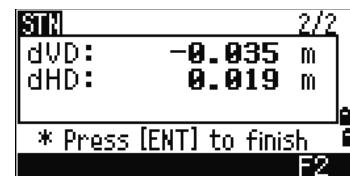
1. To enter coordinates for the backsight point (BS), press **[1]** or select **Coord** from the Backsight screen.
2. Enter the point name. If the point exists in the job, its coordinates are shown.
3. If you intend to take a distance measurement to the BS, enter the height of target in the HT field.
4. Sight the BS, and then press **[ENT]** to complete the setup.



HA Azimuth calculated by coordinates

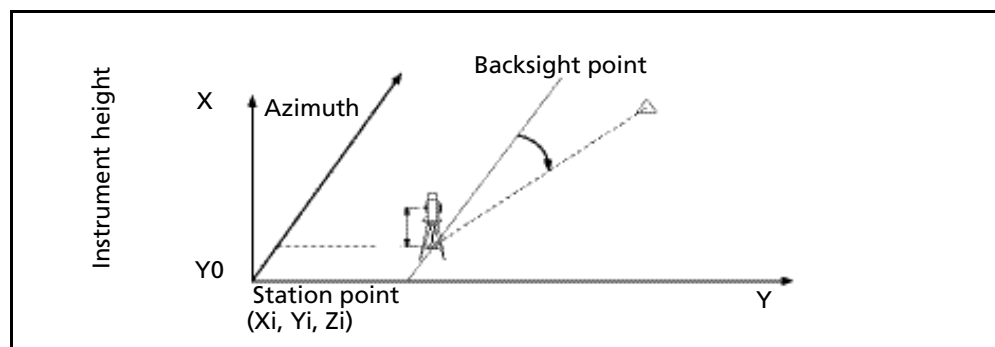


If measuring to a known coordinate BS, press **[DSP]** to display a QA screen. The QA screen shows the dHD and dVD values, which indicate the difference between the measured distance and the distance calculated from the known coordinates.

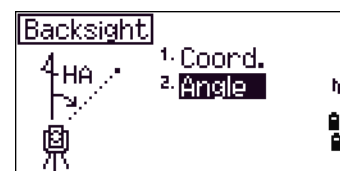


5. To record the station, press **[ENT]**.
6. To finish the station setup after taking a distance measurement, press **[ENT]**.

### Sighting the backsight by entering the azimuth angle



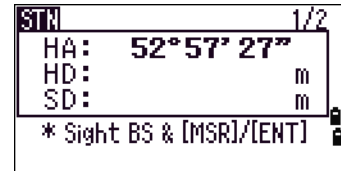
1. To enter the azimuth angle to the backsight point, press **[2]** or select **Angle** from the Backsight screen.
2. If there is no point name for the BS, press **[ENT]** on the BS field.



- 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".

- Sight the BS point and press **[ENT]**.



## Base XYZ

Select this option to change the instrument XYZ values.

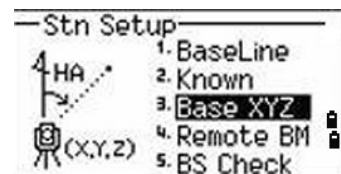
Base XYZ does not store an ST record in the job, so the BS Check cannot check the backsight if you enter a station using the Base XYZ option.

You can use this function without an open job.

- Press **[3]** or select **Base XYZ** from the Stn Setup menu.

The current instrument XYZ values are shown as the default.

- Enter the new instrument XYZ values and then press **[ENT]**.
- 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]**.

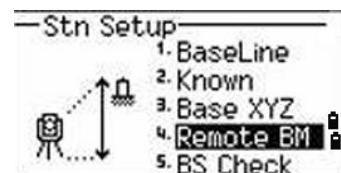


The Stn Setup menu appears.

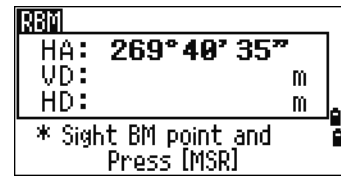
## Remote BM

Select this option to determine the station elevation.

- Press **[4]** or select **Remote BM** from the Stn Setup menu.
- Enter the BM point and press **[ENT]**. The point appears briefly. The cursor then moves to the HT field.
- Enter the HT and then press **[ENT]**.



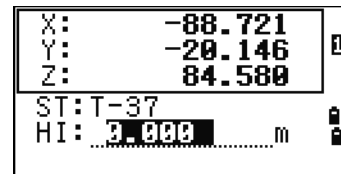
4. Sight the Bench Mark point and then press **[MSR1]** or **[MSR2]**.



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.

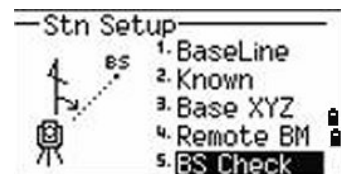
## BS Check

Select these options to check and reset the backsight direction.

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

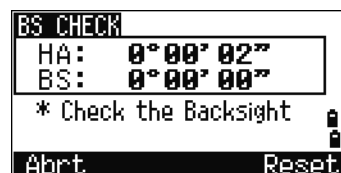
This function always refers to the backsight point from the last station (ST) record stored in the current open job.

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 **Abt t** softkey or press **[ESC]**.



## Layout menu

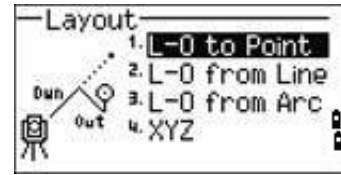
To access the Layout menu, press **[L-O]** in the BMS.

To select a command from the Layout menu, press the corresponding number key. Alternatively, press **[↑]** or **[↓]** to highlight the command and then press **[ENT]**.

The last function used is highlighted.

There are four layout options:

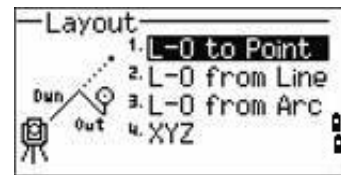
- [L-O to Point, page 62](#)
- [L-O from Line, page 63](#)
- [L-O from Arc, page 64](#)
- [XYZ, page 65](#)



### L-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 **L-O to Point** from the Layout menu.

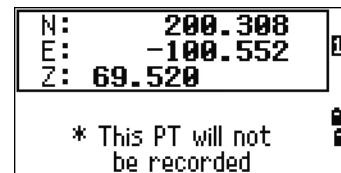


2. Enter the first point (P1) along the line.

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

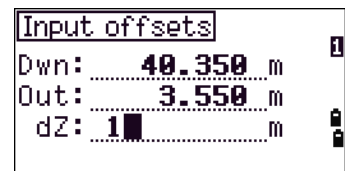
If you press **[ENT]** without entering a PT name, you can enter temporary coordinates. Temporary coordinates are not recorded in the job.

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]**.



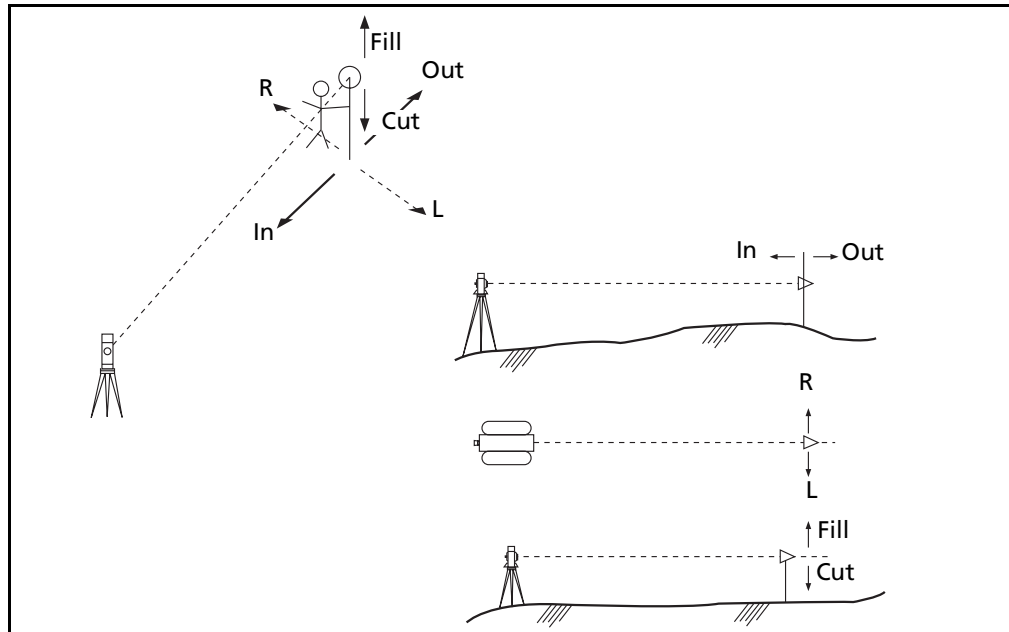
When a distance measurement is taken, the difference between the measured point and the design point appears.

- To record the point as an SO record, press **[ENT]**.

**Note** – Press **[DSP]** to switch between display screens. See also [page 83](#).

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

POINT		1/7
dHA+	17°08'42"	
R +	60.33	m
OUT+	195.53	m
CUT↓	4.70	m
* Press [ENT] to finish		



## L-O from Line

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

- Press **[2]** or select **L-O** from **Line** from the **Layout** menu.
- Enter the first point for the reference line.

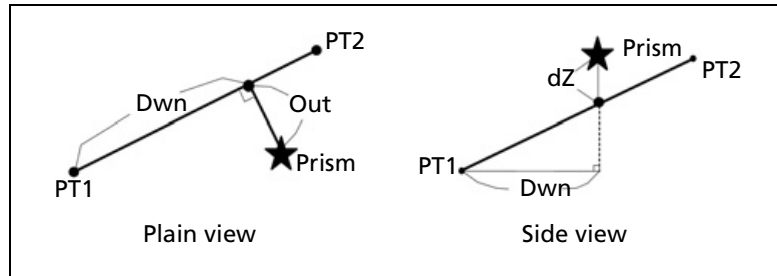
Alternatively, select the **MSR** softkey to measure a point.

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

- Enter the second point for the reference line.
- 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]**.

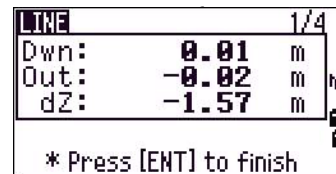
Layout	
1.	L-O to Point
2.	<b>L-O from Line</b>
3.	L-O from Arc
4.	XYZ

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



- 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

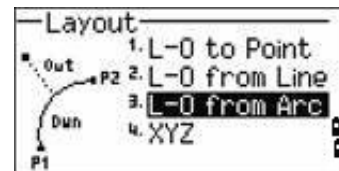


**Note** – Press **[DSP]** to switch between display screens. See also [page 83](#).

### L-O from Arc

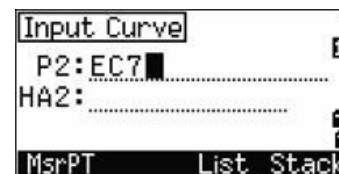
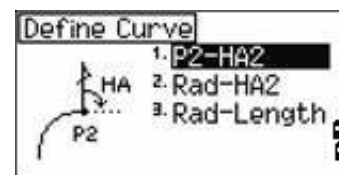
Select this option to measure distance and offset values on the arc-curve.

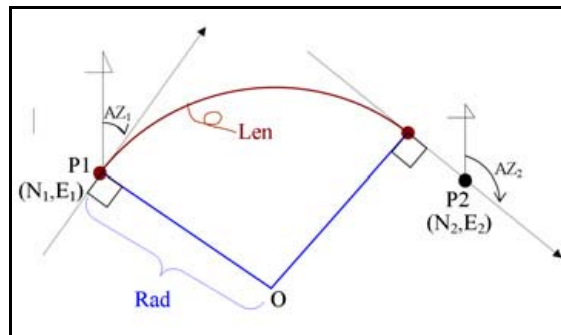
- Press **[3]** or select L-O from Arc from the Layout menu.
- Enter the start of the curve point (P1) and the azimuth of its tangent line (HA1).  
 Alternatively, to enter P1 by direct measurement, select the **[MSR]** softkey.
- Choose a method to define the curve.



P2 can be any point on the tangent line that is to exit the curve.

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





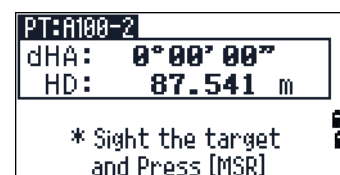
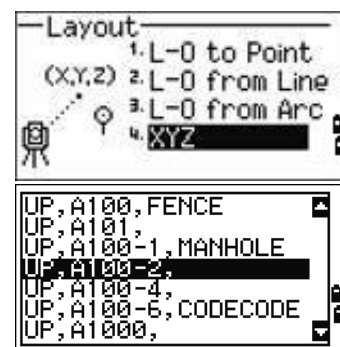
Once you entered all factors, the TS635 Construction Total Station calculates the curve. If the curve length (Len) is too large for a circle of the given radius, the curve is shortened.

**Note** – Press **[DSP]** to switch between display screens. See also [page 83](#).

## XYZ

Select this option to specify the layout point by coordinates.

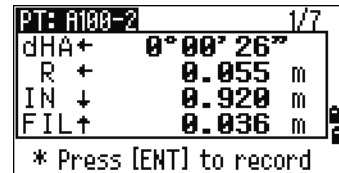
1. Press **[4]** or select **XYZ** in the Layout menu.
2. Do one of the following:
  - Enter the point name that you want to establish and then press **[ENT]**.
  - Specify the point by code or radius from the TS635 Construction Total Station. If several points are found, they are displayed in a list. Press **[↑]** or **[↓]** to move up and down the list. Use **[←]** to move up one page, or **[→]** to move down one page.
3. Highlight a point in the list and then press **[ENT]**.  
The delta angle and the distance to the target are shown.
4. Rotate the instrument until the dHA is close to 0°00'00". Press **[MSR1]** or **[MSR2]**.



dHA            Difference in horizontal angle to the target point  
HD             Distance to the target point

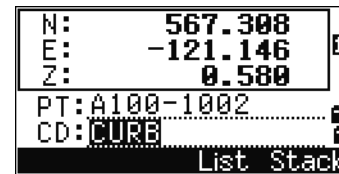
- Ask the rod person to adjust the target position. When the target is on the intended position, the displayed errors become 0.000 m (0.000 ft).

dHA	Difference in horizontal angle to the target point
R/L	Right/Left (Lateral error)
IN/OUT	In/Out (Longitudinal error)
CUT/FIL	Cut/Fill



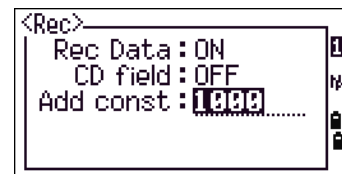
Once a measurement is taken, the Cut/Fill value and Z coordinate are updated as the VA is changed.

- To record the point, press **[ENT]**. The PT field defaults to the specified PT + 1000.

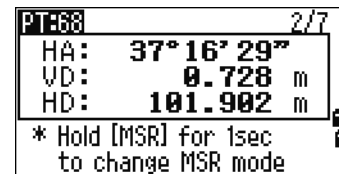


Press **[MENU]** and then select **Settings / Rec.**

Use the Add Constant field to specify an integer. The integer is added to the point number that is being laid out to generate a new number for recording the layout point. The default value is 1000. For example, when you stake out PT3 with an Add Constant of 1000, the default value in the SO field (layout record) is 1003.



The display then returns to the observation screen. Press **[ESC]**. The display returns to the PT/CD/R input screen. If you entered the stakeout point using a single point name, the PT defaults to the last PT + 1.

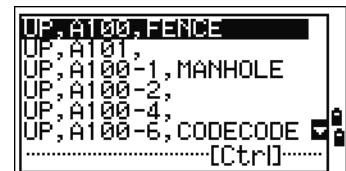
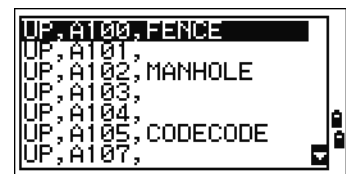
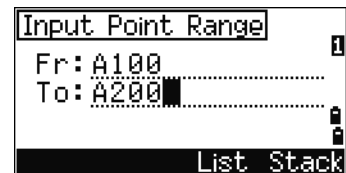
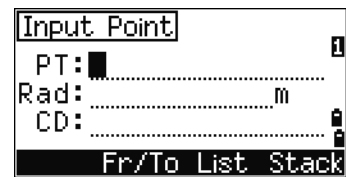


- If you selected a point from the list, the display returns to the list, unless all points have been selected. Press **[ESC]** to return to the point input screen.



### Advanced feature: Specifying a layout list by inputting points by range

1. Select the Fr/To softkey when the PT field is selected.
2. Enter the start point (Fr) and the end point (To). The range between Fr and To must be less than 1001 points.
  - If existing points are found between Fr and To, a point list appears.  
To highlight a point in the list, press  $\uparrow$  or  $\downarrow$ . To go to the layout observation screen, press  $\text{ENT}$ .
  - If you have assigned a control job, and additional points are found in the control job, the  $\text{Ctrl}$  1 softkey appears under the list.



## Programs menu

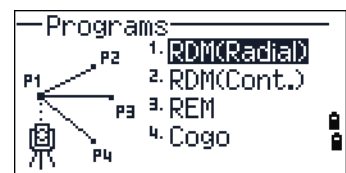
To access the Programs menu, press  $\text{PRG}$  in the BMS.

To select a command from the Programs menu, press the corresponding number key. Alternatively, press  $\uparrow$  or  $\downarrow$  to highlight the command and then press  $\text{ENT}$ .

The last function used is highlighted.

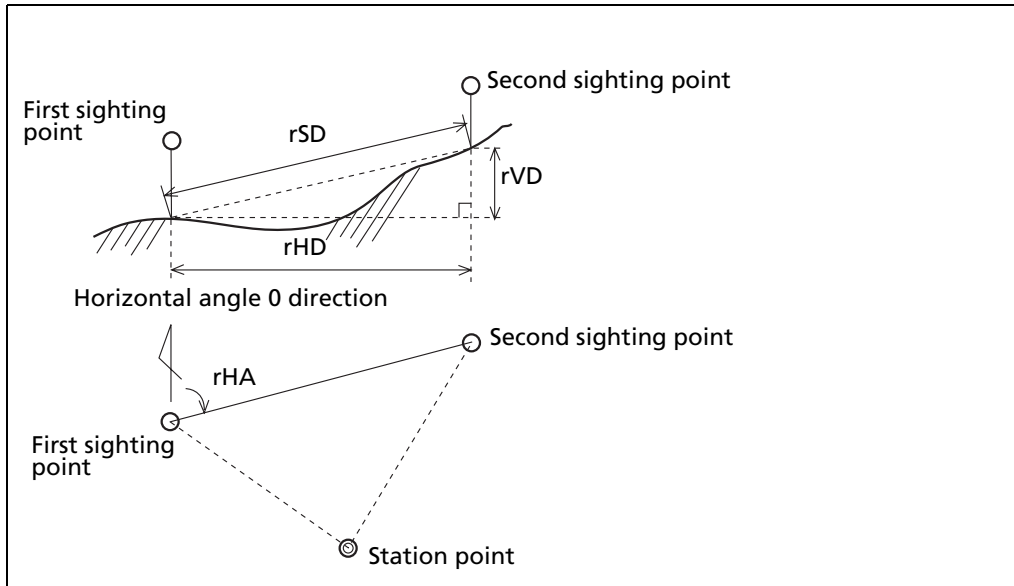
The Programs menu has the following options:

- [RDM \(Radial\), page 69](#)
- [RDM \(Cont\), page 69](#)
- [REM, page 70](#)
- [V-Plane, page 70](#)
- [Cogo, page 71](#)



### Remote distance measurement (RDM) - overview

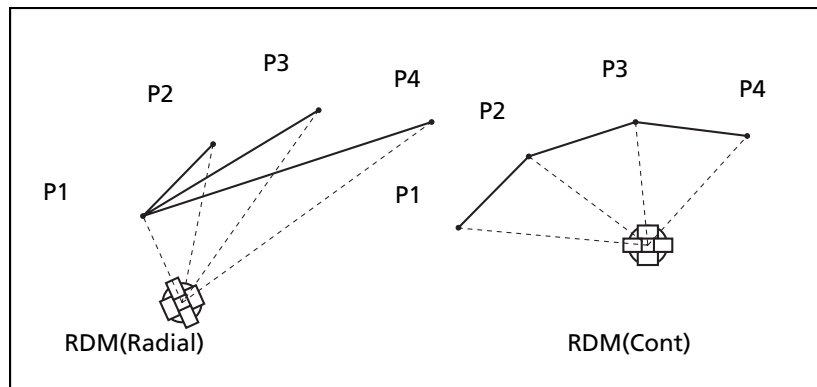
RDM or “Remote distance measurement” measures the horizontal distance, vertical distance, and slope distance between two points.



rSD	Slope distance between two points
rVD	Vertical distance between two points
rHD	Horizontal distance between two points
rV%	Percentage of grade $(rVD/rHD) \times 100\%$
rGD	Vertical grade $(rHD/rVD):1$
rAZ	Azimuth from first point to second point

### Difference between RDM (Radial) and RDM (Cont) measurement methods

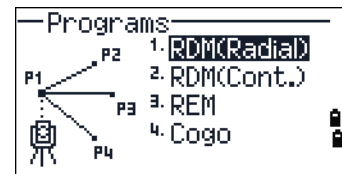
RDM (Radial) calculations are made with reference to the first point. RDM (Cont) calculations are made with reference to the two preceding points.



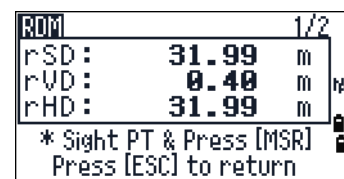
## RDM (Radial)

Choose this option to measure between the current point and the first point measured.

1. Press **[1]** or select **RDM(Radial)** in the Programs menu.
2. Sight the first point and press **[MSR1]** or **[MSR2]**.  
The distance from the station point to the first point appears.
3. Sight the second point and press **[MSR1]** or **[MSR2]**.  
The distances between the first and second point are displayed.

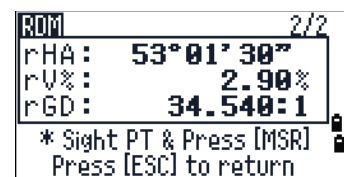


- |     |  |
|-----|--|
| rSD | Slope distance between two points      |
| rVD | Vertical distance between two points   |
| rHD | Horizontal distance between two points |



4. To change display screens, press **[DSP]**.

- |     |  |
|-----|--|
| rHA | Azimuth from first point to second point |
| rV% | Percentage of grade (rVD/rHD) x 100%     |
| rGD | Vertical grade (rHD/rVD): 1              |

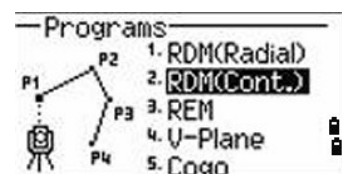


5. Press **[ESC]** to exit.

## RDM (Cont)

Choose this option to measure between the current point and the immediately preceding point.

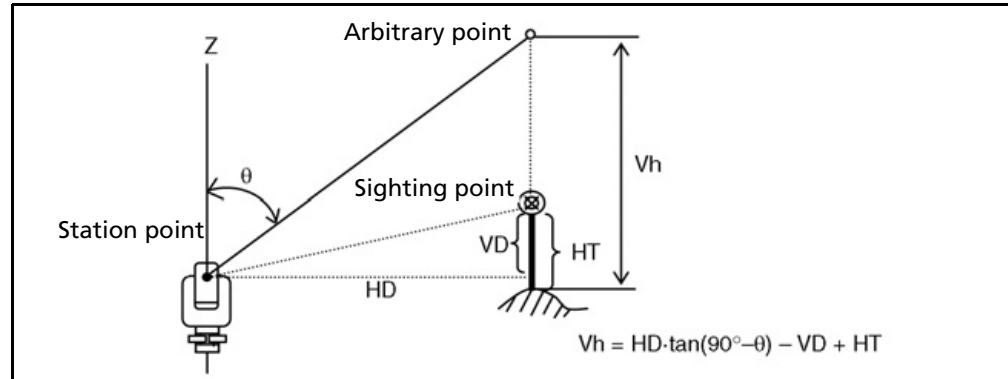
1. Press **[2]** or select **RDM(Cont.)** from the Programs menu.
2. Follow the procedure as for a radial RDM measurement. See also [RDM \(Radial\)](#), page 69.



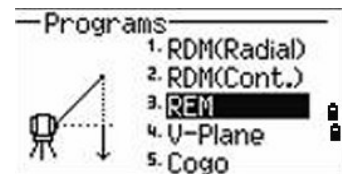
## REM

Choose this option to measure a remote elevation.

*Note – A prism is required only at the sighting (target) point.*

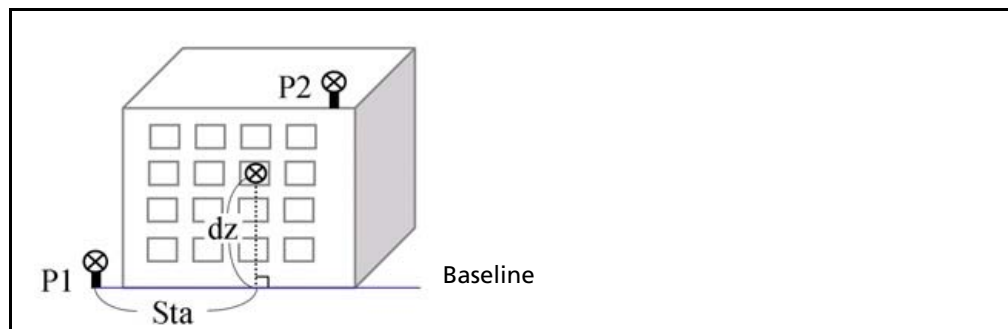


1. Press **[3]** or select **REM** in the Programs menu.
2. Enter the height of the target.
3. Sight the target point and press **[MSR1]** or **[MSR2]**.
4. Loosen the vertical clamp and then turn the telescope to aim at an arbitrary point.  
The difference in elevation ( $V_h$ ) appears.
5. Press **[ESC]** to exit.

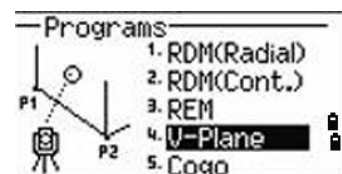


## V-Plane

Choose this option to measure distance and offset values in the vertical plane, using the 2-Pt Reference Plane function.

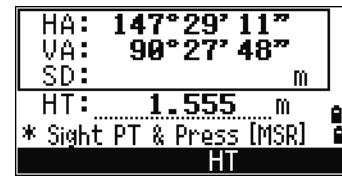


1. Press **[4]** or select **U-Plane** in the Programs menu.
2. Enter the first point in the vertical plane:



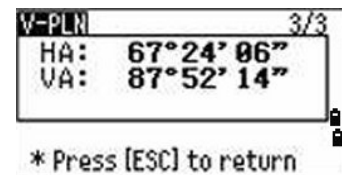


- a. To enter the first point by direct measurement, select the MSR softkey. A temporary observation screen appears.
  - b. Press [MSR1] or [MSR2]. The Record PT screen appears.
  - c. Enter a value in the PT and CD fields, and then press [ENT].
3. Enter the second point in the vertical plane. To do this, repeat [Step 2](#).



Once the plane is defined, the calculated Dwn and dZ values are updated as you move the telescope. No distance measurement is required.

Dwn	Horizontal distance from P1 to the target point along the baseline
dZ	Vertical distance from P1 to the target point



**Note** – Press [DSP] to switch between display screens. See also [page 83](#).

4. Press [ESC] to exit this function.

## Cogo

Choose the Cogo option to perform coordinate geometry (Cogo) calculations.

To open the Cogo menu, press [5] on the Programs menu.

There are five items in the Cogo menu:

- [Inverse, page 72](#)
- [Input, page 74](#)
- [Area & Perm, page 76](#)
- [Down+Out, page 77](#)
- [Intersection, page 78](#)



## Inverse

Choose this option from the Cogo menu to calculate angle and distance between two coordinates.

Press **[1]** or select **Inverse** in the Cogo menu. The Inverse menu appears.

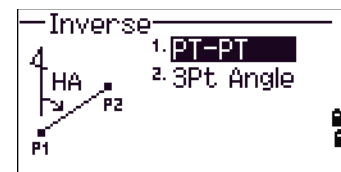


### PT-PT inverse

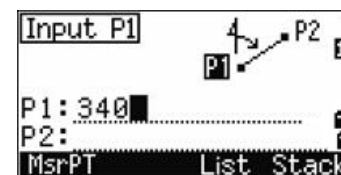
PT-PT calculates the distance and the angle between two input points.

To calculate a PT-PT inverse:

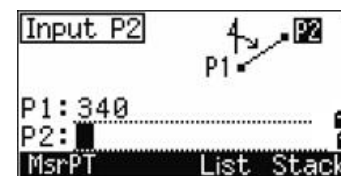
1. Press **[1]** or select **PT-PT** in the Inverse menu.
2. Enter the first point number or name, and then press **[ENT]**.



If you press **[ENT]** without entering a point name, a coordinate input screen appears, and you can enter coordinates. These coordinates are *not* stored to the database. If you want to store the point, specify a new point name.

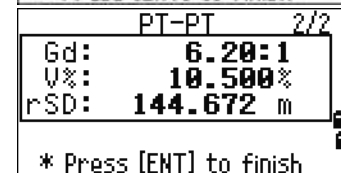
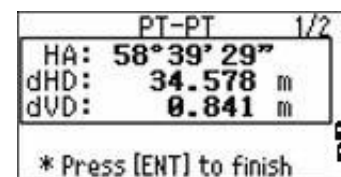


3. Type the second point number/name, and then press **[ENT]**. If necessary select the **MSR** softkey to shoot the point on the spot so that you can use it in the calculation.



The azimuth, horizontal distance, and vertical distance from the first point to the second point are displayed.

4. Do one of the following:
  - To return to the PT input screen, press **[ESC]**.
  - To return to the Cogo menu, press **[ENT]**.
  - To change the contents of the result screen, press **[DSP]**.



Gd	Grade (HD/VD)
V%	100/Gd
rSD	Slope distance PT1 to PT2

### 3Pt Angle

If you choose 3Pt Angle, the TS635 Construction Total Station calculates the angle between two lines defined by three points.

To calculate a 3Pt angle:

1. Press **[2]** or select **3Pt Angle** from the Inverse menu.
 

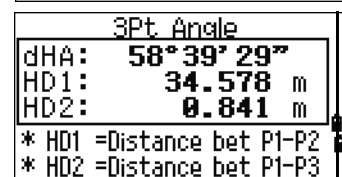
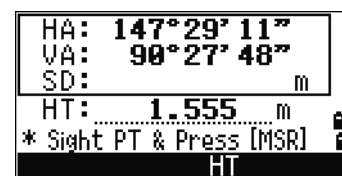
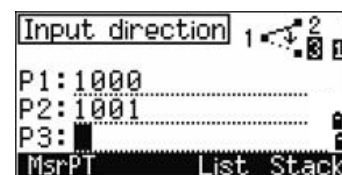
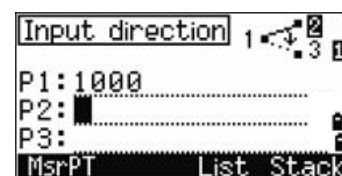
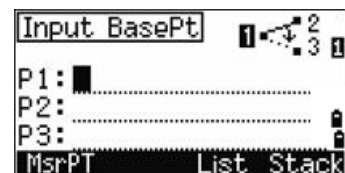
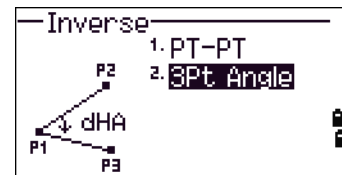
P1 is the base point. Two lines are to be defined by P2 and P3, both from P1.
2. Enter the P1 point name. Alternatively, use the **MSR** softkey to take a measurement to the point.
3. Enter the second point (P2) to define the baseline, P1-P2. The angle (dHA) is measured from the baseline.
4. Enter the third point (P3) to define the second line, P1-P3.

When you press the MSR softkey, a temporary measuring screen appears. Sight the target and press **[MSR1]** or **[MSR2]** to take a measurement.

After the measurement, a recording point screen appears. To store the measured point, enter the PT, HT, and CD values and press **[ENT]**. To use the point without recording it, press **[ESC]**.

When you have entered three points, the instrument calculates the angle and distances.

5. Do one of the following:
  - To return to the Inverse menu, press **[ENT]**.
  - To return to the Input BasePt screen, press **[ESC]**.



## Input

Choose this option from the Cogo menu to calculate and manually input coordinates.

To enter the Input menu, press **[2]** or select **Input** from the Cogo menu. There are three functions in this menu for recording new coordinate points.

### Azimuth+HD input

To calculate a coordinate by an angle and distance input from the base point (P1), press **[1]** or select **HA+HD** from the Input menu.

Enter the base point, P1. Type the point name and press **[ENT]**.

Enter the azimuth, horizontal distance, and vertical distance. Then press **[ENT]**.

For example, to enter  $123^{\circ}45'45''$ , type 123.4545 and then press **[ENT]**.

If you do not enter a value in the dVD field, the value 0.0000 is used.

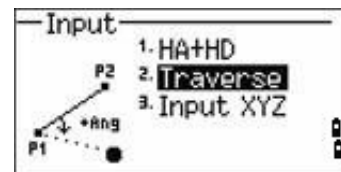
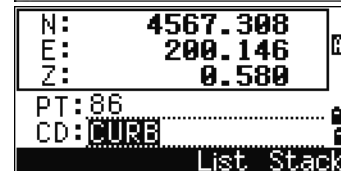
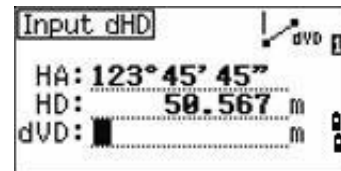
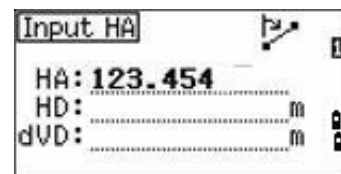
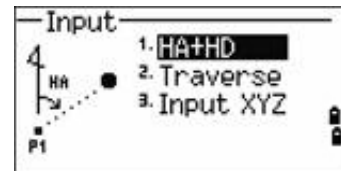
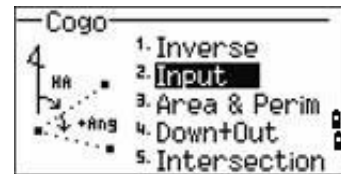
A recording point screen with the calculated coordinates appears. The PT field defaults to the last recorded point + 1.

Press **[ENT]** to store the point.

### Traverse

To calculate a new point based on two defined points and the angle, horizontal and vertical distances from the line defined by those two points, use the Traverse (2Pt Angle) function.

Press **[2]** or select **Traverse** in the Input menu.



To enter P1 and P2, enter point names or take measurements to targets.

Enter the plus-minus angle, horizontal distance, and vertical distance from the baseline defined by P1-P2.

If you do not enter a value in the dVD field, the value 0.0000 is used.

When you press **[ENT]** in the dVD field, a new point is calculated. The name in the PT field defaults to the last recorded point, + 1.

To record the new point and return to the point input screen, press **[ENT]**.

P1 (the base point) defaults to the previously recorded point value. P2 defaults to the previous P1 value.



**Tip** – To continuously calculate a new point, enter +Ang, HD, and dVD from the previous bearing line. This is a convenient way to enter Traverse points.

### Entering coordinates

To manually enter the XYZ coordinates, press **[3]** or select **Input XYZ** from the Input menu.

The PT name defaults to the last recorded PT + 1.

Enter the coordinates using the numeric keys. To move to the next field, press **[ENT]** or **[v]** in a field.

To store the point as an MP record and return to the point input screen, press **[ENT]** in the Z field. The default PT is incremented to the next value.

You can record NE, NEZ, or Z-only data.

## Area & Perm

Choose this option from the Cogo menu to calculate area and perimeter.

Press **[3]** or select **Area & Perm** in the Cogo menu.

To take a measurement, enter the first point and press **[ENT]**, or select the **MSR** softkey.

In the upper right corner of the screen, a counter indicates how many points you have entered.

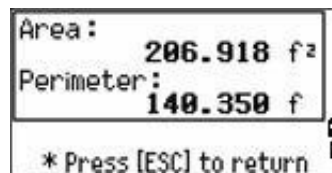
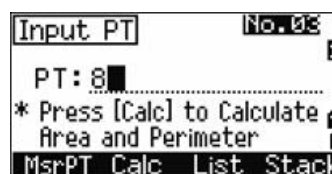
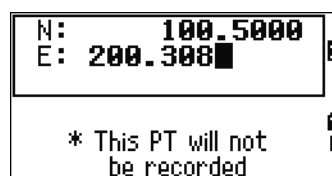
To input point numbers consecutively, use the **Fr/To** softkey. See also [Advanced feature: Entering a range of points](#), page 76.

If you enter a new point name, you can enter new coordinates and record the point. If you do not want to record the point, press **[ENT]** without entering a value in the PT field. An XY coordinate input screen appears.

Continue to enter points until you have defined all the points in the lot. Then, press **[v]** to calculate the area and perimeter.

The first and last points that you enter are joined to close the area. You must enter the points in the order in which they define the lot. You can enter up to 99 points.

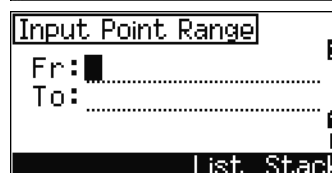
Press **[ENT]** to exit from the function, or press **[ESC]** to return to the previous screens one by one.



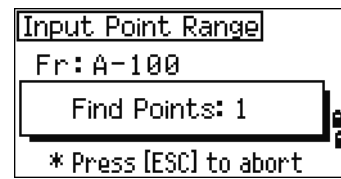
### Advanced feature: Entering a range of points

To quickly enter a sequential range of points, use the range input function. To access this function, select the **Fr/To** softkey in the No. 01 or No. 02 input screens.

Enter the start point name in the **Fr** field and the end point name in the **To** field. You can include letters and hyphens in the point names, but the last character must be numeric.

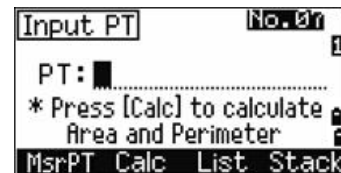


To start searching for matching points, press **[ENT]** in the To field. The counter shows the number of matching points found.



When the search is complete, you are returned to the Input PT screen.

Select the **Calc** softkey to calculate the area and perimeter, or enter point names in the PT field.



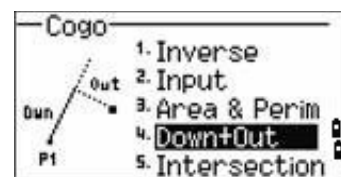
Press **[ESC]** to return to the Input PT screen where the preceding point name appears.

**Note** – If you search for a point when a control job is specified, and the system cannot find the point in the current job, the control job is also searched. If the point is found in the control job, it is copied to the current job as a UP record. See also [Setting the control job, page 89](#).

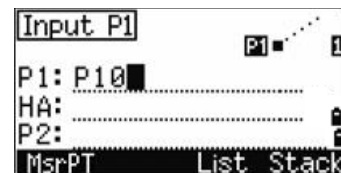
### Down+Out

Choose this option from the Cogo menu to calculate coordinates from Down and Out.

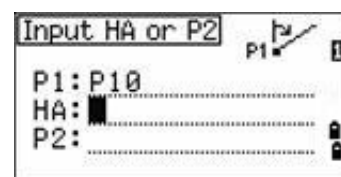
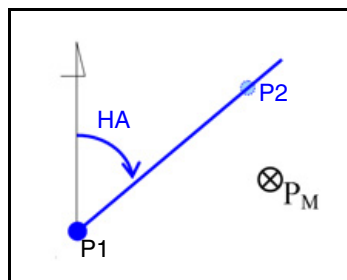
Press **[4]** or select **Down & Out** in the Cogo menu.



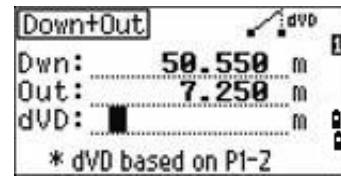
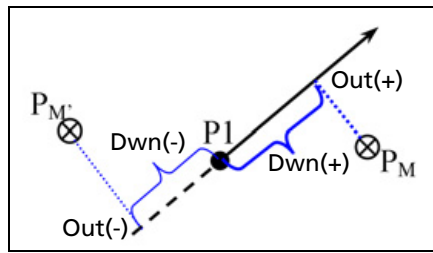
Enter the base point (P1).



Specify the azimuth bearing. To do this, enter a value in the HA or P2 field. P2 is a second point on the line.



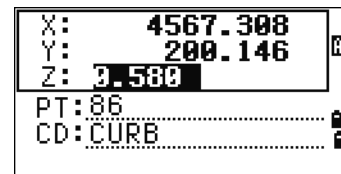
Enter the horizontal distance along the baseline (Dwn), the horizontal distance perpendicular to the line (Out), and the vertical distance (dVD).



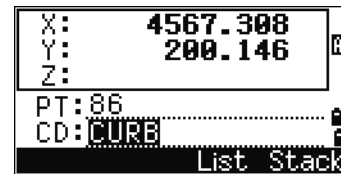
A negative value in the Dwn field means the opposite direction along the defined bearing line.

A negative value in the Out field is for the left-hand side of the bearing line.

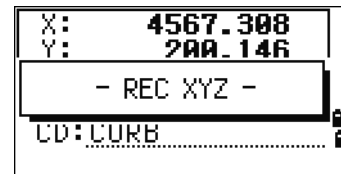
To calculate the coordinates of the point (PM), press **[ENT]** in the dVD field. You can change the Z coordinate here.



To record the point, press **[ENT]** in the CD field.



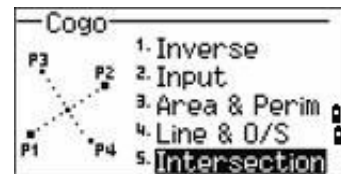
The coordinates are stored as a CC record.



### Intersection

Choose this option from the Cogo menu to calculate coordinates using intersection functions.

Press **[5]** or select **Intersection** in the Cogo menu. The Intersection menu appears. It has four functions for calculating coordinates.

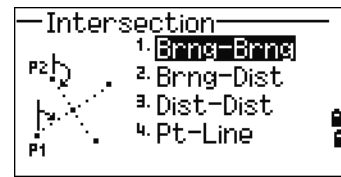




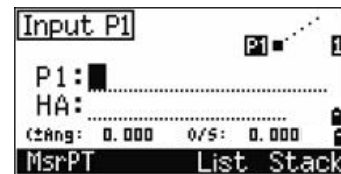
### Calculating a bearing-bearing intersection

A bearing-bearing intersection is the intersection point of two lines. To calculate a bearing-bearing intersection:

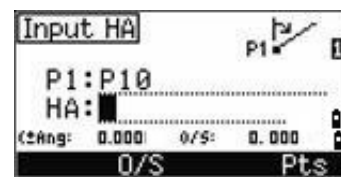
1. Press **[1]** or select **Brng-Brng** in the Intersection menu.
2. Enter the first point name and press **[ENT]**. Alternatively, to measure directly to the point, select the **MSR** softkey.



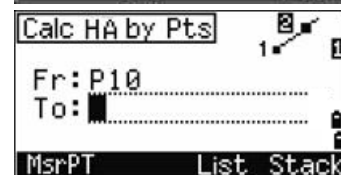
3. Define the first line by azimuth.
4. To define the line by two points, select the **Pts** softkey. The **Fr** field defaults to the P1 point, but you can change the selected point. In the **To** field, enter or measure to the second point.



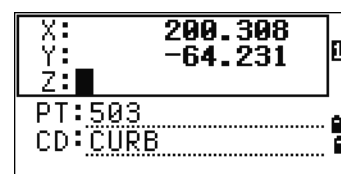
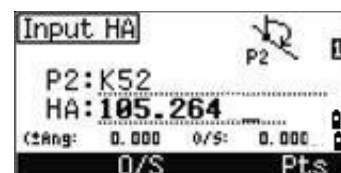
See also [Advanced feature: Entering angle and distance offsets](#), page 82.



5. Do one of the following:
  - To return to the previous screen, press **[ENT]**. The calculated value appears in the HA field.
  - To go to the next screen, press **[ENT]**.
6. Define the second line by two points or by P2 and HA.



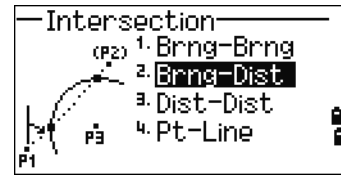
7. To calculate the coordinates of the intersection point, press **[ENT]** in the HA field. The calculated coordinates are displayed. You can input a Z coordinate if necessary.
8. Enter a value in the PT field and in the CD field.
9. To record the point, press **[ENT]**.



### Calculating a bearing-distance intersection

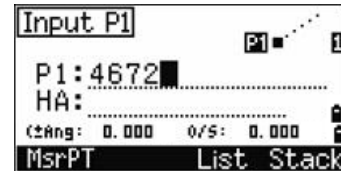
1. Press **2** or select **Brng-Dist** in the Intersection menu.

Brng-Dist calculates the intersection point formed by one line and one distance (radius).

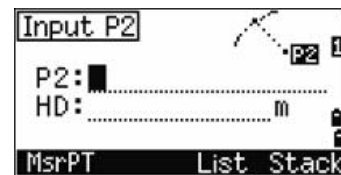


2. Enter a point on the line.

The line can be defined by two points or by a point and an azimuth.

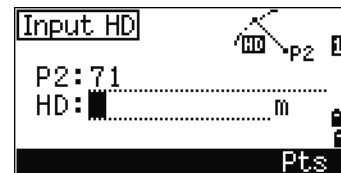


3. Enter the second point (P2) as the center of the circle.

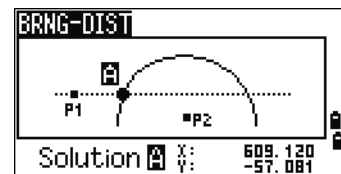


4. Enter the distance from P2:

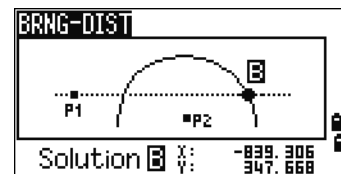
- To define the distance (HD) by two points, select the **Pt** softkey.
- To calculate the coordinates of the intersection point, press **ENT** in the HD field.



5. If there are two results, the first solution appears graphically relative to the P1-P2 line. To display the second solution, press **<** or **>**.

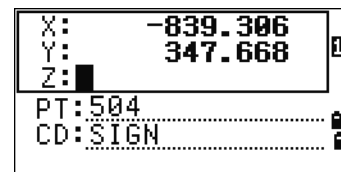


6. To record the point, press **ENT** when the required solution appears.



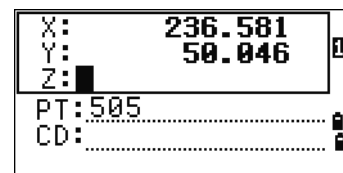
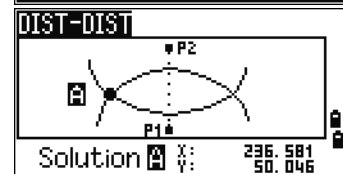
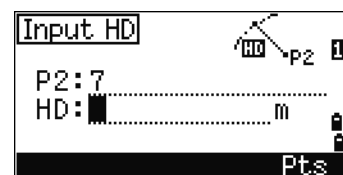
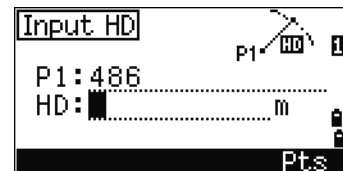
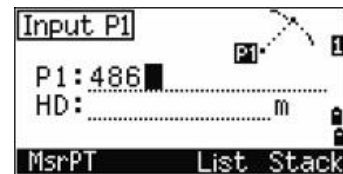
7. Enter a Z coordinate if necessary.

8. To move to the PT and CD fields, press **ENT**.



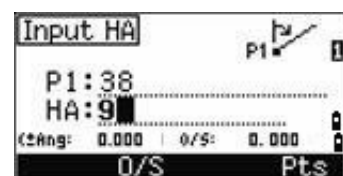
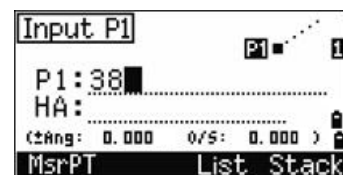
### Calculating a distance-distance intersection

1. Press **[3]** or select **Dist-Dist** in the Intersection menu.
2. Enter the first point name and press **[ENT]**, or select the **Msr** softkey to measure directly to the point.
3. Enter the distance from P1 and press **[ENT]**.
4. To define the distance (HD) by two points, select the **Pts** softkey.
5. Enter P2 and the distance from P2 (HD).
6. To calculate the coordinates of the intersection point, press **[ENT]** in the HD field.
7. Press **[←]** or **[→]** to display the second solution.
8. To record the point, press **[ENT]** when the required solution appears.
9. Enter a Z coordinate if necessary.
10. Press **[ENT]** to move to the PT and CD fields.

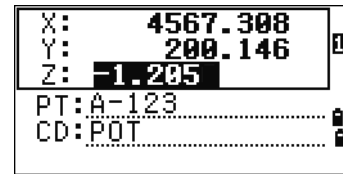
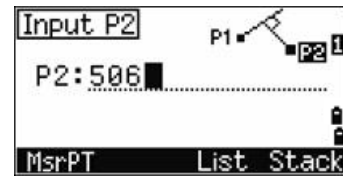


### Calculating a point-line intersection

1. Press **[4]** or select **Pt-Line** in the Intersection menu.
2. Enter the first point name and press **[ENT]**, or select the **Msr** softkey to measure directly to the point.
3. Enter the azimuth, or select the **Pts** softkey to enter another point name on the line.

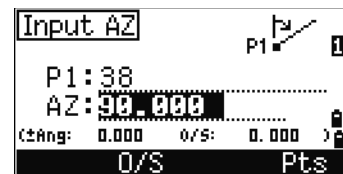


4. Enter the perpendicular point to the line, or select the **MSR** softkey to take a measurement to the point.
5. To calculate the coordinates of the intersection point, press **ENT**.  
If P1 and P2 are 3D points, the Z coordinate of the perpendicular point is calculated relative to the P1-P2 slope.
6. Enter PT and CD then press **ENT** to record the point.

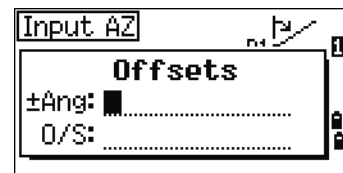
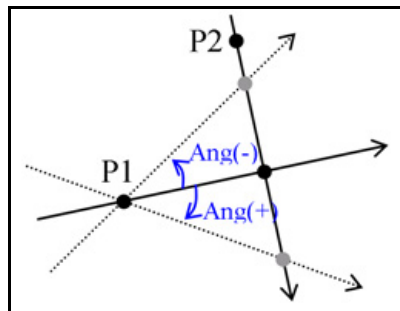


**Advanced feature: Entering angle and distance offsets**

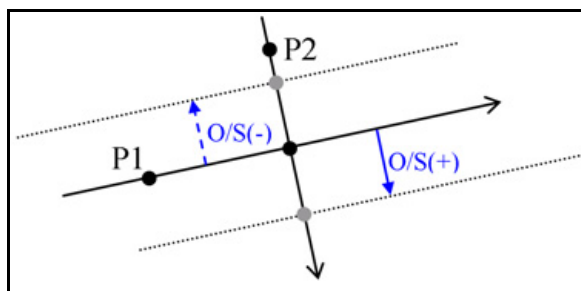
To display the offset input screen, select the **O/S** softkey.



In the **Ang** field, enter a positive value to rotate the line clockwise. Enter a negative value to rotate the line counter clockwise.



In the **O/S** field, enter a positive value to specify an offset to the right. Enter a negative value to specify an offset to the left.



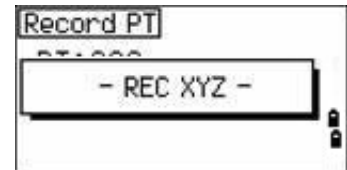
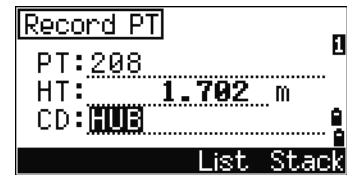
## Recording measurement data

To record points from any observation screen, press **[ENT]**.

PT defaults to the last recorded PT, + 1.

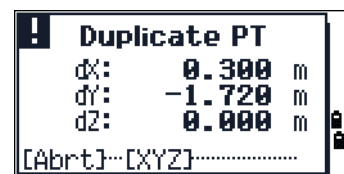
You can enter the PT name from the point list or the point stack. See [Entering a point from the point list, page 49](#), and [Entering a point from the point stack, page 49](#).

To record the point, press **[ENT]** on the last field.



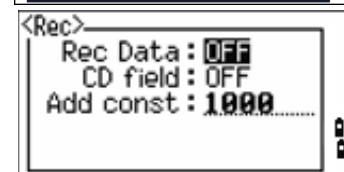
If HA or VA is moved after you take a measurement, but before you press **[ENT]**, the recalculated coordinates will be stored.

If the point name that you want to record already exists in the job, an error message appears. Depending on the type of existing record, you can overwrite the old record with the new data. See [Recording data, page 125](#).



If you do not need to record data, press **[MENU]** and set **Settings / Rec** to OFF.

The default setting is OFF.



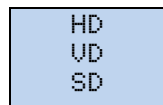
## Switching between display screens

Press **[DSP]** to switch between display screens. See the **[DSP]** button, [page 40](#). Each time you press **[DSP]**, the next screen appears. When you press **[DSP]** in the final screen, the first screen appears.

The following line display screens are available.

LINE1	LINE2	LINE3	LINE4
DOWN	X	HA	HA
OUT	Y	VA	VD
dZ	Z	SD	HD

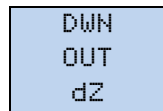
**LINE5**



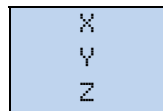
The LINE5 screen is available only if the secondary distance unit is set. See also [Other settings, page 94](#).

The following arc display screens are available.

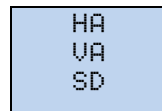
**ARC1**



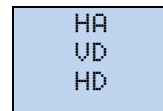
**ARC2**



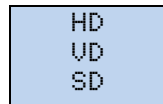
**ARC3**



**ARC4**



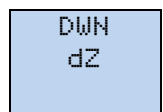
**ARC5**



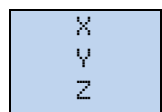
The ARC5 screen is available only if the secondary distance unit is set. See also [Other settings, page 94](#).

The following plane display screens are available.

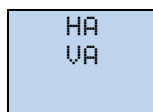
**PLN1**



**PLN2**



**PLN3**



## Menu Screen

### In this chapter:

- Job
- Settings (basic job settings)
- Data
- Communication
- 1sec-Key
- Calibration
- Time

Use the MENU screen to access functions and settings.

To display the MENU screen, press the **MENU** key.

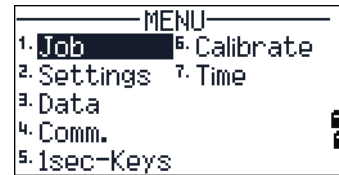
## Job

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

To open the Job Manager, press **F1** or select Job from the MENU screen.

If jobs are stored on the TS635 construction total station, the job list appears. It shows all the stored jobs with the newest job at the top of the list. See [Opening an existing job, page 86](#).

If no jobs are stored, the Create Job screen appears. See [Creating a new job, page 86](#).



### Opening an existing job

The job list shows all the jobs stored on the instrument, in descending date order.

The following symbols provide extra information about jobs:



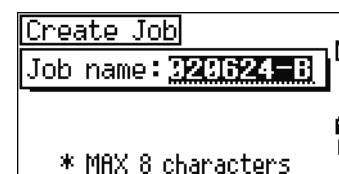
Symbol	Meaning
*	Current job
@	Control job
!	Some of the job settings are different from the current job

Press **▲** to move up or **▼** to move down the job list. Press **ENT** to open the highlighted job.

When you open a job, all job settings are automatically changed to match those used in the open job.

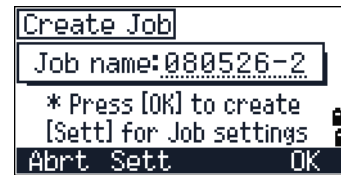
### Creating a new job

- Select the **Cr eat** softkey in the job list.
- Enter a job name of up to eight characters. Select **ENT**.
- Do one of the following:





- To check the job settings, select the **Sett** softkey.
- To create a new job using the current job settings, press **ENT** or select the **OK** softkey.



## Job settings

Job settings are separate from other temporary settings.

Job settings are established when a job is created, and cannot be changed. This ensures that the data in a job is correctly stored in the database, and that all necessary corrections are applied when you store each record.

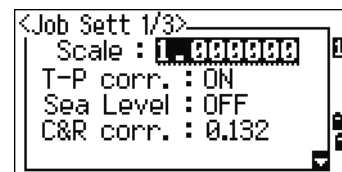
To move between fields, press **▲** or **▼**. Alternatively, to move to the next field, press **ENT**.

To change the setting in the selected field, press **◀** or **▶**.

To confirm the job settings and create the job, press **ENT** in the last field.

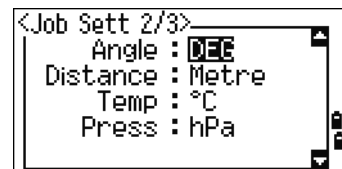
### Screen 1

Scale Factor	0.999600 to 1.000400
T-P correction	ON / OFF
Sea Level	ON / OFF
C&R correction	OFF / 0.132 / 0.200



### Screen 2

Angle unit	DEG / GON / MIL
Distance unit	Metre / US-Ft / I-Ft
Temp unit	°C / °F
Press unit	hPa / mmHg / inHg



**Screen 3**

If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.



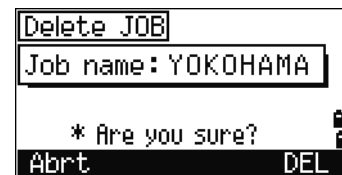
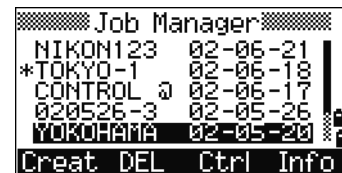
VA zero            Zenith / Horizon  
 Order             NEZ / ENZ



**Deleting a job**

*Note* – There is no undelete function in Job Manager. Before you press **ENT** or select **DEL**, make sure that the selected job is the one that you want to delete.

1. In the job list, highlight the job to delete.
2. Select the **DEL** softkey. A confirmation screen appears.
3. Do one of the following:
  - To delete the selected job, press **ENT** or select the **DEL** softkey.
  - To cancel the deletion and return to the previous screen, press **ESC** or select the **Abt t** softkey.



After you delete a job, the job list appears.



## Setting the control 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.

To set the control job:

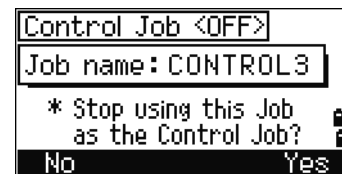
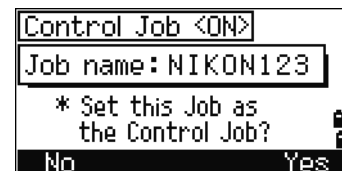
1. Highlight the job that you want to use as the control job.
2. Select the **Ctrl 1** softkey.

A confirmation screen appears.

3. Do one of the following:
  - To set the selected job as the control job, press **ENT** or select the **Yes** softkey.
  - To cancel the process, press **ESC** or select the **No** softkey.

If a control job is already assigned, the newly assigned control job replaces it as the control job.

To clear the selected control job, highlight the current control job in the job list and select the **Ctrl 1** softkey. Then press **ENT** or select the **Yes** softkey.

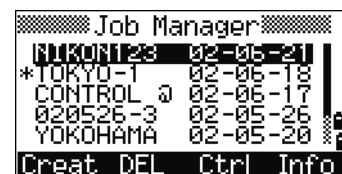


## Displaying job information

To display job information, highlight the job name and then select the **Info** softkey.

The Information screen shows the number of records in the job, the free space, and the date when the job was created. Free space indicates how many points can be stored in the job.

To return to the job list, press any button.

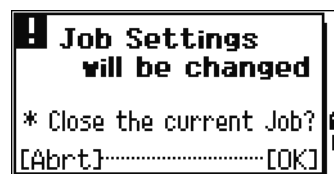
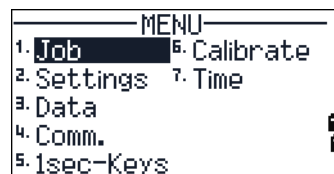


## Settings (basic job settings)

Use the Settings menu to configure the basic job settings.

Press **[2]** or select **Settings** on the MENU screen.

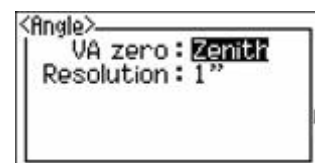
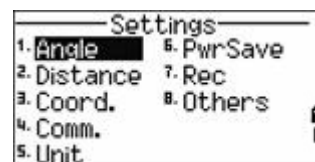
Some job settings, as identified in the following sections, cannot be changed once a job is created. If you attempt to change any of these settings while a job is open, a confirmation screen appears, asking you to create a new job with the new settings, or to work with the new settings without recording any data. See [Settings, page 126](#).



### Angle

To change the angles, press **[1]** or select **Angle** in the Settings menu.

VA zero	Zenith / Horizon
Resolution	1" / 5" / 10"
	0.2 / 1 / 2 mgon
	0.005 / 0.02 / 0.05 mil



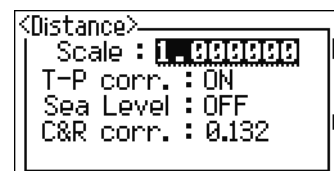
The VA zero job setting cannot be changed once a job is created.

### Distance

These settings cannot be changed once a job is created.

To change the distance, press **[2]** or select **Distance** in the Settings menu.

Scale	Numeric value between 0.999600 and 1.000400
T-P corr	ON / OFF
Sea Level	ON / OFF
C&R corr	OFF / 0.132 / 0.200



### Temperature and pressure corrections

$$K = 275 - \frac{106 \times P \times \left( \frac{10000.0}{13.5951 \times 980.665} \right)}{273 + T}$$

$$SD' = \left( 1 + \frac{K}{1000000} \right) \times SD$$

SD	Slope dist. (before adj.)
SD'	Slope dist. (after adj.)
K	Compensation coefficient
P	Pressure (hPa)
T	Temperature (°C)

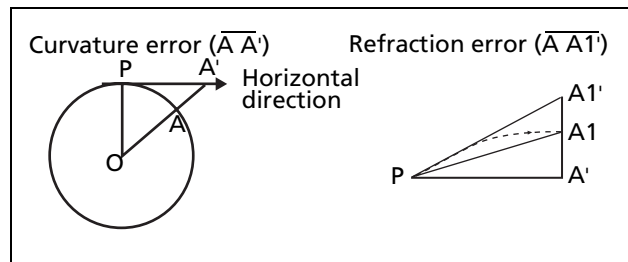
### Sea-level corrections

$$HD' = \frac{HD \times R_e}{R_e + Z_{STN}}$$

HD	Horizontal dist. (before adj.)
HD'	Horizontal dist. (after adj.)
Z <sub>STN</sub>	Instrument-Z
R <sub>e</sub>	6370 km

## Curvature and refraction corrections

Because the surface of the earth is curved, the vertical difference (VD and Z) at the measurement point, as referenced to the horizontal plane, inevitably includes some error. This error is called **curvature error**. Also, because the density of the air surrounding the earth decreases with altitude, light is refracted at different rates at different altitudes. The error caused by this change in refraction is called **refraction error**.



$$HD' = HD - \frac{SD^2 \sin(2VA)}{2R_e} \left(1 - \frac{k}{2}\right)$$

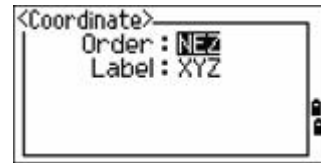
$$VD' = VD + \frac{HD^2}{2R_e} (1 - k)$$

HD	Horizontal dist. (before adj.)
HD'	Horizontal dist. (after adj.)
VD	Vertical dist. (before adj.)
VD'	Vertical dist. (after adj.)
SD	Slope dist
VA	Vertical angle
$R_e$	6370 km
k	C&R constant (0.132 or 0.200)

## Coordinate

Press **[3]** or select **Coord.** in the Settings menu. The Coordinate menu appears.

Order	NEZ / ENZ
Label	XYZ / YXZ / NEZ(ENZ)



The Order and AZ job settings cannot be changed once a job is created.

## Communications

Press **[4]** or select **Comm.** in the Settings menu. The Communication menu appears.

Ext.Comm	NIKON / SET
Port	Serial/Bluetooth
Baud (bps)	1200 / 2400 / 4800 / 9600 / 19200 / 38400
Length	7 / 8
Parity	EVEN / ODD / NONE
Stop bit	1 / 2



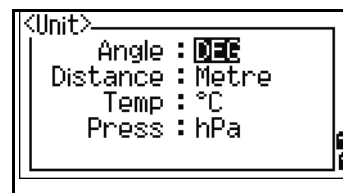
See also [Appendix B, Transferring Coordinate Data](#).

## Unit

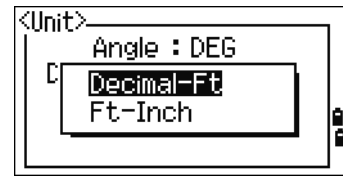
**Note** – The Angle, Distance, Temp, and Press job settings cannot be changed once a job is created.

Press **[5]** or select **Unit** in the Settings menu. The Unit menu appears.

Angle	DEG (Degree) GON (GON) MIL (Mil6400)
Distance	Meter US-Ft I-F
Temp	°C (Celsius) °F (Fahrenheit)
Pressure	hPa mmHg inHg



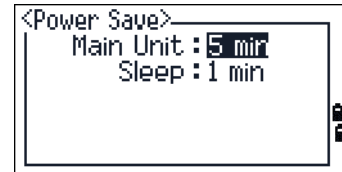
If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.



### Power saving

To open the Power Save menu, press **[4]** or select **Power Save** in the Settings menu.

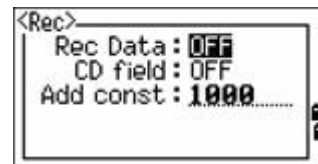
Main unit      OFF / 5 min / 10 min / 30 min  
 Sleep            OFF / 1 min / 3 min / 5 min



### Recording

Press **[7]** or select **Rec** in the Settings menu. The Rec Menu appears.

Rec Data        ON / OFF  
 CD field        ON / OFF  
 Add const      Integer between 1 and 999,999

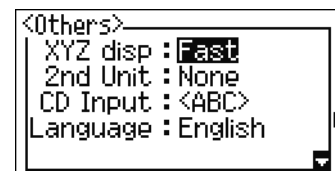


- If you need to record coordinate data from your observations, set the Rec Data field to ON.
- If you would like to record a feature code when you record coordinate data, set the CD field to ON. The CD field appears in the Recording PT screen.
- This field sets the default point number for the observed coordinate data when you select Layout / XYZ.

### Other settings

Press **[8]** or select **Other** in the Settings menu. The Others menu appears.

XYZ disp        Fast / Normal / Slow / +ENT  
 2nd Unit        None / Meter / US-Ft / I-Ft  
 CD Input        123 / ABC  
 Language        English / French / German / Italian / Dutch  
 Owner's Detail    Up to 20 characters

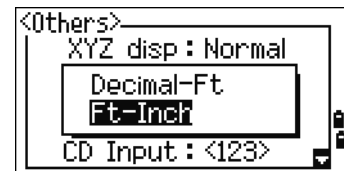




XYZ disp defines the speed to move to the next screen after showing XYZ of the input point.

When the secondary unit is set to a unit, an extra display screen is available in the BMS, layout observation screens, and L-O from line screens. The extra screen shows the HD, VD, and SD in the secondary unit.

If you select US-Ft or I-Ft, an additional settings screen appears. Use this screen to specify whether to display values in Decimal-Ft or Ft-Inch.



The CD Input field sets the default input mode when a CD field appears.

In the Language field, use  $\leftarrow$  /  $\rightarrow$  to open the language screen and  $\uparrow$  /  $\downarrow$  to select the required language. Press  $\text{ENT}$  to confirm. In the Reboot confirmation screen, press  $\text{ENT}$  to restart the instrument. The instrument reboots and shows the start-up screen in the selected language. Then a regional setting screen appears, in which you can quickly configure the instrument to a pre-set combination of the default regional settings. See [Regional configuration, page 45](#).

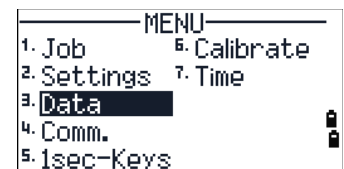


The Owner's Detail field allows you to enter your name or the name of your company. If you enter a value in this field, it appears when you start the TS635 construction total station.



## Data

Use the Data menu to view or edit records. To access it, press  $\text{3}$  on the MENU screen.

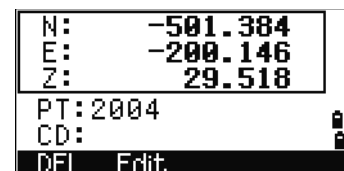


### Viewing coordinate data

Coordinate data appears in a list, with the newest record at the bottom of the screen. Use  $\uparrow$  or  $\downarrow$  to scroll through the records. Use  $\leftarrow$  or  $\rightarrow$  to move up or down one page.



Press  $\text{ENT}$  to see more detailed information about the selected record.



The header (XYZ, YXZ, NEZ, or ENZ) depends on the Coord. Label setting, which is accessed by pressing **MENU** and then selecting **Settings / Coord**. See also [Coordinate, page 93](#).

## UP, MP, CC, SS, and SO records

All coordinate records contain PT, CD, X, Y, and Z fields.

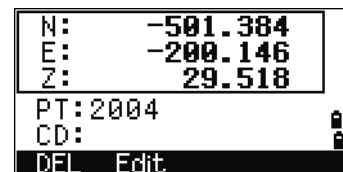
- UP records are uploaded point coordinates.
- MP records are manually input point coordinates.
- CC records are points calculated in Cogo.
- SS records are sideshot records stored in the BMS.
- SO records are stored in layout functions.

## Deleting coordinate records

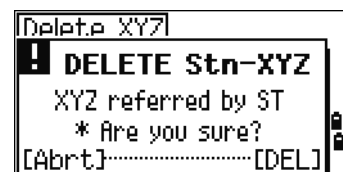
1. In the XYZ screen, use **▲** or **▼** to highlight the record that you want to delete. Then select the **DEL** softkey.
  - a. To delete the selected record, press **ENT** or select the **Yes** softkey.
  - b. To cancel the deletion of data, press **ESC** or select the **No** softkey.



Alternatively, delete coordinate data by selecting the **DEL** softkey in the detailed display screen for the record.



If the record that you want to delete is referred by any station record, a confirmation message appears.



## Editing coordinate records

You can edit point, CD, and coordinate values in coordinate records. However, you cannot edit the coordinate record for the current station.

1. Do one of the following:
  - In the XYZ screen, use **[↑]** or **[↓]** to highlight the record to edit. Then select the **Edit** softkey.
  - In the detailed data screen, select the **Edit** softkey.
2. Use **[↑]** or **[↓]** to highlight a field. Then modify the value in the selected field.
3. When you have finished editing, press **[ENT]** in the CD field.  
A confirmation screen appears.
4. Do one of the following:
  - To accept the changes and return to the data view screen, press **[ENT]** or select the **Yes** softkey.
  - To go back to the edit screen, press **[ESC]** or select the **No** softkey.



## Searching coordinate records

You can search for records by their type, point name, code, or by any combination of these values.

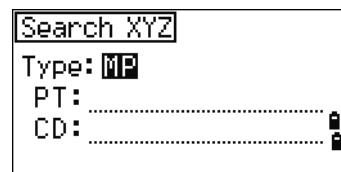
In the XYZ screen, select the **Srch** softkey to access the XYZ data search function.

To search for a record by point name, enter the point name in the PT field and press **[ENT]** twice.

You can use the asterisk (\*) as a wildcard. For example, when you enter **500\*** in the PT field, the search matches the points named 500, 500-1, 500-A, and 5000.

To search for a record by point type, move to the Type field and use **[←]** or **[→]** to change the selected point type. The options are ALL, MP, UP, CC, and RE.

- If more than one point matches the search criteria, the matching points are displayed in a list.

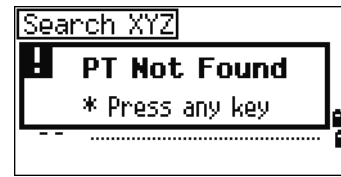


Use **[↑]** or **[↓]** to highlight the required point. Press **[ENT]** to select it.

Detailed data for the selected record appears. Select the **Disp** softkey to change the fields shown.

Press **[ESC]** to return to the list.

- If no point matches the specified criteria, an error screen appears. Press any button to return to the data screen.



### Entering coordinates

In the XYZ screen, select the **Input** softkey. A new input point screen appears.

The PT field defaults to the last recorded PT + 1, but you can change the value shown.

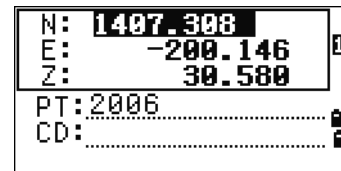
Enter the PT and CD and then press **ENT** to enter coordinates.

Use the numeric keys to enter the coordinates. Press **ENT** or **v** in each field to move to the next field.

When you press **ENT** in the CD field, the point is stored as an MP record.

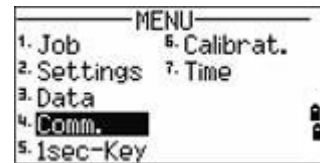
After you have recording a point, the next point input screen is shown with the updated default PT.

You can record NE, NEZ, or Z-only data.



## Communication

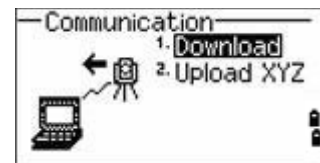
Use the Communication menu to download or upload data. To access it, press **[4]** or select **Comm.** on the MENU screen.



### Downloading coordinate data

To change the download settings, press **[1]** or select **Download** in the Communication menu.

Format	NIKON (Fixed)
Data	Coordinate (all) Coordinate (layout records only)

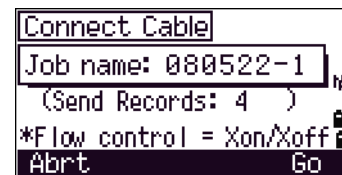


To display the total number of records that will be downloaded, press **[ENT]** in the Data field.

As each record in the current job is output from the TS635 construction total station, the current line number is updated.

Once transferring is completed, you can choose whether to delete the current job:

- To delete the current job, press **[4]**.
- To return to the Basic Measurement Screen (BMS) without deleting the current job, press **[ESC]** or select the **Abt** softkey.



### Uploading coordinate data

To upload coordinate data from a computer, press **[2]** or select **Upload XYZ** in the Communication menu.

The default data format appears.

To change the order of data fields, select the **Edit** softkey. See also [Advanced feature: Editing the data order for upload](#), page 100.

Otherwise, press **[ENT]**.

Select the **Job** softkey to go to the Job Manager screen. See also [Job](#), page 86.

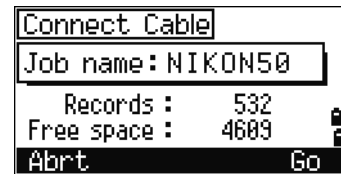


To change the communication settings, select the **Comm** softkey. The serial port settings must match the settings used by the terminal software on the computer.



Use an RS-232C cable to connect the TS635 construction total station to the computer. In the terminal program, set flow control to Xon/Xoff.

The Free space field shows the number of points that can still be stored on the TS635 construction total station.



Press **ENT** to put the TS635 construction total station in receive mode. On the computer, choose the Send Text File command in the terminal program to start sending data.

As each point is received by the instrument, the value in the Records field is incremented.

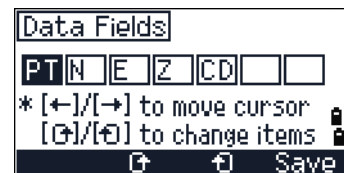
If you press **ESC** during data upload, the upload is canceled and the display returns to the Communication menu. Records that were received before you pressed **ESC** are stored in the job.

During upload, the system will truncate any code that is longer than 16 characters.

If the existing point is a UP, CC, or MP record, and it is not referred to by any station or backsight, it is automatically overwritten by the uploaded point. No error message appears.

### Advanced feature: Editing the data order for upload

1. Select the **Edit** softkey. The Data Fields screen appears.
2. To move between the fields, press **←** or **→**.
3. To change the selected item in a field, use the **↑** and **↓** softkeys. The options are PT, N, E, Z, CD, or blank.
4. To save your changes and return to the previous screen, select the **Save** softkey.



For example, if your original data is as follows:

```
1, 30.000, 20.000, L1
```

and you set the data fields to PT N E CD, then the uploaded data is:

```
PT=1, N=30.000, E=20.000, CD=L1
```

For more information about coordinate data, see [Transferring coordinate data to the total station, page 118](#).

## Uploading coordinates without points

You can upload data without points. If you do not include a point in the format definition, each line of data is automatically assigned the next available point number. To help you to select points in the field, make sure that you store an identifier in the CD field.

The data format cannot include duplicate items. Use PT, N, E, Z, and CD once each in the data format.

To skip an item in your original file, set the corresponding field to blank.

## 1sec-Key

Use the 1sec-Key menu to configure the settings for the one-second buttons, **[MSR1]**, **[MSR2]**, and **[DSP]**.

To access it, press **[5]** or select **1sec-Keys** in the MENU screen.



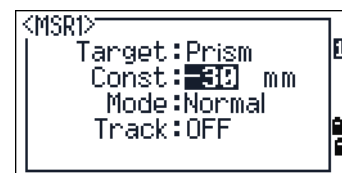
### **[MSR]** button settings

There are two **[MSR]** buttons:

- To change the settings for the **[MSR1]** button, press **[1]** or select MSR1.
- To change the settings for the **[MSR2]** button, press **[2]** or select MSR2.

Each **[MSR]** button has four settings.

In the Const and Track field, use the numeric keys to enter values. In the other fields, use **[<]** or **[>]** to change the settings.



**Tip** – To quickly access the settings screen, hold down **[MSR1]** or **[MSR2]** for one second.

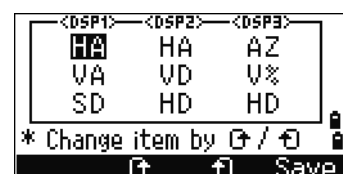
### **[DSP]** button settings

To change the display items in the BMS and in Layout observation screens, press **[2]** or select **[DSP]** in the 1sec-Keys menu.



To move the cursor, use **[<]**, **[>]**, **[^]** or **[v]**. To change the display item, press either the **[+]** softkey or the **[=]** softkey.

To save the changes, press **[ENT]** from the last line of **<DSP3>** or select the **Save** softkey.





**Tip** – To quickly access the DSP settings screen, hold down **[DSP]** for one second.

## Calibration

Use the Calibration screen to calibrate the instrument if required. To access the Calibration screen, press **[6]** or select **C a l i b r a t** from the MENU screen.

See also [Adjusting the calibration, page 106](#).



## Time

Use the Date & Time screen to set the current date and time.

1. Press **[7]** or select **T i m e** on the MENU screen. The Date & Time screen appears.

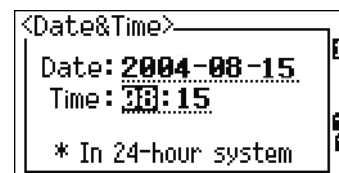
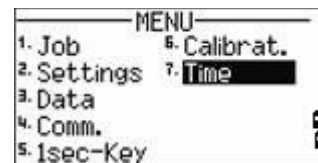
The current date and time settings are displayed.

2. Enter the date in Year-Month-Day format. For example, to change the date to August 15, 2006 press **[2][0][0][6][ENT][8][ENT][1][5][ENT]**.

If the highlighted part of the field ( for example, the year) is already correct, press **[ENT]** to use the current value. For example, if the date is already set to August 20, 2006, and you want to change the date to August 25, 2006, press **[ENT][ENT][2][5][ENT]**.

3. To move to the Time field, press **[ENT]** from the *Date* field:
4. Enter the time in 24-hour format. For example, to set the time to 4:35 PM, press **[1][6][ENT][3][5][ENT]**.
5. Do one of the following:

- To finish setting the date and time, press **[ENT]** in the Minutes field.
- To cancel the changes, press **[ESC]**.





## Checking and Adjusting

### In this chapter:

- Adjusting the electronic level
- Checking and adjusting the circular level
- Zero point errors of vertical scale and horizontal angle corrections
- The instrument constant
- Checking and adjusting the laser pointer

This chapter describes how to check the accuracy of the TS635 construction total station, and if necessary, adjust the required settings.

## Adjusting the electronic level

To adjust the electronic level, Zero point errors of vertical scale and horizontal angle corrections are used. See page 105.

## Checking and adjusting the circular level

Once you have checked and adjusted the electronic 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 of either circular level on the instrument main body or tribrach until the bubble is centered.

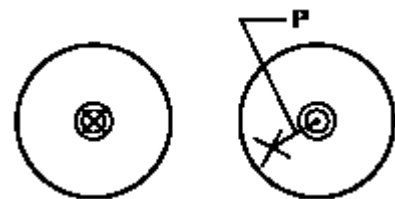


## Checking and adjusting the optical/laser plummet

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

To check and adjust the optical/laser 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.
3. Do the following:
  - Look through the optical plummet and then adjust the leveling screws until the image of the X is in the center of the reticle mark.
  - For the laser plummet, adjust the laser pointer to the X.
4. Rotate the alidade by 180°.
  - If the marked image is in the same position in the center of the reticle mark, no adjustment is required.



For the laser plummet, if the laser pointer is on the X, no adjustment is required.

5. If the image or laser pointer is not in the same position, adjust the optical or laser plummet:
  - a. 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 .
  - b. Repeat from Step 2. For laser plummet adjustment, you must remove a cap.



## Zero point errors of vertical scale and horizontal angle corrections

### Checking the calibration

1. Set up the instrument on the tripod.
2. Follow the leveling procedures described in [Leveling the instrument, page 28](#).
3. Flip the telescope to the Face-1 position. The display and tangent screws are facing towards you.
4. Sight a target that is within 45° of the horizontal plane.
5. Read the vertical angle from the VA1 field in the Basic Measurement Screen (BMS).
6. Rotate the instrument 180° and flip the telescope to the Face-2 position. The display and tangent screws are turned away from you.
7. Read the vertical angle from the VA2 field.
8. Add the two vertical angles together, VA1 + VA2.
  - No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Zenith, and VA1 + VA2 equals 360°.
  - No adjustment is required if the zero reference for vertical angles (VA zero setting) is set to Horizon, and VA1 + VA2 is either 180° or 540°.
  - An adjustment is required if VA1 + VA2 is not one of the values listed above.

**Note** – The difference between the vertical angle reading the relevant angle (either 360° for Zenith, or 180° or 540° for Horizon) is called the **altitude constant**.

### Adjusting the calibration

1. Press **[MENU]** and **[6]**. The calibration screen appears.
2. Take an F1 measurement to a target on the horizon. Press **[ENT]**.

The calibration fields for F1 are:

X1	Face-1 X-axis tilt value
Y1	Face-1 Y-axis tilt value
VA1	Face-1 vertical angle (tilt-off value)
HA1	Face-1 horizontal angle (tilt-off value)



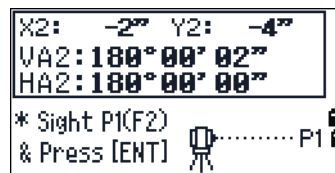
The vertical angle is shown in the V0 dir= Horiz setting.

When you have taken the measurement, the message on the bottom line changes from DO NOT TOUCH! to Turn to F2.

3. Take an F2 measurement to the same target. Press **[ENT]**.

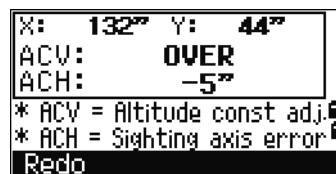
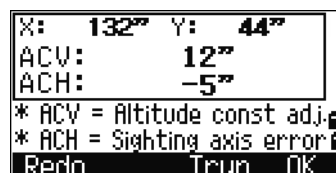
The TS635 construction total station has horizontal and vertical axis adjustment:

X2	Face-2 X-axis tilt value
Y2	Face-2 Y-axis tilt value
VA2	Face-2 vertical angle (tilt-off value)
HA2	Face-2 horizontal angle (tilt-off value)



When the observation on F2 is completed, four parameters are displayed.

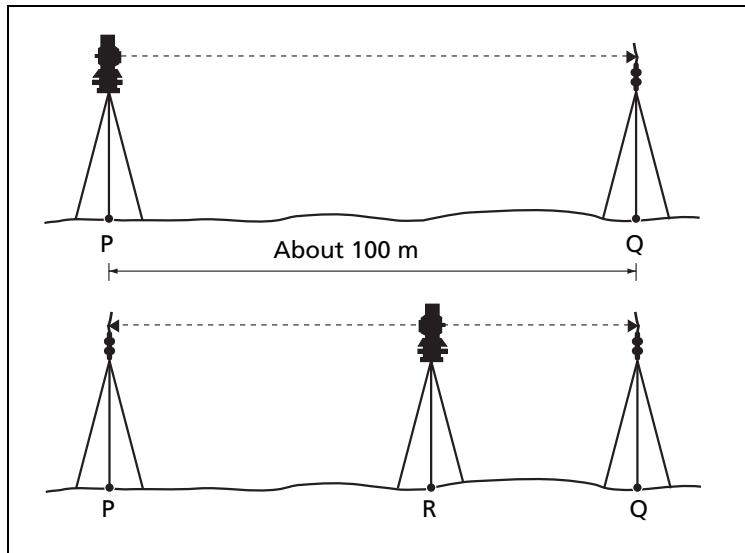
4. Do one of the following:
  - To return to the first observation screen, press **[ESC]** or select the **Redo** softkey.
  - To set parameters on the instrument, press **[ENT]** or select the **OK** softkey.
5. If ACV, ACH, or Tilt is out of range, OVER appears. Press any key to return to the first observation screen.



## 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 at the factory. However, to ensure the highest operational accuracy, we recommend that you check the instrument constant several times a year.

The following figure shows the setup to check the instrument constant.



To check the instrument constant, either compare a correctly measured base line with the distance measured by the EDM, or carry out the following procedure.

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 TS635 construction total station to the tripod at Point R.
7. Measure the distance from Point R to Point P (RP), and the distance from Point R to Point Q (RQ).
8. Calculate the difference between the value of PQ and the value of  $RP + RQ$ .
9. Move the TS635 construction 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 differences.  
The error range is within 3 mm. ***If the error is out of range, contact your dealer.***

## Checking and adjusting the laser pointer

The TS635 construction total station uses a red laser beam to measure and as a laser pointer. The laser pointer is coaxial with the line of sight of the telescope. If the instrument is well adjusted, the red laser pointer coincides with the line of sight. External influences such as shock or large temperature fluctuations can displace the red laser pointer relative to the line of sight.

# Specifications

## In this chapter:

- Measurement range
- Distance precision
- Measurement intervals
- Angle measurement
- Tilt sensor
- Tangent screws
- Tribrach
- Level
- Display and keypad
- Connections in the base of instrument
- Battery pack
- Environmental performance
- Dimensions
- Weight
- Standard components
- External device connector

This appendix details the specifications and standard components of the TS635 construction total station. It also describes the connector that is used to connect the instrument to an external power source or to communicate with an external device.

## Main body

### Telescope

Tube length	125 mm (4.91 inch)
Magnification	30×
Effective diameter of objective	45 mm (1.77 inch) EDM 50 mm (1.97 inch)
Image	Erect
Field of view	1°20' 2.3 m at 100 m (2.3 ft at 100 ft)
Resolving power	3.0"
Focussing distance	1.5 m to infinity (59 inch to infinity)

### Measurement range

Distances shorter than 1.5 m (4.92 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)
Standard prism (1P)	5,000 m (16,400 ft)
Reflectorless mode	
Reference target	300 m (984 ft)

**Notes –**

*The target should not receive direct sunlight.*

*“Reference target” refers to a white, highly reflective material (KGC 90%).*

*In reflectorless mode, the maximum measurement range is 500 m (1,640 feet).*



## Distance precision

Precise mode	
Prism mode	$\pm (3 + 2 \text{ ppm} \times D) \text{ mm}$ –10 °C through +40 °C (+14 °F through +104 °F) $\pm (3 + 3 \text{ ppm} \times D) \text{ mm}$ (–20 °C through –10 °C), (+40 °C through +50 °C) (–4 °F through +14 °F), (+104 °F through +122 °F)
Reflectorless mode	$\pm (3 + 2 \text{ ppm} \times D) \text{ mm}$ –10 °C through +40 °C (+14 °F through +104 °F) $\pm (3 + 3 \text{ ppm} \times D) \text{ mm}$ (–20 °C to –10 °C), (+40 °C through +50 °C) (–4 °F through +14 °F), (+104 °F through +122 °F)
Normal mode	
Prism mode	$\pm (10 + 5 \text{ ppm} \times D) \text{ mm}$
Reflectorless mode	$\pm (10 + 5 \text{ ppm} \times D) \text{ mm}$

## Measurement intervals

Measurement intervals may vary with the measuring distance or weather conditions; At the initial measurement, it may take longer.

Precise mode	
Prism mode	1.5 sec.
Reflectorless mode	1.8 sec.
Normal mode	
Prism mode	0.8 sec.
Reflectorless mode	1.0 sec.
Prism offset correction	–999 mm to +999 mm (1 mm step)

### Angle measurement

Reading system	Absolute encoder
	Diametrical reading on HA Single reading on VA
360°	1"/5"/10"
400G	0.2 mgon / 1 mgon / 2 mgon
MIL6400	0.005 mil / 0.02 mil / 0.05 mil
DIN18723 accuracy	5" / 1.5 mgon

### Tilt sensor

Method	Liquid-electric detection
Compensation range	±3°

### Tangent screws

Type	Friction clutch endless fine motion
------	-------------------------------------

### Tribrach

Type	Detachable
------	------------

### Level

Electronic level	Displayed on the LCD
Circular level vial	Sensitivity 10' / 2 mm

### Optical plummet (Optional)

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

## Laser plummet

Wave length	635 nm
Laser class	Class 2
Focussing range	$\infty$
Laser diameter	Approximately 2 mm

## Display and keypad

Display type	Graphical LCD
Resolution	128 × 64
Display illumination	Backlight
Keys	25

## Connections in the base of instrument

Communications	
Type	RS-232C
Maximum baud rate	38400 bps asynchronous
External power supply input voltage	4.5 V through 5.2 V DC

## Battery pack

Output voltage	3.8 V DC rechargeable
Continuous operation time	
Continuous distance/angle measurement	10 hours
Distance/angle measurement every 30 seconds	16 hours
Continuous angle measurement	30 hours

**Note** – Tested at 25 °C (77 °F) (normal temperature). Operation times may vary depending on the condition and deterioration of the battery.

## Environmental performance

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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	149 mm W x 145 mm D x 306 mm H (6.6 inch W x 6.8 inch D x 13.7 inch H)
Carry case	435 mm W x 206 mm D x 297 mm H (18.5 inch W x 13.8 inch D x 9.1 inch H)

---

## Weight

---

Main unit (without battery)	Approximately 3.5 kg (7.7 lbs)
Battery	Approximately 0.1 kg (0.22 lbs)
Carry case	Approximately 2.4 kg (5.29 lbs)
Charger and AC adapter	Approximately 0.4 kg (0.9 lbs)

---

## Environmental protection

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Watertight/dust-proof protection	IP66
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## Standard components

- Instrument main body
- Battery pack (x 2)
- Universal charger, power cord, and adaptors
- Adjustment pin, Allen wrench
- The *TS635 Construction Total Station User Guide* (this document)
- Carry case

## External device connector

This connector can be used to connect to an external power source or to communicate with an external device.

Before using the external device connector, make sure that the external device meets the specifications below.

<b>Input voltage</b>	4.5 V DC to 5.2 V DC
<b>System</b>	RS-232C
<b>Signal level</b>	±9 V standard
<b>Maximum baud rate</b>	38400 bps asynchronous
<b>Compatible male connector</b>	Hirose HR10A-7P-6P or HR10-7P-6P



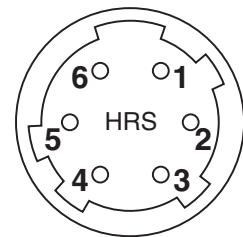
**CAUTION** – Except when connected as shown in the [System diagram, page 14](#), use of the Hirose HR10A-7P-6P or HR10-7P-6P is at your own risk.



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

The external device connector is a Hirose HR 10A-7R-6S female connector. The pinouts for connecting the instrument to an external device connector are shown below:

Pin	Signal	Description
1	RxD	Receive data (Input)
2	TxD	Send data (Output)
3	NC	No connection
4	V	Power
5	GND	Ground
6	NC	No connection



**CAUTION** – Only use the pin connections shown above. Using other connections will damage the instrument.



**CAUTION** – The TS635 total station has different pin assignments from other Construction total stations.

To connect to an external power source, supply power to Pin 4 (power terminal) and Pin 5 (ground terminal) on the instrument. The instrument will use the external power source even if the internal battery packs is attached.



**CAUTION** – Make sure that the power supplied is within the rated input range (4.5 V to 5.2 V, 1 A maximum). Power supplied outside this range will damage the instrument.

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.

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

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.

## Transferring Coordinate Data

### In this chapter:

- Transferring coordinate data to the total station
- Transferring coordinate data from the total station

The TS635 construction total station uses lists of coordinate data. This chapter describes how to transfer data between the total station and the office computer.

## Transferring coordinate data to the total station

### Settings

To configure the transmission speed and other settings, press **(MENU)** and then select **Settings / Comm.** See also [Communications, page 93](#).



### Record format

You can transfer coordinate records to the TS635 construction total station in the following formats:

PT	,	X	,	Y	,	Z	,	CD
----	---	---	---	---	---	---	---	----

PT		X		Y		Z		CD
----	--	---	--	---	--	---	--	----

PT	,	X	,	Y	,	Z
----	---	---	---	---	---	---

PT		X		Y		Z
----	--	---	--	---	--	---

PT	,	X	,	Y	,	,	CD
----	---	---	---	---	---	---	----

PT		X		Y		CD
----	--	---	--	---	--	----

PT	,	X	,	Y	,	,
----	---	---	---	---	---	---

PT	,	X	,	Y	,
----	---	---	---	---	---

PT	,	,	,	Z	,	CD
----	---	---	---	---	---	----

PT	,	,	,	Z
----	---	---	---	---



The formats use the following codes:

Code	Description	Length
PT	Point number	Up to 20 digits
X	Actual X coordinate	Variable length
Y	Actual Y coordinate	Variable length
Z	Actual Z coordinate	Variable length
CD	Feature code	Up to 16 characters

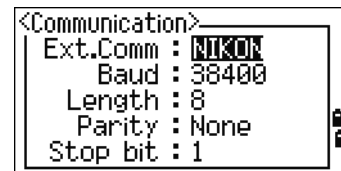
### Data example

```
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
```

## Transferring coordinate data from the total station

### Settings

To configure the transmission speed and other settings, press **[MENU]** and then select **Settings / Comm.** See also [Communications, page 93](#).



### Data examples

#### Nikon coordinate data format

```
1,100.0000,200.0000,10.0000,
2,200.0000,300.0000,20.0000,
3,116.9239,216.9140,11.8425,TRAIN PLATFORM
4,126.6967,206.2596,11.2539,RAMP
11,100.0045,199.9958,10.0000,
13,116.9203,216.9113,11.7157,
14,126.6955,206.2579,10.9908,
21,100.0103,199.9958,10.0000,
31,100.0013,200.0005,10.0000,
41,100.0224,200.0331,9.9000,
43,116.9263,216.9165,11.8016,CURB
44,126.7042,206.2871,10.8193,DITCH
45,116.9266,216.9160,11.8028,
46,126.7046,206.2845,10.8213,CP POINT
```



## Error Messages

### In this chapter:

- Cogo
- Communications
- Data
- Job manager
- Layout
- Programs
- Recording data
- Searching
- Settings
- Station setup
- System error

The appendix describes the error messages that may appear when you use the TS635 construction total station.

## Cogo

### NO Result

The system was unable to calculate an area because points were not entered in the correct order.

Press any key to return to the Cogo menu. Then enter the points in the correct order.

### 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. Then use a different point.

### XY-coordinate is required

The input point does not have XY (NE) coordinates.

Press any key to return to the point input screen. Then enter a point that has X and Y coordinates.

## Communications

If an error is detected while data is being transferred to the TS635 construction total station, the total station stops the transfer and displays one of the following messages:

### Check Data

There are errors in the data that is being transferred to the total station, such as an alphabetic character in a coordinate field.

Press any key. Then check the specified line in the data.

### DUPLICATE PT



---

**CAUTION** – If the existing point is a UP, CC, or MP record, and the point is not referred to by ST or BS, the existing point will be overwritten by the uploaded record. No error message appears.

---

The uploaded data contains a duplicate PT.

Press any button. Then check the specified point in the data.

### PT MAX20 chars

The uploaded data contains a PT with a name or number that is longer than 20 digits.

Press any button. Then check the specified line in the data.

### XYZ OVERRANGE

The uploaded data contains a coordinate that is longer than 13 digits.

Press any button. Then check the specified line in the data.

## Data

### Can't Edit XYZ from measurement

You have tried to change the coordinates of an SO, SS, or CP record. You cannot change the coordinates of these records.

Press any button to return to the previous screen.

### DELETE Stn-XYZ

You have tried to delete a coordinate record that the current ST or BS refers to. You must confirm that you want to delete this record.

To...	Press...
delete XYZ	the <b>DEL</b> softkey
return to the previous screen without deleting XYZ	<b>ESC</b> or the <b>Abort</b> softkey

## Job manager

### Cannot Assign

You have tried to set the current job as the control file.

Press any button to return to the previous screen. Then select a different job.

### Can't Create

There is no space available to create a job or record a point.

Press any button to return to the Job Manager. Then select the **DEL** softkey to delete old jobs.

### Existing Job

You have entered an existing job name for a new job.

Press any button and then change the name for the new job.

### MAX 32Jobs

You are trying to create a new job when the maximum number of jobs (32) is already stored.

Press any button to return to the Job Manager. Then select the **DEL** softkey to delete old jobs.

## Layout

### Input Error

The point name style used in the Fr field is not the same as the style used in the To field. For example, the Fr field style is 1, and the To field style is A200.

Press any button to return to the Fr/To input screen. Then re-enter the point name, using the same naming style in both fields.

### NO Stn Setup

You did not perform a station setup or BS check before entering the Layout function.

To...	Press...
go to the Stn Setup menu	<b>2</b> or select Stn Setup
return to the Basic Measurement Screen (BMS)	<b>ESC</b>
go to the Stakeout menu	<b>1</b> or select Continue



**CAUTION** – Selecting Continue does **not** resume the last ST record. You should only use the Continue option if you are sure that the previous ST coordinates and the current HA orientation are correct. Otherwise, records in the Stakeout function may not be correct.

## Programs

### NO Stn Setup



**CAUTION** – Selecting Continue does **not** resume the last ST record. You should only use the Continue option if you are sure that the previous ST coordinates and the current HA orientation are correct. Otherwise, records in the Programs function may not be correct.

You did not perform a station setup or BS check before entering the Programs function.

To...	Press...
go to the Stn Setup menu	<b>2</b> or select Stn Setup
return to the BMS	<b>ESC</b>
go to the Programs menu	<b>1</b> or select Continue

## Recording data

### DATA FULL

The data storage is full.

Press any button to return to the Basic Measurement Screen (BMS). Then:

To...	Press...
delete unnecessary data	<b>MENU</b> and select <b>Data</b>
delete jobs	<b>MENU</b> and select <b>Job</b>

### DUPLICATE PT

The input PT you are trying to record already exists in the current job. An existing coordinate record cannot be overwritten by measured data.

Press any button to return to the point input screen. Change the setting in the PT field.

### Duplicate PT

The input PT you are trying to record already exists in the current job as an SS, SO, or CP record. An existing SS, SO, or CP record can be overwritten by measured data.

To...	Press...
return to the PT input screen	<b>ESC</b> or the <b>Abort</b> softkey
record RAW data and update XYZ data	the <b>XYZ</b> softkey
record RAW data only	the <b>RAW</b> softkey

### No Open Job

No job is open.

To...	Press...
open the job list, if there are existing jobs	<b>1</b> or select <b>Select Job</b>
create a new job	<b>2</b> or select <b>Create Job</b>
return to the previous screen	<b>ESC</b>

### NO Stn Setup

There is no station record in the current job, or a station setup or BS check has not been done since the program was rebooted.

To...	Press...
continue recording	<b>1</b> or select <b>Continue</b> . If there is already an ST record in the job, the message <b>CO, Use current orientation</b> appears.
go to the Stn Setup menu	<b>2</b> or select <b>STN Setup</b>
return to the previous screen	<b>ESC</b>

### OVER RANGE

You are trying to record a coordinate with more than 13 digits.

Press any button to return to the previous screen. Then check the setting for the current ST coordinate.

## Searching

### PT Not Found

There is no point that matches the criteria entered.

Press any button to return to the point input screen.

This message may appear in any function where the PT/CD is input, such as Station Setup or Stakeout.

## Settings

### Job Settings will be changed

You have changed one or more of the following job settings:

- VA zero or HA in the Angle screen (see [Angle, page 90](#))
- Scale, T-P, Sea Lvl, or C&R in the Distance screen (see [Distance, page 90](#))
- Coord or Az Zero in the Coordinates screen (see [Coordinate, page 93](#))
- Angle, Dist, Temp, or Press in the Unit screen (see [Unit, page 93](#))

To...	Press...
discard the changes to the job settings	<b>ESC</b> or the <b>ABT</b> softkey. The current job remains open.
close the current job and save the changes to the job settings	<b>ENT</b> or the <b>OK</b> softkey.

**Note** – To record a point using the new settings, create a new job using the new settings.



## Station setup

### Same Coordinate

The input PT or coordinate is identical to the current station in STN/2:Known, or the same coordinate or point name/number is found in Resection.

Press any button to return to the PT input screen. Then use a different PT.

### Space LOW

There is not enough space to record a station when you start any of the Station Setup functions.

To...	Press...
return to the BMS	press <b>(ESC)</b> or select the <b>ABRT</b> softkey. Select the <b>DEL</b> softkey in Job Manager to delete old jobs.
continue	press <b>(ENT)</b> or select the <b>OK</b> softkey. You may not be able to record the whole process.

### XY-coordinate is required

The input point for ST/BS does not have N/E coordinates.

Press any button to return to the PT input screen. Then use a PT that has N/E coordinates.

### Z-coordinate is required

The input point for Benchmark does not have a Z coordinate.

Press any button to return to the PT input screen. Then use a PT that has a Z coordinate. See [page 68](#).

## System error

### =SYSTEM ERROR=

The system has detected an internal error that is related to the lower-level system. Press any key to turn the instrument off. The system will reboot when this error is reported. If you still have more points to shoot in the site, turn the instrument on and repeat the open a job and station setup procedures.

Data stored before this error will be kept safely in the Job file. If the error appears frequently, please contact your dealer or Trimble Support and report the message that appears below the =SYSTEM ERROR= line.

